

is critically undersized. The crossing lacks sufficient hydraulic capacity to pass the 10-year peak flow under existing conditions, and is therefore also undersized for larger peak flows as well as expected increases in extreme flows under projected future climate conditions.

Proposed Concept

Replace the existing undersized culvert with a 7.5-foot wide open-bottom arch to accommodate the 1.2 times bankfull width design standard of the Massachusetts River and Stream Crossing Standards. Realign the crossing to better match the existing stream channel alignment. Reconstruct the stream banks and channel at and within the crossing to match the existing stream channel up and downstream of the crossing.

- Provide increased hydraulic capacity to reduce flooding risk
- Reduce geomorphic risk associated with poor crossing alignment and freefall condition
- Protect outlet and surrounding intersection from scour

4.1.3 Blood Road

Site Description

Blood Road crosses an unnamed stream approximately 0.6 miles north of Saundersdale Road. The crossing consists of a single, 30-foot long, 1.5foot diameter smooth plastic pipe (Figure 15). There is a small dam, approximately 2-feet in height located 10-feet upstream of the crossing. Bankfull width could not be measured at this location due to the density of invasive multiflora rose on the downstream side of the crossing; however based on visual assessment, the degree of constriction was rated as moderate. The structure had both an inlet drop, and a freefall condition at the outlet, with a drop of 1.2 feet from the pipe to the stream bottom. Structural condition was not a major concern at this crossing, but geomorphic risks were considered moderate, and the crossing was rated poorly for hydraulic capacity. The existing structure is undersized for the 10-year peak flow under existing conditions, and is therefore also undersized for larger peak flows as well as expected increases in extreme flows under projected future climate conditions.



Figure 15. View of freefall condition at existing crossing outlet taken during field assessment on October 16, 2018.

Proposed Concept

Evaluate removal of the upstream, non-jurisdictional dam and replace the existing undersized culvert with an embedded box culvert sized to accommodate the 1.2 times bankfull width design standard of the Massachusetts River and Stream Crossing Standards (based on available information, it is estimated that the structure will need to be approximately 4-feet wide).



- Provide increased hydraulic capacity to reduce risks from road overtopping
- Reduce geomorphic risk associated with inlet drop and freefall conditions
- Reduce risk of flooding associated with potential dam failure

4.1.4 Center Depot Road

Site Description

Center Depot Road crosses an unnamed stream approximately just northwest of Stafford Street. At the time of field assessment, the structure inlet was completely submerged, and the outlet was partially submerged (Figure 16). The outlet was observed to be a 2-foot diameter concrete pipe, representing a severe constriction relative to the stream's 6-foot bankfull width (note that in the immediate vicinity of the crossing, the bankfull width was measured at approximately 12 feet, likely due to backwatering from the nearby, downstream Stafford Street crossing). In addition to the geomorphic risk and barriers to wildlife passage associated with this level of constriction, the existing structure is undersized for the 10-year peak flow under existing conditions, and is therefore also undersized for larger peak flows as well as expected increases in extreme flows under projected future climate conditions.

Proposed Concept

Replace the existing undersized culvert with a 7.5-foot wide embedded box culvert to accommodate the 1.2 times bankfull width design standard of the Massachusetts River and Stream Crossing Standards.

- Provide increased hydraulic capacity to reduce risks from road overtopping
- Eliminate the observed backwater condition which is resulting from insufficient structure capacity
- Improve aquatic and terrestrial passage



Figure 16. View of partially-submerged outlet at existing crossing taken during field assessment on October 31, 2018.

4.1.5 Freeman Road

Site Description

Freeman Road crosses an unnamed stream just south of Mugget Hill Road and approximately 600 feet from Wabash Pond. The crossing consists of a 2.5-foot wide, corrugated metal elliptical arch pipe set into a concrete headwall (Figure 17). The structure is severely constricting relative to the stream's 8-foot bankfull width. The constricted condition has led to the formation of a large downstream scour pool and deposition of sediment both upstream and downstream of the crossing. Structural condition was rated as adequate for all assessed features. The existing crossing is sized to pass the 10-year peak flow, but is undersized for larger peak flows and for future climate conditions.



Proposed Concept

Replace the existing undersized culvert with a 10-foot wide embedded box culvert to accommodate the 1.2 times bankfull width design standard of the Massachusetts River and Stream Crossing Standards. Restore the stream banks and stream channel to repair scour.

- Provide increased hydraulic capacity to reduce risks of flooding
- Reduce the potential for scour and erosion and associated geomorphic risk by reducing constriction
- Improve hydrologic connectivity of the upstream and downstream ecosystems



Figure 17. View of outlet and scour pool at existing crossing taken during field assessment on October 18, 2018.

- 4.2 Top Priority Crossings—Town of Spencer
- 4.2.1 Wire Village Road

Site Description

Wire Village Road crosses an unnamed tributary to Turkey Hill Brook (xy42267367198603). The crossing consists of a single, 37-foot long, 2-foot diameter corrugated metal pipe which projects out from the embankment at the outlet and terminates in a 3.7 foot freefall onto a cascade of rocks to reach the stream bottom (Figure 18). The structure severely constricts the stream's 14-foot bankfull width. These combined conditions present significant barriers to aquatic passage at a site which has a high Index of Ecological Integrity rating, an indicator of stream habitat quality and overall ecological benefit of



Figure 18. View of outlet freefall condition looking downstream from existing crossing outlet during field assessment on November 6, 2018.

removing an existing barrier. Embankment piping was also noted during the field assessment,



which resulted in an elevated structural risk score. The existing structure is undersized for all evaluated return interval peak flows, including the existing 10-year peak flow.

Proposed Concept

Replace the existing undersized culvert with a 17-foot span bridge to accommodate the 1.2 times bankfull width design standard of the Massachusetts River and Stream Crossing Standards. Reconstruct the stream channel and banks through the crossing to match the existing channel and banks, including stream substrate and slope.

- Provide increased hydraulic capacity to reduce risks from flooding and road overtopping
- Reduce geomorphic risk associated with freefall conditions and the fact that the crossing slope is significantly less than that of the natural channel
- Eliminate a significant barrier to aquatic passage in a high-value habitat area

4.2.2 Elm Street

Site Description

Elm Street crosses an unnamed tributary to the Sevenmile River approximately 300 feet south of Route 9. Because of its location in a densely developed town center area, the crossing received one of the highest scores for flood impact potential across all assessed structures. The crossing consists of two concrete box culverts, each of which is 5 feet wide and 3.3 feet high. The structures outlet to a freefall of nearly 12 feet to reach the stream bottom (Figure 19). This creates an insurmountable barrier for aquatic wildlife. The stream is also channelized between concrete walls in the area immediately downstream of the crossing. There were no concerns recorded relative to structural condition, and the crossing's two structures provide adequate width to approximately match the stream's bankfull width. Hydraulically, however, the



Figure 19. View of freefall condition at existing crossing outlet during field assessment on November 12, 2018.

existing crossing is undersized for all evaluated return interval peak flows, including the existing 10-year peak flow. There is a mapped FEMA 100-year flood zone located approximately 2,500 feet downstream of the crossing.

Proposed Concept

Replace the existing undersized culvert with a bridge of minimum 12-foot span to accommodate the 1.2 times bankfull width design standard of the Massachusetts River and Stream Crossing Standards. Reconstruct the stream channel and banks through the crossing to match the



existing channel and banks, including stream substrate and slope. Lower the invert to facilitate limited aquatic passage.

- Provide increased hydraulic capacity to accommodate peak flows and reduce risks from flooding
- Reduce geomorphic risk associated with freefall conditions and the fact that the crossing slope is significantly less than that of the natural channel
- Provided limited improvements to aquatic passage

4.2.3 Water Street

Site Description

Water Street crosses an unnamed tributary to the Sevenmile River approximately 500 feet southeast of Route 9 (as the crow flies), and just west of the intersection of Water Street and Valley Street. The crossing's outlet consists of a 4-foot diameter, round concrete pipe. The inlet was unassessed, as the culvert is buried under an adjacent factory/warehouse building located at 1 Water Street. Based on aerial imagery, the inlet appears to be located on private property at or near the rear of the building. Field assessment indicates that the structure changes material approximately 30 feet from the outlet. The material further inside could not be identified with certainty, but appeared to be metal. It was noted that rock and sediment are collapsing in on the structure; structural integrity of the culvert barrel was therefore rated as critical and deformation was evident within the structure. The crossing severely constricts the channel's 15-foot bankfull width, and both a large scour pool and downstream sediment deposition were present at the crossing. The structure length is estimated from aerial imagery to be at minimum 120 feet; there is a



Figure 20. View of freefall condition at existing crossing outlet during field assessment on November 15, 2018.

freefall condition at the outlet with a drop of 1.2 feet to the stream bottom (Figure 20). Hydraulic capacity could not be calculated due to the limited data available at this site. However, based on the partial information collected for the outlet and the estimated peak flow rates at the crossing, it is anticipated that the existing crossing is undersized for the 10-year and larger peak flows, as well as for future climate conditions. Because of its location in Spencer's densely developed town center area, the crossing received one of the highest scores for flood impact potential across all assessed structures. There is a mapped FEMA 100-year flood zone located approximately 950 feet downstream of the crossing.



Proposed Concept

Due to the nature of the site, it is likely that any proposed replacement of the Water Street crossing will need to be done in conjunction with redevelopment of the site at 1 Water Street. If such redevelopment were to occur in the future, the Town should evaluate a stream re-alignment and/or daylighting project that allows the stream to flow at its full 15-foot bankfull width. The proposed replacement crossing at Water Street should consist of an 18-foot span bridge or open-bottom arch to accommodate the 1.2 times bankfull width design standard of the Massachusetts River and Stream Crossing Standards. The stream channel and banks should be reconstructed to match the existing upstream and downstream channel and banks, including stream substrate and slope.

- Provide increased hydraulic capacity to accommodate peak storm flows and reduce risks from flooding
- Eliminate a significant barrier to aquatic passage and improve habitat quality
- Provide green space in the town center area
- Provide additional flood storage and slow flows upstream of a FEMA-designated 100year flood zone

4.2.4 Mill Street

Site Description

Mill Street crosses an unnamed tributary to the Sevenmile River approximately 270 feet from Route 9, and 125 feet west of Valley Street. The crossing consists of a 4-foot diameter, round concrete pipe which severely constricts the channel's 10-foot bankfull width (Figure 21). A freefall onto cascade at the outlet, downstream scour pool, and high bank erosion along the channelized stream contribute to high geomorphic risk at this crossing. The channel banks have

been armored with large rip rap in an attempt to control erosion. Hydraulically, the structure is undersized for all evaluated return interval peak flows, including the 10year peak flow and is expected to become further undersized relative to future climate conditions. Because of its location in Spencer's densely developed town center area (and between adjacent high priority crossings both upstream and downstream), the crossing received one of the highest scores for flood impact potential across all assessed structures. There is a mapped FEMA 100-year flood zone located approximately 1,500 feet downstream of the crossing.



Figure 21. View of existing crossing inlet during field assessment on November 15, 2018.

Proposed Concept

Replace the existing undersized culvert with a 12-foot wide open-bottom arch to accommodate the 1.2 times bankfull width design standard of the Massachusetts River and Stream Crossing



Standards. Reconstruct the stream channel and banks through the crossing to match the existing channel and banks, including stream substrate and slope.

- Provide increased hydraulic capacity to accommodate peak flows and reduce risks from flooding
- Reduce the potential for scour and erosion and associated geomorphic risk by reducing constriction

4.2.5 May Street

Site Description

May Street crosses an unnamed tributary to the Sevenmile River mid-way between Cherry Street and Holmes Street, approximately 1,000 feet south of Route 9. This crossing is not located on a mapped stream, but was identified by field staff while conducting assessments at other crossings in the neighborhood. The crossing is located approximately 1,000 feet upstream of Muzzy Lake, which is mapped as a FEMA-designated 100-year flood zone. The crossing consists of two corrugated metal pipes, one of 1.5-foot diameter, and a second pipe which appeared to be a round pipe,



Figure 22. View of existing crossing inlet during field assessment on November 8, 2018.

but had been crushed, yielding effective dimensions of 3-feet wide by 2-feet high (Figure 22). The combined 4.5-foot width of the two culverts is severely constricting relative to the 8-foot bankfull width of the channel. A freefall at the outlet of the smaller pipe drops 1 foot to the stream bottom. There is an additional drainage pipe which empties into the smaller culvert inside the pipe; its origin could not be determined. A downstream scour pool, and sediment deposition both upstream and downstream of the crossing are indicative of high geomorphic risk at this location. Hydraulically, the crossing is significantly undersized for all evaluated return interval peak flows, including the 10-year peak flow. Note that the peak flow estimates and hydraulic capacity analysis do not account for additional flows entering the smaller culvert from the contributing storm drainage pipe. Because of its location in Spencer's densely developed town center area, the crossing received one of the highest scores for flood impact potential across all assessed structures.

Proposed Concept

Replace the existing undersized culvert with a 10-foot wide embedded box culvert to accommodate the 1.2 times bankfull width design standard of the Massachusetts River and Stream Crossing Standards. Reconstruct the stream channel and banks through the crossing to match the existing channel and banks, including stream substrate and slope. Determine the contributing drainage area for the drainage pipe that empties into the smaller of the two stream



culverts and investigate green infrastructure opportunities to infiltrate or retain this water upstream.

- Provide increased hydraulic capacity to accommodate peak flows and reduce risks from flooding
- Reduce the potential for scour and erosion and associated geomorphic risk by reducing constriction
- Reduce additional pressure on the crossing capacity from contributing drainage flows, decrease peak flows, and potentially improve water quality in the stream.
- 4.2.6 Valley Street

Site Description

Valley Street crosses an unnamed tributary to the Sevenmile River approximately 300 feet from Route 9, and 220 feet west of Elm Street. The Valley Street crossing is just 200 feet downstream of the high-priority Elm Street crossing. The crossing consists of a 6.5-foot wide by 5.5 foot tall concrete box/bridge (Figure 23). The stream enters the inlet at a sharp bend due to poor alignment of the structure, roadway, and stream. Bankfull width at this location was measured to be 28 feet, although this assessment may be unduly influenced by the proximity of the adjacent crossings and the extensive channelization and armoring of the

stream; although the true bankfull width may be narrower, the crossing is believed to severely constrict the stream. A secondary structure enters just below the crossing outlet (at left in Figure 23); that structure's origination point is unknown. Both the crossing and secondary structure are flanked by concrete wingwalls and there is considerable bank armoring downstream of the crossing. The upstream channel is also directed into the crossing inlet by concrete wingwalls and armored with large riprap. Hydraulically, the structure is sized to pass the existing 25-year peak flow, but is undersized for the larger return interval peak flows that were evaluated, and is expected to be undersized for all but the 10-year peak flow under future climate conditions. The crossing also received high structural risk scores due to erosion and undermining of the concrete footings (Figure 24), poor alignment, and condition of the wingwalls and armoring. Because of its location in Spencer's densely developed town center area (and between adjacent high priority crossings both upstream and downstream), the crossing received one of the highest scores for flood impact potential across all assessed structures. There is a mapped FEMA 100-year flood zone located approximately 2,200 feet downstream of the crossing.



Figure 24. View of undermining and erosion of concrete structure during field assessment on November 12, 2018.



Proposed Concept

Replace the existing undersized crossing with a 12-foot span bridge (this value should be adjusted to match more detailed assessment of bankfull width) to accommodate the 1.2 times bankfull width design standard of the Massachusetts River and Stream Crossing Standards. Reconstruct the stream channel and banks through the crossing to match the existing channel and banks, including stream substrate and slope. Determine the origin of the secondary pipe and evaluate green infrastructure or other opportunities to infiltrate or retain this water upstream, and redesign the crossing to better integrate the two structures.

- Improve alignment of the stream with the crossing to reduce geomorphic risk
- Provide increased hydraulic capacity to accommodate peak flows and reduce risks from flooding
- Alleviate failure risks due to undermining of the structure
- Explore potential to decrease peak flows by reducing contributions from the secondary structure



Appendix A Stream Crossing Survey Field Data Form (blank)

ſ	FUSS&O'NEILL Road- Field I	Stream Crossing Assessment Data Form	QA/QC INITIALS:DATE: StatusFINALFOLLOW-UP								
	Crossing Code	State or Local ID/NameDate	Start Time AM / PM 🛔								
	Lead Field Data Collector	Asst. Field Data Collectors	End Time AM / PM								
	Municipality	CountyStream									
ΑΤΑ	Road GPS Coordinates (Decimal degrees)	Type MULTI-LANE PAVED UNPAVED	DRIVEWAY TRAIL RAILROAD								
ING D	Crossing Type BRIDGE CULVERT B BURIED STREAM INACCESSIBLE PA	MULTIPLE CULVERT FORD NO CROSSING REMOVED CROSSING	Number of Culverts / Cells								
D S S	Photo # INLET Photo # O	UTLET Photo # Photo #									
CRO	Photo # UPSTREAM Photo # D	OWNSTREAM Photo # Photo # Photo #									
•	Photo # ROADWAY Photo #	Photo # Photo # Photo #									
	Flow Condition NO FLOW TYPICAL-LO	W MODERATE HIGH Road-Killed Wildlife	or None								
	Visible Utilities OVERHEAD WIRES WAT	ER/SEWER PIPES GAS LINE NONE OTHER									
	Alignment SHARP BEND MILD BEND	NATURALLY STRAIGHT CHANNELIZED STRAIGHT Road Fill Height _	Road Crest Height २								
	Bankfull Width Confidence HIGH	LOW/ESTIMATED Constriction SEVERE MODERATE SPANS O	NLY BANKFULL/ACTIVE CHANNEL 율								
	Tailwater Scour Pool NONE SMALL	LARGE SPANS FULL CHANNEL & BANKS									
œ	Using HY-8? YES NO Estimated Over	topping LengthCrest Width Road Surface Type	PAVED GRAVEL GRASS								
-ΥH	Channel Slope Side Slope 5:1 0.5:1	4:1 3:1 2:1 1:1 Stream Substrate MUCK/SILT SAND GRA steeper than 0.5:1 BEDROCK UNKNOWN	AVEL COBBLE BOULDER 효								
	Bank Erosion HIGH LOW ESTIMAT	ED NONE Significant Break in Valley Slope YES NO UNKN	IOWN								
С U	Sediment Deposition UPSTREAM OWNSTREAM WITHIN STRUCTURE NONE										
0	Elevation of Sediment Deposits >= 1/2 Bankfull Height YES NO										
	Tidal? YES NO UNKNOWN	Tide Chart Location	Tide Prediction AM / PM								
L L	Tide Stage LOW SLACK TIDE LOW EBB	TIDE LOW FLOOD TIDE UNKNOWN OTHER	ů								
DI.	Vegetation Above/Below COMPARABLE SLIGHTLY DIFFERENT MODERATELY DIFFERENT VERY DIFFERENT UNKNOWN										
-	Tide Gate Type NONE STOP LOGS FLAP GATE SLUICE GATE SELF-REGULATING OTHER										
	Tide Gate Severity NONE MINOR N	NO AQUATIC PASSAGE									
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S	TRUCTURE 1 Structure Material SMOOTH PLASTIC CORRUGATED PLASTIC SMOOTH METAL CORRUGATED METAL	19-35								
	Outlet Shape 1 2 3 4 5 6 7 FORD UNKNOWN REMOVED Outlet Armoring NONE NOT EXTENSIVE EXTENSIVE	ਕੇ VE								
OUTLET	Outlet Grade (Pick one) AT STREAM GRADE FREE FALL CASCADE FREE FALL ONTO CASCADE UNKNOWN									
	Outlet Dimensions A. Width B. Height C. Substrate/Water Width D. Water Depth									
	Outlet Drop to Water Surface Outlet Drop to Stream Bottom E. Abutment Height (Type 7 bridges only)									
	L. Structure Length (Overall length from inlet to outlet)									
INLET	Inlet Shape 1 2 3 4 5 6 7 FORD UNKNOWN REMOVED	35-43								
	Inlet Type PROJECTING HEADWALL WITH SQUARE EDGE HEADWALL WITH GROOVED EDGE HEADWALL WITH SQUARE EDGE AND WINGWALLS HEADWALL WITH GROOVED/BEVELED EDGE AND WINGWALLS MITERED TO SLOPE OTHER NONE	pp.								
	Inlet Grade (Pick one) AT STREAM GRADE INLET DROP PERCHED CLOGGED/COLLAPSED/SUBMERGED UNKNOWN	_								
	Inlet Dimensions A. Width B. Height C. Substrate/Water Width D. Water Depth									
S	Slope % Slope Confidence HIGH LOW Internal Structures NONE BAFFLES/WEIRS SUPPORTS OTHER	43-56								
	Structure Substrate Matches Stream NONE COMPARABLE CONTRASTING NOT APPROPRIATE UNKNOWN	.dd								
DIT	Structure Substrate Type (Pick one) NONE SILT SAND GRAVEL COBBLE BOULDER BEDROCK UNKNOWN									
N N	Structure Substrate Coverage NONE 25% 50% 75% 100% UNKNOWN									
	Physical Barriers (Pick all that apply) NONE DEBRIS/SEDIMENT/ROCK DEFORMATION FREE FALL FENCING DRY OTHER									
NO	Severity (Choose carefully based on barrier type(s) above) NONE MINOR MODERATE SEVERE									
Ĩ	Water Depth Matches Stream YES NO-SHALLOWER NO-DEEPER UNKNOWN DRY									
ADD	Water Velocity Matches Stream YES NO-FASTER NO-SLOWER UNKNOWN DRY									
	Dry Passage through Structure? YES NO VINKNOWN Height above Dry Passage									

				INLET					OUTLET	Г		
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00	Longitudinal Alignment											
2 2	Level of Blockage											
っ て	Flared End Section											
Z	Invert Deterioration											
	Buoyancy or Crushing											
2	Cross-Section Deformation											
	Structural Integrity of Barrel											
ر	Joints and Seams											
1	Footings											
2	Headwall/Wingwalls											
)	Armoring											
	Apron/Scour Protection											
2	Embankment Piping											

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S	RUCTURE 2 Structure Material SMOOTH PLASTIC CORRUGATED PLASTIC SMOOTH METAL CORRUGATED METAL	19-35									
	CONCRETE WOOD ROCK/STONE FIBERGLASS COMBINATION Outlet Shape 1 2 3 4 5 6 7 FORD UNKNOWN REMOVED Outlet Armoring NONE NOT EXTENSIVE XTENSIVE	ਰ IVE									
OUTLET	Outlet Grade (Pick one) 🛛 AT STREAM GRADE 📄 FREE FALL 🔛 CASCADE 🔛 FREE FALL ONTO CASCADE 🔛 UNKNOWN										
	Outlet Dimensions A. Width B. Height C. Substrate/Water Width D. Water Depth										
	Outlet Drop to Water Surface Outlet Drop to Stream Bottom E. Abutment Height (Type 7 bridges only)										
	L. Structure Length (Overall length from inlet to outlet)										
ILET	Inlet Shape 1 2 3 4 5 6 7 FORD UNKNOWN REMOVED	35-43									
	Inlet Type PROJECTING HEADWALL WITH SQUARE EDGE HEADWALL WITH GROOVED EDGE HEADWALL WITH SQUARE EDGE AND WINGWALLS HEADWALL WITH GROOVED/BEVELED EDGE AND WINGWALLS MITERED TO SLOPE OTHER NONE	Ър									
-	Inlet Grade (Pick one) AT STREAM GRADE INLET DROP PERCHED CLOGGED/COLLAPSED/SUBMERGED UNKNOWN										
	Inlet Dimensions A. Width B. Height C. Substrate/Water Width D. Water Depth										
S	Slope % Slope Confidence HIGH LOW Internal Structures NONE BAFFLES/WEIRS SUPPORTS OTHER	43-56									
N OI	Structure Substrate Matches Stream 🗾 NONE 🔤 COMPARABLE 📄 CONTRASTING 📄 NOT APPROPRIATE 📑 UNKNOWN	.dd									
DIT	Structure Substrate Type (Pick one) NONE SILT SAND GRAVEL COBBLE BOULDER BEDROCK UNKNOWN										
N O N	Structure Substrate Coverage NONE 25% 50% 75% 100% UNKNOWN										
∧ L	Physical Barriers (Pick all that apply) NONE DEBRIS/SEDIMENT/ROCK DEFORMATION FREE FALL FENCING DRY OTHER										
NO	Severity (Choose carefully based on barrier type(s) above) 🗾 NONE 🗾 MINOR 📃 MODERATE 📃 SEVERE										
ITI	Water Depth Matches Stream 🖉 YES 🖉 NO-SHALLOWER 🔄 NO-DEEPER 💭 UNKNOWN 📄 DRY	_									
A D D	Water Velocity Matches Stream 🗾 YES 🔄 NO-FASTER 🔄 NO-SLOWER 📄 UNKNOWN 📄 DRY										
	Dry Passage through Structure? 📄 YES 📄 NO 📄 UNKNOWN 🛛 🛛 Height above Dry Passage										

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SS	Longitudinal Alignment											
S E	Level of Blockage											
AS	Flared End Section											
z	Invert Deterioration											
0 E	Buoyancy or Crushing											
Ξ	Cross-Section Deformation											
Z	Structural Integrity of Barrel											
ŭ	Joints and Seams											
┛┛	Footings											
2	Headwall/Wingwalls											
	Armoring											
⊃~	Apron/Scour Protection											
STI	Embankment Piping											

ROAD-STREAM CROSSING ASSESSMENT FIELD DATA FORM

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FORM ADAPTED BY FUSS & O'NEILL, INC. (WITH PERMISSION) FROM THE NAACC AQUATIC CONNECTIVITY STREAM CROSSING SURVEY DATA FORM

S	RUCTURE 3 Structure Material SMOOTH PLASTIC CORRUGATED PLASTIC SMOOTH METAL CORRUGATED METAL	19-35									
	CONCRETE WOOD ROCK/STONE FIBERGLASS COMBINATION Outlet Shape 1 2 3 4 5 6 7 FORD UNKNOWN REMOVED Outlet Armoring NONE NOT EXTENSIVE EXTENS	ਕੇ IVE									
OUTLET	Outlet Grade (Pick one) 🛛 AT STREAM GRADE 📄 FREE FALL 🔛 CASCADE 🔛 FREE FALL ONTO CASCADE 📃 UNKNOWN										
	Outlet Dimensions A. Width B. Height C. Substrate/Water Width D. Water Depth										
	Outlet Drop to Water Surface Outlet Drop to Stream Bottom E. Abutment Height (Type 7 bridges only)										
	L. Structure Length (Overall length from inlet to outlet)										
INLET	Inlet Shape 1 2 3 4 5 6 7 FORD UNKNOWN REMOVED	35-43									
	Inlet Type PROJECTING HEADWALL WITH SQUARE EDGE HEADWALL WITH GROOVED EDGE HEADWALL WITH SQUARE EDGE AND WINGWALLS HEADWALL WITH GROOVED/BEVELED EDGE AND WINGWALLS MITERED TO SLOPE OTHER NONE	Ър									
	Inlet Grade (Pick one) AT STREAM GRADE INLET DROP PERCHED CLOGGED/COLLAPSED/SUBMERGED UNKNOWN										
	Inlet Dimensions A. Width B. Height C. Substrate/Water Width D. Water Depth										
S	Slope % Slope Confidence HIGH LOW Internal Structures NONE BAFFLES/WEIRS SUPPORTS OTHER	43-56									
NO	Structure Substrate Matches Stream 🗾 NONE 🔤 COMPARABLE 📄 CONTRASTING 📄 NOT APPROPRIATE 📑 UNKNOWN	pp.									
DIT	Structure Substrate Type (Pick one) NONE SILT SAND GRAVEL COBBLE BOULDER BEDROCK UNKNOWN										
N O N	Structure Substrate Coverage NONE 25% 50% 75% 100% UNKNOWN										
∧ L	Physical Barriers (Pick all that apply) NONE DEBRIS/SEDIMENT/ROCK DEFORMATION FREE FALL FENCING DRY OTHER										
NO	Severity (Choose carefully based on barrier type(s) above) 🗾 NONE 🔄 MINOR 🔛 MODERATE 🔛 SEVERE										
ITIC	Water Depth Matches Stream 📕 YES 📕 NO-SHALLOWER 📕 NO-DEEPER 📕 UNKNOWN 📕 DRY										
A D D	Water Velocity Matches Stream 🗾 YES 🔄 NO-FASTER 🔄 NO-SLOWER 📄 UNKNOWN 📄 DRY										
	Dry Passage through Structure? 📄 YES 📄 NO 📄 UNKNOWN 🛛 🛛 Height above Dry Passage										

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22	Longitudinal Alignment											
Ц Л	Level of Blockage											
A	Flared End Section											
Z	Invert Deterioration											
	Buoyancy or Crushing											
	Cross-Section Deformation											
Z	Structural Integrity of Barrel											
٢	Joints and Seams											
L A	Footings											
בי	Headwall/Wingwalls											
5	Armoring											
	Apron/Scour Protection											
	Embankment Piping											

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S	TRUCTURE 4 Structure Material SMOOTH PLASTIC CORRUGATED PLASTIC SMOOTH METAL CORRUGATED METAL	19-35								
	Outlet Shape 1 2 3 4 5 6 7 FORD UNKNOWN REMOVED Outlet Armoring NONE NOT EXTENSIVE EXTENSIVE	ਕੇ IVE								
OUTLET	Outlet Grade (Pick one) AT STREAM GRADE FREE FALL CASCADE FREE FALL ONTO CASCADE UNKNOWN									
	Outlet Dimensions A. Width B. Height C. Substrate/Water Width D. Water Depth									
	Outlet Drop to Water Surface Outlet Drop to Stream Bottom E. Abutment Height (Type 7 bridges only)									
	L. Structure Length (Overall length from inlet to outlet)									
	Inlet Shape 1 2 3 4 5 6 7 FORD UNKNOWN REMOVED	35-43								
INLET	Inlet Type PROJECTING HEADWALL WITH SQUARE EDGE HEADWALL WITH SQUARE EDGE AND WINGWALLS HEADWALL WITH GROOVED/BEVELED EDGE AND WINGWALLS MITERED TO SLOPE OTHER NONE	.dd								
	Inlet Grade (Pick one) AT STREAM GRADE INLET DROP PERCHED CLOGGED/COLLAPSED/SUBMERGED VNKNOWN									
	Inlet Dimensions A. Width B. Height C. Substrate/Water Width D. Water Depth									
S	Slope % Slope Confidence HIGH LOW Internal Structures NONE BAFFLES/WEIRS SUPPORTS OTHER	43-56								
<u>v</u>	Structure Substrate Matches Stream NONE COMPARABLE CONTRASTING NOT APPROPRIATE UNKNOWN	pp.								
DIT	Structure Substrate Type (Pick one) NONE SILT SAND GRAVEL COBBLE BOULDER BEDROCK UNKNOWN									
N N	Structure Substrate Coverage NONE 25% 50% 75% 100% UNKNOWN									
¶ L	Physical Barriers (Pick all that apply) NONE DEBRIS/SEDIMENT/ROCK DEFORMATION FREE FALL FENCING DRY OTHER									
NO_	Severity (Choose carefully based on barrier type(s) above) NONE MINOR MODERATE SEVERE									
Ĩ	Water Depth Matches Stream YES NO-SHALLOWER NO-DEEPER UNKNOWN DRY									
A D	Water Velocity Matches Stream YES NO-FASTER NO-SLOWER UNKNOWN DRY									
	Dry Passage through Structure? 📉 YES 📉 NO 🔤 UNKNOWN 🛛 🛛 Height above Dry Passage									

												0
Ż		INLET					OUTLET					. 57-7
ш ≶		Adequate	Poor	Critical	Unknown	N/A	Adequate	Poor	Critical	Unknown	N/A	dd
SS	Longitudinal Alignment											
S E	Level of Blockage											
AS	Flared End Section											
z	Invert Deterioration											
0 E	Buoyancy or Crushing											
Ξ	Cross-Section Deformation											
Z	Structural Integrity of Barrel											
ŭ	Joints and Seams											
┛┛	Footings											
2	Headwall/Wingwalls											
	Armoring											
⊃~	Apron/Scour Protection											
STI	Embankment Piping											

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S	RUCTURE 5 Structure Material SMOOTH PLASTIC CORRUGATED PLASTIC SMOOTH METAL CORRUGATED METAL	19-35									
	CONCRETE WOOD ROCK/STONE FIBERGLASS COMBINATION Outlet Shape 1 2 3 4 5 6 7 FORD UNKNOWN REMOVED Outlet Armoring NONE NOT EXTENSIVE EXTENSI	d VE									
OUTLET	Outlet Grade (Pick one) 🛛 AT STREAM GRADE 🔄 FREE FALL 🔛 CASCADE 🔄 FREE FALL ONTO CASCADE 📃 UNKNOWN										
	Outlet Dimensions A. Width B. Height C. Substrate/Water Width D. Water Depth										
	Outlet Drop to Water Surface Outlet Drop to Stream Bottom E. Abutment Height (Type 7 bridges only)										
	L. Structure Length (Overall length from inlet to outlet)										
ILET	Inlet Shape 1 2 3 4 5 6 7 FORD UNKNOWN REMOVED	35-43									
	Inlet Type PROJECTING HEADWALL WITH SQUARE EDGE HEADWALL WITH GROOVED EDGE HEADWALL WITH SQUARE EDGE AND WINGWALLS HEADWALL WITH GROOVED/BEVELED EDGE AND WINGWALLS MITERED TO SLOPE OTHER NONE	pp.									
2	Inlet Grade (Pick one) AT STREAM GRADE INLET DROP PERCHED CLOGGED/COLLAPSED/SUBMERGED UNKNOWN										
	Inlet Dimensions A. Width B. Height C. Substrate/Water Width D. Water Depth										
S	Slope % Slope Confidence HIGH LOW Internal Structures NONE BAFFLES/WEIRS SUPPORTS OTHER	 43-56									
NO	Structure Substrate Matches Stream 📄 NONE 📄 COMPARABLE 📄 CONTRASTING 📄 NOT APPROPRIATE 📄 UNKNOWN	pp.									
DIT	Structure Substrate Type (Pick one) NONE SILT SAND GRAVEL COBBLE BOULDER BEDROCK UNKNOWN										
N O N	Structure Substrate Coverage NONE 25% 50% 75% 100% UNKNOWN										
∧ L	Physical Barriers (Pick all that apply) NONE DEBRIS/SEDIMENT/ROCK DEFORMATION FREE FALL FENCING DRY OTHER										
NO	Severity (Choose carefully based on barrier type(s) above) 🗾 NONE 🔄 MINOR 🔛 MODERATE 🔛 SEVERE										
ITIC	Water Depth Matches Stream 📃 YES 🗾 NO-SHALLOWER 📄 NO-DEEPER 📃 UNKNOWN 🔛 DRY	_									
A D D	Water Velocity Matches Stream YES NO-FASTER NO-SLOWER UNKNOWN DRY										
	Dry Passage through Structure? YES NO UNKNOWN Height above Dry Passage										

												Ģ
z		INLET				OUTLET					. 57-7	
ц Х		Adequate	Poor	Critical	Unknown	N/A	Adequate	Poor	Critical	Unknown	N/A	č
22	Longitudinal Alignment											
Ц Л	Level of Blockage											
A	Flared End Section											
Z	Invert Deterioration											
	Buoyancy or Crushing											
	Cross-Section Deformation											
Z	Structural Integrity of Barrel											
٢	Joints and Seams											
L A	Footings											
בי	Headwall/Wingwalls											
5	Armoring											
	Apron/Scour Protection											
	Embankment Piping											

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S	RUCTURE 6 Structure Material SMOOTH PLASTIC CORRUGATED PLASTIC SMOOTH METAL CORRUGATED METAL	19-35									
	CONCRETE WOOD ROCK/STONE FIBERGLASS COMBINATION Outlet Shape 1 2 3 4 5 6 7 FORD UNKNOWN REMOVED Outlet Armoring NONE NOT EXTENSIVE EXTENSI	d VE									
OUTLET	Outlet Grade (Pick one) 🛛 AT STREAM GRADE 🔄 FREE FALL 🔄 CASCADE 🔄 FREE FALL ONTO CASCADE 📃 UNKNOWN	_									
	Outlet Dimensions A. Width B. Height C. Substrate/Water Width D. Water Depth										
	Outlet Drop to Water Surface Outlet Drop to Stream Bottom E. Abutment Height (Type 7 bridges only)	_									
	L. Structure Length (Overall length from inlet to outlet)										
INLET	Inlet Shape 1 2 3 4 5 6 7 FORD UNKNOWN REMOVED	35-43									
	Inlet Type PROJECTING HEADWALL WITH SQUARE EDGE HEADWALL WITH GROOVED EDGE HEADWALL WITH SQUARE EDGE AND WINGWALLS HEADWALL WITH GROOVED/BEVELED EDGE AND WINGWALLS MITERED TO SLOPE OTHER NONE	pp.									
	Inlet Grade (Pick one) AT STREAM GRADE INLET DROP PERCHED CLOGGED/COLLAPSED/SUBMERGED UNKNOWN	_									
	Inlet Dimensions A. Width B. Height C. Substrate/Water Width D. Water Depth										
S	Slope % Slope Confidence HIGH LOW Internal Structures NONE BAFFLES/WEIRS SUPPORTS OTHER	 43-56									
N OI	Structure Substrate Matches Stream NONE COMPARABLE CONTRASTING NOT APPROPRIATE UNKNOWN	pp.									
DIT	Structure Substrate Type (Pick one) NONE SILT SAND GRAVEL COBBLE BOULDER BEDROCK UNKNOWN										
N O N	Structure Substrate Coverage NONE 25% 50% 75% 100% UNKNOWN										
∧ L	Physical Barriers (Pick all that apply) NONE DEBRIS/SEDIMENT/ROCK DEFORMATION FREE FALL FENCING DRY OTHER										
NO	Severity (Choose carefully based on barrier type(s) above) NONE MINOR MODERATE SEVERE										
TIC	Water Depth Matches Stream 🖉 YES 🖉 NO-SHALLOWER 📄 NO-DEEPER 📄 UNKNOWN 📄 DRY										
A D D	Water Velocity Matches Stream YES NO-FASTER NO-SLOWER UNKNOWN DRY										
	Dry Passage through Structure? YES NO UNKNOWN Height above Dry Passage										

												Ģ
z				INLET					OUTLET			57-7
ц Х		Adequate	Poor	Critical	Unknown	N/A	Adequate	Poor	Critical	Unknown	N/A	č
22	Longitudinal Alignment											
Ц Л	Level of Blockage											
A	Flared End Section											
Z	Invert Deterioration											
	Buoyancy or Crushing											
	Cross-Section Deformation											
Z	Structural Integrity of Barrel											
ک	Joints and Seams											
L A	Footings											
בי	Headwall/Wingwalls											
5	Armoring											
	Apron/Scour Protection											
	Embankment Piping											

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S	TRUCTURE 7 Structure Material SMOOTH PLASTIC CORRUGATED PLASTIC SMOOTH METAL CORRUGATED METAL	19-35
	Outlet Shape 1 2 3 4 5 6 7 FORD UNKNOWN REMOVED Outlet Armoring NONE NOT EXTENSIVE EXTENSIVE	ਕੇ VE
LET	Outlet Grade (Pick one) AT STREAM GRADE FREE FALL CASCADE FREE FALL ONTO CASCADE UNKNOWN	
LN O	Outlet Dimensions A. Width B. Height C. Substrate/Water Width D. Water Depth	
	Outlet Drop to Water Surface Outlet Drop to Stream Bottom E. Abutment Height (Type 7 bridges only)	
	L. Structure Length (Overall length from inlet to outlet)	
	Inlet Shape 1 2 3 4 5 6 7 FORD UNKNOWN REMOVED	35-43
NLET	Inlet Type PROJECTING HEADWALL WITH SQUARE EDGE HEADWALL WITH GROOVED EDGE HEADWALL WITH SQUARE EDGE AND WINGWALLS HEADWALL WITH GROOVED/BEVELED EDGE AND WINGWALLS MITERED TO SLOPE OTHER NONE	.dd
=	Inlet Grade (Pick one) AT STREAM GRADE INLET DROP PERCHED CLOGGED/COLLAPSED/SUBMERGED UNKNOWN	
	Inlet Dimensions A. Width B. Height C. Substrate/Water Width D. Water Depth	
S	Slope % Slope Confidence HIGH LOW Internal Structures NONE BAFFLES/WEIRS SUPPORTS OTHER	43-56
N 0	Structure Substrate Matches Stream NONE COMPARABLE CONTRASTING NOT APPROPRIATE UNKNOWN	pp.
DIT	Structure Substrate Type (Pick one) NONE SILT SAND GRAVEL COBBLE BOULDER BEDROCK UNKNOWN	
N N	Structure Substrate Coverage NONE 25% 50% 75% 100% UNKNOWN	
	Physical Barriers (Pick all that apply) NONE DEBRIS/SEDIMENT/ROCK DEFORMATION FREE FALL FENCING DRY OTHER	
NO	Severity (Choose carefully based on barrier type(s) above) NONE MINOR MODERATE SEVERE	
ITIC	Water Depth Matches Stream YES NO-SHALLOWER NO-DEEPER UNKNOWN DRY	
ADD	Water Velocity Matches Stream YES NO-FASTER NO-SLOWER UNKNOWN DRY	
	Dry Passage through Structure? 📄 YES 📄 NO 📄 UNKNOWN 🛛 🛛 Height above Dry Passage	

				1.						
			INLET					OUTLE1	Г	
	Adequate	Poor	Critical	Unknown	N/A	Adequate	Poor	Critical	Unknown	N/A
Longitudinal Alignment										
Level of Blockage										
Flared End Section										
Invert Deterioration										
Buoyancy or Crushing										
Cross-Section Deformation										
Structural Integrity of Barrel										
Joints and Seams										
Footings										
Headwall/Wingwalls										
Armoring										
Apron/Scour Protection										
Embankment Piping										

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Structure Shape & Dimensions

- 1) Select the Structure Shape number from the diagrams below and record it on the form for Inlet and Outlet Shape.
- 2) Record on the form in the appropriate blanks dimensions A, B, C and D as shown in the diagrams;
 C captures the width of water or substrate, whichever is wider; for dry culverts without substrate, C = 0.
 D is the depth of water -- be sure to measure inside the structure; for dry culverts, D = 0.
- 3) Record Structure Length (L). (Record abutment height (E) only for Type 7 Structures.)
- 4) For multiple culverts, also record the Inlet and Outlet shape and dimensions for each additional culvert.

NOTE: Culverts 1, 2 & 4 may or may not have substrate in them, so height measurements (B) are taken from the level of the "stream bed", whether that bed is composed of substrate or just the inside bottom surface of a culvert (grey arrows below show measuring to bottom, black arrows show measuring to substrate).



ROAD-STREAM CROSSING ASSESSMENT FIELD DATA FORM FORM ADAPTED BY FUSS & O'NEILL, INC. (WITH PERMISSION) FROM THE NAACC AQUATIC CONNECTIVITY STREAM CROSSING SURVEY DATA FORM



Appendix B Road-Stream Crossing Scoring and Prioritization Results



Appendix B—Table 1. Road-Stream Crossing Scoring and Prioritization Results, organized by watershed and overall crossing priority scores. (Page 1 of 4)

mbd <th>XY Code</th> <th>Road Name</th> <th>Town</th> <th>Stream Name</th> <th>HUC 12 Watershed Name</th> <th>Existing Hydraulic Risk Score-Binned</th> <th>Future Hydraulic Risk Score-Binned</th> <th>Geomorphic Vulnerability Score</th> <th>Structural Condition Score</th> <th>Transportation Disruption Score</th> <th>Flood Impact Potential Score</th> <th>AOP Score</th> <th>Ecological Benefit Score</th> <th>Impact Score</th> <th>Existing Hydraulic Risk Score</th> <th>Future Hydraulic Risk Score</th> <th>Geomorphic Risk Score</th> <th>Structural A Risk Score</th> <th>OP Benefit Score</th> <th>Crossing Risk Score I</th> <th>Crossing Priority Value</th> <th>Scaled Crossing Priority</th> <th>Relative Priority Rating</th>	XY Code	Road Name	Town	Stream Name	HUC 12 Watershed Name	Existing Hydraulic Risk Score-Binned	Future Hydraulic Risk Score-Binned	Geomorphic Vulnerability Score	Structural Condition Score	Transportation Disruption Score	Flood Impact Potential Score	AOP Score	Ecological Benefit Score	Impact Score	Existing Hydraulic Risk Score	Future Hydraulic Risk Score	Geomorphic Risk Score	Structural A Risk Score	OP Benefit Score	Crossing Risk Score I	Crossing Priority Value	Scaled Crossing Priority	Relative Priority Rating
web web web main web main web main	xy42162777192843	A Young Rd	Charlton	Unnamed	Buffumville Lake-Little R.	5	5	4	5	1	3	5	3	3	15	15	12	15	15	15	30	0.6	High
witcher witcher <t< td=""><td>xy42165477195502</td><td>Cemetery Rd</td><td>Charlton</td><td>Unnamed</td><td>Buttumville Lake-Little R.</td><td>5</td><td>5</td><td>3</td><td>5</td><td>1</td><td>3</td><td>5</td><td>3</td><td>3</td><td>15</td><td>15</td><td>9</td><td>15</td><td>15</td><td>15</td><td>30</td><td>0.6</td><td>High</td></t<>	xy42165477195502	Cemetery Rd	Charlton	Unnamed	Buttumville Lake-Little R.	5	5	3	5	1	3	5	3	3	15	15	9	15	15	15	30	0.6	High
websel webse webse webse <td>xy42142557192428</td> <td>Richardson Corner Rd</td> <td>Charlton</td> <td>Unnamed</td> <td>Buffumville Lake-Little R.</td> <td>3</td> <td>4</td> <td>3</td> <td>5</td> <td>1</td> <td>3</td> <td>5</td> <td>3</td> <td>3</td> <td>9</td> <td>12</td> <td>9</td> <td>15</td> <td>15</td> <td>15</td> <td>30</td> <td>0.6</td> <td>High</td>	xy42142557192428	Richardson Corner Rd	Charlton	Unnamed	Buffumville Lake-Little R.	3	4	3	5	1	3	5	3	3	9	12	9	15	15	15	30	0.6	High
matrix matrix<	xy42136897194127	Morton Station Rd	Charlton	Unnamed	Buffumville Lake-Little R.	3	4	3	5	1	2	5	3	2	6	8	6	10	15	10	27.5	0.55	High
witch <th< td=""><td>xy42161267193605</td><td>Dodge Rd</td><td>Charlton</td><td>Unnamed</td><td>Buttumville Lake-Little R.</td><td>4</td><td>5</td><td>3</td><td>5</td><td>1</td><td>3</td><td>3</td><td>3</td><td>3</td><td>12</td><td>15</td><td>9</td><td>15</td><td>9</td><td>15</td><td>27</td><td>0.54</td><td>Medium</td></th<>	xy42161267193605	Dodge Rd	Charlton	Unnamed	Buttumville Lake-Little R.	4	5	3	5	1	3	3	3	3	12	15	9	15	9	15	27	0.54	Medium
multice<	xy42165247193920	Dodge Rd	Charlton	Unnamed	Buffumville Lake-Little R.	5	5	3	2	1	3	3	3	3	15	15	9	6	9	15	27	0.54	Medium
restand <t< td=""><td>xy4211108/192074</td><td>Private driveway</td><td>Charlton</td><td>Unnamed</td><td>Buttumville Lake-Little R.</td><td>5</td><td>5</td><td>2</td><td>2</td><td>1</td><td>3</td><td>3</td><td>3</td><td>3</td><td>15</td><td>15</td><td>6</td><td>6</td><td>9</td><td>15</td><td>27</td><td>0.54</td><td>Medium</td></t<>	xy4211108/192074	Private driveway	Charlton	Unnamed	Buttumville Lake-Little R.	5	5	2	2	1	3	3	3	3	15	15	6	6	9	15	27	0.54	Medium
rpr-nterm rpr-nterm <t< td=""><td>xy42164887195042</td><td>Starrord St</td><td>Charlton</td><td>Unnamed</td><td>Burrumville Lake-Little R.</td><td>5</td><td>5</td><td>3</td><td>5</td><td>3</td><td>2</td><td>3</td><td>5</td><td>3</td><td>15</td><td>15</td><td>9</td><td>15</td><td>9</td><td>15</td><td>27</td><td>0.54</td><td>Medium</td></t<>	xy42164887195042	Starrord St	Charlton	Unnamed	Burrumville Lake-Little R.	5	5	3	5	3	2	3	5	3	15	15	9	15	9	15	27	0.54	Medium
Princip Princip Description Description <thdescription< th=""> <thdes< td=""><td>xy421/851/192861</td><td>Stanord St Turper Pd</td><td>Charlton</td><td>Unnamed Into Tucker Pond</td><td>Buffumville Lake Little B</td><td>5</td><td>5</td><td>3</td><td>5</td><td>3</td><td>2</td><td>5</td><td>3</td><td>3</td><td>15</td><td>15</td><td>9</td><td>15</td><td>9</td><td>15</td><td>2/</td><td>0.54</td><td>Modium</td></thdes<></thdescription<>	xy421/851/192861	Stanord St Turper Pd	Charlton	Unnamed Into Tucker Pond	Buffumville Lake Little B	5	5	3	5	3	2	5	3	3	15	15	9	15	9	15	2/	0.54	Modium
number Orden Other Intrody (LackSite) 5 6 5 6 7 5 7 7 7	xy4215/01/192118	Stafford St	Charlton	Little River	Buffumville Lake-Little R.	2	3	5	5	2	3	2	4	3	12	15	9	15	0	15	20.5	0.53	Modium
Openet in the state	xy4210329/1948/6	Cemetery Road	Charlton	Little River	Buffumville Lake Little P	2	5	4	5	1	2	2	4	1	0	5	12	12	0 16	5	20.5	0.53	Medium
Internet (in the number of the numb	xy421/303/193044	Northside Rd	Charlton	Unnamed	Buffumville Lake Little P	5	5	4	5	1	3	2	3	3	5	15	4	15	10	15	20.5	0.55	Medium
model considi Considi <thc< td=""><td>xy42158147196473</td><td>J Hammond Rd</td><td>Charlton</td><td>Unnamed</td><td>Buffumville Lake-Little R</td><td>3</td><td>4</td><td>4</td><td>5</td><td>1</td><td>3</td><td>2</td><td>3</td><td>3</td><td>9</td><td>12</td><td>17</td><td>15</td><td>6</td><td>15</td><td>25.5</td><td>0.51</td><td>Medium</td></thc<>	xy42158147196473	J Hammond Rd	Charlton	Unnamed	Buffumville Lake-Little R	3	4	4	5	1	3	2	3	3	9	12	17	15	6	15	25.5	0.51	Medium
multiplicity control control intermine intermine <th< td=""><td>xy42153827193982</td><td>Carroll Hill Rd</td><td>Charlton</td><td>Unnamed</td><td>Buffumville Lake-Little R</td><td>5</td><td>5</td><td>4</td><td>5</td><td>1</td><td>1</td><td>5</td><td>3</td><td>1</td><td>5</td><td>5</td><td>4</td><td>5</td><td>15</td><td>5</td><td>25.5</td><td>0.5</td><td>Medium</td></th<>	xy42153827193982	Carroll Hill Rd	Charlton	Unnamed	Buffumville Lake-Little R	5	5	4	5	1	1	5	3	1	5	5	4	5	15	5	25.5	0.5	Medium
non-stand Outwood Outwood Outwood Non-stand Non-	xy42183977195290	Gould Rd	Charlton	Unnamed	Buffumville Lake-Little R	5	5	4	5	1	1	5	3	1	5	5	4	5	15	5	25	0.5	Medium
model model <th< td=""><td>xy42141577195023</td><td>Old Worcester Rd</td><td>Charlton</td><td>Unnamed</td><td>Buffumville Lake-Little R.</td><td>1</td><td>1</td><td>4</td><td>5</td><td>1</td><td>1</td><td>5</td><td>3</td><td>1</td><td>1</td><td>1</td><td>4</td><td>5</td><td>15</td><td>5</td><td>25</td><td>0.5</td><td>Medium</td></th<>	xy42141577195023	Old Worcester Rd	Charlton	Unnamed	Buffumville Lake-Little R.	1	1	4	5	1	1	5	3	1	1	1	4	5	15	5	25	0.5	Medium
number link Outs Unromedia Link S S S S </td <td>xy42128277194621</td> <td>Bond Rd</td> <td>Charlton</td> <td>Unnamed</td> <td>Buffumville Lake-Little R.</td> <td>5</td> <td>5</td> <td>4</td> <td>2</td> <td>1</td> <td>1</td> <td>5</td> <td>3</td> <td>1</td> <td>5</td> <td>5</td> <td>4</td> <td>2</td> <td>15</td> <td>5</td> <td>25</td> <td>0.5</td> <td>Medium</td>	xy42128277194621	Bond Rd	Charlton	Unnamed	Buffumville Lake-Little R.	5	5	4	2	1	1	5	3	1	5	5	4	2	15	5	25	0.5	Medium
number Intermediation (no. I	xy42152637195905	Northside Rd	Charlton	Unnamed	Buffumville Lake-Little R.	5	5	3	2	1	1	5	3	1	5	5	3	2	15	5	25	0.5	Medium
weblestell <th< td=""><td>xy42162427193267</td><td>Hammond Hill Rd</td><td>Charlton</td><td>Little River</td><td>Buffumville Lake-Little R.</td><td>1</td><td>1</td><td>3</td><td>5</td><td>2</td><td>3</td><td>1</td><td>3</td><td>3</td><td>3</td><td>3</td><td>9</td><td>15</td><td>3</td><td>15</td><td>24</td><td>0.48</td><td>Medium</td></th<>	xy42162427193267	Hammond Hill Rd	Charlton	Little River	Buffumville Lake-Little R.	1	1	3	5	2	3	1	3	3	3	3	9	15	3	15	24	0.48	Medium
Phylony A+ Phane M Outman Outman Informite Lake.Uter, 3 4 4 2 1 3 2 3 9 12 12	xy42161027196751	Stafford St	Charlton	Unnamed	Buffumville Lake-Little R.	3	4	3	2	3	2	3	3	3	9	12	9	6	9	12	22.5	0.45	Medium
web made dimmine lake-lake lake,	xy42110777191657	AF Putnam Rd	Charlton	Unnamed	Buffumville Lake-Little R.	3	4	4	2	1	3	2	3	3	9	12	12	6	6	12	21	0.42	Medium
mm2125371938Maget IndiaMareeBuffamile Lak-Lithe In551552755 </td <td>xy42131187192927</td> <td>Richardson Corner Rd</td> <td>Charlton</td> <td>Unnamed</td> <td>Buffumville Lake-Little R.</td> <td>5</td> <td>5</td> <td>3</td> <td>5</td> <td>2</td> <td>1</td> <td>3</td> <td>3</td> <td>2</td> <td>10</td> <td>10</td> <td>6</td> <td>10</td> <td>9</td> <td>10</td> <td>19.5</td> <td>0.39</td> <td>Medium</td>	xy42131187192927	Richardson Corner Rd	Charlton	Unnamed	Buffumville Lake-Little R.	5	5	3	5	2	1	3	3	2	10	10	6	10	9	10	19.5	0.39	Medium
mp1232337 mp1 mp1 mp11 mp111 mp111 <	xy42134547194385	Mugget Hill Rd	Charlton	Unnamed	Buffumville Lake-Little R.	5	5	3	5	2	2	2	3	2	10	10	6	10	6	10	18	0.36	Medium
wheeles behade	xy42132337193594	Oxford Rd	Charlton	Unnamed	Buffumville Lake-Little R.	5	5	3	5	2	1	2	3	2	10	10	6	10	6	10	18	0.36	Medium
mp2112737398.38Old Ordrif IOutrom IMuturwile Lake Little R1112511222224104101010.3410mp211677713883Ordrom IUnamedMuturwile Lake Little R111	xy42145557192463	Richardson Corner Rd	Charlton	Unnamed	Buffumville Lake-Little R.	5	5	4	2	1	1	5	2	1	5	5	4	2	10	5	17.5	0.35	Medium
my24117757838Mean<	xy42119277190458	Old Oxford Rd	Charlton	unamed	Buffumville Lake-Little R.	1	1	2	5	1	2	2	2	2	2	2	4	10	4	10	17	0.34	Low
yq211721795501/0000name0name0ndium ulta like01/0000	xy42166777192888	Meadow lane	Charlton	Unnamed	Buffumville Lake-Little R.	1	1	3	1	1	3	2	3	3	3	3	9	3	6	9	16.5	0.33	Low
yq2127971963jone forOright (Oright (Buffunylic labe-Utile R, oright (11<	xy42141177195195	Old Worcester Rd	Charlton	Unnamed	Buffumville Lake-Little R.	3	4	4	5	1	2	1	3	2	6	8	8	10	3	10	16.5	0.33	Low
vp21200719523 Old Morester M Orande Burnande Luitle Luitle, 5 5 5 5 7 7 7 7 </td <td>xy42177627196108</td> <td>Jones Rd</td> <td>Charlton</td> <td>Little River</td> <td>Buffumville Lake-Little R.</td> <td>1</td> <td>1</td> <td>4</td> <td>5</td> <td>1</td> <td>2</td> <td>1</td> <td>3</td> <td>2</td> <td>2</td> <td>2</td> <td>8</td> <td>10</td> <td>3</td> <td>10</td> <td>16.5</td> <td>0.33</td> <td>Low</td>	xy42177627196108	Jones Rd	Charlton	Little River	Buffumville Lake-Little R.	1	1	4	5	1	2	1	3	2	2	2	8	10	3	10	16.5	0.33	Low
my242s3773463 Book More Darkin Unamed Buffunvile Lake-Litte M 5 5 3 2 1 3 2 10 10 6 4 5 5 30 10 my242s3773463 Book More Darkin Unamed Buffunvile Lake-Litte M 5 5 4 5 1 1 3 3 1 5 5 4 5 5 4 5 5 4 5 5 4 5 5 4 5 5 4 5 5 4 5 5 4 5 5 4 5 5 4 5 5 4 5 5 4 5 5 4 5 5 4 5 5 4 5 5 4 5<	xy42140307195328	Old Worcester Rd	Charlton	Unnamed	Buffumville Lake-Little R.	5	5	3	5	1	2	1	3	2	10	10	6	10	3	10	16.5	0.33	Low
my22283719808 imported	xy42132677194633	Bond Rd	Charlton	Unnamed	Buffumville Lake-Little R.	5	5	3	2	1	2	1	3	2	10	10	6	4	3	10	16.5	0.33	Low
xq242x719518 lally Lane Chrinto Unnamed Buffurmile Lake-Litte R. 5 5 4 5 5 5 6 6 0.22 Low xq212x1719264 Coung Act Chrinto Unnamed Buffurmile Lake-Litte R. 5 5 6 1 1 3 3 1 5 5 6 6 0.22 Low xq212x1719264 Curlito Minito Minito Minito Minito Lake-Litte R. 5 5 4 5 5 6 0.22 Low xq223x1719750 Banch Mill Goad Series Minito Min	xy42168537194808	Brook Drive	Charlton	Little River	Buffumville Lake-Little R.	5	5	3	2	1	2	1	3	2	10	10	6	4	3	10	16.5	0.33	Low
wd21x47195244 Gould A Gradin Manade Buffurmile Lake-Little R 5 5 1 5 5 4 5 9 5 16 0.32 Low wd212671925555 Hild Maget Rad Gradin Innamed Buffurmile Lake-Little R 5 5 3 1 5 5 3 2 9 5 16 0.32 Low wd220781975575 Bach Mill Managet Rad Spence Innamed Buffurmile Lake-Little R 5 3 2 1 1 3 3 1 5 5 3 2 9 5 16 0.32 Low wd22078197578 Bach Mill Managet Buffurmile Lake-Little R 5 3 2 1 1 3 3 1 5 5 3 2 9 4 155 0.3 Low Wd21491918245 wd214041918245 Bord Mill Buffurmile Lake-Little R 3 4 2 1 4 4 6 4 6 16 0.3 Low wd214049192855 Divide Mil	xy42085247195198	Lallys Lane	Charlton	Unnamed	Buffumville Lake-Little R.	5	5	4	5	1	1	3	3	1	5	5	4	5	9	5	16	0.32	Low
xy2122747129245 Norman Charton Unamedic Buffurwile Lake-Little R. 5 5 7 7 5 9 5 10 0.2 Ltmax xy21247979565 Ritch Migae Spence Unamedic Buffurwile Lake-Little R. 5 5 1 1 3 3 1 5 5 3 2 9 5 16 0.32 Low xy21257975755 Bach Mill Road Spence Unamedic Buffurwile Lake-Little R. 5 5 3 1 5 5 3 2 9 5 16 0.32 Low xy2121797575 Banch Mill Diamedic Buffurwile Lake-Little R. 3 4 2 1 3 3 1 3 3 1 3 3 1 3 3 1 3 1 3 3 1 3 3 1 3 3 1 3 3 1 3 3 1	xy42174177196244	Gould Rd	Charlton	Unnamed	Buffumville Lake-Little R.	5	5	4	5	1	1	3	3	1	5	5	4	5	9	5	16	0.32	Low
xy22479719565 Ulter Mugget Road Charton Unamed Buffumvile Lettler, 5 5 3 2 9 5 16 0.32 Low xy220787197544 Eat Charton Road Spence Unamed Buffumvile Lettler, 5 5 4 1 5 5 4 1 9 5 16 0.32 Low xy220781737544 Eat Charton Road Spence Unamed Buffumvile Lettler, 5 5 4 1 1 3 3 1 5 5 4 15 0.32 Low xy2202713747 Eat Charton Road Spence Unamed Buffumvile Lake-Little, R 4 3 2 1 2 4 2 4 4 4 4 5 0.3 0.4 0.4 0.4 15 0.3 0.4 </td <td>xy42162747192455</td> <td>A Young Rd</td> <td>Charlton</td> <td>Unnamed</td> <td>Buffumville Lake-Little R.</td> <td>5</td> <td>5</td> <td>3</td> <td>5</td> <td>1</td> <td>1</td> <td>3</td> <td>3</td> <td>1</td> <td>5</td> <td>5</td> <td>3</td> <td>5</td> <td>9</td> <td>5</td> <td>16</td> <td>0.32</td> <td>Low</td>	xy42162747192455	A Young Rd	Charlton	Unnamed	Buffumville Lake-Little R.	5	5	3	5	1	1	3	3	1	5	5	3	5	9	5	16	0.32	Low
xy422027373753 Baon Hill Road Spence Unnamed Buffurmile Lake-Little R. 5 5 4 1 1 1 3 3 1 5 5 3 2 9 5 16 0.32 Low xy42137137484 East Charlton Roda Spence Unnamed Buffurmile Lake-Little R. 5 5 4 1 1 1 3 3 1 5 5 4 1 0.2 Low xy42137137484 East Charlton Roda Spence Unnamed Buffurmile Lake-Little R. 3 4 2 1 4 4 4 4 4 5 5 0.3 Low xy4214375137857 Colum Unnamed Buffurmile Lake-Little R. 3 2 1 1 3 3 1 4 4 4 6 8 6 2 4 6 0.3 Low 3 2 1 1 3 2 1 1 3 2 1 1 1 3 3 1 1 1 </td <td>xy42164797196567</td> <td>Little Mugget Road</td> <td>Charlton</td> <td>Unnamed</td> <td>Buffumville Lake-Little R.</td> <td>5</td> <td>5</td> <td>3</td> <td>2</td> <td>1</td> <td>1</td> <td>3</td> <td>3</td> <td> 1</td> <td>5</td> <td>5</td> <td>3</td> <td>2</td> <td>9</td> <td>5</td> <td>16</td> <td>0.32</td> <td>Low</td>	xy42164797196567	Little Mugget Road	Charlton	Unnamed	Buffumville Lake-Little R.	5	5	3	2	1	1	3	3	1	5	5	3	2	9	5	16	0.32	Low
xy42195719744/4 5 st Charlton Road 5 st Charlto	xy42202787197525	Bacon Hill Road	Spencer	Unnamed	Buffumville Lake-Little R.	5	5	3	2	1	1	3	3	1	5	5	3	2	9	5	16	0.32	Low
xy4211241719452 bond Rd bond	xy42195177197446	East Charlton Road	Spencer	Unnamed	Buffumville Lake-Little R.	5	5	4	1	1	1	3	3	1	5	5	4	1	9	5	16	0.32	Low
xy4242029/19/4/8 tast hariton idde spece Unnamed Buffumile Lake-Little R, 4 4 3 2 1 1 1 4 4 3 2 9 4 15 0.31 Low xy421403719825 Oluw mdd Charton Unnamed Buffumile Lake-Little R, 3 3 2 1 2 4 6 4 6 8 6 15 0.31 Low xy421403719825 Oldw Orcrester Rd Charton Unnamed Buffumile Lake-Little R, 5 0 0 1 2 0 0 2 10 0	xy42112417194562	Bond Rd	Charlton	Unnamed	Buffumville Lake-Little R.	3	3	4	2	1	1	3	3	1	3	3	4	2	9	4	15.5	0.31	Low
xy42143/1938/s Colum nd Marmed Buffumville lake-luttle R. 2 3 2 1 2 2 4 6 4 4 6 6 15 0.3 Low xy421407193212 Bay Bark Rd Charto Unnamed Buffumville lake-luttle R. 5 5 0 0 1 2 2 1 4 6 4 6 8 6 2 4 6 10 15 0.3 Low xy421407192322 Partridge Hill Rd Charto Unnamed Buffumville lake-luttle R. 4 4 4 4 6 4 6 4 6 10 15 0.3 Low xy421007192032 Partridge Hill Rd Charto Unnamed Buffumville lake-luttle R. 4 4 6 1 1 3 2 1 4 2 8 6 2 4 6 4 4 6 4 4 6 4 4 6 4 4 6 4 4 6 4 4 6<	xy42202297197478	East Charlton Rd	Spencer	Unnamed	Buttumville Lake-Little R.	4	4	3	2	1	1	3	3	1	4	4	3	2	9	4	15.5	0.31	Low
xy4240907192219 gay rath rd Charton Unnamed Burfumylie Lake-Little R. 3 4 3 2 1 2 3 2 6 8 6 4 6 8 15 0.3 Low xy421093719283 Patridge Hill R/W orcester RI Charton Unamed Burfumylie Lake-Little R. 5 5 0 0 1 2 2 1 4 2 8 6 2 4 8 14 0.28 Low xy42109307319283 Patridge Hill RW Charton South Fork Niver Burfumylie Lake-Little R. 3 4 3 1 1 2 1 4 2 6 8 6 2 4 8 14 0.28 Low xy4210407193669 Olige Ct Charton Unamed Burfumylie Lake-Little R. 2 3 2 4 6 4 6 12 0.24 Low xy4210407196151 Stafford St Oharton Unamed Burfumylie Lake-Little R. 5 5 3 2 3 1	xy42114437193875	Colburn Rd	Charlton	Unnamed	Buffumville Lake-Little R.	2	3	2	2	1	2	2	4	2	4	6	4	4	8	6	15	0.3	Low
xy424027 Jarbase On workset read On work Buffumville Lake-Little R. S S S D <thd< td=""><td>xy42149017192219</td><td>Bay Path Rd</td><td>Charlton</td><td>Unnamed</td><td>Buffumville Lake-Little R.</td><td>3</td><td>4</td><td>3</td><td>2</td><td>1</td><td>2</td><td>2</td><td>3</td><td>2</td><td>6</td><td>8</td><td>6</td><td>4</td><td>6</td><td>8</td><td>15</td><td>0.3</td><td>Low</td></thd<>	xy42149017192219	Bay Path Rd	Charlton	Unnamed	Buffumville Lake-Little R.	3	4	3	2	1	2	2	3	2	6	8	6	4	6	8	15	0.3	Low
xy42104307132532 ratrrage initial constrained oral made buttinuitie take-little R. 4 4 4 5 1 2 1 4 2 8 8 6 2 4 8 14 0.28 Low xy4200507191520 Potter Village Rd Charlton Unnamed Buffumville take-little R. 3 4 3 1 1 2 3 2 2 6 8 6 2 4 8 14 0.28 Low xy4200507191520 Polie Village Rd Charlton Unnamed Buffumville take-little R. 1 1 3 2 1 1 2 3 2 4 6 4 6 6 12 0.24 Low xy4210450719550 Paniels Road Charlton Unnamed Buffunville take-little R. 2 3 2 1 1 2 3 1 5 5 3 1 0 0 1 1 0 0 1 1 0 0 1 1 0 1 1	xy42142097194565	Old Worcester Rd	Charlton	Unnamed	Buffumville Lake-Little R.	5	5	0	0	1	2	0	0	2	10	10	0	0	0	10	15	0.3	Low
xy4209307/19120 rotter vinage ka charton south rotk kiver Buffumvile Lake-Little R. 3 4 3 1 1 2 1 4 2 6 8 6 2 4 8 14 0.28 Low xy4211197190203 Daje Ct Charton Unnamed Buffumvile Lake-Little R. 2 3 2 3 2	xy42104307192832	Partridge Hill Rd	Charlton	Unnamed	Buffumville Lake-Little R.	4	4	3	1	2	2	1	4	2	8	8	6	2	4	8	14	0.28	Low
xy+21111/19/19/200 Dolge Ct Charlton Junnine Lake-Little R. 1 1 3 2 1 2 2 5 4 6 6 12 0.24 Low xy42101607193669 Daniels Road Charlton Unnamed Buffumville Lake-Little R. 2 3 2 1 2 2 3 2 4 6 4 6 6 12 0.24 Low xy4210407193669 Daniels Road Charlton Unnamed Buffumville Lake-Little R. 2 3 2 1 1 2 3 2 4 6 4 6 6 12 0.24 Low xy42109487194331 Daniels Rod Charlton Unnamed Buffumville Lake-Little R. 5 5 3 2 1 1 5 5 3 2 3 1 5 5 3 2 6 5 11.5 0.23 Low xy42109487194331 Daniels Rod Charlton Unnamed Buffumville Lake-Little R. 5 5 3 2	xy42095057191520	Potter Village Kd	Charlton	South Fork River	Buttumville Lake-Little R.	3	4	3	1	1	2	1	4	2	6	8	ь	2	4	8	14	0.28	Low
xy+221040/15500 Damines Nadu Charlon Onnamed Dummine Lake-Little R. 2 3 2 4 6 4 4 6 6 12 0.24 Low xy42104017196151 Stafford St Charlton Unnamed Buffumville Lake-Little R. 2 3 2 1 1 2 3 2 4 6 6 12 0.24 Low xy42104017196151 Stafford St Charlton Unnamed Buffumville Lake-Little R. 2 3 2 1 1 2 3 2 4 6 6 12 0.24 Low xy42104017196151 Stafford St Charlton Unnamed Buffumville Lake-Little R. 5 5 3 2 1 1 2 3 1 5 5 3 2 1 0 3 1 5 5 3 2 6 4 4 6 11 0.22 Low xy42050727194446 Ramshorn Rd Charlton Unnamed Buffumville Lake-Little R. 5 3	xy4211119/190203	Donge Ct	Charlton	Unnamed	Buffumville Lake Little R.	1	1	3	2	1	2	2	3	2	2	2	ь	4	6	6	12	0.24	LOW
xy+21040/19031 Stational Charlon Unmanded Burfumilie Lake-Little R. 2 3 2 1 1 2 3 2 4 6 4 2 6 6 12 0.24 10000 xy42109487194331 Daniels Rd Charlton Unnamed Burfumilie Lake-Little R. 5 5 3 5 1 1 2 3 1 5 5 3 5 6 5 1.5 0.23 Low xy42097191342 Oxbow Rd Charlton Unnamed Burfumilie Lake-Little R. 5 5 3 2 1 1 2 3 1 5 5 3 5 6 5 1.5 0.23 Low xy42157407191542 Oxbow Rd Charlton Little River Burfumilie Lake-Little R. 5 5 3 2 1 1 2 2 2 2 6 4 4 6 11.5 0.23 Low xy42157407191542 Oxbow Rd Charlton Unnamed Buffumilie Lake-Little R.	xy4210160/193669	Daniels Koad	Charlton	Unnamed	Durrumville Lake-Little K.	2	3	2	2	1	2	2	3	2	4	6	4	4	C	C	12	0.24	LOW
xy4209572719446 Charles for $C - C - C - C - C - C - C - C - C - C $	xy42164017196151	Daniels Rd	Charlton	Unnamed	Buffumville Lake-Little R	2 5	3	2	1	1	2	2	3	2	4	5	4	2	6	5	11 5	0.24	LOW
Average function Clarifier During trace-latter R. 5 5 5 5 6 1 6 11.5 0.23 1000 xy4215747191542 Oxbow Rd Charlton Little River Buffumilie Lake-Little R. 1 1 3 2 1 1 3 2 1 4 2 2 6 4 4 6 11.5 0.23 Low xy421547191542 Oxbow Rd Charlton Unamed Buffumilie Lake-Little R. 1 1 3 2 1 4 2 2 6 4 4 6 11.5 0.23 Low xy4201217193746 Charlton Unamed Buffumilie Lake-Little R. 5 5 3 2 1 1 2 2 6 4 6 11.5 0.23 Low xy4201217193746 Colum Rd Charlton Unamed Buffumilie Lake-Little R. 5 5 3 2 1 1 5 5 3 2 1 5 5 3 2 4 5 <td>xy+2109467194331</td> <td>Pamshorn Pd</td> <td>Charlton</td> <td>Unnamed</td> <td>Buffumville Lake-Little R.</td> <td>5</td> <td>5</td> <td>3</td> <td>2</td> <td>1</td> <td>1</td> <td>2</td> <td>2</td> <td></td> <td>5</td> <td>5</td> <td>3</td> <td>2</td> <td>6</td> <td>5</td> <td>11.5</td> <td>0.25</td> <td>Low</td>	xy+2109467194331	Pamshorn Pd	Charlton	Unnamed	Buffumville Lake-Little R.	5	5	3	2	1	1	2	2		5	5	3	2	6	5	11.5	0.25	Low
xy421970111472 Oxform full Charlon Little river Duffumilie Lake-Little R. 1 1 1 1 1 2 1 4 2 2 0 4 4 6 11 0.22 Little river xy4209042719376 Daniels Rd Charlon Unnamed Buffumilie Lake-Little R. 5 5 3 2 1 1 5 5 3 2 1 5 5 3 2 1 1 2 2 1 5 5 3 2 1 5 5 3 2 1 5 5 3 2 1 5 5 3 2 1 5 5 3 2 1 5 5 3 2 1 <td>xy42095727194446</td> <td>Oxbow Rd</td> <td>Charlton</td> <td>Little River</td> <td>Buffumville Lake Little R.</td> <td>5</td> <td>5</td> <td>2</td> <td>2</td> <td>1</td> <td>2</td> <td>1</td> <td>د ۱</td> <td></td> <td>2</td> <td>2</td> <td>5</td> <td>2</td> <td>1</td> <td>5</td> <td>11.5</td> <td>0.23</td> <td>Low</td>	xy42095727194446	Oxbow Rd	Charlton	Little River	Buffumville Lake Little R.	5	5	2	2	1	2	1	د ۱		2	2	5	2	1	5	11.5	0.23	Low
xy42151715176Collarity of mainingOffinitingDuffurning Calcebra 3 3 2 1 1 2 2 1 3 3 2 4 5 9.5 0.19 LOWxy4212137193176Colburn RdCharltonUnnamedBuffurning Calcebra 5 5 3 2 1 1 2 2 1 5 5 3 2 4 5 9.5 0.19 LOWxy42138547191196Turner RdCharltonLittle RiverBuffurning Lake-Little R. 5 5 3 1 1 1 4 1 5 5 3 1 4 5 9.5 0.19 Lowxy421537191487GlenmareCharltonLittle RiverBuffurning Lake-Little R. 5 5 3 1 1 1 4 2 2 4 4 9.5 0.19 Lowxy421537191487GlenmareCharltonLittle RiverBuffurning Lake-Little R. 1 1 1 1 1 4 2 2 4 4 9.5 0.19 Lowxy421537191487GlenmareCharltonLittle RiverBuffurning Lake-Little R. 1 1 1 1 1 1 1 1 2 1 <t< td=""><td>xy42137407191542</td><td>Daniels Rd</td><td>Charlton</td><td></td><td>Buffumville Lake Little P</td><td>L L</td><td>E .</td><td>2</td><td>2</td><td>1</td><td>2</td><td>2</td><td>3</td><td>2</td><td>2 5</td><td>2 5</td><td>2</td><td>4</td><td>4</td><td>5</td><td>11</td><td>0.22</td><td>Low</td></t<>	xy42137407191542	Daniels Rd	Charlton		Buffumville Lake Little P	L L	E .	2	2	1	2	2	3	2	2 5	2 5	2	4	4	5	11	0.22	Low
$xy42131547191196 \text{Under Window Charles Utility River} \qquad Buffumilie Lake-Little R. 5 5 5 3 1 1 1 2 1 1 5 5 3 1 4 5 9.5 0.19 LOW \\ xy42138547191196 \text{Under Window Charles Utility River} \qquad Buffumilie Lake-Little R. 5 5 3 1 1 1 1 1 1 4 1 5 5 3 1 4 5 9.5 0.19 LOW \\ xy42151911916 \text{Under Window Charles Utility River} \qquad Buffumilie Lake-Little R. 5 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 $	xy4203042/193/40	Colburn Rd	Charlton	Unnamed	Buffumville Lake Little R	5	5	3	2	1	1	2	2		5	5	2	2	4	5	9.5	0.19	Low
$A_{T} = 2300 + 772100 + 77101427 = 0$ (denote a twee reverted by the final scale little Barer = Burger with the Barer = Burg	xy+211213/1331/0	Turper Rd	Charlton	Little River	Buffumville Lake-Little R	5	5	2	2	1	1	1	4		5	5	2	2	4	5	9.5	0.19	Low
AYTALJILITAT VIEWEE VIEWE	xy42157197191487	Glenmere	Charlton	Little River	Buffumville Lake-Little R	1	1	2	1	1	2	1	4	2	2	2	4	2	4	4	8	0.16	Low

XY Code	Road Name	Town	Stream Name	HUC 12 Watershed Name	Existing Hydraulic Risk Score-Binned	Future Hydraulic Risk Score-Binned	Geomorphic Vulnerability Score	Structural Condition Score	Transportation Disruption Score	Flood Impact Potential Score	AOP Score	Ecological Benefit Score	lmpact Score	Existing Hydraulic Risk Score	Future Hydraulic Risk Score	Geomorphic Risk Score	Structural Risk Score	AOP Benefit Score	Crossing Risk Score	Crossing Priority Value	Scaled Crossing Priority	Relative Priority Rating
xy42087307198010	East Baylies Rd	Charlton	Unnamed	Cady Brook-Quinebaug R.	5	5	3	5	1	4	3	3	4	20	20	12	20	9	20	34.5	0.69	High
xy42156087197349	Stafford St.	Charlton	Unnamed	Cady Brook-Quinebaug R.	5	5	4	2	3	4	3	3	4	20	20	16	8	9	20	34.5	0.69	High
xy42096677198620	Blood Rd	Charlton	Unnamed	Cady Brook-Quinebaug R.	5	5	3	2	1	4	3	3	4	20	20	12	8	9	20	34.5	0.69	High
xy42156627197367	Center Depot Rd	Charlton	Unnamed	Cady Brook-Quinebaug R.	5	5	3	2	3	4	3	3	4	20	20	12	8	9	20	34.5	0.69	High
xy42130987196310	Freeman rd	Charlton	Unnamed	Cady Brook-Quinebaug R.	4	5	3	1	1	4	3	3	4	16	20	12	4	9	20	34.5	0.69	High
xy42161187200811	Brookfield Rd	Charlton	Unnamed	Cady Brook-Quinebaug R.	5	5	3	5	2	4	2	3	4	20	20	12	20	6	20	33	0.66	High
xy42111857201283	Rt 169/ Southbridge Rd	Charlton	Unnamed	Cady Brook-Quinebaug R.	1	1	4	5	4	3	3	2	4	4	4	16	20	6	20	33	0.66	High
xy42149767198830	City depot rd	Charlton	Cady Brook	Cady Brook-Quinebaug R.	3	4	3	5	3	4	1	4	4	12	16	12	20	4	20	32	0.64	High
xy42087757198556	Saundersdale Rd	Charlton	Unnamed	Cady Brook-Quinebaug R.	5	5	2	1	1	4	1	4	4	20	20	8	4	4	20	32	0.64	High
xy42106617201530	Southbridge Rd	Charlton	Unnamed	Cady Brook-Quinebaug R.	2	3	3	5	4	2	2	2	4	8	12	12	20	4	20	32	0.64	High
xy42106447196847	Fitzgerald Rd	Charlton	Unnamed	Cady Brook-Quinebaug R.	5	5	4	5	1	3	5	3	3	15	15	12	15	15	15	30	0.6	High
xy42162337201150	Jennings Rd	Charlton	Unnamed	Cady Brook-Quinebaug R.	0	0	4	5	1	3	5	3	3	0	0	12	15	15	15	30	0.6	High
xy42140167196908	L Stevens rd	Charlton	Unnamed	Cady Brook-Quinebaug R.	5	5	4	2	1	3	5	3	3	15	15	12	6	15	15	30	0.6	High
xy42114817197758	Flint Rd	Charlton	Unnamed	Cady Brook-Quinebaug R.	5	5	3	2	1	3	5	3	3	15	15	9	6	15	15	30	0.6	High
xy42086917197636	Saundersdale Rd	Charlton	Unnamed	Cady Brook-Quinebaug R.	1	2	4	2	1	3	5	3	3	3	6	12	6	15	12	28.5	0.57	High
xy42111057198161	Flint Rd	Charlton	Unnamed	Cady Brook-Quinebaug R.	5	5	3	5	1	3	3	4	3	15	15	9	15	12	15	28.5	0.57	High
xy42132677196532	Old Mugget Hill Rd	Charlton	Unnamed	Cady Brook-Quinebaug R.	5	5	3	2	1	3	4	3	3	15	15	9	6	12	15	28.5	0.57	High
xy42173857197799	Rt 31	Charlton	Unnamed	Cady Brook-Quinebaug R.	0	0	4	5	1	2	5	3	2	0	0	8	10	15	10	27.5	0.55	High
xy42126877195771	Freeman Rd	Charlton	Unnamed	Cady Brook-Quinebaug R.	5	5	4	5	1	3	3	3	3	15	15	12	15	9	15	27	0.54	Medium
xy4216101/19/4/0	French Rd	Charlton	Unnamed	Cady Brook-Quinebaug R.	5	5	3	5	1	3	3	3	3	15	15	9	15	9	15	27	0.54	Medium
XV42162687200688	Fitzgerald Rd	Charlton	Unnamed	Cady Brook-Quinebaug R.	5	5	4	3	1	3	3	3	3	15	15	12	9	9	15	27	0.54	Modium
xv42091887197995	Fast Baylies Rd	Charlton	Unnamed	Cady Brook-Quinebaug R.	5	5	3	2	1	3	3	3	3	15	15	9	6	9	15	27	0.54	Medium
xy42142517198085	Masonic Home Rd	Charlton	Unnamed	Cady Brook-Quinebaug R.	5	5	4	2	3	2	3	3	3	15	15	12	6	9	15	27	0.54	Medium
xy42113347200846	Harrington Rd	Charlton	Unnamed	Cady Brook-Quinebaug R.	2	3	3	5	1	3	4	2	3	6	9	9	15	8	15	26.5	0.53	Medium
xy42133017196236	Old Muggett Hill Rd	Charlton	Unnamed	Cady Brook-Quinebaug R.	5	5	4	5	1	3	2	3	3	15	15	12	15	6	15	25.5	0.51	Medium
xy42131217196233	Mugget Hill Rd	Charlton	Unnamed	Cady Brook-Quinebaug R.	1	2	3	5	2	3	2	3	3	3	6	9	15	6	15	25.5	0.51	Medium
xy42106537197190	Baylies Rd	Charlton	Unnamed	Cady Brook-Quinebaug R.	5	5	3	2	1	3	2	3	3	15	15	9	6	6	15	25.5	0.51	Medium
xy42189937198728	Charlton Rd	Spencer	Pratt Brook	Cady Brook-Quinebaug R.	5	5	3	1	2	3	2	3	3	15	15	9	3	6	15	25.5	0.51	Medium
xy42130787200373	Rt 169/Southbridge rd	Charlton	Unnamed	Cady Brook-Quinebaug R.	3	4	2	5	3	2	3	2	3	9	12	6	15	6	15	25.5	0.51	Medium
xy42121127199192	T Hall Rd	Charlton	Unnamed	Cady Brook-Quinebaug R.	5	5	4	5	1	1	5	3	1	5	5	4	5	15	5	25	0.5	Medium
xy42182517197340 xy42136907196850	Old Spencer Road	Charlton	Unnamed	Cady Brook-Quinebaug R.	4	5	4	5	1	1	5	3	3	4	5	4	5 15	15	5 15	25	0.5	Medium
xy42121757195680	Ereeman Bd	Charlton	Unnamed	Cady Brook-Quinebaug R.	5	5	2	5	1	3	1	3	3	15	15	6	15	3	15	24	0.48	Medium
xy42148377198910	Brookfield Rd	Charlton	Cady Brook	Cady Brook-Quinebaug R.	5	5	2	1	3	3	1	3	3	15	15	6	3	3	15	24	0.48	Medium
xy42138947200830	Capen	Charlton	Unnamed	Cady Brook-Quinebaug R.	5	5	3	2	1	2	4	3	2	10	10	6	4	12	10	23	0.46	Medium
xy42158627197801	J Davis Rd	Charlton	Unnamed	Cady Brook-Quinebaug R.	5	5	0	0	1	3	0	0	3	15	15	0	0	0	15	22.5	0.45	Medium
xy42083537198917	Saundersdale Rd	Charlton	Unnamed	Cady Brook-Quinebaug R.	3	4	2	1	1	3	2	4	3	9	12	6	3	8	12	22	0.44	Medium
xy42177687201045	North Sturbridge Rd	Charlton	Unnamed	Cady Brook-Quinebaug R.	5	5	5	5	1	1	4	3	1	5	5	5	5	12	5	20.5	0.41	Medium
xy42095477196408	Number 6 Schoolhouse Rd	Charlton	Unnamed	Cady Brook-Quinebaug R.	5	5	4	2	1	1	4	3	1	5	5	4	2	12	5	20.5	0.41	Medium
xy42099757197835	E Baylies Rd	Charlton	Unnamed	Cady Brook-Quinebaug R.	5	5	3	2	1	1	3	4	1	5	5	3	2	12	5	20.5	0.41	Medium
XY42161437198682	City Depot Rd	Charlton	Unnamed	Cady Brook-Quinebaug R.	1	1	4	1	3	2	2	2	3	3	3	12	3	4	12	10.5	0.4	Modium
xv42106337201203	Harrington Rd	Charlton	Unnamed	Cady Brook-Quinebaug R.	5	5	5	5	1	2	3	3	2	10	10	10	10	9	10	19.5	0.39	Medium
xv42114917198523	Burlingame Rd	Charlton	Unnamed	Cady Brook-Quinebaug R.	2	3	3	5	1	2	3	3	2	4	6	6	10	9	10	19.5	0.39	Medium
xy42172927198463	N. Sturbridge Rd.	Charlton	Unnamed	Cady Brook-Quinebaug R.	4	5	2	5	1	2	3	3	2	8	10	4	10	9	10	19.5	0.39	Medium
xy42174737197712	Old Spencer Road	Charlton	Unnamed	Cady Brook-Quinebaug R.	1	1	3	2	1	3	3	3	3	3	3	9	6	9	9	18	0.36	Medium
xy42105187198986	Guelphwood Rd	Charlton	Unnamed	Cady Brook-Quinebaug R.	5	5	3	5	1	2	2	3	2	10	10	6	10	6	10	18	0.36	Medium
xy42112477195971	off Freeman Rd	Charlton	Unnamed	Cady Brook-Quinebaug R.	5	5	3	5	1	2	2	3	2	10	10	6	10	6	10	18	0.36	Medium
xy42112277196178	Private road, off Freeman Rd	Charlton	Unnamed	Cady Brook-Quinebaug R.	5	5	2	5	1	2	2	3	2	10	10	4	10	6	10	18	0.36	Medium
xy42142567198722	Gillespie road	Charlton	Unnamed	Cady Brook-Quinebaug R.	5	5	3	2	1	2	2	3	2	10	10	6	4	6	10	18	0.36	Medium
xy4210/05/19/112	Dresser Hill Kd	Charlton	Unnamed	Cady Brook-Quinebaug R.	4	5	2	1	2	2	2	3	2	8	10	4	2	6	10	18	0.36	Medium
xy42102267198637	Blood Rd	Charlton	Unnamed	Cady Brook-Quinebaug R.	5	5	3	5	1	2	2	2	2	10	10	6	201	4	10	16 5	0.34	Low
xy42145297199404	S Sturbridge Rd	Charlton	Unnamed	Cady Brook-Quinebaug R.	5	5	2	5	1	2	1	3	2	10	10	4	10	3	10	16.5	0.33	Low
xy42154847200829	North Sullivan Rd	Charlton	Unnamed	Cady Brook-Quinebaug R.	5	5	2	5	1	1	3	3	1	5	5	2	5	9	5	16	0.32	Low
xy42126987197546	Burlingame Rd	Charlton	Unnamed	Cady Brook-Quinebaug R.	5	5	3	2	1	1	3	3	1	5	5	3	2	9	5	16	0.32	Low
xy42144697200588	Sullivan Rd	Charlton	Unnamed	Cady Brook-Quinebaug R.	2	3	3	1	1	3	1	3	3	6	9	9	3	3	9	15	0.3	Low
xy42105957201225	Harrington Rd	Charlton	Unnamed	Cady Brook-Quinebaug R.	5	5	4	2	1	1	4	2	1	5	5	4	2	8	5	14.5	0.29	Low
xy42090427198544	Blood Rd	Charlton	Unnamed	Cady Brook-Quinebaug R.	1	1	2	1	1	4	1	4	4	4	4	8	4	4	8	14	0.28	Low
xy42110377201340	Rt 169/ Southbridge Rd	Charlton	Cady Brook	Cady Brook-Quinebaug R.	1	1	2	1	4	3	1	4	4	4	4	8	4	4	8	14	0.28	Low
xy42119347200890	Southbridge Rd	Charlton	Cady Brook	Cady Brook-Quinebaug R.	1	1	2	1	4	1	1	4	4	4	4	8	4	4	8	14	0.28	Low
xy42120787198245	Burlingame Rd	Charlton	Unnamed	Cady Brook-Quinebaug R.	2	3	4	5	1	1	2	3	1	2	3	4	5	6	5	11.5	0.23	Low
xy4210899/199566	Pumpkin Lane	Charlton	Unnamed	Cady Brook-Quinebaug R.	5	5	3	2	1	1	2	3	1	5	5	3	2	ь	5	11.5	0.23	LOW

Appendix B—Table 1 (continued). Road-Stream Crossing Scoring and Prioritization Results, organized by watershed and overall crossing priority scores. (Page 2 of 4)

XY Code	Road Name	Town	Stream Name	HUC 12 Watershed Name	Existing Hydraulic Risk Score-Binned	Future k Hydraulic Risk Score-Binned	Geomorphic Vulnerability Score	Structural Condition Score	Transportation Disruption Score	Flood Impact Potential Score	AOP Score	Ecological Benefit Score	lmpact Score	Existing Hydraulic Risk Score	Future Hydraulic Risk Score	Geomorphic Risk Score	< Structural . Risk Score	AOP Benefit Score	Crossing Risk Score	Crossing Priority Value	Scaled Crossing Priority	Relative Priority Rating
xy42175207199213	North Sturbridge rd	Charlton	Pratt Brook	Cady Brook-Quinebaug R.	5	5	3	2	1	1	2	3	1	5	5	3	2	6	5	11.5	0.23	Low
xy42092937198533	Blood Rd	Charlton	Unnamed Cody Brook	Cady Brook-Quinebaug R.	1	1	2	1	1	3	1	4	3	3	3	6	3	4	6	11	0.22	Low
xy42104877198197	Mcintyre Rd	Charlton	Unnamed (outflow Mcintyre Pond)	Cady Brook-Quinebaug R.	1	1	2	1	1	2	1	4	2	2	2	4	2	4	4	8	0.22	Low
xy42126357200530	Snake Hill Rd	Charlton	Cady Brook	Cady Brook-Quinebaug R.	1	1	2	1	1	1	1	4	1	1	1	2	1	4	2	7	0.14	Low
xy42287607202967	Brooks Pond Road	Spencer	Unnamed	Lake Lashaway-East Brookfield R.	5	5	3	5	1	4	3	3	4	20	20	12	20	9	20	34.5	0.69	High
xy42294267202555	Northwest Road	Spencer	Unnamed	Lake Lashaway-East Brookfield R.	5	5	4	2	1	3	4	3	3	15	15	12	6	12	15	28.5	0.57	High
xy42303717203221	Northwest Rd	Spencer	Unnamed	Lake Lashaway-East Brookfield R.	5	5	4	2	1	2	5	3	2	10	10	8	4	15	10	27.5	0.55	High
xy42286837202473	Northwest Rd	Spencer	Unnamed	Lake Lashaway-East Brookfield R.	5	5	3	5	1	3	3	2	3	15	15	9	15	6	15	25.5	0.51	Medium
xy42292877203452	Brooks Pond Road	Spencer	Unnamed	Lake Lashaway-East Brookfield R.	4	5	4	2	1	2	4	3	2	8	10	8	4	12	10	23	0.46	Medium
xy42305827203527	Northwest Road	Spencer	Unnamed	Lake Lashaway-East Brookfield R.	4	5	4	5	1	2	2	3	2	8	10	8	10	6	10	18	0.36	Medium
xy42258927202459	Norcross Rd	Spencer	Unnamed	Lake Lashaway-East Brookfield R.	5	5	3	5	1	1	3	3	1	5	5	3	5	9	5	16	0.32	Low
xy42273107202839	Thornberry Circle	Spencer	Unnamed	Lake Lashaway-East Brookfield R.	1	1	3	2	1	2	2	3	2	2	2	6	4	G	6	12	0.24	Low
xy42296207203571	Washburn Terrace	Spencer	Unnamed	Lake Lashaway-East Brookfield R.	5	5	3	5	1	1	2	3	1	5	5	3	5	6	5	11.5	0.23	Low
xy4211315/203585	N Ayers Kd Borry Corpor Rd	Charlton	Unnamed	McKinstry Brook-Quinebaug R.	5	5	3	2	1	1	4	3	1	5	5	3	2	12	5	20.5	0.41	Medium
xy42120387202373	Brookfield Rd	Charlton	McKinstry Brook	McKinstry Brook-Quinebaug R.	5	5	4	2	2	1	3	3	2	10	10	8	4	9	10	19.5	0.39	Medium
xy42127177203084	Hill rd	Charlton	McKinstry brook	McKinstry Brook-Quinebaug R.	5	5	3	5	1	2	2	3	2	10	10	6	10	6	10	18	0.36	Medium
xy42129607202680	Hill Rd	Charlton	Unnamed	McKinstry Brook-Quinebaug R.	5	5	4	5	1	1	3	3	1	5	5	4	5	9	5	16	0.32	Low
xy42242817199556	Elm St	Spencer	Unnamed	Sevenmile River	5	5	2	1	1	5	5	3	5	25	25	10	5	15	25	45	0.9	High
xy42267367198603	Wire Village Road	Spencer	Unnamed	Sevenmile River	5	5	4	5	2	3	5	5	3	15	15	12	15	25	15	45	0.9	High
xy42240257199930	Water St Mill St	Spencer	Unnamed	Sevenmile River	0	0	3	5	2	5	4	3	5	0	0	15	25	12	25	43.5	0.87	High
xy422433777198653	May St	Spencer	Unnamed	Sevenmile River	5	5	4	2	1	5	2	3	5	25	25	20	10	6	25	40.5	0.81	High
xy42242787199625	Valley St	Spencer	Unnamed	Sevenmile River	3	4	2	5	1	5	1	3	5	15	20	10	25	3	25	39	0.78	High
xy42272437198670	Gold Nugget Rd	Spencer	Unnamed	Sevenmile River	5	5	4	2	1	4	4	3	4	20	20	16	8	12	20	36	0.72	High
xy42270727198232	Wire village Rd	Spencer	Unnamed	Sevenmile River	1	2	4	5	2	4	3	3	4	4	8	16	20	9	20	34.5	0.69	High
xy42263087199328	Wire Village Road, Hastings Ro	oa Spencer	Turkey Hill Brook	Sevenmile River	5	5	3	3	2	4	1	4	4	20	20	12	12	4	20	32	0.64	High
xy42239757200792 xy42268137195837	Howard Hurley Road	Spencer	Unnamed	Sevenmile River	4	5	3	5	3	4	5	4	4	15	20	12	4	4	15	32	0.64	High
xy42305577198908	Browning Pond Rd	Spencer	Unnamed	Sevenmile River	1	1	4	5	1	3	5	3	3	3	3	12	15	15	15	30	0.6	High
xy42294187200495	Unnamed road	Spencer	Unnamed	Sevenmile River	1	1	3	5	1	3	5	3	3	3	3	9	15	15	15	30	0.6	High
xy42304087198719	Route 31	Spencer	Unnamed	Sevenmile River	1	1	3	5	2	3	5	3	3	3	3	9	15	15	15	30	0.6	High
xy42199857200814	Jolicouer Rd	Spencer	Unnamed	Sevenmile River	5	5	4	2	2	3	5	3	3	15	15	12	6	15	15	30	0.6	High
xy42238157200544	Old Main Street	Spencer	Unnamed	Sevenmile River	1	1	3	1	2	4	5	3	4	4	4	12	4	15	12	28.5	0.57	High
xy42208937201200	South Spencer Kd Hastings St	Spencer	Unnamed	Sevenmile River	5	5	4	5	1	2	5	3	2	10	10	8	10	15	10	27.5	0.55	High
xy42238587202619	Smithville Rd	Spencer	Unnamed	Sevenmile River	5	5	3	5	1	2	5	3	2	10	10	6	10	15	10	27.5	0.55	High
xy42300367199122	Route 31	Spencer	Unnamed	Sevenmile River	1	1	3	5	2	1	5	3	2	2	2	6	10	15	10	27.5	0.55	High
xy42284237198810	McCormick Rd	Spencer	Unnamed	Sevenmile River	5	5	4	5	1	3	3	3	3	15	15	12	15	9	15	27	0.54	Medium
xy42201697200513	Hebert road	Spencer	Unnamed	Sevenmile River	5	5	4	2	1	3	3	3	3	15	15	12	6	9	15	27	0.54	Medium
xy42303767198648	Old N Spencer Road	Spencer	Unnamed	Sevenmile River	5	5	4	2	1	3	3	3	3	15	15	12	6	9	15	27	0.54	Medium
xy4220311/200432	Cranberry Meadow Kd	Spencer	Unnamed	Sevenmile River	5	5	3	2	1	3	3	3	3	15	15	9	6	9	15	27	0.54	Medium
xy42275017198713	McCormick Rd	Spencer	Unnamed	Sevenmile River	5	5	4	1	1	3	3	3	3	15	15	12	3	9	15	27	0.54	Medium
xy42246907200739	Meadow Rd	Spencer	Unnamed	Sevenmile River	4	5	3	5	3	2	2	4	3	12	15	9	15	8	15	26.5	0.53	Medium
xy42200137200815	Cranberry Meadow road	Spencer	Unnamed	Sevenmile River	5	5	4	5	1	3	2	3	3	15	15	12	15	6	15	25.5	0.51	Medium
xy42236057200384	Bixby Road	Spencer	Unnamed	Sevenmile River	5	5	4	2	1	3	2	3	3	15	15	12	6	6	15	25.5	0.51	Medium
xy42201497199404	Gauthier Rd	Spencer	Unnamed	Sevenmile River	5	5	3	2	1	3	3	2	3	15	15	9	6	6	15	25.5	0.51	Medium
xy42203977200329	Cranberry Meadow Kd Route 31	Spencer	Unnamed Sevenmile River	Sevenmile River	5	5	3	2 5	1	3	2	3	3	15	15	9	6 15	5	15	25.5	0.51	Medium
xy42264517200054	Cooney Rd	Spencer	Unnamed	Sevenmile River	5	5	3	5	1	3	2	2	3	15	15	9	15	4	15	24.5	0.49	Medium
xy42229927198732	Charlton Rd	Spencer	Unnamed	Sevenmile River	5	5	2	2	3	3	2	2	3	15	15	6	6	4	15	24.5	0.49	Medium
xy42265067200832	North Spencer Road	Spencer	Unnamed	Sevenmile River	5	5	4	1	2	3	4	1	3	15	15	12	3	4	15	24.5	0.49	Medium
xy42185207199955	Ethier Drive	Spencer	Unnamed	Sevenmile River	4	5	3	5	1	2	4	3	2	8	10	6	10	12	10	23	0.46	Medium
xy42293737200320	road to Trappist monastery, fr	o Spencer	Sevenmile River	Sevenmile River	5	5	4	2	1	2	3	4	2	10	10	8	4	12	10	23	0.46	Medium
xy42227287201523	Condon Dr	Spencer	Unnamed	Sevenmile River	5	5	3	5	1	1	4	3	1	5	5	3	5	12	5	20.5	0.41	Medium
xy422/295/19/449	Faxton Kd Gale Dr	Spencer	Snaw Brook	Sevenmile River	2	3	2	1	2	4	1 5	4	4	8	12	8	4	4	12	20	0.4	Medium
xy42280417199470	Hastings Rd	Spencer	Unnamed	Sevenmile River	5	5	4	5	1	2	5	2	2	10	10	8	10	10	10	20	0.4	Medium
xy42271257198105	Wire Village Road	Spencer	Unnamed	Sevenmile River	5	5	4	5	2	2	3	3	2	10	10	8	10	9	10	19.5	0.39	Medium
xy42250947201116	Smithville Road	Spencer	Unnamed	Sevenmile River	0	0	4	5	1	2	3	3	2	0	0	8	10	9	10	19.5	0.39	Medium
xy42228277199149	Dufault Road	Spencer	Unnamed	Sevenmile River	5	5	3	5	1	2	3	3	2	10	10	6	10	9	10	19.5	0.39	Medium
xy42275157196572	Overlook Drive	Spencer	Unnamed	Sevenmile River	5	5	3	5	1	2	3	3	2	10	10	6	10	9	10	19.5	0.39	Medium



Appendix B—Table 1 (continued). Road-Stream Crossing Scoring and Prioritization Results, organized by watershed and overall crossing priority scores. (Page 4 of 4)

XY Code	Road Name	Town	Stream Name	HUC 12 Watershed Name	Existing Hydraulic Risk Score-Binned	Future Hydraulic Risk Score-Binned	Geomorphic Vulnerability Score	Structural Condition Score	Transportation Disruption Score	Flood Impact Potential Score	AOP Score	Ecological Benefit Score	lmpact Score	Existing Hydraulic Risk Score	Future Hydraulic Risk Score	Geomorphic Risk Score	Structural Risk Score	AOP Benefit Score	Crossing Risk Score	Crossing Priority Value	Scaled Crossing Priority	Relative Priority Rating
xy42308507197236	West Ave	Spencer	Unnamed	Sevenmile River	5	5	3	5	1	2	3	3	2	10	10	6	10	9	10	19.5	0.39	Medium
xy42205567198530	Charlton Road	Spencer	Unnamed	Sevenmile River	1	1	3	5	2	2	3	3	2	2	2	6	10	9	10	19.5	0.39	Medium
xy42281107199475	Hastings Rd	Spencer	Unnamed	Sevenmile River	5	5	4	2	1	2	3	3	2	10	10	8	4	9	10	19.5	0.39	Medium
xy42216117198192	I Capen Road	Spencer	Unnamed	Sevenmile River	5	5	3	2	1	2	3	3	2	10	10	6	4	9	10	19.5	0.39	Medium
xy42199597201527	S. Spencer	Spencer	Unnamed	Sevenmile River	5	5	4	1	1	2	3	3	2	10	10	8	2	9	10	19.5	0.39	Medium
xy42303177196551	Pine Acres Rd	Spencer	Unnamed	Sevenmile River	5	5	3	5	1	2	2	4	2	10	10	6	10	8	10	19	0.38	Medium
xy42272047196057	Donnelly Cross Rd	Spencer	Shaw Brook	Sevenmile River	2	3	3	5	1	2	2	4	2	4	6	6	10	8	10	19	0.38	Medium
xy42264767200487	Cooney Rd	Spencer	Sevenmile River	Sevenmile River	4	5	2	1	1	2	2	4	2	8	10	4	2	8	10	19	0.38	Medium
xy42201717202002	Tom Casey Rd	Spencer	Unnamed	Sevenmile River	5	5	3	2	1	2	3	2	2	10	10	6	4	6	10	18	0.36	Medium
xy42260657196861	Donnelly Rd	Spencer	Unnamed	Sevenmile River	4	5	3	2	1	2	2	3	2	8	10	6	4	6	10	18	0.36	Medium
xy42247397201674	Smithville Road	Spencer	Unnamed	Sevenmile River	5	5	2	2	1	2	2	3	2	10	10	4	4	6	10	18	0.36	Medium
xy42260997201315	North Brookfield Road	Spencer	Unnamed	Sevenmile River	3	4	3	2	2	2	3	3	2	6	8	6	4	9	8	17.5	0.35	Medium
xy42232837198227	Ash st	Spencer	Unnamed	Sevenmile River	5	5	4	5	1	2	2	2	2	10	10	8	10	4	10	17	0.34	Low
xy42303367196556	Pine Acres Rd	Spencer	Turkey Hill Brook	Sevenmile River	5	5	3	5	1	2	1	4	2	10	10	6	10	4	10	17	0.34	Low
xy42197057200456	William Casey Rd	Spencer	Unnamed	Sevenmile River	1	1	3	1	1	2	3	3	2	2	2	6	2	9	6	16.5	0.33	Low
xy42193307200113	Cranberry Meadow Rd	Spencer	Cranberry River	Sevenmile River	5	5	2	1	2	2	1	3	2	10	10	4	2	3	10	16.5	0.33	Low
xy42210937198505	Rt 31/Charlton Rd	Spencer	Unnamed	Sevenmile River	5	5	2	5	2	1	1	3	2	10	10	4	10	3	10	16.5	0.33	Low
xy42219927198461	E Charlton Rd	Spencer	Unnamed	Sevenmile River	5	5	3	5	1	1	3	3	1	5	5	3	5	9	5	16	0.32	Low
xy42290757199790	Hastings Rd	Spencer	Unnamed	Sevenmile River	5	5	4	2	1	1	3	3	1	5	5	4	2	9	5	16	0.32	Low
xy42182467200949	Casey Rd	Charlton	Unnamed	Sevenmile River	5	5	3	2	1	1	3	3	1	5	5	3	2	9	5	16	0.32	Low
xy42207027199959	Gauthier Road	Spencer	Cranberry River	Sevenmile River	1	1	3	1	1	3	1	3	3	3	3	9	3	3	9	15	0.3	Low
xy42272807197888	Gold Nugget Rd	Spencer	Turkey Hill Brook	Sevenmile River	1	1	2	1	1	4	1	5	4	4	4	8	4	5	8	14.5	0.29	Low
xy42250337200809	Smithville Road	Spencer	Sevenmile River	Sevenmile River	1	1	2	1	1	4	1	4	4	4	4	8	4	4	8	14	0.28	Low
xy42265567198812	Wire Village Rd	Spencer	Turkey Hill Rd	Sevenmile River	1	1	2	1	2	4	1	4	4	4	4	8	4	4	8	14	0.28	Low
xy42228237201256	S. Spencer Rd	Spencer	Cranberry River	Sevenmile River	4	4	2	1	2	1	1	4	2	8	8	4	2	4	8	14	0.28	Low
xy42237777200419	Main St (Rt 9)	Spencer	Unnamed	Sevenmile River	1	1	2	1	4	3	1	3	4	4	4	8	4	3	8	13.5	0.27	Low
xy42309397200824	Browning Pond Rd	Spencer	Unnamed	Sevenmile River	5	5	2	5	1	1	2	3	1	5	5	2	5	6	5	11.5	0.23	Low
xy42299977197076	Thompson Pond Road	Spencer	Unnamed	Sevenmile River	5	5	3	3	1	1	2	3	1	5	5	3	3	6	5	11.5	0.23	Low
xy42288707199641	Hastings Rd	Spencer	Unnamed	Sevenmile River	5	5	4	2	1	1	2	3	1	5	5	4	2	6	5	11.5	0.23	Low
xy42218447199671	Howe Rd	Spencer	Unnamed	Sevenmile River	5	5	3	2	1	1	2	3	1	5	5	3	2	6	5	11.5	0.23	Low
xy42243597198244	Holmes St	Spencer	Unnamed	Sevenmile River	1	2	2	1	1	3	1	3	3	3	6	6	3	3	6	10.5	0.21	Low
xy42255867200411	Pleasant St (Rt 31)	Spencer	Sevenmile River	Sevenmile River	1	1	2	1	3	3	1	3	3	3	3	6	3	3	6	10.5	0.21	Low
xy42215717200032	Howe Rd	Spencer	Unnamed	Sevenmile River	2	3	3	1	1	1	2	3	1	2	3	3	1	6	3	10.5	0.21	Low
xy42216267199982	Howe Rd	Spencer	Cranberry River	Sevenmile River	5	5	3	1	1	1	1	4	1	5	5	3	1	4	5	9.5	0.19	Low
xy42235117195800	Greenville St	Spencer	Unnamed	Upper French R.	5	5	3	2	2	4	3	3	4	20	20	12	8	9	20	34.5	0.69	High
xy42210397196698	Marble Rd	Spencer	Unnamed	Upper French R.	5	5	4	1	1	4	3	3	4	20	20	16	4	9	20	34.5	0.69	High
xy42216107196594	GH Wilson Rd	Spencer	Unnamed	Upper French R.	5	5	3	5	1	4	2	3	4	20	20	12	20	6	20	33	0.66	High
xy42219257195030	Chickering Rd	Spencer	Unnamed	Upper French R.	5	5	4	2	2	1	5	3	2	10	10	8	4	15	10	27.5	0.55	High
xy4218618/191//1	Stanord street	Chariton	Unnamed	Opper French R.	5	5	4	5	3	3	3	3	3	15	15	12	15	9	15	27	0.54	iviedium
xy42230047196304	R Jones rd	Spencer	Unnamed	Upper French R.	5	5	3	2	1	3	3	3	3	15	15	9	6	9	15	2/	0.54	Medium
xy42182137192179	Stafford St	Charlton	Unnamed	Upper French R.	5	5	2	5	3	1	2	3	3	15	15	6	15	6	15	25.5	0.51	Medium
xy42202327194820	Wilson Ave	Spencer	Unnamed	Upper French R.	4	4	4	5	1	1	5	3	1	4	4	4	5	15	5	25	0.5	Medium
xy42237067196301	Greenville St	Spencer	Unnamed	Upper French R.	5	5	3	5	2	2	4	3	2	10	10	6	10	12	10	23	0.46	Medium
xy42243857197039	Garrett Ln	Spencer	Unnamed	Upper French R.	4	5	3	5	1	2	4	3	2	8	10	6	10	12	10	23	0.46	Medium
xy42200797194993	Clark Road	Spencer	Unnamed	Upper French R.	5	5	4	5	1	1	4	3	1	5	5	4	5	12	5	20.5	0.41	Medium
xy42207977195437	Clark Road	Spencer	Unnamed	Upper French R.	5	5	3	5	1	2	3	3	2	10	10	6	10	9	10	19.5	0.39	Medium
xy42206457196685	Clark Road	Spencer	Unnamed	Upper French R.	5	5	4	2	1	2	3	3	2	10	10	8	4	9	10	19.5	0.39	Medium
xy42235187196071	Greenville st	Spencer	Unnamed	Upper French R.	5	5	3	2	2	2	2	3	2	10	10	6	4	6	10	18	0.36	Medium
xy4221/157196004	G H Wilson rd	Spencer	unamed	Upper French R.	5	5	3	1	1	2	2	3	2	10	10	6	2	6	10	18	0.36	Medium
xy42226517197364	R Joned Rd	Spencer	Unnamed	Upper French R.	3	4	3	2	1	2	3	3	2	6	8	6	4	9	8	17.5	0.35	Medium
xy42185247192643	Applewood Ln	Charlton	Unnamed	Upper French R.	0	0	3	1	1	2	3	3	2	0	0	6	2	9	6	16.5	0.33	Low
xy42209657195437	Wilson	Spencer	Unnamed	Upper French R.	1	2	3	5	1	1	2	3	1	1	2	3	5	6	5	11.5	0.23	Low
xy42199547194538	Clark Rd	Spencer	Unnamed	Upper French R.	0	0	2	1	1	1	1	3	1	0	0	2	1	3	2	5.5	0.11	Low
xy42190507201969	South Spencer Rd	Spencer	Unnamed	Upper Quaboag R.	5	5	3	2	1	2	3	3	2	10	10	6	4	9	10	19.5	0.39	Medium



Appendix B—Table 2. Top-ranked crossings based on hydraulic risk score under existing conditions.

XY Code	Road Name	Town	Stream Name	HUC 12 Watershed Name	Impact Score	Existing Hydraulic Risk Score	Future Hydraulic Risk Score	Geomorphic Risk Score	Structural Risk Score	AOP Benefit Score	Crossing Risk Score	Crossing Priority Value	Scaled Crossing Priority	Relative Priority Rating
xy42242817199556	Elm St	Spencer	Unnamed	Sevenmile River	5	25	25	10	5	15	25	45	0.9	High
xy42241537199888	Mill St	Spencer	Unnamed	Sevenmile River	5	25	25	25	15	9	25	42	0.84	High
xy42243777198653	May St	Spencer	Unnamed	Sevenmile River	5	25	25	20	10	6	25	40.5	0.81	High
xy42272437198670	Gold Nugget Rd	Spencer	Unnamed	Sevenmile River	4	20	20	16	8	12	20	36	0.72	High
xy42087307198010	East Baylies Rd	Spencer	Unnamed	Cady Brook-Quinebaug R.	4	20	20	12	20	9	20	34.5	0.69	High
xy42096677198620	Blood Rd	Spencer	Unnamed	Cady Brook-Quinebaug R.	4	20	20	12	8	9	20	34.5	0.69	High
xy42156087197349	Stafford St.	Spencer	Unnamed	Cady Brook-Quinebaug R.	4	20	20	16	8	9	20	34.5	0.69	High
xy42156627197367	Center Depot Rd	Spencer	Unnamed	Cady Brook-Quinebaug R.	4	20	20	12	8	9	20	34.5	0.69	High
xy42287607202967	Brooks Pond Road	Spencer	Unnamed	Lake Lashaway-East Brookfield R.	4	20	20	12	20	9	20	34.5	0.69	High
xy42210397196698	Marble Rd	Spencer	Unnamed	Upper French R.	4	20	20	16	4	9	20	34.5	0.69	High
xy42235117195800	Greenville St	Spencer	Unnamed	Upper French R.	4	20	20	12	8	9	20	34.5	0.69	High
xy42161187200811	Brookfield Rd	Spencer	Unnamed	Cady Brook-Quinebaug R.	4	20	20	12	20	6	20	33	0.66	High
xy42216107196594	GH Wilson Rd	Spencer	Unnamed	Upper French R.	4	20	20	12	20	6	20	33	0.66	High
xy42087757198556	Saundersdale Rd	Spencer	Unnamed	Cady Brook-Quinebaug R.	4	20	20	8	4	4	20	32	0.64	High
xy42263087199328	Wire Village Road, Hastings Road	Spencer	Turkey Hill Brook	Sevenmile River	4	20	20	12	12	4	20	32	0.64	High

Appendix B—Table 3. Top-ranked crossings based on future hydraulic risk score under projected future climate (precipitation and peak flow) conditions.

XY Code	Road Name	Town	Stream Name	HUC 12 Watershed Name	Impact Score	Existing Hydraulic Risk Score	Future Hydraulic Risk Score	Geomorphic Risk Score	Structural Risk Score	AOP Benefit Score	Crossing Risk Score	Crossing Priority Value	Scaled Crossing Priority	Relative Priority Rating
xy42242817199556	Elm St	Spencer	Unnamed	Sevenmile River	5	25	25	10	5	15	25	45	0.9	High
xy42241537199888	Mill St	Spencer	Unnamed	Sevenmile River	5	25	25	25	15	9	25	42	0.84	High
xy42243777198653	May St	Spencer	Unnamed	Sevenmile River	5	25	25	20	10	6	25	40.5	0.81	High
xy42242787199625	Valley St	Spencer	Unnamed	Sevenmile River	5	15	20	10	25	3	25	39	0.78	High
xy42272437198670	Gold Nugget Rd	Spencer	Unnamed	Sevenmile River	4	20	20	16	8	12	20	36	0.72	High
xy42087307198010	East Baylies Rd	Spencer	Unnamed	Cady Brook-Quinebaug R.	4	20	20	12	20	9	20	34.5	0.69	High
xy42096677198620	Blood Rd	Spencer	Unnamed	Cady Brook-Quinebaug R.	4	20	20	12	8	9	20	34.5	0.69	High
xy42156087197349	Stafford St.	Spencer	Unnamed	Cady Brook-Quinebaug R.	4	20	20	16	8	9	20	34.5	0.69	High
xy42156627197367	Center Depot Rd	Spencer	Unnamed	Cady Brook-Quinebaug R.	4	20	20	12	8	9	20	34.5	0.69	High
xy42287607202967	Brooks Pond Road	Spencer	Unnamed	Lake Lashaway-East Brookfield R.	4	20	20	12	20	9	20	34.5	0.69	High
xy42210397196698	Marble Rd	Spencer	Unnamed	Upper French R.	4	20	20	16	4	9	20	34.5	0.69	High
xy42235117195800	Greenville St	Spencer	Unnamed	Upper French R.	4	20	20	12	8	9	20	34.5	0.69	High
xy42130987196310	Freeman Rd	Spencer	Unnamed	Cady Brook-Quinebaug R.	4	16	20	12	4	9	20	34.5	0.69	High
xy42161187200811	Brookfield Rd	Spencer	Unnamed	Cady Brook-Quinebaug R.	4	20	20	12	20	6	20	33	0.66	High
xy42216107196594	GH Wilson Rd	Spencer	Unnamed	Upper French R.	4	20	20	12	20	6	20	33	0.66	High
xy42087757198556	Saundersdale Rd	Spencer	Unnamed	Cady Brook-Quinebaug R.	4	20	20	8	4	4	20	32	0.64	High
xy42263087199328	Wire Village Road, Hastings Road	Spencer	Turkey Hill Brook	Sevenmile River	4	20	20	12	12	4	20	32	0.64	High
xy42239757200792	Meadow Rd	Spencer	Unnamed	Sevenmile River	4	16	20	12	4	4	20	32	0.64	High



Appendix B—Table 4. Top-ranked crossings based on geomorphic risk score.

XY Code	Road Name	Town	Stream Name	HUC 12 Watershed Name	Impact Score	Existing Hydraulic Risk Score	Future Hydraulic Risk Score	Geomorphic Risk Score	Structural Risk Score	AOP Benefit Score	Crossing Risk Score	Crossing Priority Value	Scaled Crossing Priority	Relative Priority Rating
xy42241537199888	Mill St	Spencer	Unnamed	Sevenmile River	5	25	25	25	15	9	25	42	0.84	High
xy42243777198653	May St	Spencer	Unnamed	Sevenmile River	5	25	25	20	10	6	25	40.5	0.81	High
xy42272437198670	Gold Nugget Rd	Spencer	Unnamed	Sevenmile River	4	20	20	16	8	12	20	36	0.72	High
xy42156087197349	Stafford St.	Spencer	Unnamed	Cady Brook-Quinebaug R.	4	20	20	16	8	9	20	34.5	0.69	High
xy42210397196698	Marble Rd	Spencer	Unnamed	Upper French R.	4	20	20	16	4	9	20	34.5	0.69	High
xy42270727198232	Wire village Rd	Spencer	Unnamed	Sevenmile River	4	4	8	16	20	9	20	34.5	0.69	High
xy42111857201283	Rt 169/ Southbridge Rd	Spencer	Unnamed	Cady Brook-Quinebaug R.	4	4	4	16	20	6	20	33	0.66	High
xy42240257199930	Water St	Spencer	Unnamed	Sevenmile River	5	0	0	15	25	12	25	43.5	0.87	High

Appendix B—Table 5. Top-ranked crossings based on structural risk score.

XY Code	Road Name	Town	Stream Name	HUC 12 Watershed Name	Impact Score	Existing Hydraulic Risk Score	Future Hydraulic Risk Score	Geomorphic Risk Score	Structural Risk Score	AOP Benefit Score	Crossing Risk Score	Crossing Priority Value	Scaled Crossing Priority	Relative Priority Rating
xy42240257199930	Water St	Spencer	Unnamed	Sevenmile River	5	0	0	15	25	12	25	43.5	0.87	High
xy42242787199625	Valley St	Spencer	Unnamed	Sevenmile River	5	15	20	10	25	3	25	39	0.78	High
xy42270727198232	Wire village Rd	Spencer	Unnamed	Sevenmile River	4	4	8	16	20	9	20	34.5	0.69	High
xy42087307198010	East Baylies Rd	Spencer	Unnamed	Cady Brook-Quinebaug R.	4	20	20	12	20	9	20	34.5	0.69	High
xy42287607202967	Brooks Pond Road	Spencer	Unnamed	Lake Lashaway-East Brookfield R.	4	20	20	12	20	9	20	34.5	0.69	High
xy42111857201283	Rt 169/ Southbridge Rd	Spencer	Unnamed	Cady Brook-Quinebaug R.	4	4	4	16	20	6	20	33	0.66	High
xy42161187200811	Brookfield Rd	Spencer	Unnamed	Cady Brook-Quinebaug R.	4	20	20	12	20	6	20	33	0.66	High
xy42216107196594	GH Wilson Rd	Spencer	Unnamed	Upper French R.	4	20	20	12	20	6	20	33	0.66	High
xy42149767198830	City depot Rd	Spencer	Cady Brook	Cady Brook-Quinebaug R.	4	12	16	12	20	4	20	32	0.64	High
xy42106617201530	Southbridge Rd	Spencer	Unnamed	Cady Brook-Quinebaug R.	4	8	12	12	20	4	20	32	0.64	High



Appendix B—Table 6. Top-ranked crossings based on aquatic organism passage benefit score.

XY Code	Road Name	Town	Stream Name	HUC 12 Watershed Name	Impact Score	Existing Hydraulic Risk Score	Future Hydraulic Risk Score	Geomorphic Risk Score	Structural Risk Score	AOP Benefit Score	Crossing Risk Score	Crossing Priority Value	Scaled Crossing Priority	Relative Priority Rating
xy42267367198603	Wire Village Road	Spencer	Unnamed	Sevenmile River	3	15	15	12	15	25	15	45	0.9	High
xy42175037195644	Cemetery Road	Spencer	Little River	Buffumville Lake-Little R.	1	5	5	4	5	16	5	26.5	0.53	Medium
xy42242817199556	Elm St	Spencer	Unnamed	Sevenmile River	5	25	25	10	5	15	25	45	0.9	High
xy42162777192843	A Young Rd	Spencer	Unnamed	Buffumville Lake-Little R.	3	15	15	12	15	15	15	30	0.6	High
xy42106447196847	Baylies Rd	Spencer	Unnamed	Cady Brook-Quinebaug R.	3	15	15	12	15	15	15	30	0.6	High
xy42167467200810	Fitzgerald Rd	Spencer	Unnamed	Cady Brook-Quinebaug R.	3	15	15	12	15	15	15	30	0.6	High
xy42268137195837	Howard Hurley Road	Spencer	Unnamed	Sevenmile River	3	15	15	12	15	15	15	30	0.6	High
xy42305577198908	Browning Pond Rd	Spencer	Unnamed	Sevenmile River	3	3	3	12	15	15	15	30	0.6	High
xy42162337201150	Jennings Rd	Spencer	Unnamed	Cady Brook-Quinebaug R.	3	0	0	12	15	15	15	30	0.6	High
xy42165477195502	Cemetery Rd	Spencer	Unnamed	Buffumville Lake-Little R.	3	15	15	9	15	15	15	30	0.6	High
xy42142557192428	Richardson Corner Rd	Spencer	Unnamed	Buffumville Lake-Little R.	3	9	12	9	15	15	15	30	0.6	High
xy42294187200495	Unnamed road	Spencer	Unnamed	Sevenmile River	3	3	3	9	15	15	15	30	0.6	High
xy42304087198719	Route 31	Spencer	Unnamed	Sevenmile River	3	3	3	9	15	15	15	30	0.6	High
xy42140167196908	L Stevens Rd	Spencer	Unnamed	Cady Brook-Quinebaug R.	3	15	15	12	6	15	15	30	0.6	High
xy42199857200814	Jolicouer Rd	Spencer	Unnamed	Sevenmile River	3	15	15	12	6	15	15	30	0.6	High
xy42114817197758	Flint Rd	Spencer	Unnamed	Cady Brook-Quinebaug R.	3	15	15	9	6	15	15	30	0.6	High
xy42238157200544	Old Main Street	Spencer	Unnamed	Sevenmile River	4	4	4	12	4	15	12	28.5	0.57	High
xy42086917197636	Saundersdale Rd	Spencer	Unnamed	Cady Brook-Quinebaug R.	3	3	6	12	6	15	12	28.5	0.57	High
xy42208937201200	South Spencer Rd	Spencer	Unnamed	Sevenmile River	2	10	10	8	10	15	10	27.5	0.55	High
xy42254367199108	Hastings St	Spencer	Unnamed	Sevenmile River	2	10	10	8	10	15	10	27.5	0.55	High
xy42173857197799	Rt 31	Spencer	Unnamed	Cady Brook-Quinebaug R.	2	0	0	8	10	15	10	27.5	0.55	High
xy42238587202619	Smithville Rd	Spencer	Unnamed	Sevenmile River	2	10	10	6	10	15	10	27.5	0.55	High
xy42136897194127	Morton Station Rd	Spencer	Unnamed	Buffumville Lake-Little R.	2	6	8	6	10	15	10	27.5	0.55	High
xy42300367199122	Route 31	Spencer	Unnamed	Sevenmile River	2	2	2	6	10	15	10	27.5	0.55	High
xy42303717203221	Northwest Rd	Spencer	Unnamed	Lake Lashaway-East Brookfield R.	2	10	10	8	4	15	10	27.5	0.55	High
xy42219257195030	Chickering Rd	Spencer	Unnamed	Upper French R.	2	10	10	8	4	15	10	27.5	0.55	High
xy42153827193982	Carroll Hill Rd	Spencer	Unnamed	Buffumville Lake-Little R.	1	5	5	4	5	15	5	25	0.5	Medium
xy42183977195290	Gould Rd	Spencer	Unnamed	Buffumville Lake-Little R.	1	5	5	4	5	15	5	25	0.5	Medium
xy42121127199192	T Hall Rd	Spencer	Unnamed	Cady Brook-Quinebaug R.	1	5	5	4	5	15	5	25	0.5	Medium
xy42182517197340	Old Spencer Road	Spencer	Unnamed	Cady Brook-Quinebaug R.	1	4	5	4	5	15	5	25	0.5	Medium
xy42202327194820	Wilson Ave	Spencer	Unnamed	Upper French R.	1	4	4	4	5	15	5	25	0.5	Medium
xy42141577195023	Old Worcester Rd	Spencer	Unnamed	Buffumville Lake-Little R.	1	1	1	4	5	15	5	25	0.5	Medium
xy42128277194621	Bond Rd	Spencer	Unnamed	Buffumville Lake-Little R.	1	5	5	4	2	15	5	25	0.5	Medium
xy42152637195905	Northside Rd	Spencer	Unnamed	Buffumville Lake-Little R.	1	5	5	3	2	15	5	25	0.5	Medium



Appendix B—Table 7. Top-ranked crossings based on impact score.

XY Code	Road Name	Town	Stream Name	HUC 12 Watershed Name	Impact Score	Existing Hydraulic Risk Score	Future Hydraulic Risk Score	Geomorphic Risk Score	Structural Risk Score	AOP Benefit Score	Crossing Risk Score	Crossing Priority Value	Scaled Crossing Priority	Relative Priority Rating
xy42242817199556	Elm St	Spencer	Unnamed	Sevenmile River	5	25	25	10	5	15	25	45	0.9	High
xy42240257199930	Water St	Spencer	Unnamed	Sevenmile River	5	0	0	15	25	12	25	43.5	0.87	High
xy42241537199888	Mill St	Spencer	Unnamed	Sevenmile River	5	25	25	25	15	9	25	42	0.84	High
xy42243777198653	May St	Spencer	Unnamed	Sevenmile River	5	25	25	20	10	6	25	40.5	0.81	High
xy42242787199625	Valley St	Spencer	Unnamed	Sevenmile River	5	15	20	10	25	3	25	39	0.78	High
xy42272437198670	Gold Nugget Rd	Spencer	Unnamed	Sevenmile River	4	20	20	16	8	12	20	36	0.72	High
xy42270727198232	Wire village Rd	Spencer	Unnamed	Sevenmile River	4	4	8	16	20	9	20	34.5	0.69	High
xy42087307198010	East Baylies Rd	Spencer	Unnamed	Cady Brook-Quinebaug R.	4	20	20	12	20	9	20	34.5	0.69	High
xy42287607202967	Brooks Pond Road	Spencer	Unnamed	Lake Lashaway-East Brookfield R.	4	20	20	12	20	9	20	34.5	0.69	High
xy42156087197349	Stafford St.	Spencer	Unnamed	Cady Brook-Quinebaug R.	4	20	20	16	8	9	20	34.5	0.69	High
xy42096677198620	Blood Rd	Spencer	Unnamed	Cady Brook-Quinebaug R.	4	20	20	12	8	9	20	34.5	0.69	High
xy42156627197367	Center Depot Rd	Spencer	Unnamed	Cady Brook-Quinebaug R.	4	20	20	12	8	9	20	34.5	0.69	High
xy42235117195800	Greenville St	Spencer	Unnamed	Upper French R.	4	20	20	12	8	9	20	34.5	0.69	High
xy42210397196698	Marble Rd	Spencer	Unnamed	Upper French R.	4	20	20	16	4	9	20	34.5	0.69	High
xy42130987196310	Freeman Rd	Spencer	Unnamed	Cady Brook-Quinebaug R.	4	16	20	12	4	9	20	34.5	0.69	High
xy42111857201283	Rt 169/ Southbridge Rd	Spencer	Unnamed	Cady Brook-Quinebaug R.	4	4	4	16	20	6	20	33	0.66	High
xy42161187200811	Brookfield Rd	Spencer	Unnamed	Cady Brook-Quinebaug R.	4	20	20	12	20	6	20	33	0.66	High
xy42216107196594	GH Wilson Rd	Spencer	Unnamed	Upper French R.	4	20	20	12	20	6	20	33	0.66	High
xy42149767198830	City depot Rd	Spencer	Cady Brook	Cady Brook-Quinebaug R.	4	12	16	12	20	4	20	32	0.64	High
xy42106617201530	Southbridge Rd	Spencer	Unnamed	Cady Brook-Quinebaug R.	4	8	12	12	20	4	20	32	0.64	High
xy42263087199328	Wire Village Road, Hastings Road	Spencer	Turkey Hill Brook	Sevenmile River	4	20	20	12	12	4	20	32	0.64	High
xy42239757200792	Meadow Rd	Spencer	Unnamed	Sevenmile River	4	16	20	12	4	4	20	32	0.64	High
xy42087757198556	Saundersdale Rd	Spencer	Unnamed	Cady Brook-Quinebaug R.	4	20	20	8	4	4	20	32	0.64	High
xy42238157200544	Old Main Street	Spencer	Unnamed	Sevenmile River	4	4	4	12	4	15	12	28.5	0.57	High
xy42272957197449	Paxton Rd	Spencer	Shaw Brook	Sevenmile River	4	8	12	8	4	4	12	20	0.4	Medium
xy42272807197888	Gold Nugget Rd	Spencer	Turkey Hill Brook	Sevenmile River	4	4	4	8	4	5	8	14.5	0.29	Low
xy42090427198544	Blood Rd	Spencer	Unnamed	Cady Brook-Quinebaug R.	4	4	4	8	4	4	8	14	0.28	Low
xy42110377201340	Rt 169/ Southbridge Rd	Spencer	Cady Brook	Cady Brook-Quinebaug R.	4	4	4	8	4	4	8	14	0.28	Low
xy42119347200890	Southbridge Rd	Spencer	Cady Brook	Cady Brook-Quinebaug R.	4	4	4	8	4	4	8	14	0.28	Low
xy42250337200809	Smithville Road	Spencer	Sevenmile River	Sevenmile River	4	4	4	8	4	4	8	14	0.28	Low
xy42265567198812	Wire Village Rd	Spencer	Turkey Hill Rd	Sevenmile River	4	4	4	8	4	4	8	14	0.28	Low
xy42237777200419	Main St (Rt 9)	Spencer	Unnamed	Sevenmile River	4	4	4	8	4	3	8	13.5	0.27	Low



Appendix C Road-Stream Crossing Scoring and Prioritization Methods

 $\label{eq:F2017} F: \label{eq:F2017} F: \label{eq:F2017} P2017 \label{F2017} P2017 \l$

Hydraulic Capacity Worksheet Massachusetts Road-Stream Crossing Assessment Integrated Water Infrastructure Vulnerability Assessment and Climate Resiliency Plan – Town of Charlton and Town of Spencer May 2019

Table 1: Headwater Depth at Qfailure

Road-Stream Crossing Structure Type and Material	Allowable Headwater Depth ¹
Stone Masonry or Wood Culvert	HW = 1.0 x D
Smooth or Corrugated Metal or Plastic Culvert ²	HW = 1.2 x D
Concrete Culvert	HW = 1 foot below lowest point in roadway surface
Bridge	HW = 1 foot below lowest point of bottom of bridge deck

Table 2: Tailwater Depth used in Calculating Hydraulic Capacity (Q_{failure})

Crossing Type	Crossing Structure Slope	Tailwater Depth
	> 2%	TW = 0.75 x D
		TW = 0.75 x D
Non Tidal Crossings		when HW/D < 1.3
Non-Truar Crossings	< 2%	
		TW = 1.0 x D
		when HW/D≥1.3
Tidal Crossings	Not Applicable	TW = 1.0 x D
Crossings discharging		Based on elevation of
directly into a lake,	Not Applicable	receiving water body or
pond, or wetland ¹		wetland
Crossings with		
cascade or free fall at		
the outlet with a		Based on elevation
significant drop to	Not Applicable	drop at outlet
the normal elevation		
or the downstream		
cnannel		

 $^{\rm 1}$ Situations where the tailwater depth is dictated by the water elevation in the downstream receiving water body or wetland and does not vary with flow, where available.

Table 3: Hydraulic Capacity Score

Hydraulic Capacity Rating (Capacity Ratio > 1.0 for listed Return Interval)	Hydraulic Capacity Score
100-Year	1
50 Year	2
25-Year	3
10 Year	4
< 10-Year	5

Equation 1: Hydraulic Capacity Ratio

$$Capacity Ratio_{R.I.} = \frac{HW_{failure}}{HW_{R.I.}}$$

Capacity $Ratio_{R.L} > 1.0$

Crossing has sufficient capacity to convey the return interval peak discharge

Capacity $Ratio_{R.L} \leq 1.0$

Crossing is undersized for the return interval peak discharge

Geomorphic Vulnerability Worksheet Massachusetts Road-Stream Crossing Assessment Integrated Water Infrastructure Vulnerability Assessment and Climate Resiliency Plan – Town of Charlton and Town of Spencer May 2019

Table 1: Crossing Alignment Impact Potential Ratings

Impact Rating	Alignment
1	Naturally straight
2	Mild bend
3	
4	Channelized straight
5	Sharp bend

Table 2: Bankfull Width Impact Potential Ratings When Confident Width Measurements are Available

Impact Rating	Inlet Width/Bankfull Width Ratio (ft/ft)
1	≥1.0
2	1.0-0.85
3	0.85-0.7
4	0.7-0.5
5	≤0.5

Table 3: Bankfull Width Impact Potential Ratings When No Confident Width Measurements are Available

Impact Rating	Constriction
1	None – Spans full
-	channel and banks
2	Slight – Spans only
2	bankfull/active channel
3	
4	Moderate
5	Severe

Table 4: Channel and Crossing Structure Slope Impact Potential Ratings

Impact Rating	Slope Conditions at Crossing	
1	No natural break in slope AND crossing	
1	structure slope = channel slope	
2	No natural break in slope but crossing	
Ζ	structure slope greater than channel slope	
2	Natural break in slope present but crossing	
5	structure = channel slope	
Δ	No natural break in slope but crossing	
4	structure slope less than channel slope	
	Natural slope break present AND crossing	
5	structure slope different from channel slope	
	(less than or greater than)	

Table 5: Sediment Continuity Impact Ratings

Impact Rating	Sediment Deposition, Elevation of Sediment Deposits, and Tailwater Scour Pool
1	No deposition upstream AND no tailwater scour pool
2	Deposition upstream <½ bankfull height OR small tailwater pool
	No deposition upstream AND large tailwater scour pool downstream
3	Deposition upstream <½ bankfull height AND small tailwater pool
	Deposition upstream ≥½ bankfull height AND no tailwater scour pool
4	Both deposition AND tailwater pool present with either deposition ≥½ bankfull height OR a large tailwater scour large pool
5	Deposition upstream ≥½ bankfull height AND large tailwater pool

Table 6: Bank Erosion and Outlet Armoring Impact Ratings

Impact Rating	Bank Erosion and Outlet Armoring		
1	No bank erosion or outlet armoring		
2			
3	Low levels of bank erosion and/or Outlet armoring not extensive		
4			
5	High levels of bank erosion and/or extensive outlet armoring		

Table 7: Inlet and Outlet Grade Impact Ratings

Impact Rating	Character of Inlet and Outlet Grade
1	Both inlet and outlet at stream grade
2	Inlet drop OR cascade at outlet
3	Inlet drop AND cascade at outlet
4	Perched or clogged/collapsed/submerged inlet
	Free fall or free fall onto cascade at outlet
5	Inlet drop AND either free fall or free fall on free fall onto cascade at outlet

Geomorphic Vulnerability Worksheet (continued) Massachusetts Road-Stream Crossing Assessment Integrated Water Infrastructure Vulnerability Assessment and Climate Resiliency Plan – Town of Charlton and Town of Spencer May 2019

Table 8: Combined Geomorphic Potential Impact Ratings

Combined Potential Impact Rating	Likelihood for Geomorphic Impacts
3	Very unlikely
4-6	Unlikely
7-9	Possible
10-12	Likely
13-15	Very likely

Table 9: Combined Observed Geomorphic Impact Ratings

Combined Impact Rating	Degree of Observed Geomorphic Impacts
3	None
4-6	Minor
7-9	Moderate
10-12	Significant
13-15	Severe

Table 10: Overall Geomorphic Impact Score

Sum of Geomorphic Potential Impact Ratings and Observed Geomorphic Impact Ratings	Geomorphic Impact score
6	1
7-12	2
13-18	3
19-24	4
25-30	5

Structural Condition Worksheet

Massachusetts Road-Stream Crossing Assessment

Integrated Water Infrastructure Vulnerability Assessment and Climate Resiliency Plan – Town of Charlton and Town of Spencer May 2019

Table 1: Level 1 Variables		
Number of Variables Marked "Critical" (Inlet, Outlet, or	Condition	
Both)	Score	
 Any one of the following variables: Cross Section Deformation Barrel Condition/Structural Integrity Footing Condition Level of Blockage 	0.0	
None of the above variables are marked "Critical"	1.0	

Table 2A: Level 2 Variables – Part I

Number of Variables Marked "Critical"	Condition Score
Any three of the following variables (inlet, outlet, or both): Buoyancy or Crushing Invert Deterioration Joints and Seams Condition Longitudinal Alignment Headwall/Wingwall Condition Flared End Section Condition Apron/Scour Protection Condition (outlet only) Armoring Condition Embankment Piping	0.0
 Any two of the following variables (inlet, outlet, or both): Buoyancy or Crushing Invert Deterioration Joints and Seams Condition Longitudinal Alignment Headwall/Wingwall Condition Flared End Section Condition Apron/Scour Protection Condition (outlet only) Armoring Condition Embankment Piping 	0.1
 Any one of the following variables (inlet/outlet/both): Buoyancy or Crushing Invert Deterioration Joints and Seams Condition Longitudinal Alignment Headwall/Wingwall Condition Flared End Section Condition Apron/Scour Protection Condition (outlet only) Armoring Condition Embankment Piping 	0.2
None of the above variables are marked "Critical"	1.0

Table 2B: Level 2 Variables – Part II

Number of Variables Marked "Poor"	Condition Score	
Any three of the following variables (inlet, outlet, or both): Cross Section Deformation Barrel Condition/Structural Integrity Footing Condition Level of Blockage	0.0	
Any two of the following variables (inlet, outlet, or both): Cross Section Deformation Barrel Condition/Structural Integrity Footing Condition Level of Blockage		
Any one of the following variables (inlet, outlet, or both): Cross Section Deformation Barrel Condition/Structural Integrity Footing Condition Level of Blockage		
None of the above variables are marked "Poor"	1.0	

Table 3: Level 3 Variables

Variables marked as "Poor" (inlet, outlet, or both)		
Buoyancy or Crushing		
Invert Deterioration		
Joints and Seams Condition		
Longitudinal Alignment		
Headwall/Wingwall Condition		
Flared End Section Condition		
Apron/Scour Protection Condition (outlet only)		
Armoring Condition		
Embankment Piping		

Table 4: Structural Condition Binned Score

Lowest Score Resulting from Level 1, Level 2, and Level 3 Variable Assessment	Structural Condition Binned Score
0.81 - 1.00	1
0.61 - 0.80	2
0.41 - 0.60	3
0.21 - 0.40	4
0.0 - 0.20	5

Equation 1: Level 3 Condition Score

Score $= 1.0 - (0.1 \times N)$ N = number of variables fromTable 3 marked "Poor"

Aquatic Organism Passage Worksheet

Massachusetts Road-Stream Crossing Assessment

Integrated Water Infrastructure Vulnerability Assessment and Climate Resiliency Plan – Town of Charlton and Town of Spencer May 2019

Table 1: Component Scores for AOP Field Variables

Field Variable	Level	Component Score
	Severe	0
Constriction	Moderate	0.5
Constriction	Spans Only Bankfull/Active Channel	0.9
	Spans Full Channel and Banks	1
	Inlet Drop	0
	Perched	0
Inlet Grade	Clogged/Collapsed/Submerged	1
	Unknown	1
	At Stream Grade	1
	Baffles/Weirs	0
Internal	Supports	0.8
Structures	Other	1
	None	1
	Extensive	0
Outlet Apron	Not Extensive	0.5
	None	1
	Severe	0
Physical	Moderate	0.5
Barriers	Minor	0.8
	None	1
	Large	0
Scour Pool	Small	0.8
	None	1
	None	0
Substrate	25%	0.5
Coverage	50%	0.5
	75%	0.7
	100%	1
Substrate	None	0
Matches	Not Appropriate	0.25
Stream	Contrasting	0.75
	Comparable	1
	No (Significantly Deeper)	0.5
Water Depth	No (Significantly Shallower)	0
	Yes (Comparable)	1
	Dry (Stream Also Dry)	1
	No (Significantly Faster)	0
Water Velocity	No (Significantly Slower)	0.5
	Yes (Comparable)	1
	Dry (Stream Also Dry)	1

Equation 1: Openness Measurement (feet)

Openness Measurement = <u>Structure Cross Sectional Area</u> <u>Structure Length</u>

Equation 2: Openness Score (S_o), for openness measurement (x) in feet $S_o = (1-e^{-5.7x})^{2.6316}$

Equation 3: Height Score (S_h) for height measurement (x) in feet

$$S_h = min\left(\frac{1.1x^2}{4.84 + x^2}\right), 1)$$

Table 2: Weights associated with each variable in the component scoring algorithm

Parameter	Weight
Outlet Drop	0.161
Physical Barriers	0.135
Constriction	0.090
Inlet Grade	0.088
Water Depth	0.082
Water Velocity	0.080
Scour Pool	0.071
Substrate Matches Stream	0.070
Substrate Coverage	0.057
Openness	0.052
Height	0.045
Outlet Apron	0.037
Internal Structures	0.032

Table 3: Binned Aquatic Passability Score

Aquatic Passability Score	Descriptor	Binned Aquatic Passability Score
1.00	No Barrier	1
0.80 - 0.99	Insignificant Barrier	1
0.60 - 0.79	Minor Barrier	2
0.40 - 0.59	Moderate Barrier	3
0.20 - 0.39	Significant Barrier	4
0.0 - 0.19	Severe Barrier	5

Table 4: Binned Ecological Integrity Score

Aquatic Index of Ecological Integrity (IEI) Value	Binned Ecological Integrity Score
0.0-0.3	1
0.31-0.5	2
0.51-0.7	3
0.71-0.9	4
0.91-1.0	5

Equation 4: Outlet Drop Score (S_{od}) for outlet drop measurement (x) in feet

$$S_{od} = 1 - \frac{1.029412x^2}{0.26470588 + x^2}$$

Equation 5: Aquatic Passability Score

Aquatic Passability Score = Minimum [Composite Score, Outlet Drop score] Transportation Services Disruption Worksheet Massachusetts Road-Stream Crossing Assessment Integrated Water Infrastructure Vulnerability Assessment and Climate Resiliency Plan – Town of Charlton and Town of Spencer May 2019

Table 1: Transportation Disruption Component Scores

Disruption Rating	Road Classification (Highway Functional Classification)
1	Local Roads, Trails, Driveways
2	Major and Minor Collectors
3	Minor Arterials
4	Other Principal Arterials
5	Interstates, Freeways, and Expressways

Flood Impact Potential Worksheet

Massachusetts Road-Stream Crossing Assessment

Integrated Water Infrastructure Vulnerability Assessment and Climate Resiliency Plan – Town of Charlton and Town of Spencer May 2019

Equation 1: Stream Buffer Distance as a Function of Bankfull Width (for use where bankfull width available)

Stream Buffer Distance = 2 × Bankfull Width

Table 1: Stream Buffer Distance as a Function of Crossing Structure Width and Degree of Constriction

(for use where bankfull width not available)

Crossing Structure Constriction Rating	Stream Buffer Distance (Substitute for Equation 8-1)
Severe	4 x Structure Width
Moderate	3 x Structure Width
Spans Only Bankfull Active Channel	2 x Structure Width
Spans Full Channel and Banks	2 x Structure Width

Table 2: Flood Impact Rating – Developed Area

Flood Impact Rating	Percent Developed Area within Potential Flood Impact Area Buffer Polygon
1	<5% developed area
2	<10% developed area
3	<25% developed area
4	<50% developed area
5	>50% developed area

Table 3: Flood Impact Rating – Upstream and Downstream Crossings

Flood Impact Rating	Number of Upstream and Downstream Crossings within Potential Flood Impact Area Buffer Polygon
1	0
2	
3	1
4	
5	>1

Note: -- indicates category not used

Table 4: Binned Flood Impact Potential Scores

Binned Flood Impact Potential Score	Sum of Component Flood Impact Ratings
1	1 – 2
2	3 – 4
3	5 — 6
4	7 – 8
5	9 - 10



Figure 1: Stream Crossing Buffer Diagram
Prioritization Worksheet

Massachusetts Road-Stream Crossing Assessment Integrated Water Infrastructure Vulnerability Assessment and Climate Resiliency Plan – Town of Charlton and Town of Spencer May 2019

Equation 1: Crossing Failure Risk

Failure Risk = Probability of Failure × Magnitude of the Impact of Failure

Equation 2: Impact Score

Impact Score = Maximum [Binned Transportation Disruption Score, Binned Flood Impact Potential Score]

Equation 3: Existing Hydraulic Risk Score

Existing Hydraulic Risk Score = Binned Existing Hydraulic Capacity Score × Impact Score

Equation 4: Future Hydraulic Risk Score

Future Hydraulic Risk Score = Binned Future Hydraulic Capacity Score × Impact Score

Equation 5: Geomorphic Risk Score

Geomorphic Risk Score = Binned Geomorphic Vulnerability Score × Impact Score

Equation 6: Structural Risk Score

Structural Risk Score = Binned Structural Condition Score × Impact Score

Equation 7: Crossing Risk Score

Crossing Risk Score = Maximum Baximum Existing Hydraulic Risk Score, Climate Change Risk Score, Geomorphic Risk Score, Structural Risk Score

Equation 8: Aquatic Passage Benefit Score

Aquatic Passage Benefit Score = Binned Aquatic Passability Score × Binned Ecological Integrity Score

Equation 9: Crossing Priority Score

Crossing Priority Score = Maximum[Aquatic Passage Benefit Score, Crossing Risk Score]

+ Average[Aquatic Passage Benefit Score, Crossing Risk Score]

Table 1: Relative Priority Ratings

Crossing Priority Score (normalized)	Priority Rating
0.55 - 1.00	High
0.35 - 0.54	Medium
0.00 - 0.34	Low



Appendix C

Dams Assessment Technical Memorandum



MEMORANDUM

TO:	Project Steering Committee
FROM:	Erik Mas, PE and Rachael Weiter, EIT Fuss & O'Neill, Inc. 1550 Main Street, Suite 400 Springfield, MA 01103
DATE:	June 20, 2019
RE:	Dams Assessment Integrated Water Infrastructure Vulnerability Assessment and Climate Resiliency Plan MVP Action Grant – Town of Charlton & Town of Spencer

1 Introduction

The Town of Charlton and the Town of Spencer were awarded a FY18 EEA Municipal Vulnerability Preparedness (MVP) Program Action Grant to conduct a comprehensive, regional climate change vulnerability assessment and develop an associated management plan that addresses the major types of water infrastructure in both communities including transportation systems (culverts and bridges), dams and natural impoundments, wastewater collection and treatment systems, water supply, and storm infrastructure. The project consists of a series of technical assessments focused on each type of water infrastructure and associated climate change vulnerabilities. A key goal of this project is to promote resiliency measures that consider both infrastructure and natural system solutions. The integrated plan is intended to help local decision-makers think more strategically about ways to utilize natural systems to provide more effective strategies to reduce flooding, while also benefitting water quality and ecological health.

Based on information available from MassGIS, there are 51 state-registered dams in Charlton and Spencer, four of which are Town-owned. Many of these are relatively small dams built to power industrial mills of the 17th and 18th centuries, are no longer used for their original purpose, and are in poor or deteriorating condition. Some of these dams could pose upstream flooding hazards by backing up water during floods. Dams also present a hazard to downstream areas in the event of a breach or failure, which can result from aging infrastructure, insufficient maintenance and changes in upstream flow regimes. Dam failure can release large quantities of flow, sediment (sometimes contaminated), and debris and is therefore a threat to property, ecosystems, and public safety. Dams have also fragmented the riverine systems in the watershed, preventing the movement of fish and other aquatic life to feed, spawn, or migrate past the dams.

The objective of the technical assessment described in this memorandum is to assess the structural condition of 20 dams and evaluate potential management alternatives and provide recommendations for each dam to increase flood resilience and provide ecological benefits.



2 Dam Assessments

2.1 Selection of Dams for Assessment

Dams to be included in the assessment were initially identified based on review of database files provided by the Massachusetts Department of Conservation and Recreation Office of Dam Safety (ODS). Dams categorized as High or Significant Hazard dams were prioritized, as were municipally-owned dams. Staff from the Town of Charlton and the Town of Spencer (the Towns) supplied information on which dams were already slated for repair activities and which were of greater concern to the Towns. The number of dams selected for assessment was also dictated by the available project budget and the need to assess road-stream crossings and potential sites for the implementation of green infrastructure and low impact development that are included in the study and are documented in additional technical memoranda.

Twenty dams in the Towns were ultimately selected for field surveys and vulnerability assessment, though four additional dams were added to this selection after discovery in the field (see Section 2.3). The locations of the selected dams are shown on the maps in Figures 1 and 2. Table 1 provides summary information on each dam, including hazard classifications, which are defined in Table 2.

The dams initially selected for assessment include two (2) dams owned by the Town of Spencer, three (3) dams owned wholly or partially by the Town of Charlton, and three (3) dams owned by the Massachusetts Department of Conservation and Recreation (MADCR). The remaining twelve (12) dams are either privately owned or of unknown ownership. Ten (10) dams retain recreational impoundments and one (1) dam is used for flood control and as an emergency water supply for the Town of Spencer; two additional dams are used for both recreation and flood control. Five (5) of the dams originally selected for assessment and all ten of the dams discovered in the field (including the four dams added to the assessment) have no known use.

2.2 Office of Dam Safety File Review

Files maintained by the ODS were reviewed to gather available information on each dam selected for assessment. The files requested included the most recent one or two inspection reports and the most recent Emergency Action Plan (if available) for each dam. Dams owned by either the Town of Spencer or the Town of Charlton were excluded from the request, as these reports were available from the towns.

Hazard classification, flood hazard mapping, upstream and downstream development and infrastructure, and current condition identified from previous dam inspection reports were considered in the analysis described in Section 3.

FUSS&O'NEILL



Figure 1. Registered Dams and Dams Assessed in the Town of Spencer





Figure 2. Registered Dams and Dams Assessed in the Town of Charlton



Dam ID Number	Dam Name	Impoundment Name	Stream Name	Ownership	Current Use(s)	Hazard Class
			Taura af Chaulta			
			Town of Charite	n		
MA00101	/IA00101 Glen Echo Dam		Cady Brook Headwaters	Town of Charlton	Flood Control; Lakeside Property	High
MA00103	Little Nugget Lake Dam	Little Nugget Lake	Little Nugget Brook	Town of Charlton	Recreation	Significant
MA01829	Lambs Pond Dam	Lambs Pond		Blair Builders Inc.	Recreation	Significant
MA00100	Ashworth Dam	Upper Sibley Pond	Ashworth Brook	Orrin J. Sisco	Unknown	Significant
MA00099	Lower Sibley Pond Dam	Lower Sibley Pond	Ashworth Brook	Catherine C. Gauthier; in probate as of Spring 2019 according to Todd Girard	None Known	Significant
MA01827	Wee Laddie Pond Dam	Wee Laddie Pond	Little River	St. Mark Coptic Orthodox Church	None Known; Current or past uses may include Conservation and/or Recreation	Significant
MA01838	Farm Pond Dam	Dodge Pond	Unnamed Tributary to the South Charlton Reservoir	Frank and Donna Robert	Recreation	N/A
MA01835	Mcintyres Pond Dam	McIntyre Pond	Deans Brook Headwaters	Thaddeus Mroczkowski	Unknown	N/A
MA01830	MA01830 Rail Road Pond Dam		Unnamed Tributary to Cady Brook	Town of Charlton (half); Anthony Kestigan (half)	Supports Public Road (Old Spencer Road)	Significant
MA03428	Carpenter Mill Pond Dam	Carpenter Mill Pond	Cady Brook		None Known	N/A
	Power Station Dam		Cady Brook		None Known	N/A
	Dam 3		Cady Brook		None Known	N/A
	Dam 4		Cady Brook		None Known	N/A
			Town of Spence	er		
MA01997	Lac Marie Dam	Lac Marie Pond	Seven Mile River	Cistercian Abbey of Spencer, Inc.	Recreation	Significant
MA02379	Muzzy Meadow Dam	Spencer Pond	Unnamed Tributary to Seven Mile River	Town of Spencer	Aesthetics, Future Skating Pond/Trails	High
MA02583	Moose Hill Pond Dam	Moose Hill Pond	Shaw Brook	MADCR	Flood Control, Emergency Water Supply	High
MA00700	Cranberry Meadow Pond Dam	Cranberry Meadow Pond	Cranberry River	Private - Unknown. Town of Spencer states they do	Recreation	Significant

Table 1. Dams Selected for Assessment in the Towns of Charlton and Spencer



Dam ID Number	Dam Name	Impoundment Name	Stream Name	Ownership	Current Use(s)	Hazard Class
				not own this dam		
MA00699	Lake Whittemore Dam	Lake Whittemore	Tributary of Seven Mile River	Worcester County Electric Company	Recreation	High
MA00698	Sugden (Reservoir) Dam	Sugden Reservoir	Shaw Brook	Town of Spencer	Flood Control, Recreation	High
MA00695	Browning Pond Dam	Browning Pond	Seven Mile River	Great Trails Council, BSA	Recreation	Significant
MA00901	Buck Hill Conservation Dam	Buck Hill Pond	Seven Mile River	Worcester County 4H Center, Inc.	Conservation and Recreation	Significant
MA01995	Cedar (or Cider) Millpond Dam	Cider Mill Pond	Outflow brook below Whittemore Dam;	Walter and Suzanne Mendala	Supports Parking Lot	N/A
MA01175	Howe Mill Pond Dam	Howe Mill Pond (lower portion of Howe Pond)	Cranberry River	MADCR	Recreation, Aesthetics, Cultural	Significant
MA02542	Howe Reservoir Dam	Howe Reservoir (upper portion of Howe Pond)	Cranberry River	MADCR	Recreation	Significant

Table 1. Dams Selected for Assessment in the Towns of Charlton and Spencer

Table 2. Dam Hazard Class Definitions

Dam Hazard Class	Definition
Low	The dam is located where failure may cause minimal property damage and loss of life is not expected
Significant	The dam is located where failure may cause loss of life and damage to property
High	The dam is located where failure will likely cause loss of life and serious damage to property.

2.3 Field Data Collection

Limited visual condition assessments of the selected dams were conducted on November 27, November 29, December 5, and December 12, 2018 using visual dam inspection forms adapted from ODS's standard dam inspection forms. Digital photographs were also taken at each site. A blank copy of the field data collection form is provided in Attachment A.

Access to the sites was facilitated by staff at each of the Towns, who contacted dam owners to secure permission to access the dams. Access was granted to ten (10) of the eleven (11) dams in Spencer and four (4) of the nine (9) dams originally selected for assessment in Charlton. Access permissions could not be obtained to four (4) dams in Charlton due to owner refusal, lack of reply from the owner, or lack of information to contact the owner. Access to the Cranberry Meadow Dam in Spencer could not be



obtained as the dam is buried beneath a parking lot. Access to one (1) dam in Charlton (McIntyre's Pond Dam) was granted too late in the field season to complete a visual assessment. Therefore a total of thirteen (13) dams were visually assessed in the field.

The visual dam assessments were performed by a two-person field crew led by a water resources engineer experienced in performing state dam inspections in Massachusetts. During the visual dam assessments conducted in the Town of Spencer, the field crew was accompanied by the Town Planner, Paul Dell'Aquila. Following the visual assessments, field data were checked against previous dam inspection reports when available. Completed visual assessment forms are provided in Attachment B.

In addition to the dams initially selected for visual assessment and vulnerability analysis, nine (9) unregistered dams (three in Spencer and six in Charlton) were discovered and observed from the public-right-of way during the field assessments. These dams are not included in the ODS databases. Three of these dams are located within 0.5 miles of each other along Cady Brook as it flows through Charlton City. All three may be large enough to be considered jurisdictional, and are situated upstream of other infrastructure such that they may pose a significant hazard: Dam 1 is located upstream of a non-jurisdictional dam (Carpenter Mill Dam), while Dam 2 and 3 are each located immediately upstream of either of the two upper dams may result in significant damage and flooding in Charlton City and the failure of any of the three could result in the sequential failure of the downstream dam(s). For this reason, Power Station Dam, Dam 3, and Dam 4 were included in the vulnerability assessment and prioritization described in Section 3, although limited visual condition assessments could not be completed due to lack of access to the dam sites.

2.4 Visual Assessment Findings Summary

Table 3 summarizes key field data and findings of the limited visual condition assessments. Dam condition ratings are defined in Table 4.

Dam ID Number	Dam Name	Visually Assessed?	Condition	Comments			
	Town of Charlton						
MA00101	Glen Echo Dam	Yes	Fair				
MA00103	Little Nugget Lake Dam	Yes	Good	Signs of beaver activity observed near dam			
MA01829	Lambs Pond Dam	Yes	Fair	Beaver dam at spillway has raised impoundment level			
MA00100	Ashworth Dam	No – Permission Denied	Unknown				
MA00099	Lower Sibley Pond Dam	No - Unable to Contact Owner	Poor				
MA01827	Wee Laddie Pond Dam	Yes	Poor	Beaver dam at spillway has raised impoundment level			
MA01838	Farm Pond Dam	No – Permission Denied	Fair				
MA01835	Mcintyres Pond Dam	No – Permission Granted too late in Winter Season	Unknown	Beaver dam observed on top of original dam in June 2006. At same time, original stone wall was observed to be damaged or breached and no spillway was visible.			

Table 3. Summary of Dam Visual Assessment Findings



Dam ID Number	Dam Name	Visually Assessed?	Condition	Comments
MA01830	Rail Road Pond Dam	No – No response from Owner	Poor	
MA03428	Carpenter Mill Pond Dam	No – Added to Assessment after three additional dams found in field upstream of this structure	Probably Fair or Poor	
	Power Station Dam	No – Found in Field	Unsafe	
	Dam 3	No – Found in Field	Unsafe	
	Dam 4	No – Found in Field	Unsafe	
		Town of Spence	r	
MA01997	Lac Marie Dam	Yes	Good	
MA02379	Muzzy Meadow Dam	Yes	Fair	
MA02583	Moose Hill Pond Dam	Yes	Satisfactory	
MA00700	Cranberry Meadow Pond Dam	Yes	Poor	
MA00699	Lake Whittemore Dam	Yes	Satisfactory	
MA00698	Sugden (Reservoir) Dam	Yes	Fair	
MA00695	Browning Pond Dam	Yes	Fair	
MA00901	Buck Hill Conservation Dam	Yes	Fair	Debris from beaver dam at spillway has blocked spillway inlet
MA01995	Cedar (or Cider) Millpond Dam	No – buried beneath Price Chopper Parking Lot	Fair	
MA01175	Howe Mill Pond Dam	Yes	Fair	
MA02542	Howe Reservoir Dam	Yes	Fair	Beaver dam at spillway has raised impoundment level

Table 3. Summary of Dam Visual Assessment Findings

Table 4. Dams Condition Rating Definitions

Dam Condition	Definition
Coord	No operational or maintenance deficiencies recognized. Safe performance
GOOd	is expected under all loading conditions.
Catiofastam	Minor operational and maintenance deficiencies. Infrequent hydrologic
Satisfactory	events would probably result in deficiencies.
	Significant operational and maintenance deficiencies are present, but no
Fair	structural deficiencies. Potential deficiencies exist under unusual loading
Fall	conditions. This rating may be used when uncertainties exist as to critical
	parameters
Door	Significant structural, operational, and maintenance deficiencies are
Poor	clearly recognized under normal operating conditions
Uncofo	Major structural, operational, and maintenance deficiencies exist under
Unsafe	normal operating conditions

The following issues were observed at the dams:

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- Beaver Activity: Several of the dams (Wee Laddie Pond Dam, Buck Hill Conservation Dam, Lambs Pond Dam, Howe Reservoir Dam, and Little Nugget Lake Dam) were observed to have beaver activity impacting the spillway. In addition, a beaver dam was reported at the spillway of McIntyre's Pond Dam in 2006, though it is unclear if the beaver dam still exists. Beaver dams built at dam spillways have raised the impoundment level by one (1) foot or more at Wee Laddie Pond Dam and Lambs Pond Dam, raising the risk that the dam(s) will overtop during wet periods. Todd Girard, Conservation Agent for the Town of Charlton, has also reported that beaver activity is a problem at the majority of the dams he manages in the Town of Charlton.
- Trees and Vegetation on the Embankment: The majority of the assessed dams have vegetation encroaching on or growing directly on the dam embankment. Vegetation, especially large trees, can promote the formation of voids in the dam embankment, leading to seepage and piping through the dam, thereby accelerating the degradation of the dam. Trees and vegetation should be cleared back to a distance of 20 feet from any dam and a cover of healthy grass should be maintained on dam embankments.
- Lack of Operation and Maintenance (O&M) Plans: Previous inspection reports stated that O&M Plans were not in place for the majority of the dams as of the last inspection.
 Maintenance is critical at dams to prevent small problems from accumulating and leading to failure of the dam. Dam owners should be encouraged to develop and follow O&M plans to maintain the stability and safety of the dam(s) under their care.

3 Evaluation and Prioritization of Management Alternatives

3.1 Evaluation Method

Using data from the limited visual condition assessments and available ODS file data, various management alternatives were evaluated for each dam to identify and prioritize management actions that would enhance flood resiliency and provide ecological benefits. Dam management alternatives were assessed using the flowchart in Figure 3.

The following dam management alternatives were evaluated:

- Removal/Breach: Full removal or partial breach of a dam, thereby eliminating or lowering the impoundment, reducing the risk of failure or breach, and restoring free-flowing conditions. Dam removal eliminates flood risk due to failure or breach, potentially reduces flood risk in upstream areas, meets aquatic organism passage objectives, and eliminates significant liability and costly maintenance for dam owners.
- Repair: Repair of structural components of a dam to address existing deficiencies that threaten
 the structural integrity of the dam, thereby reducing the potential for failure or breach during
 large storms. The dam repair alternative alone does not eliminate the risk of failure nor does it
 improve aquatic organism passage. In some cases, the repair option, potentially combined with
 provision of aquatic organism passage, may be the only viable alternative if removal is not
 feasible. Dam repair involves the up-front cost of the repairs and a long-term financial
 commitment to inspect and maintain the dam following the initial repairs. It also assumes that
 the owner has the willingness, ability, and financial resources to adequately maintain the dam.



- Modification/Repurposing: Modification of an existing dam to provide increased storage during floods. For example, repurposing could include increasing the elevation of the dam, dredging of the impoundment, or modification of the outlet structure to significantly reduce the impoundment size and normal pool elevation, allowing the river to flow freely under normal conditions (i.e., a dry impoundment), but allowing the impoundment to fill up and store floodwaters during larger storms. Repurposing of dams for hydropower was not considered because hydropower is generally not economically viable at the scale of the dams located within these towns.
- Aquatic Organism Passage Structure: Construction of an engineered structure at a dam to provide for passage of fish and other aquatic organisms, including fishways such as fish ladders, rock ramps, or bypass channels. This option provides enhanced stream continuity if dam removal is not feasible.
- No Action/Maintain: Maintain the dam in its current condition.

Factors considered qualitatively in the alternatives evaluation included current uses and recreational/cultural value of the dam and impoundment, the owner's ability to maintain the dam, failure risk (based on hazard classification and structural condition), flood mitigation potential, and stream continuity and aquatic habitat quality. These factors are discussed in more detail below.



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Dam Management Alternatives Evaluation Criteria



Figure 3. Dam Management Alternatives Evaluation Criteria Flowchart

Current Uses/Values of the Impoundment

Uses of impoundments may include flood control, water supply, recreation, conservation, or aesthetics/culture. Critical uses are those uses that required the dam and impoundment to remain in place without removal, breaching, or lowering of the dam in order for the value to be realized. Dams may have multiple uses, including multiple critical uses.

3.1.1 Ability to Maintain

The ability to maintain a dam was determined based on visual evidence of maintenance (or lack thereof) observed during the visual assessments, supplemented with information from previous dam inspection reports. For dams where vegetation consisted of mowed grass and deficiencies were relatively few and



minor, and where the dam owner was known, the Ability to Maintain was entered as "Yes". For dams covered in tall grasses, shrubs, and/or trees and/or dams without a known owner, the Ability to Maintain was entered as "No". Where the Ability to Maintain was unclear, the most appropriate answer was entered, with supplemental notes.

3.1.2 Failure Risk

Failure risk was estimated for each dam based on the hazard class of the dam (i.e., a rating system based on the magnitude of potential impacts in the event of dam failure) and the structural condition of the dam (i.e., likelihood of dam failure) based on the limited visual condition assessments and/or dam inspection information from the ODS file review (Figure 4). A dam may be at risk if the probability of failure is high, if the consequences of failure are high, or both.

		Good	Satisfactory	Fair	Poor	Unsafe
	Low	Low	Low	Low	Moderate	Moderate
Dam Hazard Class ¹	Significant	Low	Low	Moderate	Moderate	Severe
	High	Low	Moderate	Moderate	Severe	Severe

Dam Condition

Figure 4. Dam Failure Risk Assignment Matrix

3.1.3 Flood Mitigation Potential

Dams may provide flood mitigation services if they have sufficient available volume to attenuate flood flows from upstream and slow their release to downstream areas. Flood mitigation potential was assessed based on the ratio of the dam's impoundment area to the dam's drainage area. A higher ratio reflects an impoundment that is large in relation to the size of the watershed, and is therefore more likely to provide significant flood protection benefits to downstream properties and infrastructure (assuming adequate freeboard is available above the normal pool elevation). For each dam, the watershed area was obtained from the USGS StreamStats web tool, and the impoundment area was obtained from file review information or estimated from aerial imagery in Google Earth. Dams with a watershed ratio greater than 0.1 (i.e., where the impoundment area is 10% or greater of the watershed area) were designated as having flood mitigation potential.

3.1.4 Stream Continuity Potential

Stream continuity refers to the connectedness of different reaches of the stream and the ecological benefits associated with that connectedness. Stream Continuity Potential was estimated for each dam using the Restoration Potential Model (RPM) Tool, developed by the Division of Ecological



Restoration, MA Department of Fish and Game (MADER). This statewide analysis tool is used to evaluate the ecological benefits of dam removal. The RPM Tool evaluates environmental and stream health data upstream and downstream of a dam in order to assess how its removal may improve habitat in the stream and its local watershed. The result is a percentile ranking (0-100) of ecological benefit potential for the dam if it were removed.

The RPM Tool relies on three main environmental indicators:

- 1. Watershed Position. The Tool adds a scoring weight for dams located in reaches with unique ecological characteristics that particularly benefit from dam removal (head-of-tide habitats, coastal stream habitats, and headwaters ecosystems).
- 2. Ecological Integrity. The effect of dam removal is measured by four indicators:
 - The presence of rare species and aquatic habitats habitat upstream or downstream of a dam. Places of high ecological value and integrity have been designated by BioMap2 (<u>https://www.mass.gov/service-details/biomap2-conserving-the-biodiversity-of-massachusetts-in-a-changing-world</u>), a project of the MassWildlife's Natural Heritage & Endangered Species Program.
 - b. The percent cover of impervious surfaces upstream from the dam
 - c. The presence of mapped coldwater habitat upstream or downstream of a dam, indicating suitable year-round habitat for aquatic life such as trout.
 - d. The alteration of August stream flow due to water withdrawals, with higher alterations indicating higher stress on the aquatic ecosystem.
- 3. Connectivity. The improvement in stream connectivity (upstream and downstream) that would be gained if the dam were removed.

The data supplied in the tool and used for this analysis was last updated on April 28, 2017. For more information about DER's Restoration Potential Model Tool or how these indicators are scored, or to access the interactive map viewer of statewide dam assessments, go to <u>www.mass.gov/service-details/ders-restoration-potential-model-tool-description.</u>

3.1.5 Management Recommendations

Each of the above factors was considered in determining the most appropriate recommendation(s) for each dam using the dam management alternatives evaluation criteria flowchart (Figure 2). Feedback from the Towns was also considered in developing final management recommendations.

3.2 Prioritization Method

As human health and safety is the first and foremost concern when it comes to dams, priority he management recommendations for each dam were assigned a relative priority (low, moderate, or high) based on whether the dam is considered a low, moderate, or severe failure risk, respectively.



3.3 Assessment and Prioritization Results

Table 5 summarizes the Ability to Maintain, Failure Risk, Flood Mitigation Potential, and Stream Continuity Potential, as well as the management recommendations and relative priority, for each dam. The dam assessment and prioritization worksheet and priority category are provided in Attachment C.

Dam ID Number	Dam Name	Failure Risk/Priority ¹	Ability to Maintain	Flood Mitigation Potential	Stream Continuity Potential	Management Recommendations
		Тс	own of Charlton			
MA00101	Glen Echo Dam	Moderate	Yes	No	Moderate	Repair/Maintain
MA00103	Little Nugget Lake Dam	Low	Yes	No	Moderate	Consider adding AOP
MA01829	Lambs Pond Dam	Moderate	Yes, but owner has not removed beaver dam at spillway	No	Moderate	Remove to increase stream continuity and to address beaver problems, or Repair and remove beaver debris.
MA00100	Ashworth Dam	Unknown	Unknown	No	Moderate	Remove or No Action
MA00099	Lower Sibley Pond Dam	Severe	No	No	Low	Remove
MA01827	Wee Laddie Pond Dam	Severe	No	No	Low	Remove
MA01838	Farm Pond Dam	Low	Unknown	No	Moderate	Repair/Maintain and Consider adding AOP
MA01835	Mcintyres Pond Dam	Unknown	Unknown	No	Moderate	Consider removal; More information needed
MA01830	Rail Road Pond Dam	Severe	No	No	Not Assessed	Remove
MA03428	Carpenter Mill Pond Dam	Moderate	Unknown	No	Not Assessed	Consider removal; More information needed
	Power Station Dam	Severe	No	No	Not Assessed	Remove
	Dam 3	Severe	No	No	Not Assessed	Remove
	Dam 4	Severe	No	No	Not Assessed	Remove
		Te	own of Spencer			
MA01997	Lac Marie Dam	Low	Yes	No	High	Consider adding AOP within limited space
MA02379	Muzzy Meadow Dam	Moderate	Yes	No	Low	No Action
MA02583	Moose Hill Pond Dam	Low/ Moderate	Yes	No	Moderate	Consider adding AOP
MA00700	Cranberry Meadow Pond Dam	Severe	Yes	Yes	Low	Repair
MA00699	Lake Whittemore Dam	Low/ Moderate	Yes	Yes	Low	No Action

Table 5. Dam Assessment and Prioritization Results Summary



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Dam ID Number	Dam Name	Failure Risk/Priority ¹	Ability to Maintain	Flood Mitigation Potential	Stream Continuity Potential	Management Recommendations
MA00698	Sugden (Reservoir) Dam	Moderate	Yes	No	Moderate	Consider modifying to allow drawdown for additional flood capacity; Consider adding AOP
MA00695	Browning Pond Dam	Moderate	No	No	High	Consider removal, or Repair/Maintain and add AOP
MA00901	Buck Hill Conservation Dam	Moderate/ Severe	Yes but owner has not removed beaver dam or debris from spillway	No	Moderate	Repair/Maintain and consider adding AOP
MA01995	Cedar Millpond Dam (a.k.a. Cider Mill Pond Dam)	Low/ Unknown	No	No	Low	More information needed
MA01175	Howe Mill Pond Dam	Moderate	Yes	No	Low	Repair/Maintain
MA02542	Howe Reservoir Dam	Moderate	Yes	No	Low	Study Removal to possibly address beaver problems and provide stream/lake continuity

Table 5. Dam Assessment and Prioritization Results Summary

¹Failure risk correlates with dam priority (low failure risk = low priority, moderate failure risk medium priority, and severe failure risk = high priority). For high priority dams, a severe failure risk is indicated in bold.

3.3.1 Ability to Maintain

Visual evidence of maintenance was observed at only half of the dams that were assessed (12 out of 24 dams). Two other dams were mowed regularly but had not been cleared of debris or beaver dams building up at the spillway. All of these dams are privately owned or of unknown ownership; town-owned dams and dams owned by DCR were better maintained.

3.3.2 Failure Risk

Eight (8) of the 24 dams assessed fell into the Severe or Moderate/Severe Failure Risk category. These dams should be considered among the highest priorities for action, as they are the most likely to fail and/or have significant impacts upon failure.

Ten (10) of the 24 dams are considered a Moderate or Low/Moderate Failure Risk and two (2) are considered a low failure risk. One dam (Cedar Mill Pond Dam) is categorized as low/unknown as the dam is obscured by the parking lot above it but possibly also protected by the lot.

3.3.3 Flood Mitigation Potential

Only two (2) dams (Cranberry Meadow Pond Dam, and Lake Whittemore Dam) are considered to have Flood Mitigation Potential based on the ratio of watershed area to impoundment area. The flood mitigation benefits of a dam and associated impoundment can be enhanced by increasing the available storage volume of the impoundment. This can typically be accomplished by: 1) raising the height of the



dam, 2) dredging the impoundment, or 3) modifying the dam's low-level outlet structure to reduce the impoundment size and normal pool elevation. Cranberry Meadow Pond Dam, and Lake Whittemore Dam are both surrounded by lakeside properties and/or roads that would be negatively impacted by raising the dam elevation. Dredging of the assessed impoundments, to the extent required to appreciably enhance flood storage, is likely to be cost-prohibitive given the permitting requirements, the high cost of implementation, including sediment disposal, and the high cost of maintaining the impoundment depth through repeated dredging.

3.3.4 Stream Continuity Potential

Only two (2) dams are considered to have a high stream continuity potential. An additional nine (9) dams are considered to have a moderate stream continuity potential. Eight (8) are considered to have low stream continuity potential, and five were not assessed using the DER Restoration Potential Model.

Of the three major factors considered, ecological integrity carries the most weight, followed by connectivity. Few dams in the Charlton and Spencer receive points for watershed position, as none are coastal dams and few of the dams assessed are headwaters dams. Thus, the high number of dams with a low or moderate Stream Continuity Potential are explained primarily by low ecological integrity scores and low connectivity scores. Low connectivity scores were common due to the large number of dams and culverts within the stream networks in both towns, which limit the gain in net length of open stream that can be gained through removal of a single structure. Improvements in water quality and habitat connectivity of streams and lakes through other concurrent work by each town (such as green infrastructure and road-stream crossing replacement projects) would also increase the benefit of dam removal and increased aquatic organism passage.

4 Management Recommendations

The following is a summary of management recommendations for the 24 dams assessed.

• Removal is recommended for 11 of the 24 dams assessed, due to the high failure risk and lack of ability to maintain these structures, as well as the potential gains in aquatic connectivity upon removal.

A feasibility study for removal of Howe Reservoir Dam is also recommended to further assess the potential benefits to aquatic connectivity in Howe Pond and the Cranberry River, to address ongoing beaver problems, and to eliminate a significant hazard dam and the inspection and maintenance requirements associated with the structure.

 Repair and maintenance is recommended for five dams (Glen Echo Lake Dam, Farm Pond Dam, Cranberry Meadow Pond Dam, Buck Hill Conservation Dam, and Howe Mill Pond Dam). These dams are structures with intrinsic cultural and historic value, or that retain recreational impoundments, but that also require some repair work and maintenance to correct structural deficiencies. The addition of a fishway is also recommended for Farm Pond Dam and Buck Hill Conservation Dam.

Repair is included as a potential alternative to dam removal for Lambs Pond Dam and Browning Pond Dam. Repair of these dams would require



- Modification of Sugden (Reservoir) Dam should be considered to provide additional flood storage capacity. Modification or repurposing for flood storage or other uses is not recommended for any of the other dams, for the reasons listed under Section 3.3.3.
- Addition of a fishway (e.g., a fish ladder, eel ladder, rock ramp, and/or nature-like fishway) is recommended for Little Nugget Lake Dam, Farm Pond Dam, Lac Marie Dam, Moose Hill Pond Dam, Sugden Reservoir Dam, and Buck Hill Conservation Dam.

If repair is chosen over removal for Browning Pond Dam, the addition of a fishway or replacement of the culvert with a passage-friendly design is recommended.

• The No Action alternative is recommended for Muzzy Meadow Dam and Lake Whittemore Dam.

Eight dams were determined to be high priority dams (dams with a Severe Risk of Failure): six dams in Charlton and two dams in Spencer. Removal is recommended for all six dams located in Charlton, and repairs are recommended for the two dams located in Spencer. All eight of these dams are entirely or partially privately owned, but the municipalities can play a role in contacting the dam owners and helping connect them with funding and technical resources. More detailed site-specific recommendations were developed for these eight dams in order to provide a blueprint for future work and are described in Sections 4.2-4.7. These planning-level recommendations are intended to enhance the resilience of instream infrastructure and the river system to withstanding extreme flood events and to provide for passage of aquatic organisms under normal flow conditions. At one of the dams, we also recommend culvert replacement and upgrade along with the proposed dam management action to enhance flood resilience, water quality, and aquatic habitat using a combination of natural and infrastructure-based approaches.

4.1 Lower Sibley Pond Dam (MA#00099, Town of Charlton)

Existing Conditions

- The structure is currently considered to be in poor condition due to a five-foot long slide (area of soil that has collapsed and fallen down the dam embankment) on the downstream slope with seepage observed flowing from the right side of the slide.
- Trees, brush, stumps, and other vegetation are present on the embankment
- Many of the concrete appurtenances are displaced, cracked, spalled, and/or delaminated.
- Additional details on conditions at the dam are available from the follow-up inspection conducted January 14, 2019.
- The dam and its impoundment do not currently have any known use, and have a low flood mitigation potential.
- The dam has a low stream continuity potential as measured by DER's Restoration Potential Model tool.
- The dam has a Significant Hazard class.
- The dam is privately owned. As of April 2019, the dam is believed to be in probate.



Lower Sibley Pond Dam Spillway



Recommendations

- Remove Lower Sibley Pond Dam to improve flood resiliency, eliminate the need for maintenance, and improve aquatic connectivity.
 - Contact and coordinate with the dam owner to complete engineering design and permitting and removal of the dam.
 - Leverage grant funding and partnerships with state and federal agencies and non-profit organizations to streamline dam removal.

4.2 Wee Laddie Pond Dam (MA#01827, Town of Charlton)

Existing Conditions

- The structure was determined to be in poor condition due to the presence of a beaver dam at the dam spillway that has raised the level of the impoundment by approximately one foot. Additional debris is caught in the spillway.
- Large and small trees, brush, stumps, and other vegetation are present on the embankment.
- The concrete appurtenances on the dam are delaminated, displaced, cracked, and/or spalled. The left training wall is leaning inward.
- Additional details on conditions at the dam are available from the Phase I inspection conducted December 2, 2014.
- The dam and its impoundment do not currently have any known use, and have a low flood mitigation potential. The impoundment was historically used for irrigation and as an ice pond.
- The dam has a low stream continuity potential as measured by DER's Restoration Potential Model tool.
- The dam has a Significant Hazard class.





Wee Laddie Pond Dam Spillway. Note the beaver dam, which has caused the level of the impoundment to rise by approximately one foot.

Trees on the crest of Wee Laddie Pond Dam.







Water from the spillway of Wee Laddie Pond Dam flows directly into a culvert under Gould Road.

Recommendations

- Remove Wee Laddie Pond Dam to improve flood resiliency, eliminate the need for maintenance, and improve aquatic connectivity.
 - Contact and coordinate with the dam owner to complete engineering design and permitting and removal of the dam
 - Leverage grant funding and partnerships with state and federal agencies and non-profit organizations to streamline dam removal.
 - Coordinate the removal of Wee Laddie Pond Dam with the replacement and upgrade of the culvert under Gould Road, immediately downstream of the spillway.

4.3 Rail Road Pond Dam (MA#01830, Town of Charlton)

Existing Conditions

- The structure was determined to be in poor condition due to the presence of heavy vegetation and tree growth on the dam, including both the upstream and downstream embankments, and the presence of debris clogging the spillway on both sides of the trash rack.
- Additional details on conditions at the dam and photos are available from the follow-up inspections conducted November 19, 2018 and January 8, 2016 and the Phase I inspection conducted June 15, 2015.



- The dam and its impoundment do not currently have any known use and have a moderate flood mitigation potential.
- The dam was not assessed by DER's Restoration Potential Model tool.
- The dam has a Significant Hazard class.
- Half of the dam is owned by the Town of Charlton; the other half of the dam is privately owned. The dam owner is unknown to ODS.



2015 photo of the upstream embankment of Rail Road Pond Dam.









Rail Road Pond Dam spillway structure (photo from 2015).

Recommendations

- Remove Rail Road Pond Dam
 - Contact and coordinate with the private owner of the non-municipally owned half of the dam to complete engineering design and permitting and removal of the dam,
 - Leverage grant funding and partnerships with state and federal agencies and non-profit organizations to streamline dam removal.
- 4.4 Power Station Dam, Dam 3, and Dam 4 (Town of Charlton)

Existing Conditions

- The structures are in poor or unsafe condition due to lack of maintenance and various deficiencies.
 - The masonry at Power Station Dam is crumbling, and large voids are present under the structure, which may lead to collapse of the structure. The spillway may have failed (the spillway was obscured by trees), but is not passable for aquatic organisms.
 - The spillway of Dam 3 appears to have failed. Vegetation is growing on the remainder of the dam. Dam 3 is located approximately 20 feet upstream of Route 31/Brookfield Road. Failure of Dam 3 could plug the Route 31 crossing, causing failure of the crossing structure.
 - The spillway of Dam 4 is located approximately 15-20 feet upstream of Route 31/City Depot Road. Failure of Dam 4 could plug the Route 31 crossing, causing failure of the crossing structure. The water level in an adjacent pond (immediately to the east), which is likely a separate section of or hydrologically connected to the dam's impoundment, is within 1-3 feet of the top of the embankment facing the road.
- All three dams are located within 0.4 miles of each other along Cady Brook. A fourth dam (Carpenter Mill Pond Dam) is located approximately 600 feet downstream of Power Station Dam.
- The dams and their impoundments do not currently have any known uses.
 - o Power Station Dam historically provided electricity to Charlton City.
 - o Dam 3 was historically associated with the Charlton Woolen Mill.



- Dam 4 was formerly owned by the Red Cross and the impoundment was used for swimming lessons.
- Flood mitigation potential was not calculated for the three dams but is likely low due to the small size of the impoundments.
- The dams were not assessed by DER's Restoration Potential Model tool.
- None of the three dams are registered with the Office of Dam Safety. Therefore, none of the dams have been assigned a hazard classification.



Power Station Dam

Dam 3



Panoramic view of Dam 4, including the spillway and a masonry wall to the right of the spillway. Route 31/City Depot Road is shown at the left but is actually parallel to the dam spillway (right).

Recommendations

- Remove the Power Station Dam, Dam 3, and Dam 4.
 - Contact and coordinate with the dam owners to complete engineering design and permitting and removal of all three dams



- Leverage grant funding and partnerships with state and federal agencies and non-profit organizations to streamline dam removals.
- Consider coordinating with the owner of the Carpenter Mill Pond Dam to remove that dam in conjunction with these three dams. Removal of this fourth dam will further reduce risk to downstream infrastructure (including Route 20) and improve aquatic connectivity.
- Consider coordinating the removals of these dams with the replacement and upgrade of the road-stream crossings at Route 31 to further improve flood resilience in Charlton City and to augment improvements to aquatic connectivity in Cady Brook.
- 4.5 Cranberry Meadow Pond Dam (MA#00700, Town of Spencer)

Existing Conditions

- The structure was determined to be in poor condition due to the presence of a severe erosional scarp and undermining at the end of the paved spillway apron, and due to tree growth on the upstream left and right abutments of the dam and in the downstream channel.
- Large and small trees, brush, stumps, and other vegetation are present on the embankment, as well as deep rotting stumps.
- The upstream embankment has eroded and is nearly vertical.
- Debris appeared to have been dumped on the right abutment.
- The right training wall is deteriorated and a stone masonry wall left of the downstream end of the spillway has failed.
- Additional details on conditions at the dam are available from the follow-up inspection conducted April 26, 2018 and the Phase I inspection conducted June 30, 2013.
- Cranberry Meadow Pond is a recreational impoundment lined with residential properties, and therefore is not a candidate for alteration to increase flood storage, despite its high flood mitigation potential.
- The stop logs are inaccessible due to their location beneath the bridge. Debris has accumulated at the stop logs.
- The dam has a low stream continuity potential as measured by DER's Restoration Potential Model tool.
- The dam has a Significant Hazard class.
- The dam is privately owned. The dam owner is unknown to ODS.





Cranberry Meadow Pond Road Dam spillway. Note the voids beneath and on either side of the spillway, and vegetation on the embankment and left abutment.



Outlet of the stone culvert under Cranberry Meadow Road, approximately 200 feet downstream of the Cranberry Meadow Pond Dam spillway.

Recommendations

- Repair and maintain Cranberry Meadow Pond Dam.
 - o Repair the spillway training walls
 - Fill the eroded scarp at the end of the spillway with riprap and blend into the channel to protect against further erosion.
 - Regrade the upstream and downstream slope into a stable slope, and protect the upstream slope with riprap.
 - Move the gravel parking lot back from the crest and delineate with wheel stops to prevent traffic from driving on the dam crest.
 - Remove the brush, trees, and other vegetation from the faces of the dam and to a distance of twenty (20) feet from the dam.
 - o Develop an Operations and Maintenance (O&M) Plan for the dam.
 - Develop an Emergency Action Plan (EAP) for the dam (required for significant hazard dams as of 2019).



4.6 Buck Hill Conservation Dam (MA#00901, Town of Spencer)

Existing Conditions

- The structure was determined to be in poor condition due to the blockage of the spillway inlet by beaver activity and debris, and the boil at the foot of the dam, which is most likely due to submergence of the outlet pipe, should be investigated to determine the source. The Phase I Inspection completed on November 26, 2013 rated the dam in fair condition and also noted that the inlet pipe had partially collapsed and the outlet pipe had nearly rusted through. These deficiencies do not appear to have been corrected since the inspection, which is over five years old at the time of this report.
- The secondary spillway has not been maintained
- The trash rack at the primary spillway is severely damaged.
- Brush and other vegetation are present on the embankment. The downstream face of the dam appeared to exhibit signs of seepage, although it was difficult to be certain during the visual assessment due to snowmelt and rain.
- Additional details on conditions at the dam are available from the Phase I inspection conducted November 26, 2013.
- Buck Hill Pond is a recreational and conservation impoundment. The impoundment is not suitable for alteration to increase flood storage, despite its moderate flood mitigation potential as the surrounding topography and the length of the dam would make this strategy cost-prohibitive.
- The dam has a moderate stream continuity potential as measured by DER's Restoration Potential Model tool.
- The dam has a Significant Hazard class.
- The dam is privately owned (by Worcester County 4-H Center, Inc.).



Embankment and spillway inlet at Buck Hill Conservation Dam. Note debris in spillway and vegetation on upstream bank.





Close-up of Buck Hill Conservation Dam Spillway, showing debris and beaver activity at spillway. The damaged inlet and trash rack are difficult to see through the debris and vegetation.

Beaver Lodges in Buck Hill Pond.



Outlet of Buck Hill Pond Spillway. Note the boil at the bottom right of the image, which may be due to submergence of the outlet pipe, should be investigated to confirm that seepage and piping are not threatening the dam. The outlet pipe and downstream channel should be cleared.



Recommendations

- Repair and maintain Buck Hill Pond Dam.
 - Investigate the source of the boil at the base of the dam. Asses the dam under drier conditions to further determine whether seepage is an issue at the dam.
 - o Clear the downstream channel such that the outlet is not submerged.
 - Replace the primary spillway and trash rack.
 - Remove the brush, trees, and other vegetation from the faces of the dam and to a distance of twenty (20) feet from the dam.
 - o Develop an Operations and Maintenance (O&M) Plan for the dam.
 - Develop an Emergency Action Plan (EAP) for the dam (required for significant hazard dams as of 2019).
- 4.7 Beaver Assessments

Existing Conditions

- In addition to the beaver dams observed at Wee Laddie Pond Dam and Buck Hill Conservation Dam, beaver dams were also observed at the spillways of Lambs Pond Dam and Howe Reservoir Dam. Beaver activity was observed at the Little Nugget Lake dike.
- Todd Girard, Conservation Agent for the Town of Charlton, stated at the April 22, 2019 Steering Committee meeting that beaver activity is a problem at all Town-owned dams except Prindle Lake Dam.
- Beaver activity was identified as a major concern for Charlton during the Community Resilience Building Workshop held on April 7, 2018. Beaver-influenced areas identified included:
 - Guelphwood Road, Dresser Hill Road, and North Sturbridge Road, all of which have experienced flooding during major precipitation events due to beaver activity.
 - o Wetlands in the vicinity of the uncapped landfill on Flint Road.



Beaver dam at the spillway of Lambs Pond Dam. Note that the presence of the beaver dam has caused the surface of the impoundment to rise nearly to the crest of the dam.





View of the Lambs Pond Dam Spillway and beaver dam from downstream.



Debris placed by beavers in an effort to form a dam at the spillway of Howe Reservoir Pond. Note that the debris has caused the level of the impoundment to rise.



Tree felled by beaver near the dike at Little Nugget Lake Dam.



Recommendations

- Develop comprehensive beaver management plan to mitigate unpredictable flooding/impoundment impacts in undesirable locations while taking advantage of beaverdriven flood storage and resiliency benefits in locations where impacts to property and infrastructure can be minimized. Establish beaver management zones and appropriate management techniques for application in each zone. Develop protocols for assessing new areas of beaver activity, and apply creative engineering solutions to discourage problematic beaver activity and/or encourage beavers to reside in areas where their benefits outweigh their impacts. Consider the development of local regulatory mechanisms to give each Town authority to address problematic beaver dams on private property. Focus on known areas of problematic activity and beaver dams in the vicinity of Guelphwood Road, Dresser Hill Road, and North Sturbridge Road in the Town of ChartIton.
- Develop education and outreach efforts to establish citizen support for and participation in Town efforts to manage forests and beavers. Involve neighboring towns in these efforts to increase success rates.

Attachments: Attachment A: Dam Visual Assessment Field Form (Blank) Attachment B: Dam Visual Assessment Field Forms (Completed) Attachment C: Dam Assessment Scoring and Prioritization Results



Attachment A

Dam Visual Assessment Field Form (Blank)

Charlton-Spencer Integrated Water Infrastructure Vulnerability Assessment and Climate Resiliency Plan VISUAL DAM ASSESSMENT

DAM	SAFETY	INSPECTION	J
DIMI		I OI DOI IOI	٩

NAME OF DAM:STATE ID ;	#:		
AKA NAME:WATERCO	DURSE NAME:		
	TION INFORMATION		
CITY/TOWN:LAT. / LON	IG.:		
STATE:HAZARD C	CLASS:		
GENERAL I	DAM INFORMATION		
TYPE OF DAM:			
PURPOSE OF DAM:			
YEAR BUILT:			
INSPEC	TION SUMMARY		
DATE OF INSPECTION:NAME OF .	INSPECTOR:		
TIME OF INSPECTION:OTHER AT	TENDEES:		
WEATHER CONDITIONS:			
<u>GENERAL DAM DATA</u>			
PRIMARY SPILLWAY TYPE:	AUXILIARY SPILLWAY TYPE:		
NUMBER OF OUTLETS:	TYPE OF OUTLETS:		
HAS THE DAM BEEN BREACHED OR OVERTOPPED?			
IS THERE A FISH LADDER? (LIST TYPE IF PRESENT)			
DOES THE CREST SUPPORT A PUBLIC ROAD?			
ROADS/DRIVEWAY IMMEDIATELY DOWNSTREAM OF DAM?			
ACCESS CONDITIONS TO THE SITE:			
SECURITY DEVICES?			

Charlton-Spencer Integrated Water Infrastructure Vulnerability Assessment and Climate Resiliency Plan VISUAL DAM ASSESSMENT

DAM NAME		INSPECTION DATE
EMBANKMENT (D/S SLOPE)		
AREA INSPECTED	CONDITION	OBSERVATIONS
D/S SLOPE	TYPE (EARTH, CONCRETE, MASONRY)	
	WET AREAS (NO FLOW)	
	SEEPAGE (EARTH) OR LEAKAGE (CONCRETE)	
	SLIDE, SLOUGH, SCARP	
	EMBANKMENT-ABUTMENT CONTACT	
	SINKHOLE/ANIMAL BURROWS	
	EROSION	
	UNUSUAL MOVEMENT	
	VEGETATION (PRESENCE/CONDITION)	
	CONDITION OF JOINTS (CONCRETE)	
ADDITIONAL COMMENTS:		

Charlton-Spencer Integrated Water Infrastructure Vulnerability Assessment and Climate Resiliency Plan VISUAL DAM ASSESSMENT

DAM NAM	ΙE	INSPECTION DATE
EMBANKMENT (U/S SLOPE)		
AREA INSPECTE	CONDITION	OBSERVATIONS
U/S SLOPE	TYPE (EARTH, CONCRETE, MASONRY)	
	SLIDE, SLOUGH, SCARP	
	SLOPE PROTECTION TYPE AND COND.	
	SINKHOLE/ANIMAL BURROWS	
	EMBANKMENT-ABUTMENT CONTACT	
	EROSION	
	UNUSUAL MOVEMENT	
	VEGETATION (PRESENCE/CONDITION)	
	CONDITION OF JOINTS (CONCRETE)	
ADDITIONAL COMMENTS:		
DAM NAME		INSPECTION DATE
-------------------	----------------------------------	--------------------
		EMBANKMENT (CREST)
AREA INSPECTED	CONDITION	OBSERVATIONS
	SURFACE TYPE	
	SURFACE CRACKING	
	SINKHOLES, ANIMAL BURROWS	
	VERTICAL ALIGNMENT (DEPRESSIONS)	
CREST	HORIZONTAL ALIGNMENT	
	RUTS AND/OR PUDDLES	
	VEGETATION (PRESENCE/CONDITION)	
	ABUTMENT CONTACT	
	CONDITION OF JOINTS (CONCRETE)	
ADDITIONAL	COMMENTS:	

DAM NAME		INSPECTION DATE
		INSTRUMENTATION
AREA INSPECTED	CONDITION	OBSERVATIONS
	1. PIEZOMETERS	
	2. OBSERVATION WELLS	
	3. STAFF GAGE AND RECORDER	
	4. WEIRS	
	5. INCLINOMETERS	
INSTR	6. SURVEY MONUMENTS	
in (b i i c	7. DRAINS	
	8. FREQUENCY OF READINGS	
	9. LOCATION OF READINGS	
ADDITIONAL	L COMMENTS:	

DAM NAM	Έ		INSPEC	TION DATE	
		DOWNSTREA	M WALLS		
AREA INSPECTE	CONDITION		OB	SERVATIONS	
	1. WALL TYPE				
	2. WALL ALIGNMENT				
	3. WALL CONDITION				
	4. HEIGHT: TOP OF WALL TO MUDLINE	min:	max:		
	5. SEEPAGE OR LEAKAGE				
	6. ABUTMENT CONTACT				
D/S WALLS	7. EROSION/SINKHOLES BEHIND WALL				
	8. ANIMAL BURROWS				
	9. UNUSUAL MOVEMENT				
	10. WET AREAS AT TOE OF WALL				
	11. VEGETATION				
	12. SCOUR/EROSION AT BASE OF WALL				
ADDITION	AL COMMENTS:				

DAM NAM	ΙE		INSPECTION DATE	
		UPSTREAM WALI	.S	
AREA INSPECTE	CONDITION		OBSERVATIONS	
	1. WALL TYPE			
	2. WALL ALIGNMENT			
	3. WALL CONDITION		1	T
	4. HEIGHT: TOP OF WALL TO MUDLINE	min:	max:	avg:
	5. ABUTMENT CONTACT			
U/S WALLS	6. EROSION/SINKHOLES BEHIND WALL			
	7. ANIMAL BURROWS			
	8. UNUSUAL MOVEMENT			
	9. VEGETATION			
	10. SCOUR/EROSION AT BASE OF WALL			
ADDITION	IAL COMMENTS:			

DAM NAME		INSPECTION DATE
		DOWNSTREAM AREA
AREA INSPECTED	CONDITION	OBSERVATIONS
	ABUTMENT LEAKAGE	
	FOUNDATION SEEPAGE	
	SLIDE, SLOUGH, SCARP	
	WEIRS	
D/S AREA	DRAINAGE SYSTEM	
	INSTRUMENTATION	
	VEGETATION	
	ACCESSIBILITY	
	DOWNSTREAM HAZARD DESCRIPTIO	N
ADDITIONAI	COMMENTS:	

DAM NAME		INSPECTION DATE
		PRIMARY SPILLWAY
AREA INSPECTED	CONDITION	OBSERVATIONS
	SPILLWAY TYPE	
	WEIR TYPE	
	SPILLWAY CONDITION	
	TRAINING WALLS	
	SPILLWAY CONTROLS AND CONDITION	
	UNUSUAL MOVEMENT	
	APPROACH AREA	
	DISCHARGE AREA	
	DEBRIS	
	WATER LEVEL AT TIME OF INSPECTION	
ADDITIONAL	COMMENTS:	

DAM NAME		INSPECTION DATE
		AUXILIARY SPILLWAY
AREA INSPECTED	CONDITION	OBSERVATIONS
	SPILLWAY TYPE	
	WEIR TYPE	
	SPILLWAY CONDITION	
	TRAINING WALLS	
	SPILLWAY CONTROLS AND CONDITION	
SPILLWAY	UNUSUAL MOVEMENT	
~	APPROACH AREA	
	DISCHARGE AREA	
	DEBRIS	
	WATER LEVEL AT TIME OF INSPECTION	
ADDITIONA	L COMMENTS:	

Wood-Pawcatuck Watershed Flood Resiliency Management Plan DAM INSPECTION FIELD ASSESSMENT

DAM NAME		INSPECTION DATE
		OUTLET WORKS
AREA INSPECTED	CONDITION	OBSERVATIONS
	ТҮРЕ	
	INTAKE STRUCTURE	
	TRASHRACK	
	PRIMARY CLOSURE	
	SECONDARY CLOSURE	
	CONDUIT	
OUTLET	OUTLET STRUCTURE/HEADWALL	
WORKS	EROSION ALONG TOE OF DAM	
	SEEPAGE/LEAKAGE	
	DEBRIS/BLOCKAGE	
	UNUSUAL MOVEMENT	
	DOWNSTREAM AREA	
	MISCELLANEOUS	
ADDITIONA	L COMMENTS:	

Wood-Pawcatuck Watershed Flood Resiliency Management Plan DAM INSPECTION FIELD ASSESSMENT

Potential Recommendation Notes

Removal?

Breach/Spillway Adjustments?

Repurposing?

Fish/eel passage?

Notes:

PHOTOS

PHOTOGRAPHS INSTRUCTION PAGE:

All photographs shall be color photographs. Photographs shall be clear and include scale references where applicable. Photographs shall include, but not be limited to the following:

- 1. Overview of dam from upstream
- 2. Overview of dam from downstream
- 3. Overview of upstream face from right abutment
- 4. Overview of upstream face from left abutment
- 5. Overview of dam crest from right abutment
- 6. Overview of dam crest from left abutment
- 7. Overview of downstream face from right abutment
- 8. Overview of downstream face from left abutment
- 9. Overview of spillway from upstream
- **10.** Overview of spillway from downstream (tailrace or channel area)
- 11. Overview of right training wall
- 12. Overview of left training wall
- 13. Overview of weir
- 14. Overview of stilling basin
- 15. Overview of downstream channel
- 16. Overview of gatehouse exterior
- 17. Overview of gatehouse interior
- 18. Overview of operators
- **19.** Outlet inlets and discharge points
- 20. Overview of reservoir
- 21. Areas of specific deficiencies (e.g., cracks, erosion, displacement, seeps, deterioration, etc.)

Each photograph shall include a caption indicating the subject of the photograph as well as highlighting any specific deficiencies pictured. All photographs shall be presented with no more than two (2) photos per page. Photo location and orientation shall be indicated on the site plan included in the section entitled "Figures". Alternatively, for clarity, a separate figure can be provided in this appendix to show figure locations.

Wood-Pawcatuck Watershed Flood Resiliency Management Plan DAM INSPECTION FIELD ASSESSMENT

SKETCH



Attachment B

Dam Visual Assessment Field Forms (Completed)

VISUAL DAM ASSESSMENT.

		Filled out after return to a
TETT		DAM SAFETY INSPECTION
NAME OF DAM:	Glen Echo Dan	STATE ID #:
AKA NAME:		WATERCOURSE NAME:
		DAM LOCATION INFORMATION
CITY/TOWN:	Charlton	LAT. / LONG.:
STATE:	MA	HAZARD CLASS:
		GENERAL DAM INFORMATION
TYPE OF DAM:	Earth	2
PURPOSE OF DAM	Recreation	Sur
YEAR BUILT:	-	A A A A A A A A A A A A A A A A A A A
		E SEE FE
		INSPECTION SUMMARY
DATE OF INSPECT	ION: 12/12/18	NAME OF INSPECTOR: Rachael Weiter
TIME OF INSPECTI	ON: ~ 2 PM	OTHER ATTENDEES: Helera Farrell
WEATHER CONDI	TIONS: CLOUDING	prother Sunger mid-30s, presting
	Current t	a rig carry
	5 5	GENERAL DAM DATA
PRIMARY SPILLW	AY TYPE: Concrete co	AUXILIARY SPILLWAY TYPE:
NUMBER OF OUTL	LETS: 1	TYPE OF OUTLETS: Unknown
HAS THE DAM BEI	EN BREACHED OR OVERTOP	PPED? Possibly - Check history
IS THERE A FISH L	ADDER? (LIST TYPE IF PRES	SENT) N 6
DOES THE CREST	SUPPORT A PUBLIC ROAD?	No
ROADS/DRIVEWA		FAM OF DAM2 1143
		ass the ada to participation it i
ACCESS CONDITIC	DNS IU THE SITE: DOCC	Los Thru private ipoper y viry, orive or walk do
SECURITY DEVICH	es? <u>Chain lilak</u>	perce on Tr. walls; padlocks/Chains on gate, arece
	- marke	le; other trapdoor security type - no obvious ha
	-gate to l	DIS area from DIS enbackment
Observ	ations apply	mainly to left side of day (main have
Ala		(in our ladding
Up da	~ , 7	
Corry	d not access	right abutment
		U

DAM NA	ME	INSPECTION DATE	
	n wa are, denia	EMBANKMENT (D/S SLOPE)	
AREA INSPECI	ED	OBSERVATIONS	
	(TYPE (EARTH, CONCRETE, MASONRY)	earth	
	2. WET AREAS (NO FLOW)	N/0; moss graving on most of back unknown if due	e
	3 SEEPAGE (EARTH) OR LEAKAGE (CONCRETE)	N/0, 1 to seepage or shadle	
	4 SLIDE, SLOUGH, SCARP	overs where soil has sloughed observed along crest/bank	color
990	5 EMBANKMENT-ABUTMENT CONTACT	Fair - no major contact problems observed	,
D IS S/U	SINKHOLE/ANIMAL BURROWS	N/O-may have been coved by thoth of mown grass	1
	EROSION	Atto Former erasion around grate struct. estarun aver u/ ara	sso
1	R UNUSUAL MOVEMENT	N/D D/N	- <u>144</u> - 019
à	VEGETATION (PRESENCE/CONDITION)	mainly moss in shaded area, grass closer to left tr.	r. wall
~	CONDITION OF JOINTS (CONCRETE)	Arod N/A	
	a 11/1 15/1	2	- 5
10	and and and and and and and and and and		-
ADDITIC	NAL COMMENTS: (4) gassed		а,
17	D. w/ that	ch left on typ	91 D 1
Car			
	1		

Filled at after return to office.

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DAM NA	MEGELD	INSPECTION DATE
		EMBANKMENT (U/S SLOPE)
AREA INSPECT	CONDITION	OBSERVATIONS
	TYPE (EARTH, CONCRETE, MASONRY)	earth
	SLIDE, SLOUGH, SCARP	N70
()	SLOPE PROTECTION TYPE AND COND.	large stone blocks set into soil - starting to slide down face
	SINKHOLE/ANIMAL BURROWS	N/0- may have been observed between stones
	EMBANKMENT-ABUTMENT CONTACT	M fair/ a volt
U/S SLOPE	EROSION	NO NO
	UNUSUAL MOVEMENT	01N
	VEGETATION (PRESENCE/CONDITION)	grass growing between rocks, maneol
CKER	CONDITION OF JOINTS (CONCRETE)	N/A U U TO
ч.	PERIOR VERSION DELIS STORE	miner nugarity + graterized
	STATES STRUCT BURGONS	7 0
ADDITIO	NAL COMMENTS: 306 e	nbarkment, learing thek-wide gaps along top of stone
aurol tr	00111100	CREEKS Provide Contraction Contraction

is spence hat general. Writes historic metales / alignmeticles second and Olimate Bee

DAM NAME		INSPECTION DATE
		EMBANKMENT (CREST)
AREA INSPECTED	CONDITION	OBSERVATIONS
	SURFACE TYPE	eerth
	SURFACE CRACKING	N10 me por in merer and eque the of space
	SINKHOLES, ANIMAL BURROWS	N/0
	VERTICAL ALIGNMENT (DEPRESSIONS)	minor undulations + depressions
CREST	HORIZONTAL ALIGNMENT	good) dam curves to meet left abutment
	RUTS AND/OR PUDDLES	rute observed nor left abutment
	VEGETATION (PRESENCE/CONDITION)	grass, moveel
	ABUTMENT CONTACT	good
	CONDITION OF JOINTS (CONCRETE)	W/A
	Proceedings of the second second	White work Norse Base operation president above
ADDITIONA	L COMMENTS:	may any process on the suit standing to stand on the
	- 1 Mar and 1	
	THE REPORT AND A DESCRIPTION OF THE PROPERTY O	
	6150	

10

r

	GELD	
		INSTRUMENTATION
AREA INSPECTED	CONDITION	OBSERVATIONS
	1. PIEZOMETERS	
	2. OBSERVATION WELLS	0
12	3. STAFF GAGE AND RECORDER	
	4. WEIRS	
1.	5. INCLINOMETERS	
INSTR.	6. SURVEY MONUMENTS	
24	7. DRAINS	
	8. FREQUENCY OF READINGS	
le	9. LOCATION OF READINGS	
- lis		
ADDITIONA	AL COMMENTS:	

non mener g sist jaturanne ; ansemilit retain

DAM NAM	Ξ	INSPECTION DATE
		DOWNSTREAM WALLS
AREA INSPECTEI	CONDITION	OBSERVATIONS
	1. WALL TYPE	
	2. WALL ALIGNMENT	
	3. WALL CONDITION	
	4. HEIGHT: TOP OF WALL TO MUDLINE	min:
	5. SEEPAGE OR LEAKAGE	
	6. ABUTMENT CONTACT	
D/S WALLS	7. EROSION/SINKHOLES BEHIND WALL	
	8. ANIMAL BURROWS	
	9. UNUSUAL MOVEMENT	
	10. WET AREAS AT TOE OF WALL	
	11. VEGETATION	
	12. SCOUR/EROSION AT BASE OF WALL	
ADDITION	AL COMMENTS:	
	CELO CELO	

and wantaffinal interact. There is a section of

DAM NAN	E GEUD		INSPECTION DATE
			UPSTREAM WALLS - See training walls 1 Othurwise No
AREA INSPECTE	CONDITION		OBSERVATIONS
	1. WALL TYPE	20 3	The 2-60 and a and a cours of the
op illocky	2. WALL ALIGNMENT	N tox.	upto two town areas water town brown a
	3. WALL CONDITION		
	4. HEIGHT: TOP OF WALL TO MUDLINE	Crha	min: avg:
	5. ABUTMENT CONTACT	Now	war days puer Dis curants and ages! but a core clarith
U/S WALLS	6. EROSION/SINKHOLES BEHIND WALL	amp	there a sylonger outcouncyly a apply and they
	7. ANIMAL BURROWS	11/0	
Die visiev	8. UNUSUAL MOVEMENT	0/W	
	9. VEGETATION	1961	perfore abilities goug of he mays favore of this territ.
	10. SCOUR/EROSION AT BASE OF WALL	0/4	
	EDUMDVILLOW REENCE	OVU	
	JOAMAL TRONTINSA	010	
ADDITION	IAL COMMENTS:		
1			
AM MAYAR			TAN MORE TO MORE THE AND A DECEMBER OF A DECEMBER

e-phonon parameter game [Milling Antonio Approximation [27]

DAM NAME		INSPECTION DATE
		DOWNSTREAM AREA
AREA INSPECTED	CONDITION	OBSERVATIONS
	ABUTMENT LEAKAGE	N/O
	FOUNDATION SEEPAGE	N/O
	SLIDE, SLOUGH, SCARP	N 20
	WEIRS	converte performent a end of To wall's formes Shilling farsing
D/S AREA	DRAINAGE SYSTEM	N/O "
	INSTRUMENTATION	N/0
	VEGETATION	grassi tres + shrubs corrocching on discharge area
	ACCESSIBILITY	walk then gate from D/S embart. (left side) foot access clearly
	IN REAL DOLL & TO PRIDE DO	availon right side (up crek, or fam right abut). chidened
	DOWNSTREAM HAZARD DESCRIPTION	A C
ADDITIONAL	L COMMENTS:	not visible from Tam; sheek nags + serial photos;
		dan is upstream of Charles afty - other clans on Cably
		Bark + 2-90 1
		2
		in the second se
	Carro D	

3r

DAM NAME GEL	J.	INSPECTION DATE
		PRIMARY SPILLWAY
AREA INSPECTED	CONDITION	OBSERVATIONS
SPILLWA	АҮ ТҮРЕ	concrete agee w/ stilling basin
WEIR TV	ZDE	concrete brood-crestcol
SPILLWA	AY CONDITION	fair poor. Larger small cracks in spillway allowing seconde / Popul of largest
(f) TRAININ	IG WALLS	satisfactory cracks observed a) tops, larger cracks D/S of
SPILLWA	AY CONTROLS AND CONDITION	nechanical/hydraulie? gate - partly open - appears to be in good condition.
)	AL MOVEMENT	M/O
APPROA	CH AREA	wable to absence due to brildup of ice
(8) DISCHAE	RGE AREA	trees growing D/S of stilling basin; sediment (up to rabbles) deposited
DEBRIS		garbage observed that lifely washed over spillway; minimal woodly debails
, WATER I	LEVEL AT TIME OF INSPECTION	1-3" below spillway (estimate); unable to determine more precisily
		due to ice cover
(1) Shill	ha bash	Stones in shilling basin pushed into window occass center of bailin
ADDITIONAL COMME	NTS: Daw	face; largest cracks located above we'r a crod of shilling
LEARCHED	Las base	in, on left side, grack being workwol by gowth of thick
	Po	I'SON IVY Whe . U U U
	(3) Candi	sion of centrals below crest unknown; concrete pad housing
	Cont	als top spalling but not Structurally
	Bin this	s area by high flows O
	(1) condut	"on of bottom - unable to observe. Streambed scowed jest downstream of
	+ dong end w	eit due to flows chapping one weit

+ 4 we - out sort and to forme ordered and more

DAM NAMI	20,000	INSPECTION DATE
	notubnes (E)	AUXILIARY SPILLWAY
AREA INSPECTEL	CONDITION	OBSERVATIONS
	SPILLWAY TYPE	and a loss of state while have a state of a loss of a
2	WEIR TYPE	a har the parts of the woods a scale product of the
	SPILLWAY CONDITION	and the second states of the second second second second
	TRAINING WALLS	
	SPILLWAY CONTROLS AND CONDITION	
SPILLWAY	, UNUSUAL MOVEMENT	NV
	APPROACH AREA	
	DISCHARGE AREA	and the first the set of the set
	DEBRIS	Onif there have a state state of the state o
	WATER LEVEL AT TIME OF INSPECTION	
		allow the second and
		With a series of the series of
ADDITION,	AL COMMENTS:	beed or
	60M, U.M.	
	6449	

-Pawcatuck Watershed Flood Resiliency Management Plan	DAM INSPECTION FIELD ASSESSMENT
Wood-Paw	Ι

DAM NAME	GELD	INSPECTION DATE	
	2	OUTLET WORKS	-
AREA INSPECTED	CONDITION	OBSERVATIONS	949
	ТҮРЕ	unable to obscrie) gaded	Je
	INTAKE STRUCTURE	unable to observe	*
	TRASHRACK	Unknown	0
	PRIMARY CLOSURE	gate - type untroun	ot
	SECONDARY CLOSURE	unknown - maybe none	دىم
	CONDUIT		4. 05
OUTLET	OUTLET STRUCTURE/HEADWALL	large concrete would retaining dom en	pertement
WORKS	EROSION ALONG TOE OF DAM	NO NO	Các
	SEEPAGE/LEAKAGE	NO - see note below about sinkl	oles
	DEBRIS/BLOCKAGE	N/O- could not absence U/S side	ملا
	2. UNUSUAL MOVEMENT	NO	
	DOWNSTREAM AREA	cobble/gravel streambed	nor ?
	10	m in	00
	MISCELLANEOUS	2 sinchales above conduit immudiately	behind headwall
ADDITIONA	L COMMENTS: QOTE MOST	in closed (judging by ment on pate	sten) a three of
	dose	ration	
		entre la company de la company	

Wood-Paweatuck Watershed Plood Resiliency Management Plan

Wood-Pawcatuck Watershed Flood Resiliency Management Plan DAM INSPECTION FIELD ASSESSMENT

Potential Recommendation Notes

Removal?

No- too many lakeside properties

Breach/Spillway Adjustments?

- cannot raise for flood control due to lakeside properties - Spillway Cracks/ seepage shalld be repaired.

Repurposing?

Fish/eel passage?

May be room for a fish ladeler No noom for natural passage Not fearible - fish elevator, trap + truck Notes: Multiple dans D/S Check history of arotopping/failure leading to D/S flooding -lessons to be learned?

PHOTOS

PHOTOGRAPHS INSTRUCTION PAGE:

All photographs shall be color photographs. Photographs shall be clear and include scale references where applicable. Photographs shall include, but not be limited to the following:

- 1. Overview of dam from upstream
- 2. Overview of dam from downstream
- 3. Overview of upstream face from right abutment
- 4. Overview of upstream face from left abutment
- 5. Overview of dam crest from right abutment
- 6. Overview of dam crest from left abutment
- 7. Overview of downstream face from right abutment
- 8. Overview of downstream face from left abutment
- 9. Overview of spillway from upstream
- 10. Overview of spillway from downstream (tailrace or channel area)
- 11. Overview of right training wall
- 12. Overview of left training wall
- 13. Overview of weir
- 14. Overview of stilling basin
- 15. Overview of downstream channel
- 16. Overview of gatehouse exterior
- 17. Overview of gatehouse interior
- 18. Overview of operators
- 19. Outlet inlets and discharge points
- 20. Overview of reservoir
- 21. Areas of specific deficiencies (e.g., cracks, erosion, displacement, seeps, deterioration, etc.)

Each photograph shall include a caption indicating the subject of the photograph as well as highlighting any specific deficiencies pictured. All photographs shall be presented with no more than two (2) photos per page. Photo location and orientation shall be indicated on the site plan included in the section entitled "Figures". Alternatively, for clarity, a separate figure can be provided in this appendix to show figure locations.

Wood-Pawcatuck Watershed Flood Resiliency Management Plan DAM INSPECTION FIELD ASSESSMENT

SKETCH

	DAM SAFETY INSPECTION	
NAME OF DAM: actual LNL	STATE ID #:	2
AKA NAME:	WATERCOURSE NAME:	N. K
	e in	
	DAM LOCATION INFORMATION	
CITY/TOWN: <u>Charlton</u>	LAT. / LONG.:	2 6
STATE:	HAZARD CLASS:	E F
	GENERAL DAM INFORMATION	18
TYPE OF DAM Carth	i i	
PURPOSE OF DAM:	2 8 8	Cr. 2. S. 4
	4 8 8 2	2 6 1
YEAR BUILT:	3 0215 5	
	INSPECTION SUMMARY	g G
B An	INSI ECHON SOMMARI	
DATE OF INSPECTION:	NAME OF INSPECTOR: RW	
TIME OF INSPECTION:	TOTHER ATTENDEES:	2 2 2 8
WEATHER CONDITIONS:	ny 36°F	5 5 2
* 5	2 1 1 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1	1 4 2 3 3 4 1
368	GENERAL DAM DATA	
PRIMARY SPILLWAY TYPE: COAC	efe masure? AUXILLARY SPILLWAY T	YPE:
	I C S C S S P L	a la da a culto
NUMBER OF OUTLETS:	TYPE OF OUTLETS:	<u>Concrete riser uges y</u>
HAS THE DAM BEEN BREACHED OR O	OVERTOPPED?	
IS THERE A FISH LADDER? (LIST TYPI	EIFPRESENT)	
DOES THE CREST SUPPORT A PUBLIC	ROAD?	
KOADS/DKIVEWAT IMMEDIATELT D	SWNSTREAM OF DAM?	2 + 121)
ACCESS CONDITIONS TO THE SITE:	drive to either about (Key Ke	ad, Little Nrogger Roll
SECURITY DEVICES?	0	

00 < VATURA an bles + bruch her her m 0 L-N/O but area w/in 20° of L To, Wall the wear earth, on left side, convolin colder sized why P12079 Derv Small + LARGE trees L-minor slide in riprey -2' wide OBSERVATIONS R-NO; L-N/0 butsdape observed INSPECTION DATE reiof R'some D R. abut , L. w/0 crest + D/S bark a right richneed R- Fair - some underlight 3 EMBANKMENT (D/S SLOPE) is es a/~-7 graws-mowed - poss. concret R- N/0; central tabaic R-N10 5/2 A/N U SEEPAGE (EARTH) OR LEAKAGE (CONCRETE) TYPE (EARTH, CONCRETE, MASONRY) VEGETATION (PRESENCE/CONDITION) EMBANKMENT-ABUTMENT CONTACT CONDITION OF JOINTS (CONCRETE) CONDITION D/S SLOPE SINKHOLE/ANIMAL BURROWS WET AREAS (NO FLOW) SLIDE, SLOUGH, SCARP UNUSUAL MOVEMENT DAM NAME UNL ADDITIONAL COMMENTS: EROSION 5 NSPECTED AREA

1

v

DAM NAN	ULD B	INSPECTION DATE
	C Depression	EMBANKMENT (U/S SLOPE)
AREA INSPECTE	CONDITION	OBSERVATIONS
	TYPE (EARTH, CONCRETE, MASONRY)	Barn (see DISwalls for 154)
	SLIDE, SLOUGH, SCARP	R-N/2; L-Skeep Scarp along citire bank
PDT DA	SLOPE PROTECTION TYPE AND COND.	K- scattered stores from displaced Store armer 2 and but he
1	SINKHOLE/ANIMAL BURROWS	R-mult 2"-y" burrows ; Lt NO
•	EMBANKMENT-ABUTMENT CONTACT	R- Fair- reeds soil adeled to make with it L- crest higher
U/S SLOPE	EROSION	Q+N/0 L- crossion a collageing wall see bitans
•	UNUSUAL MOVEMENT	NYD- ward T- zame "
. 4	VEGETATION (PRESENCE/CONDITION)	R-gass, none) tall anse in clumps Dwatchn, j & sam
	CONDITION OF JOINTS (CONCRETE)	NTA T. Jong
TA		man register i verularior are base and she man i are par mon
		all FMLO
ADDITION	AL COMMENTS: (8) + ONE SMOR	I free gowing out of stone wall
	and the task	and y land sound to
Carlo Alta		ORPERATE

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the spectrum provide the Marcel Extension is the contraction of the second of the seco

extreling for rah F Wall - some on left 27 is tot buried by casing carine on helt 24 is tot buried by
Departion extended a from L while

The second second

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DAM NAME	CINI	INSPECTION DATE
		INSTRUMENTATION
AREA INSPECTED	CONDITION	OBSERVATIONS
	1. PIEZOMETERS	
	2. OBSERVATION WELLS	
	3. STAFF GAGE AND RECORDER	
	4. WEIRS	
	5. INCLINOMETERS	
INSTR.	6. SURVEY MONUMENTS	
2	7. DRAINS	
	8. FREQUENCY OF READINGS	
	9. LOCATION OF READINGS	
ADDITIONAL	L COMMENTS:	
		DDM-SETRE VOTWITT >
	[MLD]	

witten die der Bereiten der Bereiten der Bereiten der Steht der Steht der Bereiten der Bereiten der Bereiten de

DAM NAM		INSPECTION DATE
		DOWNSTREAM WALLS
AREA INSPECTEI	CONDITION	OBSERVATIONS
	1. WALL TYPE	
	2. WALL ALIGNMENT	
	3. WALL CONDITION	
	4. HEIGHT: TOP OF WALL TO MUDLINE	min: max:
	5. SEEPAGE OR LEAKAGE	
	6. ABUTMENT CONTACT	
D/S WALLS	7. EROSION/SINKHOLES BEHIND WALL	
	8. ANIMAL BURROWS	
	9. UNUSUAL MOVEMENT	
	10. WET AREAS AT TOE OF WALL	
	11. VEGETATION	
	12. SCOUR/EROSION AT BASE OF WALL	
ADDITION	IAL COMMENTS:	
	LN LD	

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DAM NAN			INSPECTION DATE
			UPSTREAM WALLS
AREA INSPECTE	CONDITION		OBSERVATIONS
	1. WALL TYPE		concrete black masury
D DITE A	2. WALL ALIGNMENT		poor ; tracters lots collapsed
	3. WALL CONDITION	1800	and retried to
	4. HEIGHT: TOP OF WALL TO MUDLINE	est	min: 3 max: 4 avg: 23.75 fr
	5. ABUTMENT CONTACT	low	wall ends before abot
U/S WALLS	6. EROSION/SINKHOLES BEHIND WALL	era	r/20 0 0 mar 402
	7. ANIMAL BURROWS	0/14	N70 N20
DUS VIKEN	8. UNUSUAL MOVEMENT	110	NO
	9. VEGETATION	2/4	small the woods strub growing from erect has shifted
	10. SCOUR/EROSION AT BASE OF WALL	6/14	NO : aggregate of concrete exposed a waterline
	Entropy Those and More	0022	of bet was write a and a particle was after
	The Deckel (BAK (CE.	NV	
ADDITION	IAL COMMENTS:	· cs	
	1 A BU	4 solu	extends to the hading US ento, togen toth the tall to a within
STARACTINA.	LUTU-	rollaps	A into pool for west of largely

CTED		THE MONTENESS STATES STATES AND AND THE TRACE
CTED	Land L	DOWNSTREAM AREA
	CONDITION	OBSERVATIONS
¥	ABUTMENT LEAKAGE	N/O
<u> </u>	OUNDATION SEEPAGE	poss on left near outlet (or could be hadred from outlet
03	SLIDE, SLOUGH, SCARP	N/0 N/19 ? walk of concepts a book of material
2	NEIRS	N/0 2 may we marely elege bened you don't as the
AREA	JRAINAGE SYSTEM	N/O
I	NSTRUMENTATION	N/O/N
	VEGETATION	range gass to large trees
4	ACCESSIBILITY	wall from base of dam
	DOWNSTREAM HAZARD DESCRIPTION	residences hitle waget he
LIONAL (COMMENTS:	board starter - allehan
	41.00	

-

DAM NAME	CUND	INSPECTION DATE
		PRIMARY SPILLWAY
AREA INSPECTED	CONDITION	OBSERVATIONS
	SPILLWAY TYPE WEIR TYPE	concrete block-stucked masony of wood 424"s second to the
5	SPILLWAY CONDITION	fair - masonty agoons well adigned but wood in poor aligner, aftin
4	TRAINING WALLS	Concrete - good Caralition, some aggregate exportue real
	SPILLWAY CONTROLS AND CONDITION	N/O except securel wood beens or 1
	UNUSUAL MOVEMENT	No
BITTANA	APPROACH AREA	Shallow sitted of pond was growing in silt; deba's caught against weig
	DISCHARGE AREA	rocky pool between'n training walls norrows to creek chite
	DEBRIS	det is - thicks, haves, et traged against wet
15	WATER LEVEL AT TIME OF INSPECTION	~2" below top board bear, lo-7 frmin below top of Tr Walls
ADDITIONA	L COMMENTS: 3 ULBA	Looking through top 3 rows of blocks
	CMLD	

(hardine-depress herepress) 200 - haden access to an access to an equal and former defining data (hardine-depress herepress) 200 - haden access to an equal back of the equation of the second s second s second s second se

DAM NAME	CNUD .	INSPECTION DATE	
		AUXILIARY SPILLWAY	
AREA INSPECTED	CONDITION	OBSERVATIONS	
	SPILLWAY TYPE	2 shall be and a set want bad to	
	WEIR TYPE		
	SPILLWAY CONDITION		
	TRAINING WALLS		
	SPILLWAY CONTROLS AND CONDITION		
SPILLWAY	UNUSUAL MOVEMENT))	
	APPROACH AREA		5
	DISCHARGE AREA		
	DEBRIS	and the state of t	
	WATER LEVEL AT TIME OF INSPECTION		
		The with the second the band have the	24
			/
ADDITIONA	AL COMMENTS:	it was a the book of the topological and book at a second at	31
	CIMID.		
Wood-Pawcatuck Watershed Flood Resiliency Management Plan DAM INSPECTION FIELD ASSESSMENT

				(condition				& head		duc	im				ilicites			
OUTLET WORKS	OBSERVATIONS	concrete riser w/ marval gate	Concrete rise	vertical Steel rack w - 1"-2" specing, good	marval gate - closed	NO ON S	concerts plastic 1.5' & (preved from 0/5 end)	rencrete, good condition. Some block S Phacked around	crolled real left of outlet - due to served	possible rear outlet shucture (based on 2/5 are eur	A debri gass, pass. debri's brun tash ack + gape	N/0 0/10	wooded swamp, rocky due to movement of d/s kunk	Earner Mat slope		to bulge/ Am out on left side of heading!	S S S S S S S S S S S S S S S S S S S	
	ED	TYPE	INTAKE STRUCTURE	TRASHRACK	PRIMARY CLOSURE	7 SECONDARY CLOSURE	CONDUIT	TO OUTLET STRUCTURE/HEADWALL	S EROSION ALONG TOE OF DAM	SEEPAGE/LEAKAGE	DEBRIS/BLOCKAGE	UNUSUAL MOVEMENT	DOWNSTREAM AREA		MISCELLANEOUS	INAL COMMENTS: (2) Startin	ſ	
	OUTLET WORKS	AREA OUTLET WORKS OUTLET WORKS OUTLET WORKS OBSERVAT	AREA INSPECTED CONDITION OUTLET WORKS OBSERVAT TYPE CONDITION OBSERVAT	AREA AREA INSPECTED TYPE CONDITION OBSERVAT OBSERVAT OBSERVAT OBSERVAT OBSERVAT OBSERVAT OBSERVAT OBSERVAT	AREA AREA NSPECTED TYPE CONDITION TYPE NTAKE STRUCTURE NTAKE STRUCTURE NTAKE STRUCTURE NOTATE NOTATE NOTATE CONCREC	AREA AREA NSPECTED CONDITION OUTLET WORKS TYPE CONDITION OBSERVAT TYPE CONDITION OBSERVAT NTAKE STRUCTURE CONDITION OBSERVAT ITASHRACK CONCINE CONCRECTION OF CONCRECTION	AREA AREA AREA INSPECTED TYPE TYPE TYPE INTAKE STRUCTURE INTAKE STRUCTURE I	AREA AREA NSPECTED TYPE TYPE TYPE NTAKE STRUCTURE NTAKE STRUCTURE NTAKE STRUCTURE NTAKE STRUCTURE NTAKE STRUCTURE TRASHRACK TRASHRACK TRASHRACK TRASHRACK TRASHRACK TRASHRACK TRASHRACK TRASHRACK TRASHRACK TRASHRACK NTAKE TRUCTURE TRASHRACK TR	AREA OUTLET WORKS AREA CONDITION OBSERVAT AREA CONDITION OBSERVAT TYPE CONCRE CONCRE OBSERVAT ITYPE CONCRE CONCRE OBSERVAT INTAKE STRUCTURE CONCRE CONCRE ONCRE ITASHRACK MALUAL AREA AN ITASHRACK MALUAL AREA AN	AREA OUTLET WORKS AREA CONDITION OBSERVAT NAPECTED CONDITION OBSERVAT TYPE CONDITION OBSERVAT ITYPE CONDITION OBSERVAT ITYPE CONDITION OBSERVAT ITYPE CONDITION OBSERVAT ITYPE CONDITION CONCRECTING ITYPE CONCRECTING CONCRECTING ITASHRACK NUMARY CLOSURE NUMARY CLOSURE PRIMARY CLOSURE MANUAL AREA NUMARY AND	OUTLET WORKS WREATED CONDITION OBSERVAT NSPECTED CONCRE NO TYPE CONCRE CONCRE OBSERVAT NTAKE STRUCTURE CONCRE NO OBSERVAT NTAKE STRUCTURE CONCRE NO OBSERVAT NAMARY CLOSURE NO NO OP PRIMARY CLOSURE NO NO NO SECONDARY CLOSURE NO NO NO OUTLET SECONDARY CLOSURE NO NO OUTLET CONDUIT CONCRE NO OUTLET STRUCTURE/HEADWALL CONCRE CONDUCT NO OUTLET STRUCTURE/HEADWALL CONCRE CONCRE OP OUTLET STRUCTURE/HEADWALL CONCRE CONCRE OP SEEP AGELLEAKAGE CONSTICUTURE/HEADWALL CONSTICUTURE/HEADWALL CONSTICUTURE/HEADWALL SEEP AGELLEAKAGE CONSTICUTURE/HEADWALL CONSTICUTURE/HEADWALL CONSTICUTURE/HEADWALL	NEFECTED OUTLET WORKS REFACTED CONDITION OBSERVAT TYPE CONDITION CONCRE OBSERVAT INTAKE STRUCTURE CONCRE CONCRE CONCRE INTAKE STRUCTURE MALUAL CONCRE CONCRE INTAKE CLOSURE MALUAL MALUAL CONCRE RECONDARY CLOSURE MALUAL MALUAL CONCRE OUTLET CONDUT CONDUT CONDUT CONDUT OUTLET STRUCTURE/HEADWALL CONDUC CONDUC CONDUC CONDUC OUTLET STRUCTURE/HEADWALL CONDUC CONDUC CONDUC CONDUC CONDUC OUTLET STRUCTURE/HEADWALL CONDUC CONDUC CONDUC CONDUC CONDUC OUTLET CONDUC CONDUC CONDUC CONDUC CONDUC CONDUC OUTLET <td>NRFECTED OUTLET WORKS NRFECTED CONDITION OBSERVAT NNTAKE STRUCTURE CONDITION OBSERVAT ITYPE CONDITION OBSERVAT ITYPE CONDITION OBSERVAT ITYPE CONDITION OBSERVAT ITYPE CONDITION CONCRET OBSERVAT ITASHRACK CONCRET CONCRET MALUE PRIMARY CLOSURE MALUE CONCRET MALUE PRIMARY CLOSURE MALUE AN/O Secondary closure OUTLEND CONDUIT CONDUIT CONDUIT CONDUIT OUTLEND CONDUIT CONDUIT CONDUIT CONDUIT CONDUIT OUTLEND CONDUIT CONDUIT CONDUIT CONDUIT CONDUIT CONDUIT OUTLEND CONDUIT CONDUIT CONDUIT CONDUIT CONDUIT OUTLEND CONDUIT CONDUIT CONDUIT CONDUIT CONDUIT OUTLEND CONDUIT CONDUIT CONDUIT CONDUIT</td> <td>OUTLET WORKS REA CONDITION OBSERVAT NSPECTED CONDITION 0BSERVAT 0BSERVAT NSPECTED CONDUTOR CONCRET 0BSERVAT 0BSERVAT NTAKE STRUCTURE CONCRET CONCRET No 0BSERVAT NTAKE STRUCTURE CONCRET CONCRET No 0 0 NARY CLOSURE MANUAL CONCRET MANUAL 0 0 0 SECONDARY CLOSURE MANUAL MANUAL MANUAL 0</td> <td>OUTLET WORKS REA sympto CONDITION OBSERVAI SYPE CONDITION OBSERVAI OBSERVAI TYPE CONDITION CONCRET OBSERVAI ITAKE STRUCTURE CONCRET CONCRET CONCRET OBSERVAI IRMARY CLOSURE CONDUT CONCRET MAQUE CONCRET MAD SECONDARY CLOSURE MAD MAD MAD MAD MAD CONDUT READ CONDUT CONDUT CONDUT CONDUT CONDUT MAD OUTLET SECONDARY CLOSURE MAD MAD MAD MAD OUTLET CONDUT CONDUT</td> <td>REA NEE CONDITION OUTLET WORKS NEE CONDITION 0BSERVAI NEE CONDITION 0BSERVAI NTARE STRUCTURE CONDITION 0BSERVAI ITAPE CONDITION 0BSERVAI ITAPE CONDITION CONDITION ITABHRACK CONDITION CONCRE NUT ASHLACK ITASHRACK NUT ASHLACK NUT ASHLACK NUT ASHLACK ITASHRACK NUT ASHLACK NUT ASHLACK NUT ASHLACK RECONDARY CLOSURE NATO NATO NUT ASHLACK CONDUIT CONDUTINE ANTO NATO RECONDARY CLOSURE NATO ANTO NATO CONDUIT CONDUIT CONDUTINE ANTO NATO OUTLET STRUCTURE/HEADWALL CABACK NATO NATO NATO OUTLET STRUCTURE/HEADWALL CABACK NATO NATO NATO OUTLET STRUCTURE/HEADWALL CABACK NATO NATO NATO SEEP AGELLEARAGE COSION ALOUT CABACK CA</td> <td>OUTLET WORKS REA WEETED CONDITION OBSERVAT NEER CONDITION OBSERVAT OBSERVAT TYPE CONDITION CONDITION OBSERVAT TYPE CONDITION CONDITION OBSERVAT TYPE CONDITION CONDITION CONDITION OBSERVAT TRASHRACK CONDITION CONDITION CONDITION CONDITION OBSERVAT PRIMARY CLOSURE CONDUT VETA CONDUC VETA CONDUC CONDUC CONDUT PRIMARY CLOSURE MANO CONDUC MANO CONDUC CONDUC CONDUT PRIMARY CLOSURE MANO CONDUC MANO CONDUC CONDUC CONDUT PROVENTION MANO CONDUC CONDUC CONDUC CONDUC CONDUC CONDUT CONDUT CONDUT CONDUC <td< td=""><td>OUTLET WORKS REA CONDITION OBSERVAT NEPECTED CONDITION OBSERVAT NEPECTED CONDITION OBSERVAT NEAR CONDITION OBSERVAT NEAR CONDITION OBSERVAT NTARE 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OUTLET STRUCTURE/HEADWALL CABACK NATO NATO NATO OUTLET STRUCTURE/HEADWALL CABACK NATO NATO NATO OUTLET STRUCTURE/HEADWALL CABACK NATO NATO NATO SEEP AGELLEARAGE COSION ALOUT CABACK CA	OUTLET WORKS REA WEETED CONDITION OBSERVAT NEER CONDITION OBSERVAT OBSERVAT TYPE CONDITION CONDITION OBSERVAT TYPE CONDITION CONDITION OBSERVAT TYPE CONDITION CONDITION CONDITION OBSERVAT TRASHRACK CONDITION CONDITION CONDITION CONDITION OBSERVAT PRIMARY CLOSURE CONDUT VETA CONDUC VETA CONDUC CONDUC CONDUT PRIMARY CLOSURE MANO CONDUC MANO CONDUC CONDUC CONDUT PRIMARY CLOSURE MANO CONDUC MANO CONDUC CONDUC CONDUT PROVENTION MANO CONDUC CONDUC CONDUC CONDUC CONDUC CONDUT CONDUT CONDUT CONDUC CONDUC <td< td=""><td>OUTLET WORKS REA CONDITION OBSERVAT NEPECTED CONDITION OBSERVAT NEPECTED CONDITION OBSERVAT NEAR CONDITION OBSERVAT NEAR CONDITION OBSERVAT NTARE STRUCTURE CONDITION OBSERVAT NTARE STRUCTURE CONDUT CONDUT NARKY CLOSURE MALUAC CONDUT CONDUT CONDUT CONDUT ACOUNTERT AND ALL CONDUT CONDUT OUTLET 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Wood-Pawcatuck Watershed Flood Resiliency Management Plan DAM INSPECTION FIELD ASSESSMENT

Potential Recommendation Notes

Removal? likely apposed by residents

Breach/Spillway Adjustments?

Rock ramp.

Repurposing? cartrain-see false LND

Fish/eel passage?

possible - would be tall fish ladder; no room far nature-like fishway except cock rang up spillway

Notes:

Training walls appear fairly new to Pond clearly used for recreation by all/most shore residuts

PHOTOS

PHOTOGRAPHS INSTRUCTION PAGE:

All photographs shall be color photographs. Photographs shall be clear and include scale references where applicable. Photographs shall include, but not be limited to the following:

- 1. Overview of dam from upstream
- 2. Overview of dam from downstream
- 3. Overview of upstream face from right abutment
- 4. Overview of upstream face from left abutment
- 5. Overview of dam crest from right abutment
- 6. Overview of dam crest from left abutment
- 7. Overview of downstream face from right abutment
- 8. Overview of downstream face from left abutment
- 9. Overview of spillway from upstream
- 10. Overview of spillway from downstream (tailrace or channel area)
- 11. Overview of right training wall
- 12. Overview of left training wall
- 13. Overview of weir
- 14. Overview of stilling basin
- 15. Overview of downstream channel
- 16. Overview of gatehouse exterior
- 17. Overview of gatehouse interior
- 18. Overview of operators
- 19. Outlet inlets and discharge points
- 20. Overview of reservoir
- 21. Areas of specific deficiencies (e.g., cracks, erosion, displacement, seeps, deterioration, etc.)

Each photograph shall include a caption indicating the subject of the photograph as well as highlighting any specific deficiencies pictured. All photographs shall be presented with no more than two (2) photos per page. Photo location and orientation shall be indicated on the site plan included in the section entitled "Figures". Alternatively, for clarity, a separate figure can be provided in this appendix to show figure locations.

Wood-Pawcatuck Watershed Flood Resiliency Management Plan DAM INSPECTION FIELD ASSESSMENT

SKETCH

NAME OF DAM: Land	s Pond Dan	STATE ID #:	MADI	829		
AKA NAME:		WATERCOURSE NA	AME:			
		DAM LOCATION INF	ORMATION			
CITY/TOWN: Cha	~lton	LAT. / LONG.:	CE			
STATE:	,	HAZARD CLASS:	E			
		GENERAL DAM INF	ORMATION			
TYPE OF DAM:	the		The			
PURPOSE OF DAM:	Icoown		No.			
YEAR BUILT:	9	5 3				ON DI
1	1	3 2				
		INSPECTION SU	MMARY			
DATE OF INSPECTION:	12/5/18	NAME OF INSPECT	OR: RW			
			201			
TIME OF INSPECTION:	<u>08:40</u> <u>Sunny</u> ,	OTHER ATTENDEE 2.3 ° F	s: <u>H</u>	4 8 4 5 7		
TIME OF INSPECTION:	08:40 Sunny,	OTHER ATTENDER	SS: HC		E	
TIME OF INSPECTION: WEATHER CONDITIONS: PRIMARY SPILLWAY TYPE	<u>O 8:40</u> <u>Sunny</u> , <u>Concrete b</u>	OTHER ATTENDER 23°F GENERAL DAM	ES: HC	TYPE:	Eweir	boards
TIME OF INSPECTION: WEATHER CONDITIONS: PRIMARY SPILLWAY TYPE NUMBER OF OUTLETS:	08:40 Sunny, Concrete b	OTHER ATTENDER	SS: <u>H</u> C (DATA ARY SPILLWAY OF OUTLETS:	TYPE:	Eweir - Com	loo and s
TIME OF INSPECTION: WEATHER CONDITIONS: PRIMARY SPILLWAY TYPE NUMBER OF OUTLETS: HAS THE DAM BEEN BREA	08:40 Sunny, Concrete be	OTHER ATTENDER	SS: <u>H</u> C (DATA ARY SPILLWAY OF OUTLETS: CON CON	rype: B les Char	Eweir - form	boards oosionjp
TIME OF INSPECTION: WEATHER CONDITIONS: PRIMARY SPILLWAY TYPE NUMBER OF OUTLETS: HAS THE DAM BEEN BREA IS THERE A FISH LADDER?	O 87.40 Sunny, Concrete be O CHED OR OVERTO	OTHER ATTENDER	DATA DATA ARY SPILLWAY OF OUTLETS:	rype:	Eweir - fom	boards orsionjp
TIME OF INSPECTION: WEATHER CONDITIONS: PRIMARY SPILLWAY TYPE NUMBER OF OUTLETS: HAS THE DAM BEEN BREA IS THERE A FISH LADDER? DOES THE CREST SUPPORT	O 87.40 Sunny, Concrete be Ched or overto (LIST TYPE IF PRES TA PUBLIC ROAD?	OTHER ATTENDER	SS: <u>H</u> C (DATA ARY SPILLWAY OF OUTLETS: CON OCO CON	rype:	Eweir - fom	boards orsionjp
TIME OF INSPECTION: WEATHER CONDITIONS: PRIMARY SPILLWAY TYPE NUMBER OF OUTLETS: HAS THE DAM BEEN BREA IS THERE A FISH LADDER? DOES THE CREST SUPPORT ROADS/DRIVEWAY IMMED	O 87.40 Sunny, Concrete be Ched or overto (LIST TYPE IF PRE: TA PUBLIC ROAD? MATELY DOWNSTR	OTHER ATTENDER 23°F GENERAL DAM Course AUXILI TYPE C PPED? SENT) NC EAM OF DAM?	SS: <u>H</u> C <i>DATA</i> ARY SPILLWAY OF OUTLETS: C	rype:	Eweir - fom	boards oosionjp
TIME OF INSPECTION: WEATHER CONDITIONS: PRIMARY SPILLWAY TYPE NUMBER OF OUTLETS: HAS THE DAM BEEN BREA IS THERE A FISH LADDER? DOES THE CREST SUPPORT ROADS/DRIVEWAY IMMED ACCESS CONDITIONS TO T	O 87.40 Sunny, Concrete be Ched or overto (LIST TYPE IF PRE: TA PUBLIC ROAD? MATELY DOWNSTR HE SITE: <u>Wa</u>	OTHER ATTENDER 23°F GENERAL DAM Colored AUXILI TYPE C PPED? SENT) NC EAM OF DAM? MC - easement	ES: <u>H</u> <i>DATA</i> ARY SPILLWAY OF OUTLETS:	rype: 3 Jes. Char louses	Eweir - fom	boards oosionjp

		23	
DAM NAME		es Aj A	INSPECTION DATE
		EMBANKMENT (D/S SLOPI	E)
AREA INSPECTED	CONDITION	1.00	OBSERVATIONS
D/S SLOPE	TYPE (EARTH, CONCRETE, MASONRY) WET AREAS (NO FLOW) SEEPAGE (EARTH) OR LEAKAGE (CONCRETE) SLIDE, SLOUGH, SCARP EMBANKMENT-ABUTMENT CONTACT EMBANKMENT-ABUTMENT CONTACT EMBANKMENT-ABUTMENT CONTACT EROSION UNUSUAL MOVEMENT UNUSUAL MOVEMENT VEGETATION (PRESENCE/CONDITION) CONDITION OF JOINTS (CONCRETE)	Recth N/0; L-NAU N/0; L-NAU R-OCOOJ; L-NAU R-HDDU L-NR R-HDDU L-NR R-HDDU assoc N/D; NRC N/N K-gass mond, &u	we gaske shake af up ted - ve
ADDITIONA	AL COMMENTS:	n. eosion either ade a	f spilling the DIS slope 5

Ans

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		EMBANKMENT (U/S SLOPE)
AREA	CONDITION	OBSERVATIONS
	TYPE (EARTH, CONCRETE, MASONRY)	earth
	SLIDE, SLOUGH, SCARP	som R- Minor Scarping
	SLOPE PROTECTION TYPE AND COND.	NZO WORD J
	SINKHOLE/ANIMAL BURROWS	R-N/0; NOL
	EMBANKMENT-ABUTMENT CONTACT	R-Fair/gove/: v. minor erasion; L-unknown (NAU)
U/S SLOPE	EROSION	in nor ersion coursed along waters edge entre night side,
	UNUSUAL MOVEMENT	SWID want repet that apple and they
	VEGETATION (PRESENCE/CONDITION)	R-gass moured) + tall a mores; L - tall graces, mony in de
	CONDITION OF JOINTS (CONCRETE)	NTR. 44 - be toul
	APRILICAT VITIGNMENT INFORMATIONS	Miller montopoly 7-10 des many agentations
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DAM NAME		INSPECTION DATE
		EMBANKMENT (CREST)
AREA INSPECTED	CONDITION	OBSERVATIONS
	SURFACE TYPE	carthy gased
	SURFACE CRACKING	glore in wede of a part grant grant
(c)	SINKHOLES, ANIMAL BURROWS	C-multiple sinkholes near spillwary + 2-1: 6 " 0, 1-12 "
	VERTICAL ALIGNMENT (DEPRESSIONS)	R-minor undulations, 2-larger indulation
CREST	HORIZONTAL ALIGNMENT	R-Fair Left - poor fair
IGNO	RUTS AND/OR PUDDLES	R-minor Lown Suctor rules L: NAL
	VEGETATION (PRESENCE/CONDITION)	Re grass - mouse ' L' tall graves sharbs, small bue 3
	ABUTMENT CONTACT	Carolkairi L'when but proper mer
	CONDITION OF JOINTS (CONCRETE)	NA LACTED N' WILL THERE I TO PORT (NY M)
	No Torte Version En enconte	Wening were
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DAM NAM	а	
		DOWNSTREAM WALLS
AREA INSPECTE	CONDITION	OBSERVATIONS
	1. WALL TYPE	
	2. WALL ALIGNMENT	
	3. WALL CONDITION	
	4. HEIGHT: TOP OF WALL TO MUDLINE	min:
	5. SEEPAGE OR LEAKAGE	
	6. ABUTMENT CONTACT	
D/S WALLS	7. EROSION/SINKHOLES BEHIND WALL	2
	8. ANIMAL BURROWS	
	9. UNUSUAL MOVEMENT	
	10. WET AREAS AT TOE OF WALL	
	11. VEGETATION	
	12. SCOUR/EROSION AT BASE OF WALL	
ADDITION	AL COMMENTS:	
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AREA INSPECTEI			UPSTRI	ZAM WALLS
	CONDITION			OBSERVATIONS
	1. WALL TYPE			
	2. WALL ALIGNMENT	8	a ochorate	
	3. WALL CONDITION	ent ext	The Fresh and	a cocore and ours a brown
2	4. HEIGHT: TOP OF WALL TO MUDLINE		min:	max: avg:
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	7. ANIMAL BURROWS	3		
AURA	8. UNUSUAL MOVEMENT	No.		
	9. VEGETATION	X		
	10. SCOUR/EROSION AT BASE OF WALL	2/1	1	
	HORINDY BOX 2011 VOE	N VO	how had	the appropriate the power approximate with a
	ADAMAL DAMATING	ally -	JAM	
ADDITION.	AL COMMENTS:			
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DAM NAME		INSPECTION DATE
		DOWNSTREAM AREA
AREA INSPECTED	CONDITION	OBSERVATIONS
 -	ABUTMENT LEAKAGE	N/O ; NAL
	FOUNDATION SEEPAGE	N/O but may be obscored by leaves debris, MAC
	SLIDE, SLOUGH, SCARP	N/D 1
	WEIRS	N/O
D/S ARFA	DRAINAGE SYSTEM	NO
	INSTRUMENTATION	N/O
	VEGETATION	tell grastes ; shals; farge + small the S
	ACCESSIBILITY	walking "
	DOWNSTREAM HAZARD DESCRIPTION	the human have 3 Successive beaus dans & another
ADDITIONA	L COMMENTS:	dan dewnstea
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DISCHARGE AREA TU part impruded by Cardine barver dans discharge are is warebed DEBRIS DEBRIS DEBRIS DEBRIS MATER LEVELAT TIME OF INSPECTION Gebeis fram beaver dur den a 2-4" but improvedance a 2' abore due for Beare MATER LEVELAT TIME OF INSPECTION TONAL COMMENTS		APPROACH AREA	beave dan	
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Wood-Pawcatuck Watershed Flood Resiliency Management Plan DAM INSPECTION FIELD ASSESSMENT



Wood-Pawcatuck Watershed Klood Resiliency Management Flat

Potential Recommendation Notes

Good cardidate. **Removal?**

Breach/Spillway Adjustments?

Repurposing? No

Paride through removal; otherwise - possible natural fishway? Beavers would likely block any technical or nature-like fishway installed, as well as dam. Fish/eel passage?

Notes:

Appears to be some rec usage but not same level as other impoundments. Houses surrounding impoundment separated From waterline by wooded Shifter Dan is a hazard to dand/s, + beaver dans are increasing risk of failure

PHOTOS

PHOTOGRAPHS INSTRUCTION PAGE:

All photographs shall be color photographs. Photographs shall be clear and include scale references where applicable. Photographs shall include, but not be limited to the following:

- 1. Overview of dam from upstream
- 2. Overview of dam from downstream
- 3. Overview of upstream face from right abutment
- 4. Overview of upstream face from left abutment
- 5. Overview of dam crest from right abutment
- 6. Overview of dam crest from left abutment
- 7. Overview of downstream face from right abutment
- 8. Overview of downstream face from left abutment
- 9. Overview of spillway from upstream
- 10. Overview of spillway from downstream (tailrace or channel area)
- 11. Overview of right training wall
- 12. Overview of left training wall
- 13. Overview of weir
- 14. Overview of stilling basin
- 15. Overview of downstream channel
- 16. Overview of gatehouse exterior
- 17. Overview of gatehouse interior
- 18. Overview of operators
- 19. Outlet inlets and discharge points
- 20. Overview of reservoir
- 21. Areas of specific deficiencies (e.g., cracks, erosion, displacement, seeps, deterioration, etc.)

Each photograph shall include a caption indicating the subject of the photograph as well as highlighting any specific deficiencies pictured. All photographs shall be presented with no more than two (2) photos per page. Photo location and orientation shall be indicated on the site plan included in the section entitled "Figures". Alternatively, for clarity, a separate figure can be provided in this appendix to show figure locations.

Wood-Pawcatuck Watershed Flood Resiliency Management Plan DAM INSPECTION FIELD ASSESSMENT

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SKETCH

				DAM SA	FETY INSP	ECTION	I				1
NAME OF DAM:	Wee h	oddie	Pond 1	STATE I	D #:	MAD	1827				
AKA NAME:				WATER	COURSE NAM	E:					
				DAMLOC	CATION INFOR	<u>MATION</u>					
CITY/TOWN:	Char	Itan		LAT. / L0	ONG.:						
STATE:	MA			HAZARI	D CLASS:	4					
				GENERA	L DAM INFOR	MATION					
TYPE OF DAM:	conc	refe +	earth	n	2	R					
PURPOSE OF DAM	1:			4	5	P			3		-
YEAR BUILT:				2	120	10			14/73		OM D
				E							
				INSP	ECTION SUMM	<u>IARY</u>					8
DATE OF INSPECT	TION:	12/5	118	NAME C)F INSPECTOR	RW					
TIME OF INSPECT	ION:	9:30	AM	OTHER	ATTENDEES:	NF					
WEATHER CONDI	TIONS:	SUDDU	1.32	6 no	wind	2)	~			0.6	
		(3	5	53	E.	R			17	
				GEN	IERAL DAM DA	<u>ITA</u>	8			5	
PRIMARY SPILLW	'AY TYPE:	Contrea	bell2	E E	AUXILIAR	Y SPILLWAY	TYPE:	1		100	
NUMBER OF OUTI	LETS:		/	3 2	TYPE OF C	OUTLETS:	2 9	1		N.	
HAS THE DAM BE	EN BREAC	HED OR OV	/ERTOPPE	ED?	Unkna	own	6 2	u			
IS THERE A FISH I	LADDER? (LIST TYPE I	IF PRESEN	IT)	No						
DOES THE CREST	SUPPORT	A PUBLIC F	ROAD?		No						
	VUQUEDI	ATELY DOV	WNSTREA	M OF DAM	1? Yes	NC.	NOC	MICL			
ROADS/DRIVEWA	Y IMMEDI				,			8	i è		
ROADS/DRIVEWA	ONS TO TH	E SITE:	Walk	-upin	long a	side of	nad				
ROADS/DRIVEWA ACCESS CONDITIO	ONS TO TH	IE SITE:	Walle	- upja	lon a s	side of	pill	4	mad	cul	to

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DAM NAME	13-	INSPECTION DATE	
	Caelo.	EMBANKMENT (D/S SLOPE)	
AREA INSPECTED	CONDITION	OBSERVATIONS	
-	TYPE (EARTH, CONCRETE, MASONRY)	earth	
2	WET AREAS (NO FLOW)	N/O - de bos	N
ĘŲ	SEEPAGE (EARTH) OR LEAKAGE (CONCRETE)	N/O	80
2	SLIDE, SLOUGH, SCARP	Soil displaced from endow to before Spillwor	0.0
-	EMBANKMENT-ABUTMENT CONTACT	a fair (good ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~	12
	SINKHOLE/ANIMAL BURROWS	y N/0 but pabable	
D/A SLUFE	EROSION	see 41 additional migor crossion of \$17	
	UNUSUAL MOVEMENT	Hes - see 4	
	VEGETATION (PRESENCE/CONDITION)	baulles, bush, grass, small trees	~~~
	CONDITION OF JOINTS (CONCRETE)	V/B	96
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ADDITIONA	L COMMENTS:	s line	Look.
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ection type and consistent of spill and faster and from the longer intert and the second second from the second se	GH, SCARP	sloughed + scarped to nearly which is some places
NIMAL BURROWS VI-ABUTMENT CONTACT Read And AMAL BURROWS Read Read Read And Read	ECTION TYPE AND COND.	Store amor right of Spill way + assoc wall no longer intact
Tr-ABUTMENT CONTACT Food See 2 OVEMENT N/O OVEMENT N/O OVEMENT N/O DE 2000 DE	NIMAL BURROWS	yes -litely
Se Z OVENNENT N/O OVENNENT N/O OF JOINTS (CONCRETE) Arts See JS widt frees, lange free lange of hyperication of hyperication of the second	NT-ABUTMENT CONTACT	gave a
OVEMENT N/O OPENENTION) bash, banbles, small frees, lage free lower the form the production of the provident of the providen	contrar .	5 2 2
A (PRESENCECONDITION) Jacob, bankles, small frees, lang frees (som trade Rening of Angeles) and som trade Rening of Angeles and Reni	OVEMENT	N/O ENDER EWEL E MAR WERE
PF JONTS (CONCRETE)	(PRESENCE/CONDITION)	bach, bambles, small frees, large frees (some todd learing
	DF JOINTS (CONCRETE)	at see us walls
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INSPECTION DATE	EMBANKMENT (CREST)	OBSERVATIONS	earth	e/m	eles - Bot least one sightale 2' putter the remarch' of "	lange endulations & dependent on S	born.	4 hely under Paush - see 4	bach, banbles, small + profe thels	good/fair	W/M	i total and	it of significant a service of many reaction where a part	all mer i parter to have a prover i to have			
		CONDITION	SURFACE TYPE	SURFACE CRACKING	SINKHOLES, ANIMAL BURROWS	VERTICAL ALIGNMENT (DEPRESSIONS)	HORIZONTAL ALIGNMENT	RUTS AND/OR PUDDLES	VEGETATION (PRESENCE/CONDITION)	ABUTMENT CONTACT	CONDITION OF JOINTS (CONCRETE)		comments: 3 fr ngh		An ICARI (PROC 3) MERING		1. 1000
DAM NAME		AREA INSPECTED			ŝ	7	CREST						ADDITIONAL	и		1.	

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DAM NAME	(ULPD	INSPECTION DATE
		INSTRUMENTATION
AREA INSPECTED	CONDITION	OBSERVATIONS
	1. PIEZOMETERS	
	2. OBSERVATION WELLS	
	3. STAFF GAGE AND RECORDER	
G	4. WEIRS	
	5. INCLINOMETERS	
INSTR.	6. SURVEY MONUMENTS	
	7. DRAINS	
	8. FREQUENCY OF READINGS	
1.	9. LOCATION OF READINGS	
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ADDITIONA	L COMMENTS:	
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	ME	INSPECTION DATE
		DOWNSTREAM WALLS
AREA	CONDITION	OBSERVATIONS
	1. WALL TYPE	Masonry
	2. WALL ALIGNMENT	poor-stores misaligned
	3. WALL CONDITION	poor-voids; see 2
	4. HEIGHT: TOP OF WALL TO MUDLINE	min:
	5. SEEPAGE OR LEAKAGE	yes wet areas ice on stone?
	6. ABUTMENT CONTACT	- N/2 and present who 3 fr of spilling Tilals
D/S WALLS	7. EROSION/SINKHOLES BEHIND WALL	probables concolor
	8. ANIMAL BURROWS	maple to observe
	9. UNUSUAL MOVEMENT	N/O L
	10. WET AREAS AT TOE OF WALL	possible
	11. VEGETATION	
	12. SCOURVEROSION AT BASE OF WALL	make to observe
ADDITIO	VAL COMMENTS:	
	1911	- Cost. Invite Dr. L.

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UNSTREAM WALLS MEAT CONDITION MEAT CONDITION OBSERVATIONS MEAT CONDITION OBSERVATIONS / I WALL TYPE CONDITION OBSERVATIONS / I WALL LIDENMERT CONCICCE/ED (EX HENSION) OBSERVATIONS 2 WALL LIDENMERT APPEORS PD FRAGE (A) only alignment Image: 3' 2 WALL CONDITION Image: 3' Image: 3' Image: 2' 2 WALL CONDITION Image: 3' Image: 3' Image: 3' 2 WALL CONDITION Image: 3' Image: 3' Image: 3' 2 WALL CONDITION Image: 3' Image: 3' Image: 3' 2 WALL CONDITION Image: 3' Image: 3' Image: 3' 2 WALL CONDITION Image: 3' Image: 3' Image: 3' 0 US E ROSONSTINCHOLES BEIND WALL Image: 3' Image: 3' 0 US E ROSONSTINCHOLES BEIND WALL Image: 3' Image: 3' 0 US I BORDONSTINCHOLES BEIND WALL Image: 3' Image: 3' 0 US I BORDONSTINCHOLES BEIND WALL Image: 3' Image: 3' 0 US I BORDONSTINCHOLES BEIND WALL Image: 3' Image: 3' 0 US I BORDONSTINCHOLES BEIND WALL Image: 3' Image: 3' 0 US	DAM NAM	E CULPD	INSPECTION DATE
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1 1 I WALLTYPE Concrete, extension of training und/s /s ported. 2 WALLAUGNMENT appears the number of dignet 3 WALLAUGNMENT appears the number of dignet 3 WALLAUGNMENT appears the number of dignet 4 HEGHT. TOP OF WALL TOMUDINE min. 2' 4 Min. 2' Min. 3' 4 HEGHT. TOP OF WALL TOMUDINE min. 2' 4 Min. 2' Min. 3' 5 ABUTMENT CONTACT eshineted 4 ECONORING P. N/D ' 4 Min. 1 P. N/D ' 4 Min. 1 Min. 2' 4 Min. 2' Min. 3' 4 Min. 2' Min	AREA INSPECTE	CONDITION	OBSERVATIONS
2. WALL ALGNMEDT 2. WALL ALGNMEDT 2. WALL ALGNMEDT 3. WALL CONDITION min. 2' 1. WALL 4. HEGHT. FOF OF WALL TO MUDLINE min. 2' 1. WALL 4. MEGHT. FOF OF WALL TO MUDLINE min. 2' 1. WALL 4. WALLS 6. EROSIONSINKHOLES BEHIND WALL PN/O; Left - Small burraust gass. where contract and the second state of the seco	1	1. WALL TYPE	concrete, expension of training walk to protect approach t
3 WALL CONDITION Imm. 2' max. 3' ave. 2.5' 4 HEIGHT: TOP OF WALL TO MUDLINE Imm. 2' max. 3' ave. 2.5' 8 ABUTMENT CONTACT 6. ABUTMENT CONTACT 0 VIS 6. EROSIONSINKHOLES BEHIND WALL. 0 VALLS 6. EROSIONSINKHOLES BEHIND WALL. 0 VALLS 7. ANIMAL BURROWS 0 VIS 7. ANIO 0 VIS 7. ANIO 0 VIS 0. VIS 0 VIS 0. VIS ADDITIONAL COMMENTS 0. ULS Evaluation 0. ULS	pp(1)044	2. WALL ALIGNMENT	appears to match on'y alignment
4 HEIGHT: TOP OF WALL TO MUDLINE min. 2' max. 3' ave. 2.5' 4 HEIGHT: TOP OF WALL TO MUDLINE 8. ABUTMENT CONTACT 6. A HOLD 2. A HOLD ave. 2. S HOLD 4 HEIGHT: TOP OF WALL 2. A HOLD 2. A HOLD 2. A HOLD 2. A HOLD ave. 2. S HOLD 4 HEIGHT: TOP OF WALL 2. A HOLD 4 HOLD 2. A MALL BURROWS 2. A HOLD 2. A HOLD 2. A HOLD 2. A HOLD 1 ANIMAL BURROWS 2. A HOLD 9. VEGETATION 9. VEGETATION 2. A HOLD 2. A HOLD 2. A HOLD 2. A HOLD 9. VEGETATION 0. VEGETATION 2. A HOLD 2. A HOLD 2. A HOLD 10. SCOURTEROSION AT BASE OF WALL 2. A HOLD 2. A HOLD 2. A HOLD ADDITIONAL COMMENTS 0. U/S Explored for A HOLD 2. A HOLD A HOLD		3. WALL CONDITION)
UNIS ABUTMENT CONTACT ESTIMATED MULLS BAUTMENT CONTACT ESTIMATED MULLS BENNOWSINKHOLES BEHIND WALL ANMAL BURROWS REHND WALL ANMAL BURROWS REHND WALL ANMAL BURROWS REAL 8 UNUSUAL MOVEMENT 8 UNUSUAL MOVEMENT 8 UNUSUAL MOVEMENT 9 VEGETATION 9 V		4. HEIGHT: TOP OF WALL TO MUDLINE	min: 2' avg: 2.5'
US WALLS MALLS 1 ANIMAL BURROWS 1 ANIMAL BURROWS R INUSUAL MOVEMENT 8 UNUSUAL MOVEMENT 9 VEGETATION 9 VEGETATION 9 VEGETATION 10. SCOUREROSION AT BASE OF WALL NO 10. SCOURERO		5. ABUTMENT CONTACT estimated	
T. ANIMAL BURROWS R - N/D L - Shull burraus poss. where compared to the compared to	U/S WALLS	6. EROSION/SINKHOLES BEHIND WALL	R-N/0; & -N/0
8 UNUSUAL MOVEMENT R-N/0; L'N/0 9. VEGETATION 9. VEGETATION 10. SCOUREROSION AT BASE OF WALL 10.5 S on Vall 10. SCOUREROSION AT BASE OF WALL N/5 ADDITIONAL COMMENTS 0.1/5 Reported 1 ADDITIONAL COMMENTS 0.1/5 Earled 29000000000000000000000000000000000000		7. ANIMAL BURROWS	R-N/0; Left - Swall burrows noss. when concate ended
9. VEGETATION moss on val 10. SCOUR/EROSION AT BASE OF WALL N/7 O ADDITIONAL COMMENTS: 0 u/s Explanation	Diz YOUN	8. UNUSUAL MOVEMENT	R-N/0, L: N/0 r
10. SCOURFEROSION AT BASE OF WALL ADDITIONAL COMMENTS: 0 U/S Explored to appropried to the Sur- Connected Spatial aggregate exported to the Sur- badly		9. VEGETATION	mess on wall
ADITIONAL COMMENTS: <u>O U/S Erfbankanut</u> conerte spalled; aggragete exposed f orthe Eucles		10. SCOUR/EROSION AT BASE OF WALL	N/S
ADDITIONAL COMMENTS: <u>O U/S Endbartanet</u> conerte spalled's aggregate expased t sigh left side sur badly		BOLININ FLORE SHERVED	
ADDITIONAL COMMENTS: <u>O U/S Endbarkment</u> conerce spalled; aggregate exposed f sigh left side sur badly			
concrete spalled, agregate exposed, the side such badly	ADDITION	AL COMMENTS: 0 U/S EABLE	kment
padiy		concrete Sy	alled' aggragete exposed , the left side surface
	ant M Ma	padily	W/SESCUDIM DW LE

	Carlo an Ac	DOWNSTREAM AREA
AREA NSPECTED	CONDITION	OBSERVATIONS
	ABUTMENT LEAKAGE	
	FOUNDATION SEEPAGE	
	SLIDE, SLOUGH, SCARP	
	WEIRS	Maria and Maria
D/C ADEA	DRAINAGE SYSTEM	Row South and a second s
DIS ANEA	INSTRUMENTATION	to all that want touroon base apart could
	VEGETATION	The wear of the wear
	ACCESSIBILITY	
	10 10 11 11 10 11 10 10 10 10 10 10 10 1	
	DOWNSTREAM HAZARD DESCRIPTION	
ADDITIONA	L COMMENTS:	atter a warder and endered
		The second manual and the second s
	01-1-00	

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INSPECTION DATE	PRIMARY SPILLWAY	OBSERVATIONS	concrete chute	untenown	Door	training walls creeked, hading off; left training wall large a	unknown-N/A?	see () (left training wall)	beaut dan surrounds estire approach, raises impounding	discharges directly to entired poor candition under Opril	debris (wood, mud) fran beaver day caught fin	22" over spilling a) Spillinger a 1' over weir due to Di		ied + learing, u/ rebur exposed) noss growing on top of		s open stran chancel. Als side head well too the d
WLPD		CONDITION	SPILLWAY TYPE	WEIR TYPE	SPILLWAY CONDITION	TRAINING WALLS	SPILLWAY CONTROLS AND CONDITION	UNUSUAL MOVEMENT	APPROACH AREA	DISCHARGE AREA	DEBRIS	WATER LEVEL AT TIME OF INSPECTION		COMMENTS:		d, which discharges to
DAM NAME		AREA INSPECTED	- AND			7			BITT NYA	(10			181	ADDITIONAL	N.	S Cas

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DAM NAME		INSPECTION DATE	Ķ
		AUXILIARY SPILLWAY	
AREA INSPECTED	CONDITION	OBSERVATIONS	
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	WEIR TYPE SPILLWAY CONDITION	a la	
ι,	TRAINING WALLS SPILLWAY CONTROLS AND CONDITION		A
SPILLWAY	UNUSUAL MOVEMENT APPROACH AREA		
	DISCHARGE AREA DEBRIS WATER LEVEL AT TIME OF INSPECTION	A LAND AND A LAND	
	000		
ADDITIONA	L COMMENTS:		
	Aq-w		



DAM NAME	(m7ba)		- 1		INSPEC	TION DATE	d.		
			633	OUTLET WORKS			rem		
AREA NSPECTED	CONDITION		hord		OBS	ERVATIONS	l des		
	TYPE		53		N A.	a di	70		
	INTAKE STRUCTURE		20		he fo	2	ulv	Ţ	
	TRASHRACK	100	2	\langle	elva	41	5	in	
	PRIMARY CLOSURE	a7a	234		ſ	e s	4	100	
	SECONDARY CLOSURE	Z 3	2	+		ano.	hàn	dr.	
	CONDUIT	5	arji			X	oni	to	
OUTLET	OUTLET STRUCTURE/HEADWALL	9	con	6		no	lba	se h	
WORKS	EROSION ALONG TOE OF DAM	6a	on	2	<u>.</u>	6	5 0		
	SEEPAGE/LEAKAGE	bas		2	20	lan	1 10	N N	
	DEBRIS/BLOCKAGE	60	28.0	-	7	ena	Joc	et o	
	UNUSUAL MOVEMENT	100 100	ano	5	2 4	han	pe	da jun	
	DOWNSTREAM AREA	1 de	6		000	1	2	10 al	
		1010 .7	1 10		A	o [0.	ava Dva	29 29	
	MISCELLANEOUS	Ne's	2 2 1 2		- 	h. h	enited NON	nd selection booled	
IDDITIONAL	L COMMENTS:		1		teri e	Con Con	10	803	
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		Z	(es:		la/cel	i i o c	actor G	oitu von	
							1	ro R	1

Wood-Paweatack Watershed Flood Resiliency Management Pla next INSECCTION ATEL IN SECONS MERCIN **Potential Recommendation Notes**

Removal?

Remare in conjunction w/ culvert replacement

Breach/Spillway Adjustments?

att to renaral; perform in conjunction of culrot replacement

Repurposing? emb. too losi not erough som to extend b/s slope

Fish/eel passage? Not a good site - no room, road & culvert in way

impound appears to be enused; no controls, rec access, hours on impoundment. Dan in v. poor condition & a hatard Notes:

PHOTOS

PHOTOGRAPHS INSTRUCTION PAGE:

All photographs shall be color photographs. Photographs shall be clear and include scale references where applicable. Photographs shall include, but not be limited to the following:

- 1. Overview of dam from upstream
- 2. Overview of dam from downstream
- 3. Overview of upstream face from right abutment
- 4. Overview of upstream face from left abutment
- 5. Overview of dam crest from right abutment
- 6. Overview of dam crest from left abutment
- 7. Overview of downstream face from right abutment
- 8. Overview of downstream face from left abutment
- 9. Overview of spillway from upstream
- 10. Overview of spillway from downstream (tailrace or channel area)
- 11. Overview of right training wall
- 12. Overview of left training wall
- 13. Overview of weir
- 14. Overview of stilling basin
- 15. Overview of downstream channel
- 16. Overview of gatehouse exterior
- 17. Overview of gatehouse interior
- 18. Overview of operators
- 19. Outlet inlets and discharge points
- 20. Overview of reservoir
- 21. Areas of specific deficiencies (e.g., cracks, erosion, displacement, seeps, deterioration, etc.)

Each photograph shall include a caption indicating the subject of the photograph as well as highlighting any specific deficiencies pictured. All photographs shall be presented with no more than two (2) photos per page. Photo location and orientation shall be indicated on the site plan included in the section entitled "Figures". Alternatively, for clarity, a separate figure can be provided in this appendix to show figure locations.

Wood-Pawcatuck Watershed Flood Resiliency Management Plan DAM INSPECTION FIELD ASSESSMENT

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		DAM SAFETY INSPECTION	
NAME OF DAM:	Lac Marie Barn	_STATE ID #:	
AKA NAME:		WATERCOURSE NAME:	
		DAM LOCATION INFORMATION	
CITY/TOWN:	Spencer	_LAT. / LONG.:	
STATE:	MA	_HAZARD CLASS:	
		GENERAL DAM INFORMATION	
TYPE OF DAM:	earth	2.04	
PURPOSE OF DAM:	unknown		
YEAR BUILT:		3	
		INSPECTION SUMMARY	
DATE OF INSPECTI	ON: 11/29/18	NAME OF INSPECTOR: RLW	-
TIME OF INSPECTI	ON: 11:11AM	OTHER ATTENDEES: HF, PD	ő
	ions cloudy	cold include	
WEATHER CONDIT	IONS. Crocky, (en , where	
		GENERAL DAM DATA	
DDIMA DV CDILLIV	V TVDE		
PRIMARY SPILLWA	AY TYPE: CANC.	AUXILIARY SPILLWAY TYPE:	7
NUMBER OF OUTL	ETS:	TYPE OF OUTLETS:	8
HAS THE DAM BEF	EN BREACHED OR OVERTOPPE	D? <u>UN</u>	
IS THERE A FISH L.	ADDER? (LIST TYPE IF PRESEN	T) NO	
DOES THE CREST S	SUPPORT A PUBLIC ROAD?	No	
DOES THE CREST S	SUPPORT A PUBLIC ROAD? 7 IMMEDIATELY DOWNSTREAT	MOFDAM? Read -	
DOES THE CREST S	SUPPORT A PUBLIC ROAD? (IMMEDIATELY DOWNSTREAD	MOFDAM? <u>Read</u> - Kyp	01006
DOES THE CREST ROADS/DRIVEWAY ACCESS CONDITIO SECURITY DEVICE	SUPPORT A PUBLIC ROAD? (IMMEDIATELY DOWNSTREAD ONS TO THE SITE: <u>walk</u> S? Gate	MOFDAM? Read - Kyp of access and to Nia	the side of dor

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JAM NAME	nder o	INSPECTION DATE	
	-	EMBANKMENT (D/S SLOPE)	
REA NSPECTED	CONDITION	OBSERVATIONS	
	TYPE (EARTH, CONCRETE, MASONRY)	earth	
	WET AREAS (NO FLOW)	N/20	
	SEEPAGE (EARTH) OR LEAKAGE (CONCRETE)	N/0	
	SLIDE, SLOUGH, SCARP	aw Mo	
	EMBANKMENT-ABUTMENT CONTACT	cros el	
	SINKHOLE/ANIMAL BURROWS	e/w	
D/S SLUPE	EROSION	N/O	
	UNUSUAL MOVEMENT	QIN	
	VEGETATION (PRESENCE/CONDITION)	marcel ands' i small amont moss	
	CONDITION OF JOINTS (CONCRETE)	N/A	
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		240 	510
DDITIONAL	L COMMENTS:		M
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	2000 2000 2000 2000		

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AREA		
AREA NSPECTEI		EMBANKMENT (U/S SLOPE) SEE DJS S/APC
	CONDITION	OBSERVATIONS
	TYPE (EARTH, CONCRETE, MASONRY)	
	SLIDE, SLOUGH, SCARP	some slimping a colar of stone amor in when end of
	SLOPE PROTECTION TYPE AND COND.	A store amor - pool
	SINKHOLE/ANIMAL BURROWS	
	EMBANKMENT-ABUTMENT CONTACT	
U/S SLOPE	EROSION	000
	UNUSUAL MOVEMENT	are manual some way (and there are according a
-	VEGETATION (PRESENCE/CONDITION)	grass, Smull Sharles, tall gasas
	CONDITION OF JOINTS (CONCRETE)	and
	ABRUCAT SURDATEST. OBDRESSIONS)	hood we
	albretores - to two activitions	
DDITIONA	AL COMMENTS:	
	ATTIT VOE TABE	
	COMDITION	e di Pri Angeleria di Pri Ange

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EMBANKMENT CREET) REFEARD CONDITION DISSERVATIONS NEWEARD CONDITION OBSERVATIONS SURFACE TYPE CONDITION OBSERVATIONS SURFACE TYPE CONDITION OBSERVATIONS SURFACE TYPE CONDITION CarAP SURFACE TYPE CONDITION CarAP SURFACE CRACKING A/A O VERTICUL ALLOXAMENT PPO O A/A HIST ANDORE NUMMENT PPO O A/A VERTICUL ALLOXAMENT PPO O A/A MITON ALLOXAMENT PPO O A/A MITON REPERCECONDITION PROSE PROSE VERETALLIANDENT PPO O A/A MITON REPERCECONDITION PROSE PROSE MITONAL CONTACT PROSE PROSE PROSE CONDITION OF JOINT ON OF JOINT ALLOXAMENT PROSE PROSE PROSE CONDITION OF JOINT ALLOXATION PROSE PROSE PROSE PROSE	DAM NAME		INSPECTION DATE	
REFETED CONDITION COBERVATIONS SURFACE TYPE CARACTYPE CAPA SURFACE TYPE CAPACING CAPA SURFACE TYPE CAPACING ANNAL BURROWS AND CAPACING AND			EMBANKMENT (CREST)	
SURFACE TYPE Carth SURFACE CRACKING M/D SURFACE CRACKING M/D SURFACE SAMMAL BURROWS M/D SURVEOLES ANIMAL BURROWS M/D VERTICAL ALIGNMENT (DEPRESSIONS) 2000 Å/M VERTICAL ALIGNMENT 2000 Å/M VERTICAL ALIGNMENT 2000 Å/M VERTICAL ALIGNMENT 2000 Å NUTS ANDOR FUDDLES M/D VEGETATION (PRESERVECONDITION) 2000 Å ABUTMENT CONTACT 2000 Å ABUTMENT 2001 Å ABUTMEN	AREA INSPECTED	CONDITION	OBSERVATIONS	
SURFACE CRACKING M/D SINFHOLES, ANIMAL BURROWS M/D SINFHOLES, ANIMAL BURROWS A/D VERTICAL ALIGNMENT QCO CH VERTICAL ALIGNMENT QCO CH RUTS ANDOR PUDDLES QCO CH VEGETATION (PRESENCECONDITION) QCO CH VEGETATION (PRESENCECONDITION) QCO CH ABUTMENT CONTACT QCO CH ABUTMENT CONTACT QCO CH ADDITIONAL CONCRETED M/D ADDITIONAL CONCRETED M/D		SURFACE TYPE	terth	
BINKHOLES, ANIMAL BURROWS N/O VERTICAL ALIONMENT (DERESSIONS) 2400 / M/B VERTICAL ALIONMENT (DERESSIONS) 2400 / M/B CREST RUTS ANDOR PUDDLES N/O RUTS ANDOR PUDDLES N/O 2000 / M/B ABUTMENT CONTACT 2400 / M/B 2000 / M/B ABUTMENT CONTACT 2400 / M/B 2000 / M/B ABUTMENT CONTACT 2400 / M/B 2000 / M/B ADDITION OF JOINTS (CONCRETE) N/O 2000 / M/B ADDITION AL CONNENTS CONDITION OF JOINTS (CONCRETE) N/O ADDITION AL CONNENTS REST / BLL, former and fals 2000 / M/B		SURFACE CRACKING	V/V	
VERTICAL ALGAMMENT (DERRESSIONS) PLOO OF MAD CREST HORIZONTAL ALGAMMENT PPOO OF NUTHER PPOO OF PPOO OF VEGETATION (PRESENCE/CONDITION) PPOO OF VEGETATION (PRESENCE/CONDITION) PPOO OF ABUTMENT CONTACT PPOO OF ADDITION OF JOINTS (CONCRETE) MO ADDITIONAL COMMENTS POO OF ADDITIONAL COMMENTS POSSI 'BLE famet out LLET controls ADDITIONAL COMMENTS POSSI 'BLE famet on tLLET controls		SINKHOLES, ANIMAL BURROWS	v/o,	
CREST HORIZONTAL ALIGNMENT PRO CA RUTS AND/OR PUDLES N/D VEGETATION (PRESENCE/CONDITION) Grass- proved; Some most; large trees encredibly ABUTMENT CONTACT Grass- proved; Some most; large trees encredibly ABUTMENT CONTACT Grass- proved; Some most; large trees encredibly ADDITION OF JOINTS (CONCRETE) N/D ADDITIONAL COMMENTS: POSSI ble former av fillet contrals ADDITIONAL COMMENTS: POSSI ble former an fillet contrals		VERTICAL ALIGNMENT (DEPRESSIONS)	grood/ 1/0	non o niid n
ADTITIONAL EVENTION AND AND AND AND AND AND AND AND AND AN	CREST	HORIZONTAL ALIGNMENT	prod	1
VEGETATION (PRESENCE/CONDITION) ABUTMENT CONTACT ABUTMENT CONTACT CONDITION OF JOINTS (CONCRETE) ADDITIONAL COMMENTS: PAGE PART ON FLET CONFRETE) ADDITIONAL COMMENTS: PAGE POWER ON CASES PAGE POWER ON CONCRETE) PAGE PAGE POWER ON CASES PAGE POWER ON CONCRETE) PAGE PAGE POWER ON CONCRETE) PAGE PAGE PAGE POWER ON CASES PAGE PAGE PAGE POWER ON CASES PAGE PAGE PAGE PAGE PAGE PAGE PAGE PAGE		RUTS AND/OR PUDDLES	and the all	
ABUTIMENT CONTACT apo d ABUTIMENT CONTACT CONDITION OF JOINT'S (CONCRETE) ADDITIONAL COMMENTS: POSSI ble former outlet controls man hole cover on crest		VEGETATION (PRESENCE/CONDITION)	grass- moweel, some most ; large trees encredening,	vola Ca
CONDITION OF JOINTS (CONCRETE) N/O ADDITIONAL COMMENTS: POSSI ble former outlet contrals -manhole cover on crest		ABUTMENT CONTACT	apo al 1 1 "	2
ADITIONAL COMMENTS: Possible former outlet contrais manhale cover on crest		CONDITION OF JOINTS (CONCRETE)	N/O	- Anton
ADDITIONAL COMMENTS: Possible former outlet contrais -manhale cover on crest		COLOR AND		
-markele cover an crest	ADDITIONAI	L COMMENTS:	ble former outlet controls	
		81 D.L. 21 D.D.B. (2018)	markele cover on crest	and the
		TITLEVELS UNA MEL WHEN ST		,
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DAM NAME		INSPECTION DATE
		INSTRUMENTATION
AREA INSPECTED	CONDITION	OBSERVATIONS
12	1. PIEZOMETERS	
	2. OBSERVATION WELLS	
01	3. STAFF GAGE AND RECORDER	
	4. WEIRS	¢
	5. INCLINOMETERS	
INSTR.	6. SURVEY MONUMENTS	2
	7. DRAINS	
12	8. FREQUENCY OF READINGS	
	9. LOCATION OF READINGS	
ADDITIONAL	L COMMENTS:	
	10101	

Alexandri (1996) A 1997 A 199 A 1997 A 1977 A 19

DAM NAM	Ε	INSPECTION DATE
		DOWNSTREAM WALLS
AREA INSPECTEI	CONDITION	OBSERVATIONS
	1. WALL TYPE	
	2. WALL ALIGNMENT	
	3. WALL CONDITION	
	4. HEIGHT: TOP OF WALL TO MUDLINE	min:
	5. SEEPAGE OR LEAKAGE	
	6. ABUTMENT CONTACT	
D/S WALLS	7. EROSION/SINKHOLES BEHIND WALL	
	8. ANIMAL BURROWS	
	9. UNUSUAL MOVEMENT	
	10. WET AREAS AT TOE OF WALL	2
	11. VEGETATION	
	12. SCOUR/EROSION AT BASE OF WALL	
ADDITION	AL COMMENTS:	
		지수는 것으로 가지 않는 것 같아.

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	UPSTREAM WALLS - 2017 SIDE ON WY
CONDITION	OBSERVATIONS
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GNMENT	apod with a way a way and a way
NOILIGN	are good wind bou outed
OP OF WALL TO MUDLINE	^o 3 t \mathcal{A} \mathcal{S} avg. \mathcal{A} \mathcal{B}
T CONTACT	my good an an
SINKHOLES BEHIND WALL	some soil loss
URROWS	No No
MOVEMENT	No
NO	NONO
OSION AT BASE OF WALL	150 minor orsion new end of wall that
N SERVO	
The second s	0/4
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(iii)per 9 fewers auxiliaria a care 0, putaryantiane gaptine 2000. 1

		DOWNSTREAM AREA
AREA INSPECTED	CONDITION	OBSERVATIONS
	ABUTMENT LEAKAGE	N/D
	FOUNDATION SEEPAGE	N/O
	SLIDE, SLOUGH, SCARP	N/O
	WEIRS	N/O
D/S AREA	DRAINAGE SYSTEM	N/0
	INSTRUMENTATION	ý/0
	VEGETATION	grass frees
	ACCESSIBILITY	work only, tow face
	1011 104 - 1011 10 Million	Ď
	DOWNSTREAM HAZARD DESCRIPTION	Rte 31 bridge - in very poor condition
ADDITIONAL	comments: Scou	r pool, back croseon, sectiment deposition d/s of
		AND

RIMARY SFILLMAY REAL CONDITION REAL OBSERVATIONS REAL CONDITION REAL CONDITION REAL CONDITION RELLAWATTYPE CONDITION RELLAWATTYPE CONDITION RELLAWATTYPE CONDITION RELLAWATTYPE CONDITION RELLAWATTYPE LEADER CONDITION RELLAWATOCONTENSIT LEADER CONDITION APPROACH AREA ACONTECT CONDITION DERRILAMATION ACONTECT CONDITION APPROACH <th co<="" th=""><th>AM NAME</th><th></th><th>INSPECTION DATE</th></th>	<th>AM NAME</th> <th></th> <th>INSPECTION DATE</th>	AM NAME		INSPECTION DATE
REAL SWEATED CONDITION ORSERVATIONS SPILLWAY TYPE CONDITION ON- ENLINANT TYPE ON- ENLINANT CONTINON		-	PRIMARY SPILLWAY	
BILLWAY TYPE CONCreft WIER TYPE Incred Crest WIER TYPE Incred Crest BILLWAY CONDITION Appeel BILLWAY CONDITION Appeel BILLWAY CONDITION Appeel BILLWAY CONDITION A/O INUUSUAL MOVEMENT A/O APPROACH AREA Alarrow APPROACH AREA Alarrow DISCHAREA Alarrow DIAL - 2:3 " Over Spillukuy	REA NSPECTED	CONDITION	OBSERVATIONS	
Weik TYPE Jeraod Crest SPIL WAY CONDITION SPIL WAY CONDITION SPIL WAY CONDITION APPO of TRAINING WALLS SPIL WAY CONTROLS APPO of TRAINING WALLS SPIL MAY CONTROLS APPO of TRAINING MUSULAL MOVEMENT A/O APPO of AREA Alfort DISCHARGE AREA Alfort MATER LEVEL AT TIME OF INSPECTION ~ 2.3 " OVER Spill Label WATER LEVEL AT TIME OF INSPECTION ~ 2.3 " OVER Spill Label DIDITIOALL _ 2.3 " OVER Spill Label		SPILLWAY TYPE	concrete	
SPILIMAY CONDITION Ope of Iraning wills Iraning wills goed Iraning wills goed SPILIMAY CONTROL M/O UNISULAL MOVEMENT M/O ANFO feat Interval Itamow Stante M/O DEBRIS AV/O WATER LEVELAT TIME OF INSPECTION 2:3 " OVOR Spillueuy MATTER LEVELAT TIME OF INSPECTION 2:3 " OVOR Spillueuy		WEIR TYPE	broad crest	
ItemInitie Walls Appool - Concrete BILL MAY CONTITION M/O BILL MAY CONTITION M/O INUSUAL MOVEMENT M/O APPROACH AREA Alear APPROACH AREA Alear DISCHARGE AREA Alear M/O YOO MARE LEVEL AT TIME OF INSPECTION 2.3 ⁴ Over Spilluary DIDIOLAL - 2.3 ⁴ Over Spilluary		SPILLWAY CONDITION	good	
BILLWAY CONTROLS AND CONDITION N/O UNUSUAL MOVEMENT N/O UNUSUAL MOVEMENT N/O JERUS A/O DISCHARGE AREA ABOOR - PLAS DONCY Failuau DISCHARGE AREA AV/O DEBRUS N/O MATER LEVELAT TIME OF INSPECTION 2.3 % OVEr Spilluauy MOTIONAL COMMENTS. -		TRAINING WALLS	govel-concrete	
UNUSULA MOVEMENT N/O APPROACH AREA N/O APPROACH AREA Alear DISCHARGE Alear DISCHARGE - 2:3 ⁴		SPILLWAY CONTROLS AND CONDITION	N/O	
APPROACH AREA APPROACH AREA DISCHARGE AREA Alarrow Stone - Masonry failinge DEBRIS N/O WATER LEVEL AT TIME OF INSPECTION ~ 2.3 ⁴ Over Spillurgy DDITIONAL COMMENTS: _ 2.3 ⁴ Over Spillurgy		UNUSUAL MOVEMENT	0/m	
DISCHARGE AREA RANGE RANGE AREA RANGE AREA RANGE RANGE AREA RANGE RANGE RANGE AREA RANGE AREA RANGE AREA RANGE RANGE AREA RANGE RANGE RANGE AREA RANGE AREA RANGE AREA RANGE RANG		APPROACH AREA	clear	
DEBRIS M/O WATER LEVEL AT TIME OF INSPECTION ~ 2.3 ^H Over Spilluouu DDITIONAL COMMENTS:		DISCHARGE AREA	larow Stone-masonry failace	
WATER LEVEL AT TIME OF INSPECTION ~ 2.3 ⁴ OVE Spilluary		DEBRIS	N/O U	
DDITIONAL COMMENTS:		WATER LEVEL AT TIME OF INSPECTION	~ 2.34 over spilluaus	
ADITIONAL COMMENTS:			0	
DDITIONAL COMMENTS:			bytan bay	
	DDITIONAL	L COMMENTS:	JA Lange	
		COMPLEX		

anti-set-Spencer Infractated V. -ter futhermatics is a tractical structure of the reference Prantices of a

DAM NAME		INSPECTION DATE
		AUXILIARY SPILLWAY
AREA INSPECTED	CONDITION	OBSERVATIONS
	SPILLWAY TYPE Weir type	concreted brad crested
	SPILLWAY CONDITION	good
	TRAINING WALLS	Same as primary
	SPILLWAY CONTROLS AND CONDITION	NO 0
SPILLWAY	UNUSUAL MOVEMENT	Q/N
	APPROACH AREA	same as primary
	DISCHARGE AREA	same as princing
	DEBRIS	N/o . O
	WATER LEVEL AT TIME OF INSPECTION	I' over spillward
ADDITIONA	AL COMMENTS:	
own waa		