OFFICE OF STRUCTURES

MANUAL FOR HYDROLOGIC AND HYDRAULIC DESIGN

APPENDIX A

GUIDELINES FOR IN-KIND REPLACEMENT OF CULVERTS AND BRIDGES

June 2020

MARYLAND DEPARTMENT OF TRANSPORTATION™

STATE HIGHWAY ADMINISTRATION

APPENDIX A GUIDELINES FOR IN-KIND REPLACEMENT OF CULVERTS AND BRIDGES

The attached guidelines, prepared by the Maryland Department of Natural Resources (DNR), are provided for use when considering an in-kind replacement of a bridge or structure. These guidelines, prepared in 1993, represent current Maryland Department of the Environment (MDE) policy on this topic.

The user needs to make sure that a replacement-in-kind project meets the needs of the MDOT SHA, as discussed in Chapter 4, as well as the requirements of the DNR/MDE as set forth in this appendix.

Please note that MDOT SHA and MDE have agreed on the method of determining design discharges as discussed in Chapter 8, Hydrology, of this Manual.

liam Donald Schaefer
Governor

Maryland Department of Natural Resources
Water Resources Administration
Tawes State Office Building
Annapolis, Maryland 21401

Torrey C. Brown, M.D.
Secretary

Robert D. Miller
Director

July 7, 1993

Mr. Hal Kassoff
Administrator
State Highway Administration
707 North Calvert Street
Baltimore, Maryland 21201

RE: In-Kind Replacement of Bridges & Culverts

Dear Mr. Kassoff:

Enclosed please find a detailed DNR-WRA Operational Policy explaining how the State's statutory and regulatory standards pertaining to waterway crossings can be met when such crossings are "in-kind" replacements of existing bridges and culverts. This policy was reviewed by the State Highway Administration and staff from ten county departments of public works and transportation.

This policy does not establish any new standards. It simply clarifies certain terms and explains the documentation necessary to demonstrate the "in-kind" nature of replacement structures. One of our objectives is to streamline WRA's review process for certain types of activities so that our staff can focus attention on proposed projects that are most likely to have significant waterway, floodplain and nontidal wetlands impacts.

Please note that authorization from WRA is still required for replacement bridges and culverts. In addition, temporary and permanent impacts to nontidal wetlands must be addressed. This policy should help SHA determine which projects do not require detailed hydrologic and hydraulic modeling, although in some instances rating curves may be necessary to demonstrate comparable hydraulic performance.

DEPARTMENT OF NATURAL RESOURCES
WATER RESOURCES ADMINISTRATION

OPERATIONAL POLICY

SUBJECT: In-Kind Replacement of Bridges and Culverts

DIVISION: Nontidal Wetlands & Waterways

POLICY NO.: 93-1

EFFECTIVE DATE: July 1, 1993

APPROVED: Robert D. Miller DATE: 6/22/93
Robert D. Miller, Esquire
Director

I. BACKGROUND

Throughout Maryland, local governments and the State Highway Administration* are responsible for the safety of public roads, bridges and culverts. These agencies routinely inspect structures to assure that proper maintenance and repair are undertaken. Frequently, older structures are found to be unsafe or below required design standards and must be replaced.

II. PURPOSE

The purpose of this policy on replacement of existing bridges and culverts is to avoid complicated, expensive and time-consuming engineering analyses that may not be necessary. Having clear definition of the qualifying parameters will make it easier for applicants to certify compliance. Just as important, this policy will expedite WRA's review of floodplain impacts.

III. REVIEW BY THE DEPARTMENT OF NATURAL RESOURCES

The Department of Natural Resources (DNR), Water Resources Administration (WRA) administers the State's regulatory programs for activities that impact water resources, including nontidal wetlands, wetlands buffers, and the 100-year floodplains along nontidal waters of the State. The primary purposes of a flood impact review are to assure that: (1) flood hazards are not increased: (2) activities are constructed to withstand the passage of the 100-year flood; (3) aquatic resources are adequately protected; and (4) stream degradation is minimized and scenic, wildlife and recreational functions are preserved.

* Structure replacements by others may be handled in accordance with this policy with prior approval by the WRA.

(1) ASSURE THAT FLOOD HAZARDS ARE NOT INCREASED. WRA typically requires applicants to submit evidence that activities do not change the predicted frequency and magnitude of flooding. Of greatest concern are sensitive floodplains where existing buildings are subject to flooding under current conditions. Activities in those floodplains are scrutinized very carefully, and detailed engineering analyses typically are required. Activities that increase flooding of existing structures are not permitted.

WRA also is charged with assuring that currently vacant or undeveloped land within the 100-year floodplain is not adversely impacted by proposed activities. Relatively small increases in predicted flood levels may be considered if all affected property owners accept the increase or if the additionally inundated area is purchased or placed in flood easement. Permits are issued if all other WRA issues have been addressed.

Activities that do not alter the frequency or magnitude of flooding are permitted if all other WRA issues have been addressed.

(2) WITHSTAND PASSAGE OF 100-YEAR FLOOD. WRA's floodplain regulations require that applicants assure that their own activities are not subject to flood damage or that all practicable measures to reduce damage have been included. For public roads, bridges and culverts, standard designs typically take this into consideration since State and local governments wish to minimize loss of structures during floods. In practice, protection includes such measures as erosion protection and road profile design to minimize damage due to weir flow.

(3) PROTECTION OF AQUATIC RESOURCES. With respect to public roads, bridges and culverts, three factors are critical for protection of aquatic resources. As a function of water use, instream construction is limited during certain times of the year in order to minimize adverse effects of sediment loading on aquatic species. At least one cell of all culverts is required to be installed 1 foot below the invert of the natural stream to assure adequate fish passage, to maintain the natural stream width, and to encourage deposition of sediment within the cell. Alternate fish passage measures may be acceptable with DNR-WRA's approval. Instream erosion protection (riprap, gabions, grout bags, etc.) must be designed and constructed to concentrate low flows. Methods of stream diversion used during construction must meet standards.

(4) PRESERVATION OF FUNCTIONS: Projects must incorporate measures to prevent stream channel erosion and instability. Areas of active erosion may be protected within limits set forth in Best Management Practices. Temporary impacts to adjacent nontidal wetlands must be minimized, conducted, and restored in accordance with Best Management Practices. For new roads, bridges and culverts, alternatives that have fewer adverse environmental impacts may have to be considered.

IV. REPLACEMENT OF EXISTING STRUCTURES

Existing bridge and culvert structures may be replaced in a number of ways:

(1) EXACT REPLACEMENT. These projects produce a new bridge or culvert that is exact in all respects to the existing structure, and does not alter any characteristics of the area. If existing conditions indicate active scour or erosion, additional erosion protection may be included while retaining the "exact replacement" designation. Methods of installation and limits of erosion protection must be consistent with Best Management Practices.

(2) STRUCTURALLY IN-KIND REPLACEMENT. Frequently, an existing structure is not replaced exactly, but minor changes may be made to the size, shape and location. Roadway profile and type of structure are unchanged. Active scour or erosion may be addressed as indicated under Exact Replacement.

(3) HYDRAULICALLY IN-KIND REPLACEMENT. In many instances, an existing structure is replaced with a different type of structure, and other minor alterations may also be made. However, under flood conditions the new structure may perform in the same or similar manner. Therefore, there is no significant change in the floodplain.

(4) STRUCTURALLY OR HYDRAULICALLY OUT-OF-KIND REPLACEMENT. Many factors may result in replacement structures that are sufficiently different from existing structures that they must be considered as new bridges and culverts.

V. STREAMLINING WRA'S FLOODPLAIN IMPACT REVIEW

Under certain circumstances and with certification by the applicant, WRA's floodplain impact review of replacement structures can be expedited. In general, replacements that, through simplified analyses, are shown not to increase flood hazards need not be subjected to rigorous individual review.

Specific criteria for the categories of replacement have been defined:

(1) EXACT REPLACEMENT. Application made through Regional Letter of Authorization (if appropriate) or separate submittal to WRA. Applicant commits to construction best management practices (BMPs) and other conditions necessary to minimize impacts on the waterway and aquatic resources, including minimization and restoration of temporarily disturbed nontidal wetlands. Applicant certifies replacement structure is exact in all respects, does not alter characteristics of the waterway, and retains or improves capability to assure passage of fish. Hydrologic and hydraulic analyses and floodplain impact review are not required.

(2) STRUCTURALLY IN-KIND REPLACEMENT. Application made through Regional Letter of Authorization (if appropriate) or separate submittal to WRA. Applicant commits to construction BMPs and other conditions necessary to minimize impacts on the waterway and aquatic resources, including minimization and restoration of temporarily disturbed nontidal wetlands. Applicant certifies replacement structure is structurally in-kind, does not alter characteristics of the waterway, and retains or improves capability to assure passage of fish. Hydraulic analyses and floodplain impact review not required if applicant certifies the following:

(a) Roadway profile unchanged (unless demonstrated to be above the 100-year water surface elevation).
(b) Structure type effectively unchanged.
(c) Structure size and shape essentially unchanged: up to 10% change in waterway opening allowed if floodplain immediately upstream and downstream contains unimproved property, and if previous replacement did not entail reduction in opening.
(d) Proposed structure meets fish passage requirements.
(e) Location essentially unchanged; as a function of waterway size, slight shifts in location to improvement alignment may be allowed if floodplain immediately upstream and downstream contains unimproved property.
(f) If the floodplain immediately upstream or downstream contains improved property, changes in structure size, shape or location must be assessed to determine if the proposed structure is hydraulically in-kind.

(3) HYDRAULICALLY IN-KIND REPLACEMENT. Application made through Regional Letter of Authorization or separate submittal to WRA (if mitigation of permanent nontidal wetlands loss required). Applicant commits to construction BMPs and other conditions necessary to minimize impacts on the waterway and aquatic resources. Replacement structure may not alter the characteristics of the waterway, and retains or improves capability to assure passage of fish. Increase in overall footprint may require mitigation of permanent nontidal wetland losses. Detailed hydrology not required. Hydraulic analyses required to demonstrate closeness of hydraulic performance (rating curves) for existing and replacement structures. Adequate range of discharges required to assess performance under low flow, pressure flow, weir flow, etc. Applicant certifies the following:

(a) Roadway profile essentially unchanged (unless demonstrated to be above 100-year water surface elevation). Changes must be adequately reflected in hydraulic analysis.
(b) Location essentially unchanged.
(c) Proposed structure meets fish passage requirements.
(d) Increase in footprint, type and areal extent of nontidal wetlands impacted, if applicable.
(e) Compliance with mitigation requirements, if applicable.
(f) If the floodplain immediately upstream and downstream contains only unimproved property and rating curve for replacement structure indicates no more than 0.5′ increase in water surface elevation for range of discharges, no hydrology required.
(g) If the floodplain immediately upstream and downstream contains only unimproved property and rating curve for replacement structure indicates more than 0.5′ but less than 1.0′ increase in water surface elevation for range of discharges, no hydrology required. Affected property owners must be notified of increase by certified mail.
(h) If the floodplain immediately upstream contains improved property and rating curve for replacement structure indicates no more than 0.1′ increase in water surface elevation for range of discharges, no hydrology required.

VI. CONDITIONS REQUIRING FULL ANALYSIS:

(1) STRUCTURALLY OR HYDRAULICALLY OUT-OF-KIND REPLACEMENT

Any bridge or culvert replacement that fails to meet the in-kind replacement criteria may be subject to complete analysis. Complete analysis refers to determination of discharges for the 2-, 10- and 100-year frequency flood events, and preparation of hydraulic modeling to determine the impact of the proposed structure. In limited circumstances, WRA may concur with selection of a range of discharges.

(2) IN-KIND REPLACEMENT DOES NOT APPLY UNDER CERTAIN CIRCUMSTANCES

This policy may be applied only in situations where unusual conditions or circumstances are not present. It shall not be used for replacement of structures that are: (1) part of a dam embankment; (2) designed for stormwater management purposes; or (3) functioning as a dam, whether by design or unintentionally. Applicants are urged to consult with WRA if any unusual conditions exist to determine if application of this policy is acceptable.

VII. SELECTION OF AN APPROPRIATE RANGE OF DISCHARGES

The range of discharges to be included in a hydraulic performance evaluation should include low flow, pressure flow, inlet and outlet control, and weir flow. However, it is also important to avoid using extraordinarily high values simply to include weir flow. For example, it may be unreasonable to evaluate weir flow for a culvert with high road profile, if the drainage area is relatively small.

Applicants must explain the rationale for selection of the upper limit of the range discharges. Where available, discharges from FEMA's Flood Insurance Rate studies may be acceptable for existing watershed development conditions. Under other circumstances, it may be reasonable to use USGS Regression Equations to estimate the 100-year discharge. To address regulatory requirements pertaining to ultimate development and to be conservative, an adjustment factor of up to 50% of the estimated 100-year discharge will be required. Alternatively, the USGS 100-year discharge plus 2 standard deviations may be acceptable.

VIII. DEFINITION OF "IMMEDIATELY UPSTREAM OR DOWNSTREAM"

The reach of stream that is potentially impacted by floodplain obstructions cannot be defined readily without sophisticated analysis. Parameters that may be important include channel slope, waterway opening, velocity, channel and overbank roughness, and magnitude of the encroachment.

This policy does not establish rigid standards for determining the length of reach up or downstream of a replacement structure that must be evaluated for potential impact on adjacent properties. It is incumbent on the applicant's prudent exercise of engineering judgement to ensure and demonstrate that an adequate reach has been considered.

IX. DEFINITION OF "UNIMPROVED PROPERTY" AND "IMPROVED PROPERTY"

For the purposes of this policy, "unimproved property" refers to property, or portions thereof, on which there are no structures or buildings. Lands that have been altered or enhanced without buildings, for example by landscaping, retaining walls, minor sheds, livestock feeding sheds, etc., are considered to be unimproved property.

For the purposes of this policy, "improved property" refers to property, or portions thereof, on which there are walled and roofed buildings and structures. The term "structures" refers to improvements other than buildings, such as storage tanks.

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