Glossary and Sources

Abbreviations Main Glossary of Terms Sources

Abbreviations

1D	one-dimensional
2D	two-dimensional
AASHTO	American Association of State Highway and Transportation Officials
AEP	annual exceedance probability
AMC	antecedent moisture condition
ADA	Americans with Disabilities Act
AMC	antecedent moisture condition
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
BFW	bankfull width
BMP	best management practice
BSTEM	Bank Stability and Toe Erosion Model
Caltrans	California Transportation Department
CDF	controlled-density fill
CEM	Channel Evolution Model
CFR	Code of Federal Regulations
cfs	cubic foot/feet per second
CIPP	cured-in-place pipe
CLOMR	Conditional Letter of Map Revision
CMZ	channel migration zone
CN	curve number
D	diameter
DBH	diameter at breast height
DNR	(Washington State) Department of Natural Resources
Ecology	Washington State Department of Ecology
EGL	energy grade line
ELJ	engineered log jam

EOE	Office of Equal Opportunity
ERDC	(U.S. Army) Engineer Research and Development Center
FEMA	Federal Emergency Management Agency
FHD	final hydraulic design
FHWA	Federal Highway Administration
FOS	factor of safety
FPSRD	*Fish Passage and Stream Restoration Design*
FPW	flood-prone width
FRA	Flood Risk Assessment
ft	foot/feet
ft^2	square foot/feet
ft/ft	foot/feet vertical per 1 foot horizontal
ft/s	foot/feet per second
FUR	floodplain utilization ratio
ga	gage
GIS	geographic information system
GPS	Global Positioning System
HATS	Highway Activities Tracking System
HDD	horizontal directional drilling
HDPE	high-density polyethylene
HDS	Hydraulic Design Series
HEC	Hydraulic Engineering Circular
HEC-RAS	Hydrologic Engineering Center's River Analysis System
HGL	hydraulic grade line
HQ	WSDOT Headquarters
HSPF	Hydrological Simulation Program-Fortran
H:V	horizontal:vertical
HW	headwater
IDF	intensity, duration, and frequency
in.	inch(es)
Injunction	2013 Federal Court Injunction for Fish Passage
ISPG	*Integrated Streambank Protection Guidelines*

LiDAR	light detecting and ranging
LOMR	Letter of Map Revision
LW	large wood (also known as LWD or LWM)
LWD	large woody debris (also known as LW or LWM)
LWM	large woody material (also known as LWD or LW)
m	meter(s)
m^2	square meter(s)
MDL	master deliverable list
MHHW	mean higher high water
MHO	minimum hydraulic opening
mph	mile(s) per hour
MRI	mean recurrence interval
MW	mobile wood (also known as MWM)
MWM	mobile woody material (also known as MW)
N	newton(s)
NAIP	National Agriculture Imagery Program
NCHRP	National Cooperative Highway Research Program
NLCD	National Land Cover Database
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
OHWL	ordinary high water level
oz	ounce(s)
PDF	Portable Document Format
PE	Professional Engineer
PEO	Project Engineer's Office
PHD	preliminary hydraulic design
PP	polypropylene
ppt	part(s) per thousand
PS&E	plans, specifications, and estimates
psi	pound(s) per square inch
PSLC	Puget Sound LiDAR Consortium
PVC	polyvinyl chloride
RCW	Revised Code of Washington

RESP	rock for erosion and scour protection
RHE	Region Hydraulics Engineer
ROW	right-of-way
SBUH	Santa Barbara Urban Hydrograph
SCS	Soil Conservation Service
SFHA	special flood hazard area
SFZ	structure-free zone
SR	State Route
SRH-2D	Sedimentation and River Hydraulics – 2D Model
Standard Specifications	*Standard Specifications for Road, Bridge, and Municipal Construction*
SWM	small woody material *(also known as slash)*
TBD	to be determined
T_c	time of concentration
TCE	temporary construction easement
TDA	threshold discharge area
TESC	temporary erosion and sediment control
TSF	ton(s) per square foot
T_t	travel time
USACE	United States Army Corps of Engineers
USBR	United States Bureau of Reclamation
USDA	United States Department of Agriculture
USFS	United States Forest Service
USGS	United States Geological Survey
UV	ultraviolet
WAC	Washington Administrative Code
WCDG	*Water Crossing Design Guidelines*
WDFW	Washington Department of Fish and Wildlife
WRIA	Water Resource Inventory Area
WSEL	water surface elevation
WSDOT	Washington State Department of Transportation

Main Glossary of Terms

A

access A means of entering or leaving a public road, street, or highway with respect to abutting property or another public road, street, or highway.

access point Any point that allows private or public entrance to or exit from the traveled way of a state highway, including "locked gate" access and maintenance access points.

aggradation Accumulation of sediment deposited by a river or stream.

approach An access point, other than a public road/street, that allows access to or from a limited access highway on the state highway system.

B

bankfull width The bankfull channel is defined as the stage when water just begins to overflow into the active floodplain. In channels where there is no floodplain, it is the width of a stream or river at the dominant channel-forming flow.

benefit/cost analysis A method of valuing a proposition by first monetizing all current expenditures to execute—cost—as well as the expected yields into the future—benefit, then dividing the total benefit by the total cost, thus providing a ratio. Alternatives may be rendered and compared in this fashion where a higher ratio is preferable, indicating a better return on investment.

bicycle Any device propelled solely by human power upon which a person or persons may ride, having two tandem wheels, either of which is 16 inches or more in diameter, or three wheels, any one of which is more than 20 inches in diameter.

bridge Any structure that is 20 feet or larger in span measured along the centerline of the roadway.

buried structures See definition in *Bridge Design Manual*, Chapter 8.

C

channel complexity The variation in physical channel components, which may include planform, longitudinal profile, cross-section, sediment distribution, etc.

channel width For the purposes of Chapter 7, channel width is used to describe bankfull width in a situation where the channel is highly influenced by man or heavily degraded conditions exist (WDFW 2013).

clear zone The total roadside border area, available for use by errant vehicles,

starting at the edge of the traveled way and oriented from the outside or inside shoulder (in median applications) as applicable. This area may consist of a shoulder, a recoverable slope, a nonrecoverable slope, and/or a clear run-out area. The clear zone cannot contain a critical fill slope, fixed objects, or water deeper than 2 feet.

climate change vulnerability
The risk that a transportation facility will be impacted by the effects of climate change.

collector A context description of a roadway intended to provide a mix of access and mobility performance. Typically low speed, collecting traffic from local roads and connecting them with destination points or arterials. This term is used in multiple classification systems, but is most commonly associated with the *Functional Classification* System.

collector system Routes that primarily serve the more important intercounty, intracounty, and intraurban travel corridors; collect traffic from the system of local access roads and convey it to the arterial system; and on which, regardless of traffic volume, the predominant travel distances are shorter than on arterial routes (RCW 47.05.021).

consider To think carefully about, especially in order to make a decision. The decision to document a consideration is left to the discretion of the engineer.

contraction scour Contraction scour, in a natural channel or at a bridge crossing, involves the removal of material from the bed and banks across all or most of the channel width. This component of scour results from a contraction of the flow area at the bridge, which causes an increase in velocity and shear stress on the bed at the bridge.

countermeasure An action or approach intended to monitor, prevent, delay, or mitigate the severity of hydraulic and/or erosion problems.

critical fill slope A slope on which a vehicle is likely to overturn. Slopes steeper than 3H:1V are considered critical fill slopes.

crossroad The minor roadway at an intersection. At a stop-controlled intersection, the crossroad has the stop.

curb section A roadway cross section with curb and sidewalk.

D

d_c Critical depth, ft

deliverable Any unique and verifiable product, result, or capability to perform a service that must be produced to complete a process, phase, or project.

depth of scour The vertical distance a streambed is lowered by scour below a

reference elevation.

design approval Documented approval of the design at this early milestone locks in design policy for 3 years. Design approval becomes part of the Design Documentation Package (see *Design Manual*, Chapter 300).

design-bid-build The project delivery method where design and construction are sequential steps in the project development process (23 CFR 636.103).

design-build contract
An agreement that provides for design and construction of improvements by a consultant/contractor team. The term encompasses design-build-maintain, design-build-operate, design-build-finance, and other contracts that include services in addition to design and construction. Franchise and concession agreements are included in the term if they provide for the franchisee or concessionaire to develop the project that is the subject of the agreement (23 CFR 636.103).

design-builder The firm, partnership, joint venture, or organization that contracts with WSDOT to perform the work.

design element Any component or feature associated with roadway design that becomes part of the final product. Examples include lane width, shoulder width, alignment, and clear zone (see *Design Manual*, Chapter 1105).

designer This term applies to WSDOT design personnel. Wherever "designer" appears in this manual, design-build personnel shall deem it to mean: Engineer of Record, Design Quality Assurance Manager, local programs project design staff, developer project design staff, design-builder, or any other term used in the design-build contract to indicate design-build personnel responsible for the design elements of a design-build project, depending on the context of information being conveyed.

design flood The discharge that is selected as the basis for the design or evaluation of a hydraulic structure including a hydraulic design flood, scour design flood, and scour check flood.

design methodology
Design methodology has the meaning used in the Washington Department of Fish and Wildlife *Water Crossing Design Guidelines*.

design reference reach
A reach of stream, preferably within the same watershed, that is relatively stable.

desirable Design criteria that are recommended for inclusion in the design.

document (verb) The act of including a short note to the Design Documentation Package that explains a design decision.

driveway A vehicular access point that provides access to or from a public roadway.

E

easement A documented right, as a right-of-way, to use the property of another for designated purposes.

element An architectural or mechanical component or design feature of a space, site, or public right-of-way.

energy grade line (EGL)
The measure of the friction slope or rate of energy head loss due to friction losses from flows along a channel, typically represented at any given point by the sum of the potential energy (i.e., elevation head including bed elevation and flow depth) and the kinetic energy (i.e. velocity head).

F

facility All or any portion of buildings, structures, improvements, elements, and pedestrian or vehicular routes located in a public right-of-way.

Federal Highway Administration (FHWA)
The division of the U.S. Department of Transportation with jurisdiction over the use of federal transportation funds for state highway and local road and street improvements.

final design Any design activities following preliminary design; expressly includes the preparation of final construction plans and detailed specifications for the performance of construction work (23 CFR 636.103). Final design is also defined by the fact that it occurs after NEPA/SEPA approval has been obtained.

five-hundred-year flood
The flood due to storm and/or tide having a 0.2 percent chance of being equaled or exceeded in any given year. Commonly denoted as Q500.

floodplain utilization ratio (FUR)
The floodplain utilization ratio is the flood-prone width (FPW) (100-year top width) divided by the bankfull width.

freeboard The vertical distance above the water surface elevation (WSEL) that is allowed for waves, surges, drift, and other contingencies.

G

geotextiles (nonwoven)
A sheet of continuous or staple fibers entangled randomly into a felt for needle-punched nonwovens and pressed and melted together at

the fiber contact points for heat-bonded nonwovens. Nonwoven geotextiles tend to have low to medium strength and stiffness with high elongation at failure and relatively good drainage characteristics. The high elongation characteristic gives them superior ability to deform around stones and sticks.

geotextiles (woven)

Slit polymer tapes, monofilament fibers, fibrillated yarns, or multifilament yarns simply woven into a mat. Woven geotextiles generally have relatively high strength and stiffness and, except for the monofilament wovens, relatively poor drainage characteristics.

H

headwater (HW) Depth from inlet invert to upstream total energy grade line, feet.

highway A general term denoting a street, road, or public way for the purpose of vehicular travel, including the entire area within the right-of-way.

hydraulic design flood

The discharge and associated probability of exceedance that reflects the desired level of service for a roadway/bridge crossing a watercourse and/or floodplain. This flood drives the capacity design (i.e., size and configuration) of the waterway opening. By definition, the approach roadway or bridge should not be inundated by the water levels produced by this flood.

hydraulic height

The minimum height required for hydraulic-related purposes, including freeboard, scour, bed thickness, and appropriate maintenance clearance. Maintenance clearance shall be included in hydraulic height only if necessary to maintain habitat elements.

hydraulic length

The horizontal length along the stream of all components of a structure within 10 feet of the structure-free zone (SFZ) including bridges, culverts, walls, wing walls, and scour countermeasures.

hydraulic opening

Represents the hydraulic width and height necessary to convey the design flood and stream processes.

hydraulic width The minimum width perpendicular to the creek that is necessary to convey the design flood and stream processes.

I

Injunction, the United States of America et al., v. State of Washington et al. Permanent Injunction Regarding Culvert Correction, United States District Court, Western District of Washington at Seattle, No. C70-9213 Subproceeding No. 01-1 (Culverts), ordered March 29, 2013.

intersection An at-grade access point connecting a state highway with a road or street duly established as a public road or public street by the local governmental entity.

Interstate System
A network of routes designated by the state and the FHWA under terms of the federal-aid acts as being the most important to the development of a national system. The Interstate System is part of the principal arterial system.

J

justify Preparing a memo to the DDP identifying the reasons for the decision: a comparison of advantages and disadvantages of all options considered. A more rigorous effort than document.

K

key pieces Logs that are large enough to persist and influence hydraulics and bed topography in a stream through a wide range of flow conditions. Key pieces are independently stable.

L

lane A strip of roadway used for a single line of vehicles.

lane width The lateral design width for a single lane, striped as shown in the *Standard Plans* and *Standard Specifications*. The width of an existing lane is measured from the edge of traveled way to the center of the lane line or between the centers of adjacent lane lines.

large woody material (LWM)
Trees and tree parts where the trunk is larger than 4 inches in diameter and larger than 6 feet in length.

lateral (storm sewer)
These are the first inlets that contribute flow into a storm sewer system.

level of service (LOS)
LOS is based on peak hour, except where noted. LOS assigns a rank (A–F) to facility sections based on traffic flow concepts like density, delay, and/or corresponding safety performance conditions. (See the *Highway Capacity Manual* and AASHTO's *Geometric Design of Highways and Streets* ["Green Book"] for further details.)

M

managing project delivery
A WSDOT management process for project delivery from team initiation through project closing.

meander belt Measurement of the width of a stream's natural meander and planform variability.

median The portion of a divided highway separating vehicular traffic traveling in opposite directions.

minimum hydraulic opening (MHO)
The minimum structure width required by the specialty report and the total height defined by minimum low chord elevation and total scour elevation.

mobile woody material (MWM)
Large woody material that is designed to move at target design flood events.

O

one-hundred-year flood
The flood due to storm and/or tide having a 1 percent chance of being equaled or exceeded in any given year. Commonly denoted as Q100.

over-coarsened channel
A constructed channel with a median particle size that is greater than 20 percent larger than the median particle size of the reference reach; is deformable at discharges below the 100-year discharge.

P

Plans, Specifications, and Estimates (PS&E)
The project development activity that follows Project Definition and culminates in the completion of contract-ready documents and the engineer's cost estimate.

preventive countermeasure
Structures or other management actions used to prevent erosion from damaging critical infrastructure.

project The Project Management Institute defines a project to be "a temporary endeavor undertaken to create a unique product or service."

project definition (see *Project Summary*)

Project Engineer This term applies to WSDOT personnel. Wherever "Project Engineer" appears in this manual, the design-builder shall deem it to mean "Engineer of Record."

project reach The segment of stream in which the project is located.

proposal The combination of projects/actions selected through the study process to meet a specific transportation system need.

purpose General project goals such as improve safety, enhance mobility, or enhance economic development.

Q

Q	Discharge, cfs.
Qc	Culvert discharge, cfs.
Qo	Overtopping discharge over total length of embankment, cfs.
Qt	Total discharge, cfs.

R

reference reach A stable segment of stream with consistent slope, geometry, planform, and sediment load that represents, to the best available knowledge, the background condition of the project reach.

regrade, channel regrade, natural channel regrade, natural regrade
Each of these terms shall be understood to mean the natural process of a stream to establish an equilibrium slope by means of aggradation or degradation over time. Regrade is expected to effect changes to the stream, its bed and banks, and may include at a minimum, incision, deposition, debris loading, downstream flooding, lateral shifting, and bank erosion. The regrade process will be set in motion by removal of the existing barrier to fish passage, and is intended to allow the stream to return to its natural channel, by processes that are unencumbered by the design and construction of a new fish-passable stream crossing. Furthermore, the regrade process may extend to areas outside of State right-of-way, although the degree, extent, and timing are unpredictable.

Request for Proposal (RFP)
The document package issued by WSDOT requesting submittal of proposals for the project and providing information relevant to the preparation and submittal of proposals, including the instructions to proposers, contract documents, bidding procedures, and reference documents.

residual pool depth
The difference in depth or bed elevation between a pool and the downstream riffle crest.

right-of-way A general term denoting land or interest therein, acquired for or designated for transportation purposes. More specifically, lands that have been dedicated for public transportation purposes or land in which WSDOT, a county, or a municipality owns the fee simple title, has an easement devoted to or required for use as a public road/street and appurtenant facilities, or has established ownership by prescriptive right.

road approach An access point, other than a public road/street, that allows access to or from a limited access highway on the state highway system.

roadway The portion of a highway, including shoulders.

roughened channel
A constructed channel with streambed material and configuration designed to be non-deformable up to the design discharge.

roundabout A circular intersection at grade with yield control of all entering traffic, channelized approaches with raised splitter islands, counter-clockwise circulation, and appropriate geometric curvature to force travel speeds on the circulating roadway generally to less than 25 mph.

S

scour Erosion of streambed or bank material due to flowing water; can be localized around bridge piers and abutments (see long-term degradation, local scour, contraction scour, and total scour).

scour check flood
The discharge associated with the 0.2 percent annual exceedance probability (e.g., 500-year) flood or the 2080 100-year projected flood (whichever is greater).

scour design flood
The discharge associated with the 1 percent annual exceedance probability (e.g., 100-year) flood or the 2080 100-year projected flood (whichever is greater).

shoulder The portion of the roadway contiguous with the traveled way, primarily for accommodation of stopped vehicles, emergency use, lateral support of the traveled way, and, where allowed, use by pedestrians and bicycles.

site Parcel(s) of land bounded by a property line or a designated portion of a public right-of-way.

slash Small trees and parts of trees where the trunk is less than 2 inches in diameter.

small woody material (SWM)
Small trees and parts of trees where the trunk is 4 inches in diameter or smaller.

speed The operations or target or posted speed of a roadway. There are three classifications of speed established:

- ***Low speed*** is considered 35 mph and below.
- ***Intermediate speed*** is considered 40–45 mph.
- ***High speed*** is considered 50 mph and above.

stable stream A stream, over time (in the present climate), that transports the flows and sediment produced by its watershed in such a manner that the dimension, pattern, and profile are maintained without either aggrading or degrading.

state highway system
All roads, streets, and highways designated as state routes in compliance with RCW 47.17.

stream designer This term applies to WSDOT design personnel and is used to distinguish the work that is performed using Chapter 7 and Chapter 10 from the rest of the *Hydraulics Manual*. Wherever "stream designer" appears in this manual, design-build personnel shall deem it to mean: Water Resources Engineer of Record, Design Quality Assurance Manager, design-builder, or any other term used in the design-build contract to indicate design-build personnel responsible for the design elements of a design-build project, depending on the context of information being conveyed.

stream simulation
The design methodology outlined in the 2013 *Water Crossing Design Guidelines* defined as Stream Simulation.

streambed mix Sediment size distribution that uses pebble counts from the reference reach for the D_{50} and D_{84} and an even, designed distribution of sizes for finer classes (USFS 2008).

structure-free zone (SFZ)
The minimum boundary within which no part of the fish passage structure, including footings, shall be allowed. SFZ incorporates additional width and height beyond the minimum hydraulic opening, not hydraulic related, such as constructibility, maintenance access, wildlife connectivity, or other project-specific needs.

superelevation The rotation of the roadway cross section in such a manner as to overcome part of the centrifugal force that acts on a vehicle traversing a curve.

superelevation transition length
The length of highway needed to change the cross slope from normal crown or normal pavement slope to full superelevation.

T

tailwater (TW) Tailwater depth measured from culvert outlet invert, feet.

thalweg Relates to the geometrics of natural or artificial water conveyance channels. More specifically, a thalweg delineates the line connecting the deepest points throughout any given point in a channel.

total scour The sum of long-term degradation, contraction scour, and local scour. Total scour should be evaluated for all flows up to and including the scour design flood and scour check flood that create the worst-case total scour for the scour design flood and scour check flood.

traveling public Motorists, motorcyclists, bicyclists, pedestrians, and pedestrians with

disabilities.

trunk (storm sewer)
The pipes that make up the storm sewer system that are not laterals.

U

urban area An area designated by the Washington State Department of Transportation (WSDOT) in cooperation with the Transportation Improvement Board and Regional Transportation Planning Organizations, subject to the approval of the FHWA.

urbanized area An urban area with a population of 50,000 or more.

W

***Water Crossing Design Guidelines* (2013 WCDG)**
The 2013 *Water Crossing Design Guidelines*, as published by the Washington Department of Fish and Wildlife at https://wdfw.wa.gov/publications/01501. This version of the document has been approved for use on WSDOT projects with exceptions as noted in Chapter 7 and Chapter 10. If a newer version of the document is published, the Hydraulics Section must approve of it prior to use.

Z

Zone A FEMA Zone designation. Areas with a 1 percent annual chance of flooding and a 26 percent chance of flooding over the life of a 30-year mortgage. Because detailed analyses are not performed for such areas, no depths or flood elevations are shown within these zones.

Zone AE FEMA Zone designation. The base floodplain where base flood elevations are provided. AE Zones are on new format FIRMs instead of A1–A30 Zones.

Zone A1-30 FEMA Zone designation. These are known as numbered A Zones (e.g., A7 or A14). This is the base floodplain where the FIRM shows a BFE (old format).

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