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| Rev. 3/12 | Bridge No. |       |
| Job No. |       |
| Missouri Department of Transportation |
| Culvert Hydraulics Report |
| Designer |       | Date |       |
| Route |       | County |       | Stream |       |
|  |
| Purpose of Hydraulic Study |
| *(Write a brief statement describing project and purpose of hydraulic study)*      |
|  |
| National Flood Insurance Program Information |
| Has a flood insurance study been performed for the community? *(www.fema.gov/home/fema/csb.htm)* |       |
| Is the culvert in a special flood hazard area? *(If yes, a floodplain development permit will be required)* |       |
| Is the culvert in a designated floodway? *(If yes, a no-rise certification will be required)* |       |
| Has a Flood Insurance Rate Map (FIRM) been published for the area? |       |
| What is the insurance rating for the site (A1, B, C, etc.)? |       |
| Base (100-yr) Flood Elevation |       | Floodway width |       |
| Map panel number |       | Map date |       |
|  |
| **Additional comments on Flood Insurance Study:**       |
|  |
| Discharge Data |
| **Drainage Area** |       | (mi2) |
| **Valley Slope** (average slope between points 10% and 85% of valley length upstream) |       | (ft/mi) |
|  |
| **Method of Analysis** (choose one or more) | **Q25** | **Q50** | **Q100** | **Q500** | Use |
| USGS regression equations |       |       |       |       | **[ ]**  |
| - Rural | Publication year =       | Region =       |       |       |       |       | **[ ]**  |
| - Urban  | Publication year =        | BDF =       or % Impervious =       |       |       |       |       | **[ ]**  |
| Stream Gage | USGS Station Number =       |       |       |       |       | **[ ]**  |
| FEMA Flood Insurance Study | Community Name =      |       |       |       |       | **[ ]**  |
| Other =       |       |       |       |       | **[ ]**  |
| **Comments on Discharge calculations:** *(method chosen and why, expected level of upstream development, etc.)*      |
| **Observed Extreme High Water** |
| Elevation =       (ft), Datum =      | Location =       | Date =       |
| **Comments on Observed Extreme High Water:** *(discharge, if known, etc.)*      |
| **Discuss flow conditions in reach and describe existing conditions that may influence hydraulic behavior in reach:**       |

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|  **Hydraulic Model**  |
| [ ]  HY-8, Ver.       | [ ]  Other =       |
| **[ ]** River Analysis System (HEC-RAS), Ver.       |

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| **Model Data** |
| Streambed Slope =  |       | (ft/ft) |
|  |
| How was streambed slope determined?       |
| Which cross section was used to determine high water surface elevations and why?       |
| Which cross section was used to determine tailwater elevations and why?       |
| **Describe the channel/overbank conditions and the roughness coefficients chosen:**       |

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| **Culvert Geometry** |
| Inlet Flowline Elevation |       | Outlet Flowline Elevation |       |
| Span |       | (ft) | Rise |       | (ft)  | Number of Barrels |       | Length (headwall to headwall) |       | (ft) |
|  |
| **Comments on Culvert Geometry:**      |

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| **Inlet Configuration** |
| [ ]  Straight Wings | [ ]  Flared Wings | [ ]  Improved Inlet (describe) |       |
|  |
| **Comments on Inlet Configuration:**       |
| **Section 404 Permit Regional Condition Requirements** |
| Stream Type: | Perennial **[ ]**  | Intermittent **[ ]**  | Ephemeral **[ ]**  |  |
| Bankfull Water Surface Elevation =       (ft) | Bankfull Discharge =       (cfs) |
| Preconstruction Bankfull Area =       (ft2) | Invert Embedment Depth =       (ft) |
| Velocity at Bankfull Discharge (ft/s) | Average Within Culvert = |       | Upstream = |       | Downstream = |       |
|  |
| Comments on stream type: *(how determined, certainty/uncertainty of type , etc.)*       |
| Comments on bankfull water surface elevation and discharge: *(sections used and why, how elevation and discharge were determined, etc.)*       |
| Additional comments on regional condition requirements: *(velocities, bankfull area, embedment depth, USACOE jurisdiction, etc.)*       |

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| **Filenames** |
| **Describe files used in culvert calculations:** *(Hy-8 filenames and descriptions, etc.)*      |
|  |
| **Culvert Calculation Results** |
|  | Existing Conditions | Proposed Conditions |
| Frequency | **Q****25** | **Q50** | **Q100** | **Q500** | Q25 | Q50 | **Q100** | **Q500** |
| High Water Surface Elevation at Culvert (ft) |       |       |       |       |       |       |       |       |
| Allowable Headwater Elevation (ft) |       |       |       |       |       |       |       |       |
| Backwater (ft) |       |       |       |       |       |       |       |       |
| Inlet or Outlet Control |       |       |       |       |       |       |       |       |
| Culvert Outlet Velocity (ft/s) |       |       |       |       |       |       |       |       |
| Tailwater Depth (ft) |       |       |       |       |       |       |       |       |
| Tailwater Velocity (ft/s) |       |       |       |       |       |       |       |       |
| % of flow overtopping road |       |       |       |       |       |       |       |       |
|  |
| **Comments on culvert calculations:** *(backwater, velocities, unusual conditions, comparison to observed high water data, etc.)*       |

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| **Scour Protection Measures** |
| **General Scour Information:** *(Describe soil conditions in streambed and overbanks)*       |
| What measures are required to protect against scour?      |
| **Additional comments on scour protection:**      |

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| **General Information** |
| Are there any improvements/buildings/crops/livestock that might be affected by alterations to the floodplain?*(Include description and estimated value)*      |
| **Special Considerations:** *(Describe any other special conditions or considerations which affect this project)*      |

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| **Culvert Layout Summary** |
| Culvert Layout |       | Skew |       |
| Loading |       | Roadway Width |       | Alignment |       |
| Tie Sta. |       |
|  |
| **Design Exceptions:** *(Provide an explanation of any design exceptions requested and approved for this project)*       |

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| **Hydraulic Analysis Summary** |

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| Hydrologic Data |
| Drainage Area =      (sq. mi.)Design High Water (DHW) Elev. =     Design High Water Frequency =     (year)Design High Water Discharge =     (cfs) |
| **Backwater/Base Flood Data (100 year)** |
| High Water Elev. =     Design Discharge =     (cfs)Estimated Backwater =     (ft)Outlet Velocity =     (ft/s) |
| Roadway Overtopping |
| Design Elev. (1’ below shoulder) =     Design Discharge =     (cfs)Design Frequency =     (year) |