

Appendix 4-A

Symbols and Acronyms

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If you require assistance accessing this information or require it in an alternative format, contact the Michigan Department of Transportation's (MDOT) Americans with disabilities Act (ADA) coordinator at [Michigan.gov/MDOT-ADA](https://www.michigan.gov/MDOT-ADA).

Symbols

Symbol	Definitions	Units
A	Cross-sectional area of flow	sft
A _i	Cross-sectional area of subsection	sft
A _t	Total cross-sectional area of section	sft
d	Hydraulic depth	ft
E	Specific energy	ft
F _r	Froude number	-
g	Gravitational acceleration	ft/s ²
h ₁	Upstream water stage (depth)	ft
h ₂	Downstream water stage (depth)	ft
h _L	Head loss due to local cross-sectional changes (minor loss) and boundary resistance	ft
K	Channel conveyance	-
K _i	Conveyance in subsection	-
K _m	Expansion or contraction loss coefficient	-
K _t	Total conveyance in section	-
K _u , K _d	Conveyance at the upstream and downstream cross-sections	-
L	Discharge-weighted or conveyance-weighted reach length	ft
L _{lob} , L _{ch} , L _{rob}	Flow distance between cross-sections in left overbank, main channel, and right overbank	ft
n	Manning's roughness coefficient or number of subsections	-
P	Wetted perimeter	ft
Q	Total discharge	cfs
Q _{lob} , Q _{ch} , Q _{rob}	Arithmetic average of flows between cross-sections for in left overbank, channel, and right overbank	cfs
Q _u , Q _d	Discharge at the upstream and downstream cross-sections	cfs

Symbol	Definitions	Units
R	Hydraulic radius	ft
S	Hydraulic slope	ft/ft
$S_{f(avg)}$	The mean slope of the energy grade lines evaluated from Manning's equation and a selected averaging technique	ft/ft
S_{fu}, S_{fd}	Friction slope at the upstream and downstream cross-sections	ft/ft
T	Channel top width at water surface	ft
τ_o	Shear stress	lb/ft ²
V	Mean velocity	fps
y	Depth	ft
z	Elevation head	ft
α	Velocity distribution coefficient	-
γ	Unit weight of water	lb/ft ³

Acronyms

1D	One Dimensional
2D	Two Dimensional
3D	Three Dimensional
AASHTO	American Association of State Highway and Transportation Officials
AEP	Annual Exceedance Probability
ARI	Annual Recurrence Interval
CFD	Computational Fluid Dynamics
DEM	Digital Elevation Model
EGLE	Michigan Department of Environment, Great Lakes, and Energy
EGL	Energy Grade Line
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FIS	Flood Insurance Study
HEC	Hydraulic Engineering Circular
HEC-RAS	Hydraulic Engineering Center's River Analysis System
HGL	Hydraulic Grade Line
LiDAR	Light Detection and Ranging
MCL	Michigan Compiled Laws
MDOT	Michigan Department of Transportation
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
NREPA	Natural Resources Environmental Protection Act, Michigan Act 451, Public Act of 1994, as amended
SMS	Surface-Water Modeling System
USACE	United States Army Corps of Engineers
USGS	United States Geological Survey
WSE	Water Surface Elevation