November 2021

WEST BROOKFIELD CULVERT ASSESSMENTS

FEDERAL-AID ELIGIBLE ROADWAYS

PRODUCED BY STAFF OF THE CMRPC |
One Mercantile Street, Worcester MA, 01608

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- *Central Massachusetts Regional Planning Commission (CMRPC)*
- *1 Mercantile Street*
- *Suite 520*
- *Worcester, MA 01608*
- *(508) 756-7717*

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- **Ms. Janet Pierce, Executive Director**
- **Central Massachusetts Regional Planning Commission**
- **1 Mercantile Street, Suite 520**
- **Worcester, MA 01608**
- **(508) 756-7717**

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Background

The Central Massachusetts Regional Planning Commission (CMRPC) began its Culvert Assessment Program in Federal Fiscal Year (FFY) 2021 as part of its Unified Planning Work Program (UPWP). As with CMRPC's other data collection efforts (i.e., traffic counting), this program will focus only on culverts along federal-aid eligible roadways in the 40 communities included in the CMRPC planning region.

The overall goal of this program is to help communities build resiliency through flood risk protection & mitigation by identifying culvert locations and prioritizing culverts for replacement or restoration. As culvert assessments are completed for each community, a summary report will be provided to each host community.

This report focuses on culvert assessments completed by CMRPC staff in the Town of West Brookfield during the Summer/Fall 2021. This report will review the impacts of climate change and flooding; the methods that were used to identify and assess culverts; results of the assessments; and provide information on relevant grants or funding opportunities to help replace or repair a culvert.

Climate Change & Flooding

According to the Resilient Massachusetts Action Team (RMAT), changes in precipitation due to climate change can be expected to bring more intense spring downpours, increased inland flooding, diminishing snowfall, and higher precipitation in winter and spring months. More intense and increasingly frequent intense rainfall events will often lead to inland flooding and threaten areas where stormwater infrastructure is not appropriately sized to accommodate higher levels of rainfall, like culverts.

Climate projections suggest that the frequency of high-intensity rainfall events will trend upward, further compounding the risk of flooding and damage to critical infrastructure. In addition, most culverts in the Commonwealth are estimated to be undersized and increasingly vulnerable to increased stream flows. Not only can undersized crossings lead to failures and significant damage to a roadway, but they also impact fish and wildlife movement. It only takes a single intense rainfall event to cause flooding and widespread damage to culverts. Failing culverts and other stream crossing infrastructure poses a substantial threat to the safety and sustainability of a community and its transportation network. It is important for the Town of West Brookfield to plan and prepare now for climate change to help reduce flooding risks and sustain culverts and other critical infrastructure during high intensity rainfall events.

Data Collection Methodology

CMRPC utilizes the North Atlantic Aquatic Connectivity Collaborative (NAACC) to identify and assess stream crossing structures. The Massachusetts Division of Ecological Restoration (MassDER) partners with the NAACC to provide training on how to evaluate if a road-stream crossing is a barrier to fish and wildlife passage, as well as stream continuity. As MassDER points out, many of these structures are barriers (mostly undersized) to fish and wildlife passage and are increasingly vulnerable to be damaged or fail during a storm event causing flood hazards and road damage.

Furthermore, Massachusetts regulations require culverts that are replaced, or installed, to meet the Massachusetts Stream Crossing Standards. By meeting these standards, culverts allow rivers to flow unrestricted and minimize risk of flood damage. Other benefits include:

- Improved habitat and ecosystem function
- Reduced maintenance and repair costs
- Climate resiliency
- Improved water quality
- Public safety
- Fish and wildlife passage

Using the NAACC data, staff used ArcGIS to complete a desktop assessment to identify structure locations using ArcGIS. Staff also mapped town priorities and other federal-aid eligible locations. Staff then used these maps to prioritize culvert assessments.

What is the NAACC?

The NAACC is a network of individuals ranging from universities, conservation organizations, and state and federal agencies from the North Atlantic Region. The NAACC provides tools and information on where restoration projects are likely to have the greatest benefits for aquatic connectivity and resiliency. The NAACC tools (https://streamcontinuity.org/naacc/about) include:

- A protocol, data form, scoring system, and database for road-stream crossing assessments that can help identify culverts and bridges that are problematic from an aquatic connectivity perspective
- In-person and online training and certification program
- Online Database
- Web-based tools to identify high-priority crossings for assessment, and to prioritize crossings for upgrade/replacement
- Support efforts to conduct crossings assessments throughout the region
- Additional crossing assessment modules (i.e., Culvert Condition Field Data Form – CMRPC staff uses this for extra information on structural conditions)

To ensure data quality, the NAACC has developed hierarchical levels of training: Lead Observer, Level 1 (L1) Coordinator, Level 2 (L2) Coordinator, and Level 3 (L3) Coordinator. A **Lead Observer** is the most basic level of training for the NAACC that gives an individual the ability to assess culverts in the field and upload assessment data to the NAACC Data Center. An **L1 Coordinator** is a local coordinator that oversees and organizes Lead Observers. Going a step further, an **L2 Coordinator** is regional and oversees surveys across large areas (i.e., watersheds or multi-town). Other responsibilities include recruiting and supervising L1 Coordinators and coordinating training. Lastly, an **L3 Coordinator** is like an L2 Coordinator, with the addition of maintaining key components of the NAACC.

For the Central Massachusetts Region, CMRPC staff completed training to assess structures under the **Non-Tidal Aquatic Connectivity Protocol and Scoring System**. This protocol observes the crossing as well as the structure itself as it relates to non-tidal stream crossings. This protocol includes both paper

and electronic versions of the data assessment form. Currently, there are three (3) Lead Observers and one (1) L2 Coordinator CMRPC staff.

Please contact Zachary Blais, Level 2 Coordinator for the Central MA Region, CMRPC Transportation Planner, zblais@cmrpc.org, if you are interested in becoming a part of the NAACC network and efforts or for information on training requirements. Additional information on how to get involved can be found here: https://streamcontinuity.org/naacc/about/get-involved.

Desktop Assessment

For the Town of West Brookfield, staff completed a desktop assessment using ArcGIS. Previously mentioned, town priorities and federal-aid eligible locations were prioritized during the desktop assessment. In general, the desktop assessment looked at the following GIS layers:

- Current locations from the NAACC Data Center
- Federal-aid eligible roadways
- MassDOT Culverts

The MassDOT culvert layer was used as a reference point to see which structures may be state-owned or at least under the MassDOT radar.

Assessing Culverts

CMRPC staff utilized the **NAACC Non-Tidal Aquatic Connectivity Stream Crossing Survey Data Form (see Appendix A)** and the **NAACC Culvert Condition Field Data Form (see Appendix B)** to assess culverts in the Town of West Brookfield. Staff completed 25 culvert assessments along federal-aid eligible roadways. The roadways that were considered for culvert assessments are:

- East Main Street (Route 9)
- North Main Street (Route 67)
- West Main Street (Route 9)
- Boston Post Road (Route 67)
- New Braintree Road
- Wickaboag Valley Road
- Snow Road

Assessments started in Summer 2021 and ended in Fall 2021. Culvert assessments were scheduled as best for efficiency. For example, roads that were close to each other were scheduled together (i.e., Snow Road and Wickaboag Valley Road were completed in the same day). Beyond filling out a data form, CMRPC staff also took images of the inlet, outlet, upstream, downstream, and pavement condition for each culvert.

Using the paper version of the NAACC Non-Tidal Aquatic Connectivity Stream Crossing Survey Data Form and NAACC Culvert Condition Field Data Form, qualified CMRPC staff uploaded all culvert information to the NAACC Online Data Center. Images of the inlet, outlet, downstream, and upstream were also uploaded for each culvert. After a culvert was uploaded and approved, the NAACC gave the structure a score based on its barrier to fish and wildlife passage. As has been mentioned, the NAACC Culvert Condition Field Data Form is not protocol yet, therefore there is no scoring system or training involved. Staff utilized this data form to understand more about the structural conditions of each structure.

Culvert Assessment Results for West Brookfield

The Town of West Brookfield has 25 culverts along federal-aid eligible roadways. Five (5) of these locations are on the MassDOT GIS Layer and are assumed to be owned by MassDOT. Therefore, it can be assumed that the town is responsible for the other 20 culverts.

Through conversations with town staff there were two (2) locations that they wanted to prioritize. One culvert was located along Shea Road, but since this culvert is not located on along federal-aid eligible roadway this culvert was not assessed at this time. The other location was on Wickaboag Valley Road. Wickaboag Valley Road is a federal-aid eligible roadway therefore this culvert was assessed. Additionally, all other culverts located along federal-aid eligible roadways were assessed.

The NAACC uses a numerical scoring approach, where mathematical formulas using the data from the assessment are used to compute a numeric score for each culvert. Scores range from 0 (no aquatic passability) to 1 (full aquatic organism passage). Shown in **Table 1**, the NAACC Culvert Aquatic Passability Scoring is assigned into six (6) categories to define Barrier Type.

Table 1: NAACC Culvert Aquatic Passability Scoring

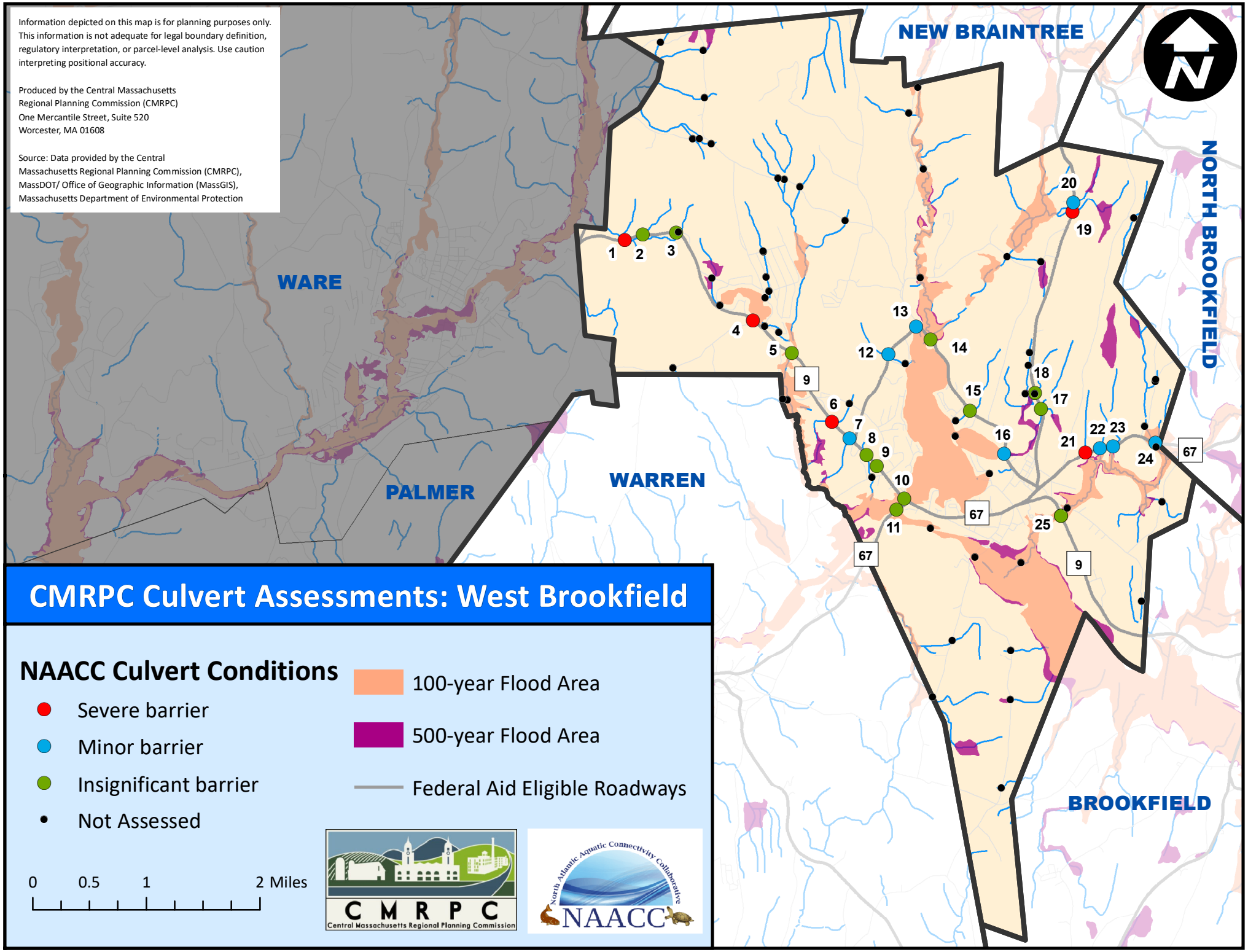
Aquatic Passability Score	Barrier Type
1.0	No Barrier
0.80 – 0.99	Insignificant Barrier
0.60 – 0.79	Minor Barrier
0.40 – 0.59	Moderate Barrier
0.20 – 0.39	Significant Barrier
0.00 – 0.19	Severe Barrier

With the completion of culvert assessments, the results were summarized into the following **Table 2** on the next page. This Table includes the Map ID, NAACC Crossing Code (includes a link to NAACC results page), the location of the culvert, the NAACC Aquatic Passability score, the barrier type, and if the culvert is within a FEMA 100/500 year flood zone. To view the results and images of the assessed culverts, please click on a Crossing Code in the below table. Following the Table, **Figure 1** shows the location barrier type of all assessed culverts in the Town of West Brookfield.

Table 2: West Brookfield Culvert Assessment Results

Map ID #	Crossing Code *(Click code to view results)*	Location (Street Name)	NAACC Score	Barrier Type	Flood Zone
1	xy4226839472209361	West Main St.	0.00	Severe	No
4	xy4225829272187264	West Main St.	0.00	Severe	Yes
19	xy4227244072132524	New Braintree Rd.	0.01	Severe	No
6	xy4224540172173544	West Main St.	0.19	Severe	No
21	xy4224172372129969	North Main St.	0.19	Severe	Yes
13	xy4225764072159261	Snow Rd.	0.66	Minor	Yes
16	xy4224144172143967	Wickaboag Valley Rd	0.71	Minor	Yes
22	xy4224232672127526	North Main St.	0.72	Minor	Yes
23	xy4224253472125259	North Main St.	0.75	Minor	Yes
7	xy4224329772170535	West Main St.	0.76	Minor	No
24	xy4224304172117975	North Main St.	0.76	Minor	Yes
12	xy4225401672163953	Snow Rd.	0.77	Minor	No
20	xy4227356172132383	New Braintree Rd.	0.77	Minor	No
15	xy4224694772149903	Wickaboag Valley Rd.	0.81	Insignificant	No
18	xy4224932472138736	New Braintree Rd.	0.81	Insignificant	Yes
2	xy4226910572206306	West Main St.	0.83	Insignificant	No
3	xy4226937272200538	West Main St.	0.83	Insignificant	No
17	xy4224730072137656	New Braintree Rd.	0.85	Insignificant	Yes
5	xy4225412972180562	West Main St.	0.89	Insignificant	Yes
8	xy4224125772167597	West Main St.	0.89	Insignificant	No
9	xy4223979072165830	West Main St.	0.89	Insignificant	No
10	xy4223570472161048	West Main St.	0.99	Insignificant	Yes
11	xy4223424072162359	Boston Post Rd.	0.99	Insignificant	Yes
14	xy4225600872156767	Wickaboag Valley Rd.	0.99	Insignificant	Yes
25	xy4223365872134127	West Main St.	0.99	Insignificant	Yes

Figure 1



Document Path: Z:\GIS Library\GIS Workspaces\Blais_Z\Culverts\West Brookfield NAACC Culvert Assessments 10312021.mxd

All in all, the assessments resulted in 12 structures as an **insignificant barrier**, eight (8) structures as a **minor barrier**, and five (5) structures as a **severe barrier**. It is important to note that there may be a culvert near the intersection of Church Street and Lake Street, but staff could not find it due to visual and residential constraints. Regarding the structures with a severe barrier, these culverts are vulnerable to failure during more frequent and more severe storm events. Of the 25 assessed structures, four (4) are bridges by MassDOT standards and all are insignificant barriers. These bridges are:

- **West Main Street** – xy4223570472161048
- **Boston Post Road** – xy4223424072162359
- **East Main Street** – xy4223365872134127
- **Wickaboag Valley Road** – xy4225600872156767

The structure on Wickaboag Valley Road was highlighted during the town's Municipal Vulnerability Preparedness (MVP) Program Workshop Sessions.

Moving Forward

The overall goal of this report is to help the Town of West Brookfield build resiliency through flood risk protection and mitigation by identifying culvert locations and prioritizing culverts for replacement or restoration. This report provides NAACC culvert data and a map showing culvert locations and their condition, as well as a table summarizing all 25 culvert assessment results. By doing so, the Town of West Brookfield can improve their inventories of critical infrastructure and prioritize culverts for repair or replacement as necessary to help improve flood resiliency and mitigation to avoid significant damage to the transportation network and wildlife.

If your community is looking to fund a culvert repair or replacement project, there are a variety of funding sources, including:

- Hazard Mitigation Grant Program (MEMA)
- Municipal Vulnerability Preparedness (MVP) Action Grant Program (EOEEA)
- Massachusetts Division of Ecological Restoration (MassDER) Culvert Replacement Municipal Assistance (CRMA) Grant Program
- Massachusetts Municipal Small Bridge Program
- Building Resilient Infrastructure and Communities (BRIC) Grant Program (MEMA)
- Pre-Disaster Mitigation (PDM) Grant Program (MEMA)

There are a number of additional culverts in the town that are not located along federal-aid eligible roadways. In this case, the CMRPC cannot assess these culverts unless it is for a specific project or contract. For any additional information, or if your community is interested and would like to complete NAACC training and assess culverts please contact Zachary Blais, Transportation Associate Planner, at zblais@cmrpc.org.

Appendix A

NAACC Non-Tidal Aquatic Connectivity Stream Crossing Survey Data Form

AQUATIC CONNECTIVITY

Stream Crossing Survey

DATA FORM

DATABASE ENTRY BY _____ ENTRY DATE _____

DATA ENTRY REVIEWED BY _____ REVIEW DATE _____

CROSSING DATA

Crossing Code _____ **Local ID** (Optional) _____

Date Observed (00/00/0000) _____ **Lead Observer** _____

Town/County _____ **Stream** _____

Road _____ **Type** ☐ MULTILANE ☐ PAVED ☐ UNPAVED ☐ DRIVEWAY ☐ TRAIL ☐ RAILROAD

GPS Coordinates (Decimal degrees) ☐☐.☐☐☐☐☐ °N Latitude — ☐☐.☐☐☐☐☐ °W Longitude

Location Description

Crossing Type ☐ BRIDGE ☐ CULVERT ☐ MULTIPLE CULVERT ☐ FORD ☐ NO CROSSING ☐ REMOVED CROSSING ☐ BURIED STREAM ☐ INACCESSIBLE ☐ PARTIALLY INACCESSIBLE ☐ NO UPSTREAM CHANNEL ☐ BRIDGE ADEQUATE

Number of Culverts/ Bridge Cells _____

Photo IDs INLET _____ OUTLET _____ UPSTREAM _____ DOWNSTREAM _____ OTHER _____

Flow Condition ☐ NO FLOW ☐ TYPICAL-LOW ☐ MODERATE ☐ HIGH

Crossing Condition ☐ OK ☐ POOR ☐ NEW ☐ UNKNOWN

Tidal Site ☐ YES ☐ NO ☐ UNKNOWN

Alignment ☐ FLOW-ALIGNED ☐ SKEWED (>45°)

Road Fill Height (Top of culvert to road surface; bridge = 0) _____

Bankfull Width (Optional) _____ **Confidence** ☐ HIGH ☐ LOW/ESTIMATED

Tailwater Scour Pool ☐ NONE ☐ SMALL ☐ LARGE

Constriction ☐ SEVERE ☐ MODERATE ☐ SPANS ONLY BANKFULL/ ACTIVE CHANNEL ☐ SPANS FULL CHANNEL & BANKS

Crossing Comments

STRUCTURE 1

Structure Material ☐ METAL ☐ CONCRETE ☐ PLASTIC ☐ WOOD ☐ ROCK/STONE ☐ FIBERGLASS ☐ COMBINATION

OUTLET

Outlet Shape ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ FORD ☐ UNKNOWN ☐ REMOVED

Outlet Armoring ☐ NONE ☐ NOT EXTENSIVE ☐ EXTENSIVE

Outlet Grade (Pick one) ☐ AT STREAM GRADE ☐ FREE FALL ☐ CASCADE ☐ FREE FALL ONTO CASCADE ☐ CLOGGED/COLLAPSED/SUBMERGED ☐ 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

Inlet Type ☐ PROJECTING ☐ HEADWALL ☐ WINGWALLS ☐ HEADWALL & WINGWALLS ☐ MITERED TO SLOPE ☐ OTHER ☐ NONE

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** _____.____

ADDITIONAL CONDITIONS

Slope % (Optional) _____ **Slope Confidence** ☐ HIGH ☐ LOW

Internal Structures ☐ NONE ☐ BAFFLES/WEIRS ☐ SUPPORTS ☐ OTHER _____

Structure Substrate Matches Stream ☐ NONE ☐ COMPARABLE ☐ CONTRASTING ☐ NOT APPROPRIATE ☐ UNKNOWN

Structure Substrate Type (Pick one) ☐ NONE ☐ SILT ☐ SAND ☐ GRAVEL ☐ COBBLE ☐ BOULDER ☐ BEDROCK ☐ UNKNOWN

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

Severity (Choose carefully based on barrier type(s) above) ☐ NONE ☐ MINOR ☐ MODERATE ☐ SEVERE

Water Depth Matches Stream ☐ YES ☐ NO-SHALLOWER ☐ NO-DEEPER ☐ UNKNOWN ☐ DRY

Water Velocity Matches Stream ☐ YES ☐ NO-FASTER ☐ NO-SLOWER ☐ UNKNOWN ☐ DRY

Dry Passage through Structure? ☐ YES ☐ NO ☐ UNKNOWN **Height above Dry Passage** _____

Comments

5/26/16

STRUCTURE 2

Structure Material ☐ METAL ☐ CONCRETE ☐ PLASTIC ☐ WOOD ☐ ROCK/STONE ☐ FIBERGLASS ☐ COMBINATION

OUTLET

Outlet Shape ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ FORD ☐ UNKNOWN ☐ REMOVED **Outlet Armoring** ☐ NONE ☐ NOT EXTENSIVE ☐ EXTENSIVE

Outlet Grade (Pick one) ☐ AT STREAM GRADE ☐ FREE FALL ☐ CASCADE ☐ FREE FALL ONTO CASCADE ☐ CLOGGED/COLLAPSED/SUBMERGED ☐ 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

Inlet Type ☐ PROJECTING ☐ HEADWALL ☐ WINGWALLS ☐ HEADWALL & WINGWALLS ☐ MITERED TO SLOPE ☐ OTHER ☐ NONE

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**_____.____

ADDITIONAL CONDITIONS

Slope % (Optional)_____ **Slope Confidence** ☐ HIGH ☐ LOW | **Internal Structures** ☐ NONE ☐ BAFFLES/WEIRS ☐ SUPPORTS ☐ OTHER_____

Structure Substrate Matches Stream ☐ NONE ☐ COMPARABLE ☐ CONTRASTING ☐ NOT APPROPRIATE ☐ UNKNOWN

Structure Substrate Type (Pick one) ☐ NONE ☐ SILT ☐ SAND ☐ GRAVEL ☐ COBBLE ☐ BOULDER ☐ BEDROCK ☐ UNKNOWN

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

Severity (Choose carefully based on barrier type(s) above) ☐ NONE ☐ MINOR ☐ MODERATE ☐ SEVERE

Water Depth Matches Stream ☐ YES ☐ NO-SHALLOWER ☐ NO-DEEPER ☐ UNKNOWN ☐ DRY

Water Velocity Matches Stream ☐ YES ☐ NO-FASTER ☐ NO-SLOWER ☐ UNKNOWN ☐ DRY

Dry Passage through Structure? ☐ YES ☐ NO ☐ UNKNOWN **Height above Dry Passage**_____

Comments

STRUCTURE 3

Structure Material ☐ METAL ☐ CONCRETE ☐ PLASTIC ☐ WOOD ☐ ROCK/STONE ☐ FIBERGLASS ☐ COMBINATION

OUTLET

Outlet Shape ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ FORD ☐ UNKNOWN ☐ REMOVED **Outlet Armoring** ☐ NONE ☐ NOT EXTENSIVE ☐ EXTENSIVE

Outlet Grade (Pick one) ☐ AT STREAM GRADE ☐ FREE FALL ☐ CASCADE ☐ FREE FALL ONTO CASCADE ☐ CLOGGED/COLLAPSED/SUBMERGED ☐ 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

Inlet Type ☐ PROJECTING ☐ HEADWALL ☐ WINGWALLS ☐ HEADWALL & WINGWALLS ☐ MITERED TO SLOPE ☐ OTHER ☐ NONE

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**_____.____

ADDITIONAL CONDITIONS

Slope % (Optional)_____ **Slope Confidence** ☐ HIGH ☐ LOW | **Internal Structures** ☐ NONE ☐ BAFFLES/WEIRS ☐ SUPPORTS ☐ OTHER_____

Structure Substrate Matches Stream ☐ NONE ☐ COMPARABLE ☐ CONTRASTING ☐ NOT APPROPRIATE ☐ UNKNOWN

Structure Substrate Type (Pick one) ☐ NONE ☐ SILT ☐ SAND ☐ GRAVEL ☐ COBBLE ☐ BOULDER ☐ BEDROCK ☐ UNKNOWN

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

Severity (Choose carefully based on barrier type(s) above) ☐ NONE ☐ MINOR ☐ MODERATE ☐ SEVERE

Water Depth Matches Stream ☐ YES ☐ NO-SHALLOWER ☐ NO-DEEPER ☐ UNKNOWN ☐ DRY

Water Velocity Matches Stream ☐ YES ☐ NO-FASTER ☐ NO-SLOWER ☐ UNKNOWN ☐ DRY

Dry Passage through Structure? ☐ YES ☐ NO ☐ UNKNOWN **Height above Dry Passage**_____

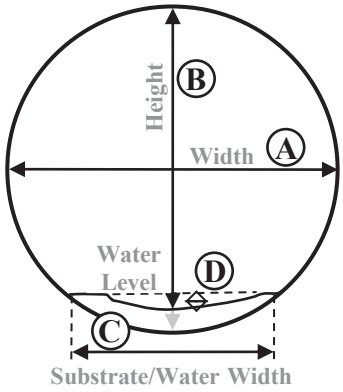
Comments

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 approriate 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.

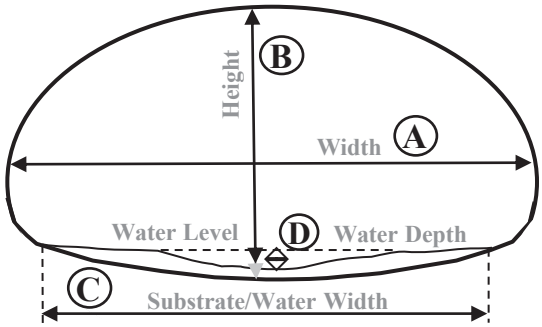
NOTE: Culverts 1, 2 & 4 may or may not have substrate in them, so height measurements (B) are taken from the level of the "stream bed", whether that bed is composed of substrate or just the inside bottom surface of a culvert (grey arrows below show measuring to bottom, black arrows show measuring to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

1



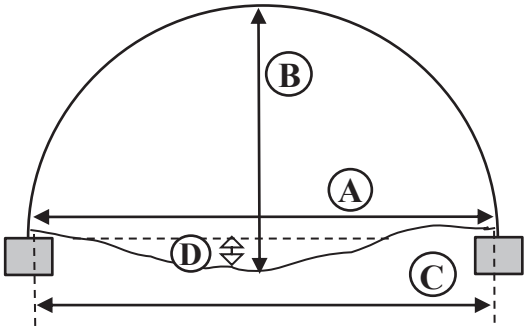
Round Culvert

2



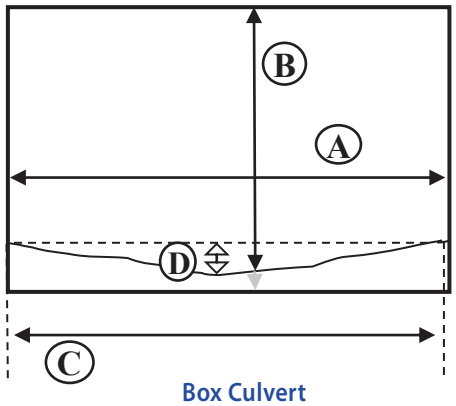
Pipe Arch/Elliptical Culvert

3



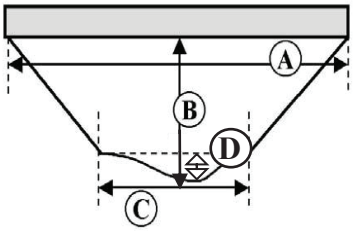
Open Bottom Arch Bridge/Culvert

4



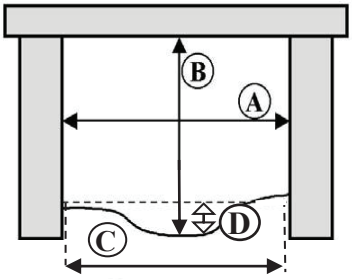
Box Culvert

5



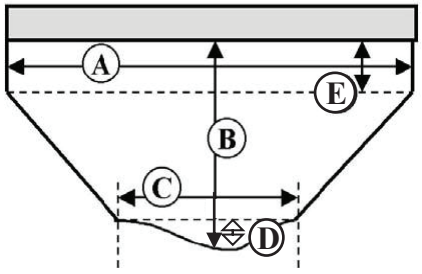
Bridge with Side Slopes

6



Box/Bridge with Abutments

7



Bridge with Abutments and Side Slopes

Appendix B

NAACC Culvert Condition Field Data Form

Culvert Assessment Form

CROSSING DATA

For multiple culvert crossings use one sheet per culvert. Go from left to right, standing at inlet looking downstream.

Crossing Code:_____ **Local ID**: (Optional)_____ **Date Observed:** (00/00/0000) ____/____/_____ Lead **Observer:**_____

Number of Culverts: ____ **Culvert** ____ **of** ____ **Stream:**_____ **Road:**_____

Location: (St.#, Pole#, Etc.)_____ **Town:**_____ **County**:_____ State:_____

GPS Coordinates: __ __ . __ __ __ __ __ °N Latitude __ __ . __ __ __ __ __ °W Longitude Time:_____ Weather:_____

Crossing Type: ☐Bridge ☐Culvert ☐Multiple Culvert ☐Ford ☐No Crossing ☐Removed Crossing ☐Buried Stream ☐Inaccessible ☐Partially Inaccessible ☐No Upstream Channel

Culvert Material: ☐Metal ☐Concrete ☐Plastic ☐Wood ☐Rock/Stone ☐Fiberglass ☐Combination **Length of Culvert**: _____

INLET

Appurtenance: ☐Headwall ☐Wingwalls ☐Headwall & Wingwalls ☐Mitered To Slope ☐Projecting ☐Flush ☐Recessed ☐Other ☐None

Inlet Shape: ☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7 **Inlet Dimensions: A. Width:**____**B. Height:**____**C. Substrate/Water Width:**____**D. Water Depth:**____**E. Abutment Height:**____

Inlet Grade: ☐At Stream Grade ☐Inlet Drop ☐Perched ☐Clogged/Collapsed/Submerged ☐Unknown

OUTLET

Appurtenance: ☐Headwall ☐Wingwalls ☐Headwall & Wingwalls ☐Mitered To Slope ☐Projecting ☐Flush ☐Recessed ☐Other ☐None

Outlet Shape: ☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7 **Outlet Dimensions: A. Width:**____**B. Height:**____**C. Substrate/Water Width:**____**D. Water Depth:**____**E. Abutment Height:**____

Outlet Grade: ☐At Stream Grade ☐Free Fall ☐Cascade ☐Free Fall Onto Cascade ☐Clogged/Collapsed/Submerged ☐Unknown

	INLET *Please check only one level for each item*					**OUTLET** *Please check only one level for each item*				
	Adequate	Poor	Critical	Unknown	N/A	Adequate	Poor	Critical	Unknown	N/A
Structural (Longitudinal) Alignment	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Channel 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	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Embankment Piping	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

To provide additional feedback on performance problems use the optional second sheet

Performance Problems Requiring Action

- Debris/Veg Blockage >1/3 of rise ☐
- Sediment Blockage >1/2 the opening ☐
- Buoyancy or Crushing-Related Inlet Failure ☐
- Poor Channel Alignment ☐
- Local Outlet Scour ☐
- Previous and/or Frequent Overtopping ☐
- Embankment Piping ☐
- Channel Degradation/Headcut ☐
- Embankment Slope Instability ☐
- No Access/Ends Totally Buried/Submerged ☐
- Aggressive Abrasion/Corrosion/Chemical ☐
- Exposed Footing (Open-Bottom Culvert Only) ☐

Notes:_____

_____

_____

Photo #:____ **Description:**_____ **Photo #:**____ **Description:**_____

Photo #:____ **Description:**_____ **Photo #:**____ **Description:**_____

Photo #:____ **Description:**_____ **Photo #:**____ **Description:**_____

Photo #:____ **Description:**_____ **Photo #:**____ **Description:**_____