The proposed Manual revisions represent an advance over the previous edition. The draft for review is 1848 pages long and not all of it was read and therefore some suggested analysis or considerations in this comment letter might be in the manual and overlooked. The Manual serves to outline measures to protect water quality and minimize the ability of stormwater to cause erosion. Though the Manual implies, it is not a land use document, it is in effect in many ways one and is one of the few mitigation methods where the impacts are transferred offsite into critical areas. The erosion prevention aim is clearly articulated on page 59:

> *"The intent of Flow Control is to prevent increases in the stream channel erosion rates that are characteristic of natural conditions by releasing runoff from the proposed development condition in a manner that delivers approximately the same amount of erosive energy to the stream as it received under predeveloped or receives under existing conditions."*

And on page 183:

> *"The objective of this Minimum Requirement is to prevent increases in the stream channel erosion rates that are characteristic of natural conditions (i.e.,. prior to disturbance by European settlement). The Flow Control Performance Standard intends to maintain the total amount of time that a receiving stream exceeds an erosion-causing threshold based upon historic rainfall and natural land cover conditions."*

And page 247 when discussing flow control exemptions for low gradient streams"

> *"A professional hydrogeologist must estimate the maximum possible velocity in the channel (based upon build-out conditions in the drainage area) versus the likely velocity necessary to initiate significant bed load movement."*

However, none of this statements address the direct impacts of water velocity upon aquatic life. Indeed, the Manual fails to consider adequately consider the impacts of stormwater management on stream life. This could be a result of the Manual being developed to deal with thresholds for channel erosion and flooding (geomorphic thresholds), as noted above with the probable assumption that protecting channels from erosion would protect the physical habitat (such as stream bed, banks, word, etc.) would protect stream live. It was not until a later edition that the Manual (page 183 in the draft being reviewed) contained the phrase: "*Maintaining the naturally occurring erosion rates within streams is vital, though by itself insufficient, to protect fish habitat and production*". Since the introduction of that phrase into the Manual, little has been to explore the consequences of that statement or if stormwater management practices have altered the water column in terms of velocity and duration of velocities in a manner that adversely affects stream life. In reducing the potential for flooding and erosion, the manual has inadvertently created the potential for other impacts to aquatic life. These other impacts cannot be addressed by increasing the volume of water stored in detention facilities. The most probable mitigation measures are to limit development so that infiltration can handle the increased volume of discharge associated with development or increasing downstream habitat complexity to provide refuge for the increase duration of elevation flows or a combination of these.

"That threshold is assumed to be 50% of the 2-year peak flow. Maintaining the naturally occurring erosion rates within streams is vital, though by itself insufficient, to protect fish habitat and production."

The concept that stormwater management can decrease functions and values even in the absence of physical alteration is actually contained in the Manual, but in reference to wetlands, not streams. The Manual (page 254) states that "*New development, redevelopment, and stormwater management projects may decrease the function and value of a wetland by …*" and "*This can happen even if the wetland is not physically altered for development or stormwater management purposes.*" The Manual (Section I-C-4). then devotes nine pages (page 258-266)to the issue of wetland hydroperiod protection The first sentence is this period is "*Protection of many wetland functions and values depends on maintaining the existing wetland's hydroperiod*." Followed by these eight pages are two pages of discussion on Compensatory Mitigation of Wetlands, then three pages on Jurisdictional Planning for Wetland Protection from Stormwater , followed by four pages of Wetland Protection Definitions. Two definitions stand out:

1. Hydrodynamics -The science involving the energy and forces acting on water or other liquids and the resulting impact on the motion of the liquid.
2. Hydroperiod - The seasonal occurrence of flooding and/or soil saturation; it encompasses the depth, frequency, duration, and seasonal pattern of inundation.

Just as stormwater management alters wetland hydroperiod, it also alters that of streams in terms of the flow (thus depth and velocity), frequency and duration of flows, and the natural range of flow variability through typically increasing the duration of discharges equivalent to small storm events compared to the pre-development stage. Stormwater management is necessary to prevent physical damage to the stream channel, but the consequences of that must be understood and mitigated.

However, the focus on reducing erosion has, despite wording on page 183, leads to inadequate attention to the impacts of stormwater management upon water volumes below that required to cause erosion. Development alters the natural range of flow variability as depicted in the figure on page 61 (inserted here is Fig. 1). However, not shown in the manual and it should be is a figure (see Figs 2 and 3 for examples) showing how urbanization creates significant flow events in a stream channel when none existent in the pre-urbanized channel and increasing the frequency of even larger flow events. If these flow events exceed the event determined by the manual then water is detained and released over a longer period of time. Though following development, the total volume of stormwater released into the stream from a site will generally remain the same, implementation of flow duration controls means that volume is water is released over a longer period of time. As water velocity generally increases with the volume of water in the stream, over much of the water column, except near obstructions and the stream boundary, water velocities increase. Many aquatic species, such as juvenile salmonids have rather limited sustained swimming speeds, speeds less than that required to erode gravel streams. Increasing the duration of higher velocity flows increased metabolic expenditures to remain in place in the water column, requires movement to areas of acceptable water velocity (which is simplified streams are few), or results in downstream displacement. All are impacts. Compounding this issue is that though stormwater management is the implicit assumption is that water moves through the current stream channel as it did through the pre-development channel. Reduced hydraulic complexity, stream channelization typically means that even if the flow volume is the same, there is less volume of water with the combination of acceptable depths and velocities required by salmonids, particularly juveniles. The same flows typically have a lower percent of the water column with acceptable velocities and depths for a variety of fish. The stormwater analysis should include in the narrative portion of the document, not buried in tables, the total volume of additional water discharged to the stream channel due to the development and changes in the duration of flows below the ½ of the two flow event over the water year

Low base flows are a current concern and base flows are expected to decline with climate change. Development also influences groundwater recharge. Stormwater calculation focus on the volume of stormwater generated and how much can be let out without causing channel erosion or altering wetland hydroperiod. Infiltration rates are determined to determine if it is feasible to infiltrate stormwater onsite and the amount of stormwater that can be infiltrated onsite as that influences the size of the required ponds. However, one of the impacts of development is a reduction of groundwater recharge.

Though LID reduces the amount of stormwater discharged to a stream channel, a LID in the absence of an analysis as described below cannot be presumed to not have a significant impact upon infiltration to groundwater zones or aquifers. There appears to be no direct analysis of changes in infiltration due to the development that might impact groundwater and thus stream flows and temperature. Though infiltration might not be an stormwater management option due to low rates of infiltration compared to the amount of stormwater generated, low rates of infiltration do not mean onsite infiltration is not important in ground water and aquifer recharge and subsequent stream flows. As the manual has identified development as leading to reduced recharge and the manual provides a rational for development not to infiltrate water, the Manual should direct all site analysis calculate the volume of water infiltrated in pre-development conditions, current conditions, and post-development conditions so there is some quantification of the impacts of the development and proposed stormwater management plan on water infiltration. This will provide local government valuable information to assess the tradeoff in potential reduced groundwater rechange versus the developers desire to maximize the footprint of the project with the potential to generate more runoff than can be infiltrated, help document changes in water that could reach aquifers or become stream flow which would assist in determining long term potential impacts of base flows and the timing when seasonal streams begin to flow and then cease to flow, provide input Streamflow Restoration activities, and help assess cumulative impacts to infiltration into aquifers and groundwater zones.

Though the impact of any one project might be small, cumulative impacts can be great. Additionally, large project that discharge into small streams or off-channel areas could have site-specific impacts.

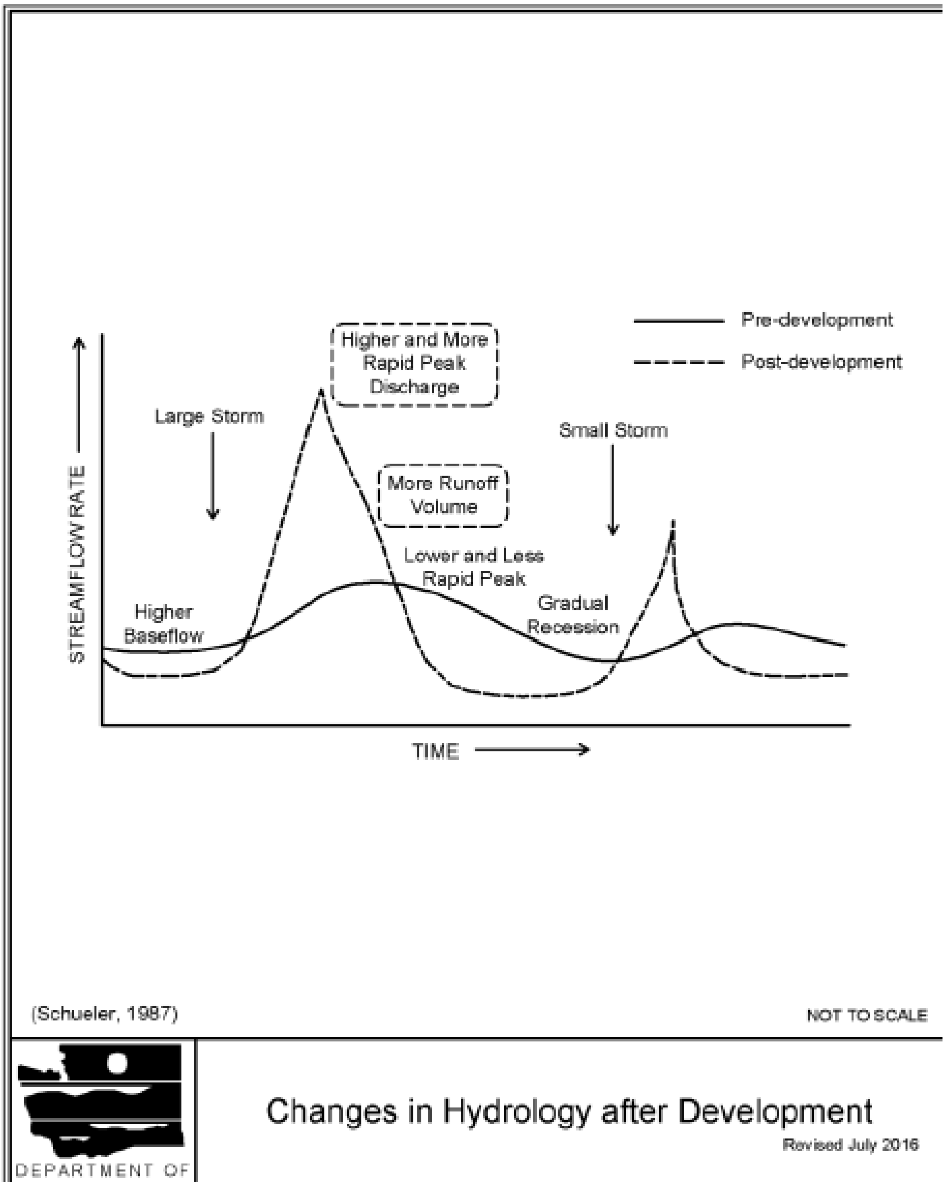

Fig 1. From Manual

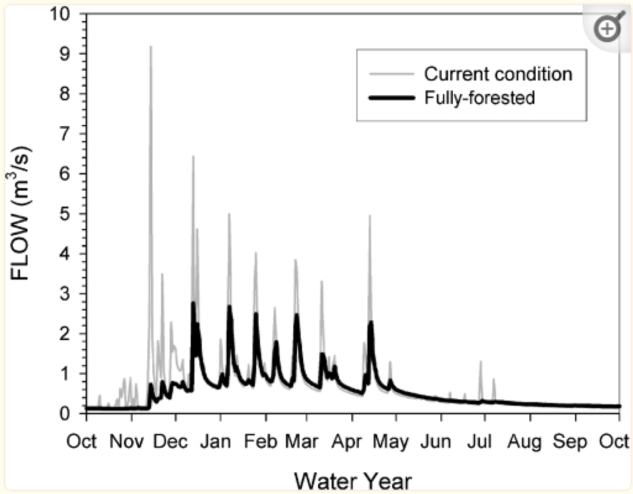

FIGURE 2

Typical Annual Runoff Pattern (October to September) Under Fully Forested and Highly Urbanized Conditions Derived From Calibrated Kelsey Creek Hydrologic Simulation Program-FORTRAN (HSPF) Model.

Fig 2. From Curtis L DeGasperi, Hans B Berge, Kelly R Whiting, Jeff J Burkey, Jan L Cassin, and Robert R Fuerstenberg. *J Am Water Resour Assoc.*2009 Apr; 45(2): 512–533.

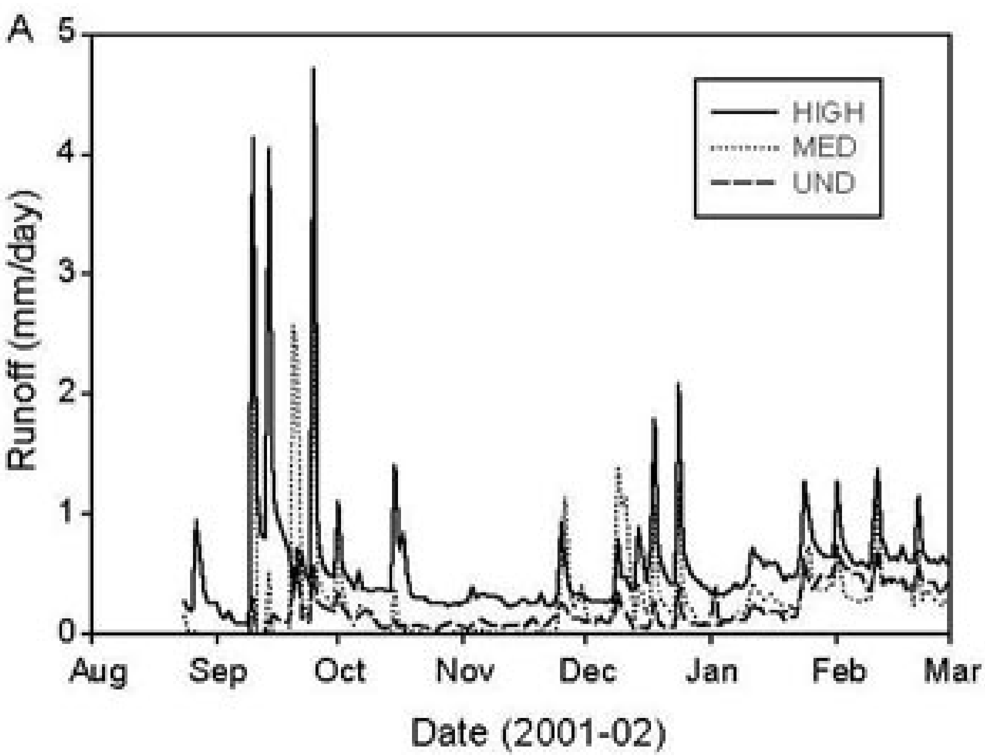

Fig 3. From Burns D et al. 2005. Effects of suburban development on runoff generation in the Croton River basin, New York, USA. *Journal of Hydrology* 311:266-281.

Specific comments on the Manual follow

Page Number	Draft Manual Wording	Comments
53	Hydrologic Changes	The hydrologic change section refers to "*increasing the frequency and duration of high streamflows*". Though correct, this statement is somewhat misleading as high is undefined. One impact has been the creation of elevated flow events in the channel when not existed before for a similar storm event.
53	illustrates some of these hydrologic changes. As a consequence of these changes in hydrology, stream channels may experience both increased flooding and reduced base flows. Natural riffles, pools, gravel bars, and other areas may be altered or destroyed. Increased channel erosion, loss of hydraulic complexity, degradation of habitat…,	The focus here is on physical changes to the channel and not alterations in the distribution or duration of water velocities that can impact aquatic life directly through displacement or increased energy expenditures to maintain position at flows or velocities below that required to cause channel erosion.
66	Biological Changes	What is lacking from the biological change section is a short discussion that the how water moves through a stream channel is greatly influence by the hydraulic complexity of the channel. More complex channels tend to have a greater diversity of depths and water velocities. The legacy of past land use practices is a reduction of hydraulic complexity. This means the water moves through this simplified channels much differently than it did in the past and even if the mean velocity is the same, the percentage of the channel with lower velocities is reduced.
66	The biological communities in wetlands are also severely impacted and altered by the hydrological changes.	There is also a considerable body of literature that the biological communities in streams are impact by alterations in velocities, depths, or increases in duration of flows that increase metabolic costs or

		exceed sustained swimming ability. Given the following statement (this issue will be addressed in more detail later) on page 183 of this draft, "*Maintaining the naturally occurring erosion rates within streams is vital, though by itself insufficient, to protect fish habitat and production*" more attention must be given to the consideration that stormwater discharges into streams are increasing the frequency or duration of flows below that causing erosion, but increasing those that produce water velocities adverse to some aquatic life, such as juvenile salmonids just increasing their metabolic expenditure or forcing them to find shelter elsewhere. As stream channel are typically simplified compared due to land use practices, there is less habitat for fish to find. This is a synergistic impact.
71	The Washington State Legislature directed Ecology in 2021 to write a synopsis report (Ecology, 2022a) on where priority areas are that are affected by this newly identified contaminant and on stormwater best management practices (BMPs) for reducing toxicity to aquatic life. Despite the widespread use and presence of 6PPD in tires and on roadways, the prevalence of 6PPD-q in aquatic areas is unknown. At this time, our understanding of what eventually happens to 6PPD and 6PPD-q in the environment is incomplete, with several key factors such as the chemical half-life, sorption potential, solubility and reactivity is still debated in the literature.	The ongoing problems with finding space to retrofit existing stormwater managements systems build to older standard, requires a risk averse approach. Future developments should include that additional space be left on site to allow for additional treatment if ongoing research shows current BMPs are insufficient to deal with 6PPD-q. Therefore, in addition, to the area required for BMPs approved in this manual, an additional area equivalent to 10% of the required area should be set aside to accommodate future treatment facilities if ongoing research indicates additional treatment is needed. There are potential ways to set aside this land without reducing the units that could be built. For example, .many developments are required to have open space. Some of this open space could be reserved for the additional facilities. Additionally, setting aside land for future stormwater treatment facilities is akin to the required practice of setting aside reserve septic fields for developments using septic.

71	Land use is tied to site development standards and where development occurs. This manual is not intended to direct those land use decisions or delve deeply into those topics. Most land use decisions occur prior to the project being proposed. This manual focuses on the management of the project.	In some rural areas, zoning densities is based upon the assumption that compliance with the Manual is expected to prevent site specific and cumulative impacts to streams. Thus, the manual could be considered to be driving some land use decisions.
71	The engineered stormwater conveyance, treatment, and detention systems advocated by this and other stormwater manuals can reduce the impacts from development to water quality and hydrology. However, they cannot replicate the natural hydrologic functions of the natural watershed that existed before development,…	Hydrologic functions are not hydraulic functions. As mentioned in a comment to page 66, water moving through a simplified channel behaves much differently than in a more complex channel. Matching land development techniques to the natural hydrologic functions and cycles of watershed is a necessary goal, but insufficient in itself to address the impacts of stormwater on stream channels and aquatic life. The focus on pre-development flows is overlooking the fact that in many places, the pre-development channel no longer exists.
71	Researchers (May et al., 1997) and regulators [e.g., (King County, 1996)] have speculated on the amount of natural land cover and soils that should be preserved in a watershed to retain sufficient hydrologic conditions to prevent stream channel degradation, maintain base flows, and contribute to achieving properly functioning conditions for salmonids. There is some agreement that preserving a high percentage (possibly 65 to 75%) of the land cover and soils in an undisturbed state is necessary. To achieve these high percentages in urban, urbanizing, and suburban	When one looks at the streams included in the figures on page 68 and 70, there are several outliers where with relatively high TIA have considerably higher biotic integrity than one would expect based upon TIA. A factor common to many of those streams is that they tended to have more intact riparian corridor; hence more in-channel wood, off-channel habitat, hydraulic complexity (diversity) and more shading. This suggests that both the volume of stormwater entering a channel and the channel condition – particularly hydraulic complexity - must be considered to determine impacts to many aquatic biota. For many years, various editions of the Stormwater Manual have included the

	watersheds, a dramatic reduction is necessary in the amount of impervious surfaces and artificially landscaped areas to accommodate our preferred housing, play, and work environments, and most significantly, our transportation choices.	following wording found on page 183 of this redline version (emphasis added): *"The objective of this Minimum Requirement is to prevent increases in the stream channel erosion rates that are characteristic of natural conditions (i.e.,. prior to disturbance by European settlement). The Flow Control Performance Standard intends to maintain the total amount of time that a receiving stream exceeds an erosion-causing threshold based upon historic rainfall and natural land cover conditions. That threshold is assumed to be 50% of the 2-year peak flow.* ***Maintaining the naturally occurring erosion rates within streams is vital, though by itself insufficient, to protect fish habitat and production.***"
72	Reducing the extent of impervious surfaces and increasing natural land cover in watersheds are also necessary to solve the water quality problems of sediment, temperature, toxicants, and bacteria.	This sentence should be amended to read: Reducing the extent of impervious surfaces and increasing natural land cover in watersheds are also necessary to solve the water quality problems of sediment, temperature, toxicants, and bacteria **and restoring stream channel is necessary to address problems of simplified stream channels.**
72	Until we are successful in applying land development techniques that result in matching the natural hydrologic functions and cycles of watersheds, management of the increased surface runoff is necessary to reduce the impact of the changes. Biological impacts in streams can occur at even low levels of development associated with rural areas where stormwater runoff has not been properly managed. Improving our stormwater detention, treatment, and source control management practices should help reduce the	Hydrologic functions are not hydraulic functions. As mentioned in a comment to page 66, water moving through a simplified channel behaves much differently than in a more complex channel. Matching land development techniques to the natural hydrologic functions and cycles of watershed is a necessary goal, but insufficient in itself to address the impacts of stormwater on stream channels and aquatic life. The focus on pre-development flows is overlooking the fact that in many places, the pre-development channel no longer exists. See also comments to page 71.

	impacts of land development in urban and rural areas. We must also improve the operation and maintenance of our engineered systems so that they function as well as possible. This manual is Ecology's latest effort to apply updated knowledge in these areas.	
73	Climate Change Impacts on Stormwater Management Water resources: Reduced water availability in the summer due to less snowpack, drier summers, and increased water temperatures.	If streams start to flow later or dry up earlier, then the window for salmonid spawning is reduced and access to overwintering or off-channel habitat might be reduced. Setting aside temperature and DO issues, streams will be impacted differently during the low flow season and the lead up and end of the low flow season: 1) flows will decrease, but continuous surface flows will continue; 2) surface flows will become discontinuous, but water will remain in deep pools. 3) the time at which flows first appear during the lower flow becomes later; 4) the time of which continuous surface flow is present occurs later; 5) the time which continuous surface flow ceases become earlier 6) the time at which surface flows last occurs becomes earlier. Alterations in infiltration due to development can influence the above. Therefore the onsite analysis and for an area within one mile of the project, the analysis should: (1) determine for permanent streams potential changes in base flow; and (2) for seasonal streams collect information as to when surface flow first appears, when surface flow becomes continuous in time and spaces, when surface flow first becomes discontinuous in time and space and when surface flow ceases.

		Collecting the paragraph 2 information above will assist in determining the potential impacts of the project on flow patterns in seasonal streams as summers become drier as a section of the onsite report. There are methods to collect this data in the short-term as well as over the long-term that do not involved considerable field work. For example, game cameras aimed at stream and set to take pictures at regulator intervals would provide the required information.
75	Stormwater managers need analytical and management tools. For example, stormwater BMPs are not sized to fully capture extreme storm events. Stormwater managers in areas with poorly draining soil (i.e. till soil) will be challenged to adequately quantify the potential effectiveness of low impact development (LID) to mitigate for future stormwater discharges.	As outline in the general comments, local land use planners need information about changes in infiltration volumes over the water year.
75	Ecology recommends the following actions to help mitigate the impacts of climate change on stormwater management design:	The proposed actions will not address direct impacts of stormwater management upon aquatic life by extending the duration of flows below the geomorphic threshold. The Manual need to recognize that increasing instream hydraulic complexity will make the stream channel more resilient to climate change as well as help protect aquatic life from the extended duration of discharge.
81	I-1.5 Pollutants from Rubber Preservatives (Including 6PPD-q)	Some reports in the press indicate that some jurisdictions have refused to implement BMPs that are shown some promise dealing with certain. To reduce the potential for older versions of local manuals that have not yet been updated to reflect this Manual, this Manual should include wording that if a newer specific bio-retention BMP is included in the Manual that local government cannot use the their older version of an applicable

		manual that does not include that BMP to tell an applicant they cannot use that technique unless the local government: (1) provides a site specific analysis as to why the new BMP is not feasible for that site; or (2) the BMP meets the infeasibility criteria. See also comments to page 71.
107	How Does the Endangered Species Act Relate to This Manual? Potential impacts that may be minimized by using the guidance in this manual include discharges containing sediment, turbidity, or abnormal pH. Specific adverse impacts include:	The focus on geomorphic impacts as related to the ESA underscores the original emphasis of the manual on erosion. Subsequently, less attention has been paid to other impacts directly impact aquatic life, particularly juvenile salmonids. Other impacts include increasing the duration of flows that increase the duration of time the velocity in portions of the stream channel exceeds that swimming abilities of stream resident fish and stream rearing juvenile salmonids.
111	An HPA may be required for stormwater discharges related to a project that may alter the natural flow or bed of state waters.	The wording of this should be changed to reflect the practice the WDFW only requires a HPA for physical stormwater features that later the natural or bed of state waters. The WDFW does not required a HPA for a project whose discharge alters the natural flow or bed of state waters in the absence of a physical structure. It would benefit aquatic live is the WDFW could require a HPA for any discharge that altered the natural flow or bed of states waters, even in the absence of physical structure, but that is beyond the purview of this manual.
160	All new development and redevelopment projects meeting the thresholds in I-3.3 Applicability of the Minimum Requirements shall preserve and maintain natural drainage patterns to the maximum extent practicable at the site. Discharges from the Project Site	The onsite analysis needs to determine whether the natural outfall location is a habitat type used by overwintering salmonids or salmonids seeking refuge from high flows and avoid discharge there. And if unable to avoid discharge, provide mitigation that provides refuge from the discharge.

	shall occur at the natural location, to the maximum extent practicable.	
183	Reduction of flows through infiltration decreases stream channel erosion and helps to maintain base flow throughout the summer months.	This statements is only correct if the amount of water infiltrated post-development is the same or greater than that pre-development. Otherwise, a more apt statement would be reduces the rate of decline in base flows.
194	Ecology recommends that local governments require development projects that discharge stormwater off-site to submit an off-site analysis report that assesses the potential off-site water quality, erosion, slope stability, and drainage impacts associated with the project, and proposes appropriate mitigation for those impacts.	Section I-1.1 of the manual opens with: *"The objective of this manual is to provide guidance on the measures necessary to control the quantity and quality of stormwater produced by new development and redevelopment. The goal of the measures is to comply with water quality standards and contribute to the protection of beneficial uses of the receiving waters."* Under beneficial uses, WAC 173-545-030 includes fish and wildlife habitat maintenance. The recommended assessment does not address this beneficial use. The assessment should include: Hydrologic mapping showing patterns of surface water movement and known subsurface water movement into, through, and out of the site area tracing the flow of water downstream until it meets a water body that Ecology exempts from the flow-control standard.; Dates seasonal streams on or downstream of the site begin and cease (1) to have intermittent flow and (2) have temporally continuous flow and the potential impact of reduced groundwater recharge on these Description of any known or observable water quality problems at the development site or downstream until marine waters are reached and whether they will continue after the development project is completed.

		Basic water quality parameters that should be considered include dissolved oxygen (DO), pH and alkalinity, temperature, turbidity/suspended solids/sediment accretion, nutrients, fecal coliform, and heavy metals. For projects involving work in stream, such as a stormwater outfall or the creation of a stormwater conveyance through a stream buffer, a habitat survey from 100 feet upstream of the work to 500 feet downstream. Name of stream habitat survey method used.
194	The initial qualitative analysis shall extend along the flow path from the project site to the receiving water, for a distance up to one mile. If the receiving water is within one-quarter mile from the project site, the analysis shall extend within the receiving water to one-quarter mile from the project site. The analysis shall extend one-quarter mile beyond any improvements proposed as mitigation.	This is insufficient to document the potential for impact on downstream aquatic resources as well as be proactive in the face of climate change. The initial qualitative analysis should extend until it reaches a flow control exempt receiving water.
195	The existing or potential impacts to be evaluated and mitigated should include:	In addition potential impacts to the following should be evaluated: Fish overwintering or high flow refugia habitats; spawning habitat; holding habitats;
195	Violations of surface water quality standards as identified in a Basin Plan or a TMDL;	A look at these will overlook many impaired waters. The analysis should also a review of the Water Quality Atlas for 303(d) list waters.
195	The objective of the off-site analysis report is to identify, evaluate, and determine measures to prevent off-site water quality,	For reasons described earlier, this sentence should be amended to read: "*The objective of the off-site analysis report is to identify, evaluate, and determine measures to*

	erosion, slope stability, and drainage impacts that may be caused or aggravated by a proposed project. "Aggravated" shall mean increasing the frequency of occurrence and/or severity of a problem.	*prevent off-site water quality, erosion, slope stability, ~~and~~ drainage impacts* ***and impacts to stream hydraulics that might impact aquatic life*** *that may be caused or aggravated by a proposed project."* Without this, the beneficial use of water for fish will typically be overlooked.
195	Ecology is not listing off-site analysis as a Minimum Requirement.	Offsite analysis should be a minimum requirement. Stormwater discharge is the major onsite impact that is transferred through buffers to offsite areas. Potential offsite impacts must be considered.
195	The existing or potential impacts to be evaluated and mitigated should include the following:	Changes to the temporal distribution of water velocities acceptable to aquatic organisms, particularly juvenile salmonids.
195	Define and map the study area The off-site analysis report should include a map of the study area to show:	The map should also show: 1. patterns of surface water movement and known subsurface water movement into, through, and out of the site area tracing the flow of water downstream until it reaches a flow control exempt receiving water. 2. known or observable water quality problems at the development site or downstream until marine waters are reached
196	The designer should review, and the off-site analysis report should summarize all available basin plans, groundwater management area plans, geotechnical reports, drainage studies, floodplain/floodway FEMA maps, wetlands inventory maps, Critical Areas maps, stream habitat reports, salmon distribution reports, etc. within the study area.	This effort would be greatly assisted in local government was encouraged to maintain an online mapping tool that either contain links to various reports prepared for an area or noted that title and date of such reports. For many jurisdictions, the only method to find such reports is to know the project number and then search applicable online portals. A problem with many drainage studies and habitat reports regarding seasonal streams is that they note a stream as being seasonal and often provide little or no information as to the extent of seasonality. For example, does the stream flow between November and April (allowing ample time for salmon to enter, spawn, and the juveniles to

		outmigrate). Or is it a stream that flow only in response to precipitation events. Or lie somewhere between. The extent of seasonality must be determined as this streams are at great risk from reduced groundwater recharge and climate change. Additionally, as many streams, even type F streams are not mapped, the lack of a stream on a map does not mean a stream is not present.
196	Field inspect the study area	The field inspection should include an assessment: (1) if the proposed discharge points or areas downstream are used by fish for overwintering, high flow refugia, or holding (2) the habitat quality of the downstream reach in terms of habitats that provide overwintering habitat, high flow refugia; and holding areas (3) spring discharges The inspection should also included a determination of the extent to which swales, ditches, and seasonal stream may backwater off larger streams during high flows events and be used fish when wetted. Ideally, the field inspection would occur with a qualified biologist who could provide input as to stream classifications.
196	Describe the drainage system, and its existing and predicted problems	This must include a description of the habitat quality of the receiving waters in terms of wood, pools, substrate size, depth, width, off-channel units, etc. to get an understanding of the habitat complexity that the stormwater will pass through.
196	Upon review of this analysis, the local jurisdiction may require mitigation measures to address the problems, or a quantitative analysis, depending on the presence of existing or predicted flooding, erosion, or water quality problems, and on the proposed	Jurisdictions typically will only require mitigation for a documented impact. Unless one looks for an impact, there is no documentation. To address this issue, add to the end of the sentence: **"or mitigation for the impacts of increase duration of flows adverse to aquatic life.**"

	design of the Stormwater Management BMPs.	
258	The Wetland Hydroperiod Protection is separated into two methods (Methods 1 and 2) that are dependent on the wetland category, and whether the project proponent has legal access to the wetland.	The Manual proposed two methods to determine to collect the information necessary to maintain annual wetland fluctuations in depth and timing as close as possible to the existing hydroperiod. The Manual should provide for a method to determine similar impacts to streams as relates to velocities and duration of velocities; provide for ways to avoid such impacts as such .the following four means listed for Wetland Hydroperiod Protection (page 265): increasing the retention of natural pervious cover; reducing the level of development;(3) reducing the total amount of impervious surfaces; and (4) increasing infiltration using on-site LID techniques; and providing for compensatory mitigation Stream channels deserve no less protection from stormwater impacts than wetlands.
315	WDFW's SalmonScape web site provides a computer mapping system for salmon recovery planners. It provides lifestage and barriers information for mainstems and named tributaries. It will need to be verified and refined by local data and knowledge, especially for smaller or un-named tributaries.	Many errors on it in stream location as well as missing many Type Ns, Np, and smaller Type F. Additionally, it has been observed while reviewing the stormwater analysis and stream habitat surveys conducted for a project that often the two reports differ on the location, nature, and extent of streams onsite. There should be a common understanding of the drainage patterns onsite and downstream. The site analysis must either not be completed until an appropriate stream survey is completed or if completed before the stream survey is completed, review the stream survey for differences from the site analysis.
342	Conduct an off-site analysis if changes in flows could impair or alter conveyance systems, streambanks, bed sediment, or aquatic habitat. See I-3.5.3 APM2:	The additional guidance is most welcome, however, the referenced Section I-3.5.3 APM2 currently, as noted elsewhere in this comment letter, requires to be expanded

	Off-Site Analysis Report for off-site analysis guidelines.	
342	Velocity of water leaving the site should not exceed 3 feet/second, if the discharge is to a stream or ditch.	This exceeds the sustained swimming speeds of juvenile salmonids. Care must be taken that this discharge points are not located in areas where juvenile salmonids congregate to overwinter or avoid high flows.
65	Identify existing drainage patterns including swales, ditches, storm drain pipe systems, etc.	Suggest including identification of those portions of swales, ditches, ephemeral streams that backwater from larger streams during storm events. These area are often used by juvenile salmonids and stream rearing salmonids for high flow refugia when flow conditions in the larger stream are adverse. To the greatest extent possible, stormwater should not be conveyed through these without mitigation such as increasing hydraulic complexity to provide cover from increased flows.
367	The analysis of adjacent properties should focus on areas both upslope and downslope from the construction project. Water bodies that will receive direct runoff from the site are a major concern. Evaluate the types, values, sensitivities of, and risks to downstream resources such as private property, stormwater facilities, public infrastructure, or aquatic systems.	The term "aquatic system" is vague. Given the emphasis in the Manual on preventing erosion, unless directed to look at alterations in water velocity, the potential for direct impacts to aquatic life will not be discussed.
366	Identify critical areas adjacent to or within the site. Critical areas may include flood hazard areas, mine hazard areas, slide hazard areas, sole source aquifers, wetlands, streambanks, fish-bearing streams, and other water bodies.	The listed critical areas should also include those areas within one Site Potential Tree Height of a stream or its channel migration zone, whichever is greater. Since adoption of various codes, there have been changes in the understanding of how wide a buffer should be and if the vegetation near a stream is a "*buffer*" to protect the stream, or is a critical area in its own right. The riparian

		area is now recognized as a critical areas in its own right with the WDFW stating[1] "*The width of the riparian ecosystem is typically defined by the outer edge of the zone of influence, which, in forested regions, is based on site-potential tree height (SPTH) measured from the edge of the active channel*." and "*Protecting functions within at least one 200-year SPTH is a scientifically supported approach if the goal is to protect and maintain full function of the riparian ecosystem.*" Rentz, R., A. Windrope, K. Folkerts, and J. Azerrad. 2020. Riparian Ecosystems, Volume 2: Management Recommendations. Habitat Program, Washington Department of Fish and Wildlife, Olympia.,
368	Adjacent areas: Describe adjacent areas, including streams, lakes, wetlands, residential areas, and roads that the construction project might affect. Describe how upstream drainage areas may affect the site. Provide a description of the upstream drainage leading to the site and the downstream drainage leading from the site to the receiving body of water.	The downstream drainage should be carried through until reaching a flow control exempt receiving water. The description should also include the stream type of both the discharge stream and any streams it joins.
368	Critical areas: Describe areas on or adjacent to the site that are classified as critical areas. Critical areas that receive runoff from the site shall be described up to ¼ mile away.	A ¼ mile distance is insufficient for a stream, the description should be carried through until reaching a flow control exempt receiving waters as mentioned above.
369	Any on-site and adjacent surface waters, critical areas, their buffers, FEMA base flood boundaries, and Shoreline Management boundaries.	There should also be a map tracing the path of water until it reaches a flow control exempt receiving water and the stream type(s) included on the map.

636/637	Flow-related standards are used to determine whether or not a proposed Flow Control BMP will provide a sufficient level of mitigation for the additional runoff from land development. There are three flow-related standards described in this	The following caveat on page 183, should be repeated here: *"The objective of this Minimum Requirement is to prevent increases in the stream channel erosion rates that are characteristic of natural conditions (i.e.,. prior to disturbance by European settlement). The Flow Control Performance Standard intends to maintain the total amount of time that a receiving stream exceeds an erosion-causing threshold based upon historic rainfall and natural land cover conditions. That threshold is assumed to be 50% of the 2-year peak flow. Maintaining the naturally occurring erosion rates within streams is vital, though by itself insufficient, to protect fish habitat and production."*