DEPARTMENT OF ECOLOGY'S JUNE 5, 2008 RESPONSE TO COMMENTS:

BURNT BRIDGE CREEK FECAL COLIFORM BACTERIA, DISSOLVED OXYGEN, AND TEMPERATURE TOTAL MAXIMUM DAILY LOAD QUALITY ASSURANCE PROJECT PLAN (MAY 2008 DRAFT)

1) Carl Addy, AddyLab

2) Greg White, CH2M Hill

3) Dorie Sutton and Doug Wise, City of Vancouver Public Works

4) Jeff Schnabel, Clark County Public Works Department, Clean Water Program

5) Skip Haak, PBS Engineering

6) Dvija Michael Bertish, Rosemere Neighborhood Association

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MEMORANDUM

TO: Carl Addy, AddyLab

FROM: Tonnie Cummings, Water Quality Program, Southwest Region, Water Cleanup/Technical Assistance Unit
Stephanie Brock, Environmental Assessment Program, Western Operations Section, Directed Studies Unit

SUBJECT: Response to comments on the May 2008 draft Burnt Bridge Creek Fecal Coliform Bacteria, Dissolved Oxygen, and Temperature Total Maximum Daily Load Quality Assurance Project Plan

DATE: June 5, 2008

Thank you for reviewing and providing comments on the draft Burnt Bridge Creek Multiparameter Total Maximum Daily Load (TMDL) Quality Assurance Project Plan (QAPP). Your input helped us clarify and refine the sampling plan for the Burnt Bridge Creek TMDL. Our response to each of your comments is provided below. The final QAPP will be published in mid-July, and then it and our memoranda providing response to comments will be posted on Ecology's Burnt Bridge Creek TMDL website (http://www.ecy.wa.gov/programs/wq/tmdl/burnt_bridge/burnt_br-tmdl.html).

It is Ecology's intention to collaborate with stakeholders in order to develop a technically defensible and usable TMDL for Burnt Bridge Creek. Therefore, we will continue open communication with all members of the technical advisory committee throughout the data collection, technical analysis, and modeling phases of this TMDL. If you have any questions, please don't hesitate to contact Tonnie (360-690-4664; tcum461@ecy.wa.gov) or Stephanie (360-407-6498; steb461@ecy.wa.gov).

Comment 1: Page 13, "Vancouver's drinking water is from a sole source aquifer (EPA, 2006) below the Burnt Bridge Creek surface watershed."
Response 1: Thank you for the clarification. Ecology added the following language, "Furthermore, the City of Vancouver drinking water is supplied by the Troutdale and Sandy River Mudstone aquifers. The Troutdale aquifer underlies the Burnt Bridge Creek

watershed and was designated as a sole source aquifer in 2006 (City of Vancouver, 2006 and EPA, 2006)."

Comment 2: Page 16, "The fecal coliform criteria are set at levels that are shown to maintain low rates of serious intestinal illness (gastroenteritis) in people. Do you have a reference for this? My understanding is that there is no correlation between fecal coliform levels and swimming related illness and E. coli levels have a near perfect correlation in fresh water swim beaches (Dufour, 1986)."
Response 2: In 2003, Ecology published the *Final Environmental Impact Statement – Washington State's Changes to the Surface Water Quality Standards* (http://www.ecy.wa.gov/programs/wq/swqs/2003_rule_rev_docs/final-eis.pdf). The document outlines proposed alternatives to the bacteria standards, including continuing to use the current fecal coliform criteria. The following excerpt from the Final Environmental Impact Statement suggests that fecal coliform is an adequate bacterial indicator, "The existing water quality standards use fecal coliform. In EPA's studies, they found no statistical relationship between the fecal coliform concentration in the water and illness rates of swimmers. However, fecal coliform is a more sensitive indicator than *E. coli*. Fecal coliform is a group of bacteria made up of *E. coli* and other organisms. Therefore, the concentration of fecal coliform would always be equal to or higher than the concentration of *E. coli*. As described earlier in the section, the correlation between *E. coli* and fecal coliform in Washington is quite high. Based on an ecology study, *E.coli* makes up typically between 90-99% of the measured fecal coliforms."

The detailed analysis of bacteria issues in the water quality standards is available in Ecology's *Setting Standards for the Bacteriological Quality of Washington's Surface Water – Draft Discussion Paper and Literature Summary* (Department of Ecology publication number 00-10- 072). This document is available for download at http://www.ecy.wa.gov/pubs/0010072.pdf. The study compiled and analyzed bacteria data from studies conducted around the world to determine the appropriate bacterial indicator for the surface water quality standards. The document says, "The technical work-group found little reason to conclude that any one indicator bacteria was sufficiently superior in all respects to justify their absolute support. The work-group could support the use of fecal coliform at concentrations below 100/100mL, or *E. coli* and enterococci at or below the EPA recommended levels of 126/100mL and 33-35/100mL. It is believed any of these criteria would be adequately protective of swimming in both fresh and marine waters."

Comment 3: Page 16, "Microbial Source Tracking study showed the existence of human sources of E. coli along with animal sources. Last paragraph on page 16 is not correct."
Response 3: The last paragraph does not refer specifically to the Burnt Bridge Creek watershed, but is written to outline the water quality criteria for bacteria in the state of Washington. We left this paragraph in the QAPP as written but added the following language regarding the Microbial Source Tracking study to the City of Vancouver section under the Historical Data Review, "The City of Vancouver and Southwest Washington Health District contracted Mansour Samadpour to conduct a Microbial Source Tracking

Study on Burnt Bridge Creek in 1999. The Draft report identifies human, pets, dogs and cats, migratory birds, urban wildlife, and livestock as the major sources of microbial pollution in Burnt Bridge Creek. Additionally, the report recommends:

- Reducing the number of septic systems in the watershed,
- Pet owner education on proper waste disposal,
- Discouraging the formation of resident bird populations of migratory birds,
- Population control of urban wildlife,
- Livestock managed under best management practices,
- Tree planting along the streambeds to reduce elevated stream temperatures (Samadpour, et. al., 1999)."

Comment 4: Page 23, "The SEH America "reverse osmosis reject water…and filter backwash water" from the wells at the site contains large amounts of nitrates concentrated from the well water."

Response 4: Thank you for that information. Ecology is currently working with SEH to gain access to their outfall to sample the nutrients, temperature, and bacteria. Also, Ecology will attempt to gain access to wells within the watershed to sample groundwater quality during the TMDL study.

Comment 5: Page 28, "Is it possible to see the data of fecal coliform tests in this graph?"

Response 5: The graph was generated from data collected by the City of Vancouver. We suggest you contact Dorie Sutton, City of Vancouver Public Works, for a copy of the data.

Comment 6: Page 33, Trend Analysis. "Is it possible to see the fecal coliform data used in this trend analysis?"

Response 6: The following graphs represent the trend analysis for the fecal coliform data collected at Alki Road between 1998–2007 by both the Department of Ecology and the City of Vancouver. Figures 1–3 show the fecal coliform trend for the entire data set, the dry season (June – October) and the wet season (November – May), respectively. The analysis found no significant trend over time. These fecal coliform graphs were not included in the draft QAPP because we only included data which showed significant trends.

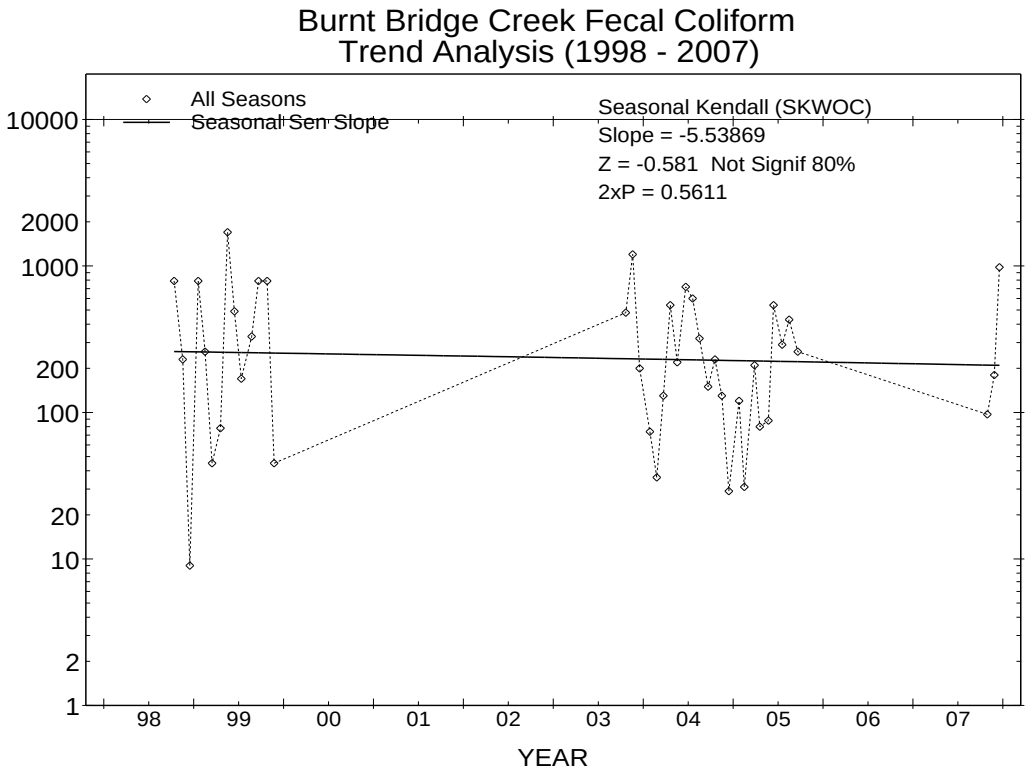

Figure 1. Fecal coliform trend analysis for the entire data set collected between 1998–2007 at the Alki Road site.

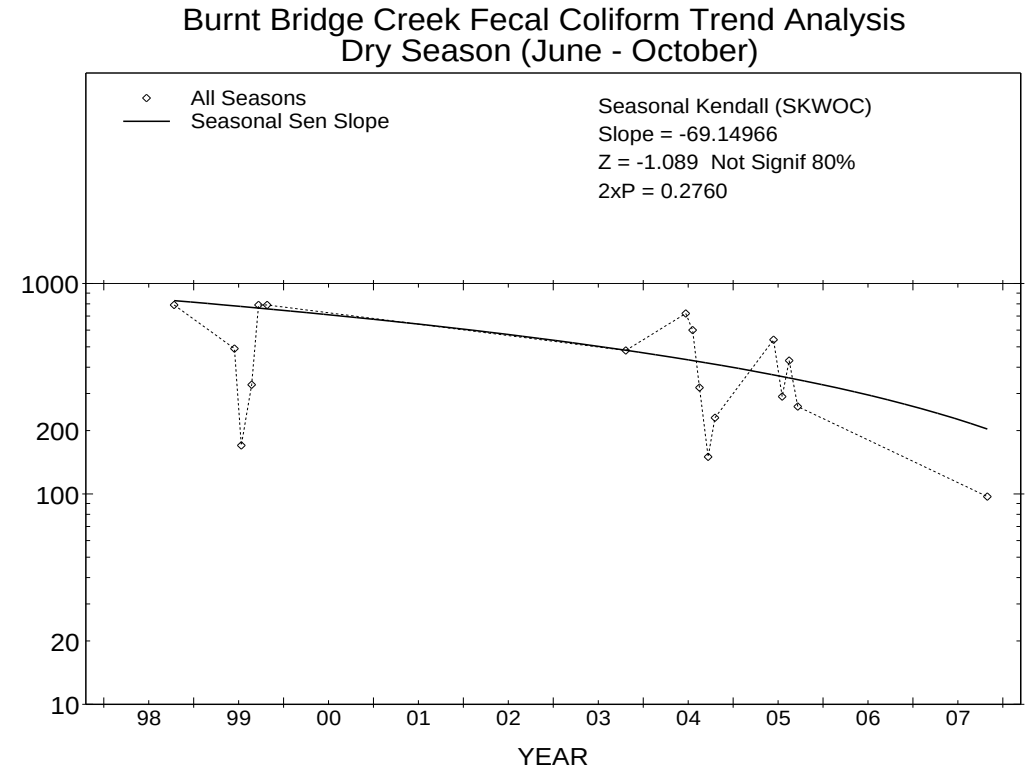

Figure 2. Fecal coliform trend analysis for dry season (June – October) data collected between 1998–2007 at the Alki Road site.

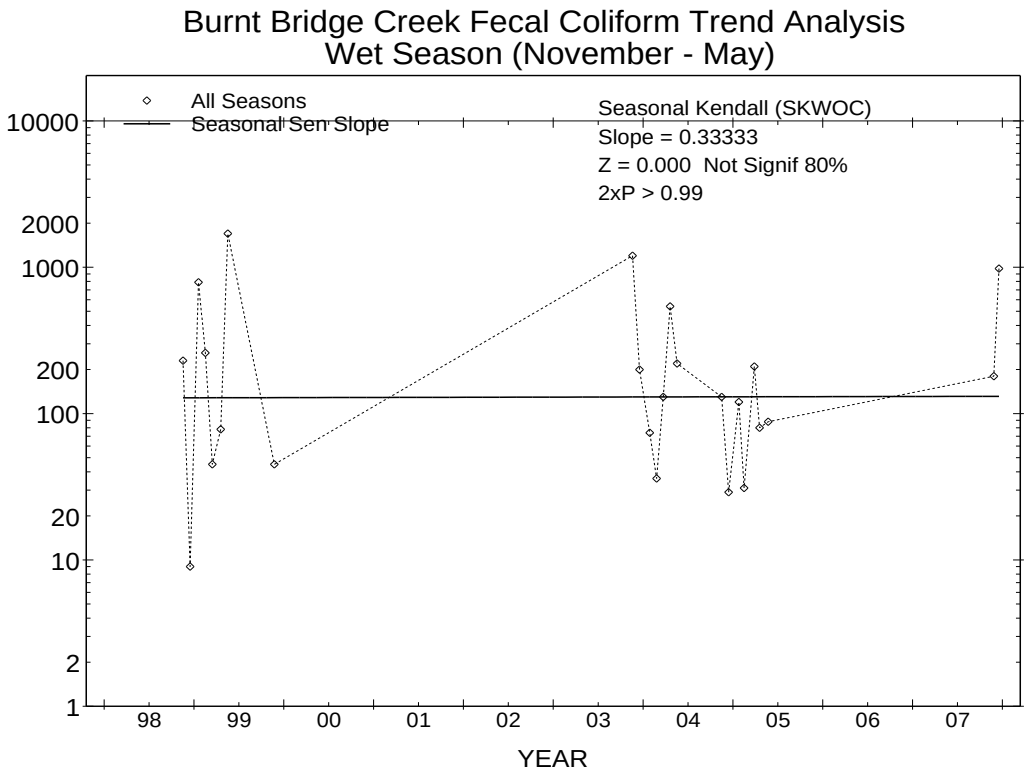

Figure 3. Fecal coliform trend analysis for wet season (November – May) data collected between 1998–2007 at the Alki Road site.

Comment 7: Page 36, "What is the significance of a BOD model? BOD is not being tested?? Does the peat soil put a BOD load on the stretch of BBC from Burton Road to 18th Street?"

Response 7: Biological oxygen demand (BOD) is not being sampled as part of this study; however, we are sampling other portions of the biochemical cycle to account for BOD in the river. Based on your comments, we changed the language in the QAPP to read, "Develop a model to simulate biochemical processes and productivity in Burnt Bridge Creek. Using critical conditions in the model, determine the capacity to assimilate BOD and nutrients. Nutrient data may be used to assist the Vancouver Lake Watershed Partnership in determining nitrogen and phosphorus loads to the lake."

To address sediment oxygen demand generated from the peat soils, we added the following survey to the Dissolved Oxygen and Synoptic Survey Section under Study Design, "Sediment Oxygen Demand will be characterized by installing sediment flux chambers in 4 representative reaches along the creek during the synoptic surveys (Roberts, 2007). The benthic chambers will remain in place for at least 24-hours. Once deployed, grab samples will be taken for Winkler titration of dissolved oxygen at dawn and dusk." The SOP is available for download at http://www.ecy.wa.gov/programs/eap/qa/docs/ECY_EAP_SOP_036BenthicFluxChambers.pdf.

Comment 8: Page 39, "Storm sampling locations should include 33rd and Drummond,"U" Street, St. Johns SD (from north), Nicholson Rd drainage, Linda Lane SD system discharge to BBC, Thunderbird Village pond discharge."
Response 8: Thank you for the suggested sampling sites. Ecology will consider these locations when choosing our representative outfalls for storm sampling events.

Comment 9: Page 40, "Reach specific fecal coliform concentration should include some indication of regrowth in the summer. Since bacterial concentrations double with each 10 degree increase in temperature, shouldn't regrowth be considered?"
Response 9: Bacterial die-off and regrowth will not be addressed in this TMDL study nor is it deemed necessary. Although bacteria can be modeled along the stream using a net growth/die-off factor, this level of intensive modeling will not be done. The TMDL approach will be the "roll-back" method. If exceedence of the fecal coliform water quality standard occurs at any station, a percent reduction will be assigned for that station signifying how much bacteria concentration needs to be "rolled-back" (i.e. reduced, through source control best management practices) to achieve water quality standards.

The doubling of bacteria populations for every 10 degree increase in temperature occurs under ideal laboratory conditions where nutrients are not limiting and die-off due to sunlight exposure is absent. In addition, regrowth occurs within a certain temperature range, beyond which die-off is initiated. The regrowth, if any, is also time dependent. We suspect the time of travel in a small stream like Burnt Bridge Creek is too short for any regrowth within the water column to be significant. However, our fecal coliform monitoring will provide stream-longitudinal profiles of bacteria concentrations at each station. These profiles will reflect the net contributions in each reach and any regrowth and die-off that may occur between stations.

Comment 10: Page 52, "Holding Time for fecal coliform. Standard Methods 9222E provides a delayed-incubation Fecal Coliform procedure to extend the holding time, since 8 hour holding time can't be achieved."
Response 10: Thank you for the information. Ecology is able to achieve the 24 hour holding times; therefore, we will continue to use the method established for this QAPP. Additionally, "…To identify any problems with holding times, two comparison studies were conducted during the Yakima Area Creeks' TMDL (Mathieu, 2005b). A total of twenty fecal coliform samples were collected in 500 mL bottles and each split into two 250 mL bottles. The samples were driven to MEL [Manchester Environmental Laboratory] within 6 hours. One set of the split samples was analyzed upon delivery. The other set was stored overnight and analyzed the next day. Both sets were analyzed using the membrane filter (MF) method. Replicates were compared to the Measurement Procedures in Table 14.

The combined precision results between the different holding times yielded a mean RSD [relative standard deviation] of 19%. This is comparable to the 23% mean RSD between field replicates for twelve Environmental Assessment (EA) Program TMDL studies using the membrane filter method, suggesting that a longer (i.e., 24-hour) holding time has little

effect on fecal coliform results processed by MEL. Samples with longer holding times did not show a significant tendency towards higher or lower FC counts compared to the samples analyzed within 6-8 hours."

Cc: James Kardouni, Kirk Sinclair, George Onwumere, Kim McKee

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MEMORANDUM

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Stephanie Brock, Environmental Assessment Program, Western Operations Section, Directed Studies Unit

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DATE: June 5, 2008

Thank you for reviewing and providing comments on the draft Burnt Bridge Creek Multiparameter Total Maximum Daily Load (TMDL) Quality Assurance Project Plan (QAPP). Your input helped us clarify and refine the sampling plan for the Burnt Bridge Creek TMDL. Our response to each of your comments is provided below. We realize that CH2M Hill has been hired to represent SEH America's interests on the Technical Advisory Committee, and that SEH America's concerns relate primarily to the temperature component of the TMDL and the effect temperature could have on dissolved oxygen (DO) and pH impairments. Nevertheless, because the fecal coliform component of the TMDL includes sampling at SEH America's outfall, our responses below also address that parameter. The final QAPP will be published in mid-July, and then it and our memoranda providing response to comments will be posted on Ecology's Burnt Bridge Creek TMDL website (http://www.ecy.wa.gov/programs/wq/tmdl/burnt_bridge/burnt_br-tmdl.html).

It is Ecology's intention to collaborate with stakeholders in order to develop a technically defensible and usable TMDL for Burnt Bridge Creek. Therefore, we will continue open communication with all members of the technical advisory committee throughout the data collection, technical analysis, and modeling phases of this TMDL. If you have any questions, please don't hesitate to contact Tonnie (360-690-4664; tcum461@ecy.wa.gov) or Stephanie (360-407-6498; steb461@ecy.wa.gov).

Comment 1: "Overall our observation is that the QAPP generally does a thorough job of defining the kinds of field studies that will be conducted, and the QA/QC procedures that will be followed for the associated field studies and sampling. These field studies, as far as they go, are comprehensive."
Response 1: Thank you.

Comment 2: "It is not possible to fully evaluate if the studies being proposed will provide all of the necessary information [regarding how the data ultimately will be used in the TMDL allocations]."
Response 2: As stated in the QAPP, Ecology intends to model stream temperature, DO, and pH with the QUAL2Kw model. Table 1 (attached below) shows the data required for the Shade and QUAL2Kw temperature module. Refer to Table 18 in the QAPP for a listing of the variables required for the DO and pH modules of QUAL2Kw. The Burnt Bridge Creek study has been designed to collect the bulk of the required data for model input using a combination of fixed sampling sites and synoptic surveys. Remaining parameters will be addressed with existing electronic sources of data, such as LiDAR or digital elevation models. Ecology has completed dozens of TMDLs throughout the state which have been accepted and approved by the U.S. Environmental Protection Agency (EPA). Therefore, we are confident that the proposed data collection in Burnt Bridge Creek will be sufficient to establish load allocations.

Comment 3: "There is not enough discussion in the QAPP to understand how natural conditions will be defined and quantified."
Response 3: The TMDL is based on system potential temperature, which is considered to be an approximation of the temperatures that would occur under natural conditions. Typically, the natural condition of temperature is calculated using the QUAL2Kw model to predict temperatures under system potential vegetation and channel conditions, and microclimate improvements. A discussion of how system potential vegetation is estimated can be found under the response to Comment 11.

Natural conditions for dissolved oxygen will be determined in a similar manner, using modeling. One potential cause of dissolved oxygen and pH violations is excessive nutrient loading to a creek. Nutrients stimulate excessive plant growth in the creek. This problem is exacerbated by high stream temperatures and too much sunlight. Growth of excess aquatic plants uses oxygen for respiration at night and can raise the pH of the water during photosynthesis during the day. Controlling the excessive growth is key to meeting pH and dissolved oxygen criteria and improving the health of the aquatic community. Nutrient loading processes and their impacts on pH and DO will be evaluated with the QUAL2Kw model to determine the system potential pH and DO for Burnt Bridge Creek.

As described in the QAPP, fecal coliform allocations will be calculated with the statistical roll-back method. As noted, Burnt Bridge Creek is a highly urbanized stream system. The goal of the fecal coliform portion of the TMDL is to bracket sources of fecal coliform in order to determine pollution sources and select best management practices to

bring the stream into compliance with water quality standards. Ecology changed the language in the Water Quality Standards and Beneficial Uses section of the QAPP to read, "Once the concentration of fecal coliform in the water reaches the numeric criterion, human activities that would increase the concentration above the criteria are not allowed. If the criterion is exceeded, the state will require that all known and reasonable technologies and targeted best management practices be implemented to reduce human impacts and bring fecal coliform concentrations into compliance with the standard."

Comment 4: "The QAPP does not specify if the major tributaries will be modeled or only serve as inputs to a model set up exclusively for the mainstem creek."
Response 4: The original Burnt Bridge Creek TMDL study plan only included modeling the mainstem. Typically, tributaries are included as point source inputs to the mainstem model. However, after considering SEH America's interest in Peterson Channel, we modified the study plan to include collection of data that would be needed to model the Channel, should that become necessary.

Comment 5: "The QUAL2Kw model does not have the capability to model branching stream networks such as in the Burnt Bridge Creek system. Therefore, is the QUAL2Kw model the most appropriate model to use for development of this TMDL?"
Response 5: See response to Comment 4. You are correct that QUAL2Kw can not model branching stream networks. Based on information collected prior to preparing the QAPP, Ecology believes that it is not necessary to model the system as a branching system. However, if during the modeling phase it becomes evident that Peterson Channel needs to be modeled, we will have collected the data necessary to perform this task.

Comment 6: "Why are the QUAL2Kw and GEMMS models the only models being considered for the temperature TMDL?"
Response 6: Discussing GEMMS in the draft QAPP was an oversight on Ecology's part; it should not have been included as a model we are considering for this basin. At this time, Ecology intends to use QUAL2Kw to model temperature, dissolved oxygen, and pH for Burnt Bridge Creek. As mentioned above, QUAL2Kw is an EPA-approved model, which Ecology has used to complete a variety of TMDL projects statewide. QUAL2Kw is the preferred model from a cost-effective and efficiency standpoint because of its capability to model temperature as well as the biochemical processes that impact dissolved oxygen and pH. If the results of our data collection indicate that a different model would be more appropriate for this system, we will evaluate other models, discuss the issue with stakeholders, and use the model that is most applicable to Burnt Bridge Creek.

Comment 7: "Modeling will be needed to determine effects of natural wetland areas in the upper watershed of Burnt Bridge Creek in order to determine natural conditions (or the system potential) with respect to instream temperature. How will this be accounted for?"
Response 7: QUAL2Kw is capable of running different management scenarios to assess their impacts on stream temperatures. After a calibrated and verified model is

developed, we will consult with the Technical Advisory Committee regarding the management scenarios that should be modeled.

Comment 8: "Because the temperature criterion is based on the highest annual running 7-day average of daily maximum temperatures, it seems that a model with at least a 7-day run capability is needed."
Response 8: QUAL2Kw has that capability. The model is run for the warmest 7-day average daily maximum temperatures by determining the period in the summer when this condition occurs. All of the instream temperature data and meteorological data is averaged hourly over this 7-day period to calculate the model inputs.

Comment 9: "Will multiple models be set up and run separately (e.g., separate model for Peterson Channel so that Peterson Channel flow can be modeled) to provide the necessary input to the model?"
Response 9: See response to Comment 5.

Comment 10: "It is critical that Peterson Channel and other significant tributaries (including Burton Channel and Cold Creek) be explicitly modeled."
Response 10: See response to Comment 4 and 5.

Comment 11: "The method for developing system potential riparian shade is not described in the QAPP. Will a soils-based approach that links soil type to typical natural vegetation in the Burnt Bridge Creek basin be used? Or will some more arbitrary specific value for effective shade be developed? If so, how, and how will that vary at different locations in the watershed as soil types differ throughout the watershed? The entire portion of the Burnt Bridge Creek mainstem upstream of SEH America and the Peterson Channel confluence with Burnt Bridge Creek was a series of large wetlands."
Response 11: The type, height, and density of system potential vegetation (at mature stages) will be determined based on existing GIS coverages and historical information compiled regarding the basin. The following resources will be utilized for development of system potential vegetation:

- Washington State Department of Natural Resources (DNR) soils coverage (http://www3.wadnr.gov/dnrapp6/dataweb/dmmatrix.html#Soils) provides digitized soil delineations and soil attributes. Site index data – a designation of the quality of a forest site based on the height of the dominant and co-dominant tallest trees in a stand – is one of the polygon attributes in the DNR soils coverage. Western Washington site conditions are estimated by using an index age of 50 years. The site index height is the average height attained by the tallest trees in a fully stocked stand at the applicable index age.
- The Natural Resources Conservation Service (NRCS) SSURGO soil layers consist of digital soil survey data and a related Access database file that provides information on vegetation characteristics for given soil types.
- Interior Columbia Basin Ecosystem Management Project (www.icbemp.gov) describes potential vegetation types based on warm/dry to cool/moist environments.

Comment 12: "If Peterson Channel will not be modeled, how will the natural temperature and Dissolved Oxygen (DO) and other constituents in the model inputs to Burnt Bridge Creek be determined for this tributary and other significant tributaries? Again, it seems imperative that Peterson Channel, Burton Channel, and Cold Creek be explicitly modeled."
Response 12: Ecology is able to run different flow and water quality scenarios as tributary inputs to the calibrated Burnt Bridge Creek model. A common scenario is to set the water quality for each tributary equal to the water quality criteria to determine the impacts on the water quality of the mainstem system. However, if at the time of modeling, it is determined that Peterson Channel needs to be modeled; this issue will be a discussed with stakeholders.

Comment 13: "The method for estimating the natural flow regime has not been defined in the QAPP."
Response 13: Determining the natural flow regime of Burnt Bridge Creek is outside of the authority of the Clean Water Act. Establishing instream flows for the basin falls under different legislation and is not part of the TMDL process. However, as part of the TMDL modeling, different flow scenarios can be evaluated to determine their impacts on instream temperature and other parameters. It is important to note that because of the legislative limitations, these different flow scenarios can not be used to develop load allocations for the basin.

Comment 14: "The QAPP acknowledges the importance of the SEH America discharge flow into Peterson Channel during low flow periods. Will this flow be deleted for modeling natural conditions?"
Response 14: See response to Comment 4.

Comment 15: "The QAPP does not identify how diversions will be adjusted to estimate natural hydrology."
Response 15: See response to Comment 13.

Comment 16: "The QAPP does not address how natural groundwater flows will be quantified."
Response 16: See response to Comment 13.

Comment 17: "Is there an existing groundwater model of the area that will be used to estimate groundwater/surface interactions in the absence of groundwater pumping? If not, how will natural baseflows in the system be estimated?"
Response 17: To reiterate, determining the natural flow regime of Burnt Bridge Creek is outside of the authority of the Clean Water Act. Establishing instream flows or the natural flow regime for the basin falls under different legislation and is not part of the TMDL process. The interaction between groundwater and surface water is simulated in the QUAL2Kw model. Groundwater flow inputs and water quality data are input as diffuse sources to the model. The interaction between surface water and hyporheic water is also simulated in the model. Different groundwater flow scenarios can be evaluated to determine their impacts on instream temperature. However, because of the legislative

limitations, these different flow scenarios can not be used to develop load allocations for the basin.

Comment 18: "The QAPP does not discuss if an attempt will be made to evaluate what a more natural morphology of the Burnt Bridge Creek channel would be considering the urbanization of this watershed over the past 150 years."
Response 18: Different morphologic channel scenarios can be run once a calibrated/verified model has been developed. Typically, Ecology uses historic information to determine which channel scenarios to model. If this information is unavailable, the channel width:depth ratio is decreased by varying percentages to evaluate the impact on the instream temperatures. These possible scenarios will be discussed with the Technical Advisory Committee during the modeling phase of the TMDL.

Comment 19: "It is possible that the study may determine that the DO criteria cannot be met under natural conditions. Therefore, one additional aspect of a natural conditions determination pertains to background concentrations of parameters that affect DO, such as nutrients, organic matter (e.g., biological oxygen demand [BOD], total organic carbon [TOC], etc), ammonia, and sediment oxygen demand (SOD)."
Response 19: If the evaluation determines that natural conditions are of lower quality than the criteria assigned, then the natural condition shall constitute the water quality criteria. Ecology will determine the natural condition of the Burnt Bridge Creek through site investigation, modeling, and historic data available. See response to Comment 3.

Comment 20: "The QAPP does not identify which surface water monitoring location(s), if any, would be used to develop natural background concentrations, or if groundwater monitoring would be used, in which case the well locations need to be identified."
Response 20: During the study, we will monitor water quality of shallow (piezometer) and deep wells. The QAPP did not specifically identify the deep wells to be monitored as that has not yet been determined. Ecology will solicit suggestions from the Technical Advisory Committee regarding deep wells to sample during our synoptic surveys in July and September.

Comment 21: "Reaeration is strongly influenced by flow and morphological characteristics of the stream, thus reaeration will be different under natural conditions than at current conditions. This will need to be accounted for in the selection of the reaeration approach to modeling."
Response 21: The QUAL2Kw has a variety of options available for calculating the reaeration rate. See QUAL2Kw Theory and Documentation for more information (available for download at http://www.ecy.wa.gov/programs/eap/models.html). We will determine the applicable method for Burnt Bridge Creek during the modeling phase based on a review of the morphologic, meteorological, and water quality data collected in the field

Comment 22: "The tables and the QAPP in general do not identify any direct measurement of reaeration in the field studies."

Response 22: See response to Comment 21.

Comment 23: "The QAPP does not identify any analyses that will be done for BOD (only dissolved organic carbon and TOC)."
Response 23: Burnt Bridge Creek experiences its low dissolved oxygen problems during summer low-flow conditions. The only point source input to the system during this time is SEH America (which only contributes a thermal load); therefore, Ecology should be able to characterize BOD in the model by collecting data on TOC, DOC, Chlorophyll-a, and nutrients. We are going to attempt to monitor one summer storm event for the suite of nutrients, TOC, DOC, TSS, and bacteria to determine the impacts of a summer storm on DO.

Comment 24: "The lack of BOD data appears to be a major data gap."
Response 24: See response to Comment 23.

Comment 25: "The QAPP tables do not identify any analyses that will be conducted for sediment oxygen demand modeling. Having the correct field data for SOD is critical and must be addressed in the QAPP."
Response 25: Ecology will collect SOD data for the model. The following survey was added to the study and is described in the Dissolved Oxygen and Synoptic Survey Section under Study Design, "Sediment Oxygen Demand will be characterized by installing sediment flux chambers in 4 representative reaches along the creek during the synoptic surveys (Roberts, 2007). The benthic chambers will remain in place for at least 24-hours. Once deployed, grab samples will be taken for Winkler titration of dissolved oxygen at dawn and dusk." The SOP is available at http://www.ecy.wa.gov/programs/eap/qa/docs/ECY_EAP_SOP_036BenthicFluxChambers.pdf.

Comment 26: "Will a simple zero-order SOD modeling approach be used, or the more sophisticated diagenesis modeling capability of the QUAL2Kw model?"
Response 26: Sediment oxygen demand is modeled using diagenesis. See QUAL2Kw Theory and Documentation for more information (available for download at http://www.ecy.wa.gov/programs/eap/models.html).

Attachment

Table 1. Model data requirements and collection source.

		MODEL		
	PARAMETER	**Effective shade**	**Qual2K**	**field data collection**
Flow	discharge - tributary		x	x
	discharge (upstream & downstream)		x	x
	flow regression constants		x	x
	flow velocity		x	x
	groundwater inflow rate/discharge		x	x
	travel time		x	x
General	calendar day/date	x	x	All Data Collected Primarly from USGS or GIS Maps
	duration of simulation	x	x	
	elevation - downstrean	x	x	
	elevation - upstream	x	x	
	elevation/altitude	x	x	
	latitude	x	x	
	longitude	x	x	
	time zone	x		
Physical	channel azimuth/stream aspect	x		
	cross-sectional area	x	x	x
	Manning's n value	x	x	x
	percent bedrock	x	x	x
	reach length	x	x	x
	stream bank slope	x		x
	stream bed slope	x	x	Collect from GIS Maps
	width - bankfull	x		x
	width - stream	x	x	x
Temperature	temperature - ground		x	x
	temperature - groundwater		x	x
	temperature - water downstream		x	x
	temperatures - water upstream		x	x
	temperature - air		x	x
	thermal gradient		x	
Vegetation	% forest cover on each side	x		x
	canopy-shading coefficient/veg density	x		x
	diameter of shade-tree crowns	x		x
	distance to shading vegetation	x		x
	topographic shade angle	x		x
	vegetation height	x		x
	vegetation shade angle	x		x
	vegetation width	x		x
Weather	relative humidity		x	Weather Staion/RH meters
	% possible sun/cloud cover		x	Weather Station
	solar radiation		x	Weather Station
	temperature - air		x	field check/weather station
	wind speed/velocity		x	Weather Station

Cc: James Kardouni, Kirk Sinclair, George Onwumere, Kim McKee
Bob Schaefer (SEH America) Annette Griffy, Dorie Sutton, Doug Wise, Victor Ehrlich (City of Vancouver Public Works)

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MEMORANDUM

TO: Dorie Sutton and Doug Wise, City of Vancouver Public Works

FROM: Tonnie Cummings, Water Quality Program, Southwest Region, Water Cleanup/Technical Assistance Unit
Stephanie Brock, Environmental Assessment Program, Western Operations Section, Directed Studies Unit

SUBJECT: Response to comments on the May 2008 draft Burnt Bridge Creek Fecal Coliform Bacteria, Dissolved Oxygen, and Temperature Total Maximum Daily Load Quality Assurance Project Plan

DATE: June 5, 2008

Thank you for reviewing and providing comments on the draft Burnt Bridge Creek Multiparameter Total Maximum Daily Load (TMDL) Quality Assurance Project Plan (QAPP). Your input helped us clarify and refine the sampling plan for the Burnt Bridge Creek TMDL. Our response to each of your comments is provided below. The final QAPP will be published in mid-July, and then it and our memoranda providing response to comments will be posted on Ecology's Burnt Bridge Creek TMDL website (http://www.ecy.wa.gov/programs/wq/tmdl/burnt_bridge/burnt_br-tmdl.html).

It is Ecology's intention to collaborate with stakeholders in order to develop a technically defensible and usable TMDL for Burnt Bridge Creek. Therefore, we will continue open communication with all members of the technical advisory committee throughout the data collection, technical analysis, and modeling phases of this TMDL. If you have any questions, please don't hesitate to contact Tonnie (360-690-4664; tcum461@ecy.wa.gov) or Stephanie (360-407-6498; steb461@ecy.wa.gov).

Comment 1: **Page 11, Overview, first paragraph:**
"Ecology is conducting a multiple parameter TMDL study on Burnt Bridge Creek because there are several reaches violating water quality standards. The parameters addressed in this study include temperature, dissolved oxygen, and fecal coliform bacteria."

"The use of the term "violate" implies a specific illegal act, or acts, have taken place and that enforcement action may be taken as a result of the data. As this data is a description of the conditions of the Creek and not an indictment of a particular party, or parties, for causing the conditions, the City feels it would be more precise to re-phrase this as *reaches not meeting water quality standards.*"
Response 1: We changed the phrase as suggested.

Comment 2: **Page 11, Study area:**
"The TMDL study area consists of the mainstem Burnt Bridge Creek watershed, all tributaries, and major stormwater inputs. Burnt Bridge Creek is located within Water Resource Inventory Area (WRIA) 28. The stream flows through the city of Vancouver in southwestern Washington (Figure 1)."

"It is important to note that the Burnt Bridge Creek watershed expands beyond Vancouver city limits and portions of the creek and tributaries are also outside city limits. It would be more accurate to state:
The stream flows through the city of Vancouver *and portions of unincorporated Clark County* in southwestern Washington."
Response 2: We changed the language as suggested.

Comment 3: **Page 13, first paragraph:**
"A presence/absence study of salmonids, performed in 2002-2003, found "…a few adult-sized trout, one possible adult salmon and less than a dozen juvenile trout and salmon combined…..The salmonids found in the creek were near pools and riffles and had good canopy cover (Ehlke, 2003)." The existing greenway project, stormwater management, and domestic septic reconstruction along Burnt Bridge Creek demonstrate the importance of wildlife habitat, aesthetics, and recreation. Furthermore, a portion of Vancouver's drinking water is acquired from aquifers below the Burnt Bridge Creek surface watershed (City of Vancouver, 2006)."

"The term "domestic septic reconstruction" could be interpreted as septic tank repair rather than the construction of sewer service lines to minimize or eliminate the use of septic tanks in the city. The City would propose a change such as:

The City of Vancouver's watershed wide management strategy to improve water quality in the Burnt Bridge Creek watershed includes an extensive greenway improvement and riparian restoration project, a targeted sewer construction and connection incentive program, enhanced stormwater treatment facilities, and an urban forestry plan designed to increase overall tree canopy cover to maximize benefits for wildlife habitat, aesthetics, and recreation. Furthermore, a portion of Vancouver's drinking water aquifers underlies the Burnt Bridge Creek watershed (City of Vancouver, 2006). The creek itself is not a known source of drinking water."
Response 3: We changed the language as suggested.

Comment 4: **Page 14, Table 2:**

pH	7833	02N	01E	38
	7834	02N	02E	60

"Listing 7834 is designated as a Category 2 in both the 2004 and draft 2008 303(d) list, it may not need to be included with in this table with the Category 5 listings."
Response 4: Thank you for noting that we had the wrong listing in the table. We changed the Listing ID to 7859 and the TRS to 02N – 02E – 66.

Comment 5: **Page 15, third paragraph:**
"The Burnt Bridge Creek watershed is listed on the 2004 303(d) list as impaired for temperature, dissolved oxygen, and fecal coliform bacteria. The applicable water quality criteria for these parameters are summarized in Table 3. pH criterion is included in the table because the draft 2008 303(d) list indicates potential pH exceedances. However, the pH listings will more than likely be excluded from the 2008 list based on recent evidence of supporting data not passing QA analysis."

"Will the 2008 303(d) list be finalized before the QAPP? Is it possible to state what the 2008 listing will actually show for pH? The City would propose a change such as:

pH has been listed as a parameter of concern in previous state water quality assessments. In recent water quality monitoring, pH sampling did show some minor excursions but did not support additional 303(d) listing as the data did not pass QA analysis. Implementation of best management practices to improve temperature, dissolved oxygen and fecal coliform bacteria is expected to have beneficial (stabilizing ?) impacts on pH as well."
Response 5: The comment period for the current assessment ended on April 30, 2008 and the list is still considered a draft. Ecology changed the paragraph in the QAPP as follows, "The Burnt Bridge Creek watershed is listed on the 2004 303(d) list as impaired for temperature, dissolved oxygen, and fecal coliform bacteria. The applicable water quality criteria for these parameters are summarized in Table 3. pH criterion is included in the table because pH has been listed as a parameter of concern in previous state water quality assessments and recent water quality monitoring did show some minor pH excursions. However, the pH listings will more than likely be excluded from the 2008 list based on recent evidence of supporting data not passing QA analysis."

Comment 6: **Page 16, paragraph 1:**
"….The fecal coliform criteria are set at levels that are shown to maintain low rates of serious intestinal illness (gastroenteritis) in people."

"This language implies that the fecal coliform criteria are not, in fact, protective as a certain number of illnesses per capita are acceptable. The City proposes the following change:

…result in low risk…"

Response 6: This language comes directly from Ecology documents supporting the water quality criteria for fecal coliform; therefore, we left the language as written.

Comment 7: **Page 16, third and fourth paragraphs:**
"….These two measures used in combination ensure that bacterial pollution in a waterbody will be maintained at levels that will not cause a greater risk to human health than intended. While some discretion exists for selecting sample-averaging periods, compliance will be evaluated for both monthly (if five or more samples exist) and seasonal (summer versus winter) data sets.

The criteria for fecal coliform are based on allowing no more than the pre-determined risk of illness to humans that work or recreate in a waterbody. Once the concentration of fecal coliform in the water reaches the numeric criterion, human activities that would increase the concentration above the criteria are not allowed. If the criterion is exceeded, the state will require that human activities be conducted in a manner that will bring fecal coliform concentrations back into compliance with the standard."

"The first sentence in paragraph four is actually explained more clearly in the preceding paragraph so it might not need to be restated in this paragraph. In the last sentence "require that human activities be conducted in a manner that will bring ..." is confusing. To be more precise, the City would propose a change such as:

Once the concentration of fecal coliform in the water reaches the numeric criterion, human activities that would increase the concentration above the criteria are not allowed. If the criterion is exceeded, the state will require that targeted BMPs be implemented to reduce human impacts and bring fecal coliform concentrations into compliance with the standard."

Response 7: We changed the language to read, "Once the concentration of fecal coliform in the water reaches the numeric criterion, human activities that would increase the concentration above the criteria are not allowed. If the criterion is exceeded, the state will require that all known and reasonable technologies and targeted best management practices be implemented to reduce human impacts and bring fecal coliform concentrations into compliance with the standard."

Comment 8: **Page 17, paragraph six:**
'While the numeric criteria generally apply……. For similar reasons, ~~take~~ samples should not be taken from anomalously oxygen rich areas…..'

"Remove extra word."

Response 8: We removed the extra word.

Comment 9: **Page 18, paragraph six:**
"Special consideration is also required to protect spawning and incubation of salmonid species. Where Ecology determines the temperature criteria established for a waterbody would likely not result in protective spawning and incubation temperatures, the following criteria apply: A) Maximum 7-DADMax temperatures of 9°C (48.2°F) at the initiation of spawning and at fry emergence for char; and B) Maximum 7-DADMax temperatures of

13°C (55.4°F) at the initiation of spawning for salmon and at fry emergence for salmon and trout"…..

"While this is informative as it relates to the TMDL program and water quality criteria in general, these criteria do not apply to Burnt Bridge Creek according to its designation by DOE in publication 06-10-038. For the sake of clarity, the City would propose the addition of the following sentence at the end of paragraph six:

Burnt Bridge Creek has not been identified as a water body requiring this designation under WAC 172-201A, therefore these additional temperature criteria will not apply to this TMDL."

Response 9: Thank you for the suggestion. We added the following sentence to the end of the paragraph, **"**Burnt Bridge Creek has not been identified as a water body requiring this designation under WAC 172-201A, therefore these supplemental temperature criteria do not apply to this TMDL."

Comment 10: **Page 20, Watershed Description, insertion after paragraph two:**
"The addition of a description of the tributaries might be useful in this section, particularly since monitoring will be occurring on these tributaries as part of this TMDL. The City proposes the following additional descriptive paragraph for insertion after paragraph two:

There are two minor tributaries that flow into Burnt Bridge Creek east of Northeast 86th Avenue. Peterson Channel conveys industrial discharge and urban stormwater runoff to Burnt Bridge Creek near the southern end of Royal Oaks County Club. Burton Channel, which also initiates east of I-205, joins the creek south of Burton Road, near the southern end of Meadow Brook Marsh. A third tributary, Cold Creek, flows west through unincorporated Clark County and joins Burnt Bridge Creek approximately 2 miles upstream of Vancouver Lake west of Interstate 5 (I-5)."

Response 10: Good comment. We added the suggested paragraph to the Watershed Description section.

Comment 11: **Page 20, Hydrology section, paragraph one:**
"The U.S. Geological Survey (USGS) operated three continuous streamflow gages on Burnt Bridge Creek from 1998 to 2000. As expected, the highest streamflows occurred during winter months and the low flow period occurred during the fall…… Table 4 summarizes the maximum, minimum and annual mean streamflow at each gaging station"

"It may be appropriate to specifically address the dramatic influence of a single industrial facility's discharge on summer base flows in this section. The City proposes the following addition to paragraph one:

Streamflows from late fall through spring are predominantly influenced by precipitation. Summer flows are maintained by natural groundwater inflow coupled with substantial pumped groundwater discharges from an industrial facility located east of Interstate 205 (I-205) that feed Peterson Channel."

Response 11: We added the following paragraph to the beginning of the Hydrology section, "Historically, Burnt Bridge Creek is a groundwater fed system. Currently, streamflows from late fall through spring are predominantly influenced by precipitation. Summer flows are maintained by natural groundwater inflow coupled with substantial pumped groundwater discharges from an industrial facility located east of Interstate 205 (I-205) that feed Peterson Channel."

Comment 12: **Page 21, top line:**
"Clark County collected continuous flow data from 4 gages between 1998 to 1998."

"Should read *1988 and* 1998."
Response 12: We corrected the text.

Comment 13: **Page 21, Geology section:**
"WRIA 28 primarily consists of continental sediments from the late Miocene, Pliocene, and Pleistocene era. Eight hydrologic units make up three major subbasins. The youngest subbasin consists of unconsolidated sedimentary rock. The next oldest subbasin consists of sedimentary rock known as the Troutdale aquifer. The third subbasin includes older rocks from marine sediments, basalt, volcanic breccia, and volcaniclastic sediment. During the late Pleistocene, the Missoula floods deposited large quantities of sediments over the Troutdale Formation. These soils tend to drain at a fast rate creating groundwater infiltration, for example the Burton sink. Burnt Bridge Creek flows through sediments consisting of basaltic boulders and cobbles with a matrix of silt, clay, gravels, and loam (Wade, 2001). However, the streambed is mostly covered with silt leaving minimal areas of exposed gravel appropriate for salmonid redds."

"The term "sediment" is frequently used to describe fine, silty deposits and it is not clear until farther down in the text that in this case it represents boulders and cobbles. It may be better to describe or define the deposits in this earlier sentence. There are also significant areas of peat and muck in the northeastern and central sections of the watershed. This is important in understanding the existing substrate changes along the stream course, particularly in the case of the peat areas, which could contribute significantly to both the nutrient and temperature load of the creek. The City proposes the following changes:

During the late Pleistocene, the Missoula floods deposited large quantities of basaltic boulders and cobbles with a matrix of silt, clay, gravels, and loam (Wade, 2001). These soils tend to drain at a fast rate creating groundwater infiltration. The eastern section of the Burnt Bridge Creek watershed is composed of these deposits and known as the Burton sink area because of the high infiltration rates. Low lying portions of the broad creek channel, in the central portion of the watershed, developed lake and marsh conditions which accumulated deep peat and muck deposits over the centuries. The streambed itself is mostly covered with silt, leaving minimal areas of exposed gravel appropriate for salmonid redds."
Response 13: We changed the section to read, "WRIA 28 primarily consists of continental sediments from the late Miocene, Pliocene, and Pleistocene era. Eight hydrologic units make up three major subbasins. The youngest subbasin consists of unconsolidated sedimentary rock. The next oldest subbasin consists of sedimentary rock known as the Troutdale aquifer. The third subbasin includes older rocks from marine

sediments, basalt, volcanic breccia, and volcaniclastic sediment. During the late Pleistocene, the Missoula floods deposited large quantities of sediments over the Troutdale Formation. Burnt Bridge Creek flows through these sediments consisting of basaltic boulders and cobbles with a matrix of silt, clay, gravels, and loam (Wade, 2001). These soils tend to drain at a fast rate creating groundwater infiltration, for example the Burton sink located in the eastern portion of the watershed. Low lying portions of the broad creek channel, in the central portion of the watershed, developed lake and marsh conditions which accumulated deep peat and muck deposits over the centuries. The streambed itself is mostly covered with silt, leaving minimal areas of exposed gravel appropriate for salmonid redds."

Comment 14: **Page 23, Industrial Wastewater, paragraph 2:**
"All of the process wastewater generated at the facility, approximately 3.1 cfs or 2.0 million gallons per day (mgd), is collected and discharged to the city of Vancouver's Marine Park wastewater treatment facility (Industrial Pretreatment Permit Number 2004-03). Domestic wastewater generated at the plant is also discharged to the city sewer at a different outfall. For the purpose of this TMDL study, the process and domestic wastewater is not considered a point source because it does not impact any surface waters within the Burnt Bridge Creek basin."

"It can be confusing to apply the term outfall to both a discharge to waterbodies and a pipe to a sanitary sewer. It would be more descriptive to refer to sanitary pipes as "connections". The City proposes the following:

Domestic wastewater generated at the plant is also discharged to the city treatment facility through a separate sanitary sewer connection."
Response 14: We incorporated the suggested change.

Comment 15: **Page 23, Industrial Wastewater, paragraph 4:**
"At outfall 001 the SEH facility discharges surface wastewater to a series of retention ponds that flow into Peterson Channel. The SEH discharge is the headwaters of Peterson Channel, which then flows into Burnt Bridge Creek near Royal Oak Drive and NE 93rd Avenue at approximate RM 8.7. During low flow events in the fall, Peterson Channel practically doubles the streamflow of Burnt Bridge Creek. SEH is considering increasing production capacity at the Vancouver facility to nearly double. Facility expansion would increase wastewater generation and increase discharge under the current permit. A portion of the increased non-process wastewater discharge would be directed to outfall 001 (SEH, 2007)."

"It is important to note that during the dry season almost all of the flow in Peterson Channel is from SEH discharge.

During low flow events in the fall, Peterson Channel (consisting almost entirely of SEH discharge flow) practically doubles the streamflow of Burnt Bridge Creek."
Response 15: We incorporated the suggested change.

Comment 16: **Page 23, Wildlife and background sources:**
"Usually these sources are dispersed and do not elevate fecal coliform counts or affect dissolved oxygen (DO) and pH in streams significantly enough to violate state criteria. Sometimes animal populations become concentrated and can cause water quality violations. Concentrated wildlife, for example nutria (coypu), raccoons, and birds in the watershed will be noted during sampling surveys."

"The City is aware of several areas where concentrated wildlife populations are likely contributing significant amounts of bacteria. There are several reaches of Burnt Bridge Creek where beavers are active. Including beaver in the abbreviated species list would be informative."
Response 16: We added beaver to the list of wildlife sources.

Comment 17: **Page 24, Stormwater sources, paragraph 4:**
"The city of Vancouver and Clark County established the Surface Water Management Utility in 1978. In 1996, the city of Vancouver took over lead control of the Utility. The Utility almost entirely manages the stormwater flowing into Burnt Bridge Creek. At this time, the utility is well established with an existing surface water utility rate structure and it has implemented many of the required NPDES Phase II Permit program elements. As part of the Phase II Permit, the city of Vancouver has developed a Stormwater Management Program Plan. Documentation of the program and the annual report summarizing how the city is complying with each section of the Phase II Permit should be available on March 31, 2008. Outside of the City/County Surface Water Management Utility, Clark County must follow Phase I of the NPDES municipal stormwater guidelines to manage stormwater before it discharges to surface water."

"There are some inaccuracies in this paragraph that the City has addressed through the changes below:

In 1996, the City of Vancouver established a city-wide Surface Water Utility. The utility almost entirely manages the stormwater flowing into Burnt Bridge Creek. One significant exception with regard to this TMDL is the Cold Creek tributary, which collects the majority of its flow in Clark County. At this time the utility is well established with an existing surface water utility rate structure and the city has implemented the required NPDES Phase II Permit program elements. As part of the Phase II Permit, the City of Vancouver has developed a Stormwater Management Program. Documentation of the program and the annual report summarizing how the city is complying with each section of the Phase II Permit are available on the city web site. Outside of the city, Clark County must follow Phase I of the NPDES municipal stormwater guidelines to manage stormwater before it discharges to surface water."
Response 17: We incorporated the suggested language.

Comment 18: **Page 24, Nonpoint sources:**
"Nonpoint sources and practices are dispersed and not controlled by discharge permits. Potential nonpoint sources within the Burnt Bridge Creek watershed include: adjacent to the creek (riparian) residential properties, riparian residential development, some agricultural land, a golf course, wildlife, pet waste, human waste, and leaking onsite septic systems.

Septic systems are designed to drain but when they are *failing* they can contribute to nonpoint source pollution. Failing would be a more appropriate word in this sentence."
Response 18: We changed the word.

Comment 19: **Page 25, paragraph 1:**
"Fecal coliform bacteria from nonpoint sources are transported to the creeks by direct and indirect means. ….. Some residences may have wastewater piped directly to waterways or may have malfunctioning on-site septic systems where effluent seeps to nearby waterways. Pet waste concentrated in public parks, on creekside trails, or private residences can be a source of contamination, particularly in urban areas. Swales, subsurface drains, and flooding through pastures and near homes can carry fecal coliform bacteria, nutrients and BOD from sources to waterways."

"The City believes it is important to note that wastewater piped directly to waterways is *illegally* piped. Also, this paragraph covers many of the different ways that fecal coliform bacteria can get into waterbodies, and may not all be specific factors contributing to the bacteria counts in Burnt Bridge Creek. The City has had problems with transient camps along the creek that have been known sources and would propose the following addition to this paragraph:

Illegal campsites can also be a source of bacteria, nutrients and BOD from human wastes."
Response 19: We incorporated the suggested changes.

Comment 20: **Page 26- Figure 2, Page 38- Figure 11:**
"It would be helpful to include sample location labels on all of the Figures for ease of correlation with the tabular information."
Response 20: Good suggestion. Labels will be added to the final QAPP graphics.

Comment 21: **Pages 28-29, Figures 3-6:**
"It would be informative to have the data for each parameter presented in boxplot format by sample location (like Figure 3) as well as in time series format (like Figures 4-6). This would enable a more focused evaluation of individual sub-reaches of the creek which may have differing factors affecting stream conditions."
Response 21: This type of evaluation will be completed for the final report.

Comment 22: **Page 29-30, text:**
"A summary of the percent of samples that violated the water criterion for dissolved oxygen, pH, and temperature is provided in Table 7. The table indicates that temperature is a problem at all sample locations in the basin. Dissolved oxygen seems to violate more

frequently in the central and upper portions of the stream. Only 3 locations barely violated the pH criteria during data collection."

"As stated previously for page 11, the use of the term "violate" in this section implies a specific illegal act, or acts, have taken place and that enforcement action may be taken as a result of the data. The City feels it would be more precise to re-phrase this information as follows:

A summary of the percent of samples that exceeded the water criterion for dissolved oxygen, pH, and temperature is provided in Table 7. The table indicates that temperature does not meet state standards at any of the 2006 sample locations in the basin. Dissolved oxygen seems to exceed the standard more frequently in the central and upper portions of the stream. Only 3 locations barely exceeded the pH criteria during data collection."

Response 22: Ecology uses the term "violate" in the text because "exceed" could imply that either the water body is of higher quality than outlined in the water quality standards or that it does not meet water quality criteria. Therefore, Ecology uses the terms "violate", "exceed", "does not meet" interchangeably to communicate that the standards are not being met. We changed the text to read, "A summary of the percent of samples that do not meet the water criterion for dissolved oxygen, pH, and temperature are provided in Table 7. The table indicates that temperature is a problem at all sample locations in the basin. Dissolved oxygen seems to violate more frequently in the central and upper portions of the stream. Only 3 locations do not comply with the pH criteria during data collection."

Comment 23: **Page 30, Table 7:**

"Data from 1998-2000 do not appear to have been used to establish 303d listings for Burnt Bridge Creek, however they are presented here as characteristic of existing conditions. In particular, the 44% exceedance figure given for BBC5 does not appear to be consistent with other results which are informing the TMDL process and the determination that pH does not currently warrant a TMDL. It is unclear whether this data accounts for the QA issues addressed during the comment period for the draft 2008 Assessment, which could alter the percentages listed here. Also, it would enhance the utility of these numbers if the individual statistics were also presented for each site (see comment above regarding boxplots) to demonstrate the magnitude of the exceedances in addition to their frequency. In general, Table 7 is complicated by the varying sample periods and absence of data. The percent exceedance does not seem to accurately represent historic monitoring data."

Response 23: We do not know which Burnt Bridge Creek data were used to generate the 2008 303(d) list. We suggest you contact Ken Koch of Ecology's Water Quality Program for this information. We used all of the data provided by the City of Vancouver to evaluate current conditions. After finding out about problems with some of the pH probes during the City's study, those data points were excluded from our analysis. A more detailed analysis, including box plots, of the data will be completed for the final report.

Comment 24: **Page 31, text:**
"Fecal coliform was collected at the site between 2003 and 2005. These data are summarized in Table 8. At this station, fecal coliform violates both the geometric mean and 10% of samples not to exceed criteria."

"By the reasoning stated previously, the City feels the use of "*exceeds*" in this section would be more precise."
***Response 24*:** See response to comment 22. We changed the wording to "does not meet."

Comment 25: **Page 31-32, Figures 7-9:**
"Again, it might be helpful to have boxplots accompany these time-series figures."
Response 25: This type of evaluation will be completed for the final report.

Comment 26: **Page 33, Trend Analysis:**
"The ambient monitoring station, 28C070, combined with the city of Vancouver station, BBC1, has a record of monthly dissolved oxygen, temperature, and pH data from 1972 through 2007. ….. However, the trend analysis for pH (Figure 10) has a slope of 0.01 and a significance of 99%. These results indicate a statistically significant increase in pH levels over the period of record (1972-2007); although pH is not violating state water quality criterion at this site."

"By the reasoning stated previously, the City feels the use of "*exceeding*" in this section would be more precise."
Response 26: We changed the text to read, "…pH is meeting state water quality criterion at this site."

Comment 27: **Page 35, Table 9:**
"Please clarify the units of the Daily Maximum column. Is this a maximum rate per hour or total accumulation for a 24 hour time period?"
Response 27: We changed the column title to "One Day Maximum."

Comment 28: **Page 39, Table 10:**

28BBC00.0	Burnt Bridge Ck downstream of Fruit Valley Rd	45.67520	-122.69253

"Samples taken downstream of Fruit Valley Rd may be impacted by flow detention in the confluence back-water area east of Fruit Valley Rd (estimated at about ten days) and by incoming flow from Vancouver Lake during tidal fluctuations. Data collected at this location should be evaluated with respect to these confounding factors."

28BBC06.8	Burnt Bridge Ck at Devine Greenway NE 65th Ave	45.63453	-122.60496

"Devine Road and NE 65th Avenue are two different locations in the greenway. Based on the lat/long and the maps provided, it appears that the monitoring location selected is *Burnt Bridge Creek at NE 65th Ave*."

Response 28: Good comments. Ecology will be sure to evaluate the tidal fluctuations and account for the flow detention upstream of Fruit Valley Road. We also changed the description for site 28BBC06.8 to "Burnt Bridge Creek at NE 65th Ave."

Comment 29: **Page 41, Temperature, paragraph 1:**
"Will there be criteria for thermistor placement with respect to representative sun or shade? The concern would be that if thermistor placement at the fixed-network sites were predominantly in the shade or in the sun the resulting air temperature data may be skewed and not accurately represent the conditions along the creek according to actual sun/shade ratios in the creek basin."
Response 29: Ecology follows *Standard Operating Procedures for continuous temperature monitoring of fresh water rivers and streams conducted in a Total Maximum Daily Load (TMDL) project for stream temperature (EAP044)* for thermistor placement. The SOP is available for download at http://www.ecy.wa.gov/programs/eap/qa/docs/ECY_EAP_SOP_044Cont_Temp_Monit_TMDL.pdf.

Comment 30: **Page 43, Time of travel, paragraph 3:**
"Ecology will notify the Ecology Vancouver Field Office, Douglas Wise from the city of Vancouver as well as local emergency contacts before injecting the dye. Announcing the dye studies will prevent unnecessary emergency actions that expend valuable resources in the event a spills complaint is submitted (i.e., somebody calls the sheriff or Ecology spills hotline because the river just turned red)."

"Please change this notification to read:
…the City of Vancouver Surface Water Management Department…"
Response 30: We incorporated the change.

Comment 31: **Page 46, Sampling Procedures, first bullet:**
- "GPS coordinates and a sketch of the site …(during installation only)."

"It might be appropriate to call out that the sun/shade condition at each specific site should be recorded at installation along with the GPS coordinates and the site sketch. *…including the effective shade at this location…*"
Response 31: Effective shade is measured at each thermistor site using hemispherical photography during our stream surveys.

Comment 32: **Page 73, Temperature, second bullet:**
- "Ecology's shade calculator (Ecology, 2003a) will be used to estimate effective shade along Burnt Bridge Creek. Effective shade will be calculated at 50- to 100-meter intervals along the streams, and then averaged over 500- to 1000-meter intervals for input to the temperature model."

"Does the QUAL2Kw Model address effective shade throughout the watershed in addition to the riparian basin? This is an important consideration for the evaluation of future management strategies that might address urban forestry practices outside of the

immediate riparian area of the creek but still have a positive impact on temperature loading to the creek."

Response 32: The shade calculator is generally run to analyze the effective shade generated by a riparian zone of approximately 180 – 300 feet on each side of the stream. It has not been programmed to run as a landscape or basin wide model. Although vegetation closest to the stream has the most direct effect on stream shading, upland vegetation provides other benefits (besides direct solar radiation shading) that are important to the overall ecological integrity of the stream. These additional benefits will need to be considered when evaluating the effectiveness/importance of upland and best management practices implemented in the basin, and include the following:

- Microclimate effect – a dense and wider riparian buffer can create a cooler microclimate near the stream, which can be observed as a reduction in air temperature, which in turn improves stream cooling.
- Reduced vulnerability to floods – during floods, a buffer as small as 30' could be completely inundated, while a wider buffer would provide more room for changes in the stream channel after a flood event.
- Reduced downstream flood peaks – plants in the riparian area can resist flow and dissipate energy contained within floodwaters.
- Reduced sediment erosion and improved stream bank stability.
- Riparian vegetation can remove excess nutrients and sediment from surface runoff and help reduce pollutants from reaching the stream.
- Litter fall (dead leaves/detritus) are a source of organic matter to the stream which form the basis of the food web for aquatic organisms.

All of these benefits will need to be considered during the development of the Implementation Strategy for this TMDL.

Comment 33: **Page 74, Dissolved Oxygen and pH:**
"Water quality modeling will be conducted using QUAL2Kw (Chapra and Pelletier, 2003) or a similar biogeochemical modeling framework. The specific modeling framework is expected to be QUAL2Kw, although an alternative framework may be used instead, depending on a review of available frameworks at the time when modeling tasks will be conducted. The water quality model will use kinetic formulations for simulating DO and pH in the water column similar to those shown in Figure 13 and Table 17."

"The City of Vancouver would like to be involved in the consideration of available modeling frameworks during the selection process."

Response 33: We appreciate your comment and will continue open communication with all stakeholders throughout all phases of this project.

Cc: James Kardouni, Kirk Sinclair, George Onwumere, Kim McKee

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MEMORANDUM

TO: Jeff Schnabel, Clark County Public Works Department, Clean Water Program

FROM: Tonnie Cummings, Water Quality Program, Southwest Region, Water Cleanup/Technical Assistance Unit
Stephanie Brock, Environmental Assessment Program, Western Operations Section, Directed Studies Unit

SUBJECT: Response to comments on the May 2008 draft Burnt Bridge Creek Fecal Coliform Bacteria, Dissolved Oxygen, and Temperature Total Maximum Daily Load Quality Assurance Project Plan

DATE: June 5, 2008

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It is Ecology's intention to collaborate with stakeholders in order to develop a technically defensible and usable TMDL for Burnt Bridge Creek. Therefore, we will continue open communication with all members of the technical advisory committee throughout the data collection, technical analysis, and modeling phases of this TMDL. If you have any questions, please don't hesitate to contact Tonnie (360-690-4664; tcum461@ecy.wa.gov) or Stephanie (360-407-6498; steb461@ecy.wa.gov).

Comment 1: p.21, 1st sentence. "Date range should be 1988 to 1998."
Response 1: We have corrected the dates.

Comment 2: p.24, Stormwater sources, final paragraph. "The proposed sampling listed on this page, page 40, and page 44 do not appear to be consistent. Additional clarification regarding storm event sampling and stormwater sampling would be helpful. Also see comment #11."

Response 2: The last paragraph under the Stormwater Sources section has been changed to read,

"Stormwater will be evaluated as part of the TMDL. The project team will attempt to capture 5 – 10 storm events during the winter season and one storm event during the summer, low-flow season in order to characterize the impact of these events. Winter storms will be sampled for bacteria only. The summer storm will include grab samples for nutrients, sediment, bacteria, and carbon. These data may be used to assign wasteload allocations (WLA) to Vancouver's stormwater management system under the Phase II permit."

The Study Design section has been updated to read:

> **"Stormwater monitoring**
>
> The purpose of storm monitoring is to better characterize potential sources of fecal coliform loading to Burnt Bridge Creek. During rain events, greater than average fecal coliform loading may occur when urban surface water flushes into the creeks. Ecology will attempt to capture five to ten storm events between June 2008 and August 2009. For this TMDL, a storm event is defined as a minimum of 0.3 inches of rainfall in a 24-hour period preceded by no more than trace rainfall in the previous 24 hours. Daily rainfall data will be obtained from local sources, such as Vancouver's Pearson Field Airport weather station # KVUO and Burnt Bridge Creek weather station # KWAVANCO4.
>
> During the wet season, Ecology will try to sample all sites twice during one storm event. However, the majority of storm event sites will only be sampled for bacteria once during the duration of the storm. When grab samples are collected, streamflow will be measured with a flow meter, or estimated using stage and rating curves, relationships with other monitoring locations, or filling a known volume over a certain amount of time. Local weather forecasts will allow anticipation of significant storm events suitable for sampling.
>
> Ecology will attempt to sample one summer storm event. During this storm event, sites and representative outfalls will be monitored for bacteria, total organic carbon (TOC), dissolved organic carbon (DOC), total suspended solids (TSS), nutrients (ammonia, nitrite-nitrate, total persulfate nitrogen, orthophosphate, and total phosphorus).
>
> The stormwater sampling sites will include all fixed network sites plus approximately 10 representative outfalls under NPDES. Stormwater NPDES permits are required to have corresponding Wasteload Allocations (WLAs) set in TMDL studies."

Comment 3: p.24, Stormwater Sources, final paragraph. "I think including BOD analysis would be particularly useful during any summer storm event sampling when DO levels are already lower and may be more significantly impacted by stormwater inputs."
Response 3: Ecology will not be sampling for biological oxygen demand (BOD) during the summer storm event. However, we will try to sample one summer storm event for nutrients, bacteria, and sediment. Ecology clarified the paragraph in the QAPP to read, "Stormwater will be evaluated as part of the TMDL. The project team will attempt to capture 5 – 10 storm events during the winter season and one storm event during the summer, low-flow season in order to characterize the impact of these events. Winter storms will be sampled for bacteria only. The summer storm will include grab samples for nutrients, sediment, bacteria, and carbon. These data may be used to assign wasteload allocations (WLA) to Vancouver's stormwater management system under the Phase II permit."

Comment 4: p.24, Non-point sources, 1st paragraph. "Might want to point out the connection between non-point sources and stormwater. The description of non-point sources is good; however, non-point sources *are* controlled by discharge permits to some extent in the form of Phase I and II NPDES requirements, and non-point sources form a major component of stormwater."
Response 4: We added the following sentence to that paragraph, "Nonpoint sources are important to understand due to their direct impact on creek water quality, but also as a major component of stormwater runoff."

Comment 5: p.31-32. "Figures 7, 8, and 9 would be more effective if the date range were spread out and the "no data" area was minimized. Hard to read/interpret the data points in the current format."
Response 5: We agree with your comment and have been struggling with Excel to improve the figures. We will attempt to improve the graphs, using a different program, for future reports.

Comment 6: p.33, Trend analysis, 1st sentence. "Stating that the period of record is from 1972 through 2007 is less than accurate since there is a 28-year data gap between 1972 and 2000. Helsel and Hirsch (Statistical Methods in Water Resources, 1993) recommend using step-trend procedures instead of the seasonal Kendall test in cases where a data gap exists which is more than 1/3 the length of the entire period of data collection. Since the TMDL does not deal specifically with pH, you could probably remove the graphic on page 34 entirely."
Response 6: Thank you for the suggestion. We re-did the analysis for the period of record between 1998-2007, and then updated the graph and text based on the revised analysis.

Comment 7: p.34, Clark County section. "The BBC Utility performed a significant fecal coliform investigation in the early 1990s (?), including ribotyping work to identify sources. There could be some useful historical information there and it should be cited in this section."

Response 7: We added the following paragraph to the City of Vancouver section under the Historical Data Review, "The City of Vancouver and Southwest Washington Health District contracted Mansour Samadpour to conduct a Microbial Source Tracking Study on Burnt Bridge Creek in 1999. The Draft report identifies human, pets, dogs and cats, migratory birds, urban wildlife, and livestock as the major sources of microbial pollution in Burnt Bridge Creek. Additionally, the report recommends:

- Reducing the number of septic systems in the watershed,
- Pet owner education on proper waste disposal,
- Discouraging the formation of resident bird populations of migratory birds,
- Population control of urban wildlife,
- Livestock managed under best management practices,
- Tree planting along the streambeds to reduce elevated stream temperatures (Samadpour, et. al., 1999)."

Comment 8: p.38, Figure 11. "Consider adding a fixed-network station at the point where BBC transitions from riverine flow to a lacustrine system, between stations 28BBC00.0 and 28BBC01.2. Presence of aging sewer infrastructure, septic tanks, the greenway trail, and concentrations of waterfowl (in the lacustrine section), in addition to potential heat loading in the lower reach, make this reach a potentially dynamic area where additional spatial resolution may be useful."
Response 8: Depending on the accessibility of the site at BBC0.00, we may end up adding a site just above the upper pond between BBC0.00 and BBC1.2.

Comment 9: p.40, Fixed network sampling. "If possible, try to capture several storm events or wet weather sampling events during the dry season (June-October). County work in Gibbons Creek a couple years ago indicated the following:

- Fecal coliform levels were significantly higher during the dry season than the wet season.
- Wet weather during the dry season resulted in the highest fecal coliform levels.
- Dry weather during the wet season resulted in the lowest fecal coliform levels."

Response 9: See response to Comment 2 and 3.

Comment 10: p.44, Riparian habitat, final paragraph. "You might want to check into available LiDAR data for use in the riparian survey. If available, it could eliminate the need for field height measurements or other field work."
Response 10: Thank you for the information. We left the language in the paragraph as written, but will use LiDAR data if available.

Comment 11: p.44, Stormwater monitoring. "Are the 5-10 storm events noted in this section in addition to the "5 or more" storm events listed on page 40 under the bacteria section? The stormwater monitoring section is somewhat confusing and seems to combine two kinds of sampling: stormwater monitoring is by definition sampling water from within the stormwater system—sampling the fixed stream network stations during storms isn't really "stormwater monitoring". Really, you are sampling stormwater from

the NPDES outfalls, plus storm event sampling within receiving waters at the fixed stations."

Response 11: See response to Comment 2 and 3.

Comment 12: p.73, Temperature, second paragraph. "Suggest using 2007 Clark County orthophotos rather than 2006 DNR photos."

Response 12: We changed the text to read, "GIS coverage of riparian vegetation in the Burnt Bridge Creek study area will be created from information collected during the 2008 temperature field study and 2007 Clark County digital aerial orthophotographs."

Comment 13: p.76. "Will only two surveys for the list of parameters on this page provide sufficient data to make meaningful comparisons to model output?"

Response 13: Yes, we have designed the study to collect data during summer low-flow conditions when Dissolved Oxygen is limited.

Cc: James Kardouni, Kirk Sinclair, George Onwumere, Kim McKee

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MEMORANDUM

TO: Skip Haak, PBS Engineering

FROM: Tonnie Cummings, Water Quality Program, Southwest Region, Water Cleanup/Technical Assistance Unit
Stephanie Brock, Environmental Assessment Program, Western Operations Section, Directed Studies Unit

SUBJECT: Response to comments on the May 2008 draft Burnt Bridge Creek Fecal Coliform Bacteria, Dissolved Oxygen, and Temperature Total Maximum Daily Load Quality Assurance Project Plan

DATE: June 5, 2008

Thank you for reviewing and providing comments on the draft Burnt Bridge Creek Multiparameter Total Maximum Daily Load (TMDL) Quality Assurance Project Plan (QAPP). Your input helped us clarify and refine the sampling plan for the Burnt Bridge Creek TMDL. Our response to each of your comments is provided below. The final QAPP will be published in mid-July, and then it and our memoranda providing response to comments will be posted on Ecology's Burnt Bridge Creek TMDL website (http://www.ecy.wa.gov/programs/wq/tmdl/burnt_bridge/burnt_br-tmdl.html).

It is Ecology's intention to collaborate with stakeholders in order to develop a technically defensible and usable TMDL for Burnt Bridge Creek. Therefore, we will continue open communication with all members of the technical advisory committee throughout the data collection, technical analysis, and modeling phases of this TMDL. If you have any questions, please don't hesitate to contact Tonnie (360-690-4664; tcum461@ecy.wa.gov) or Stephanie (360-407-6498; steb461@ecy.wa.gov).

Comment 1: Page 14, Table 2. "Peterson Channel should be Peterson Ditch."
Response 1: We changed all occurrences of Peterson Channel to Peterson Ditch.

Comment 2: Page 16, bottom of page. "The following statements are made on this page regarding fecal coliforms: "If the criterion is exceeded, the state will require that human

activities be conducted in a manner that will bring fecal coliform concentrations back into compliance with the standard. If natural levels of fecal coliform (from wildlife) cause criteria to be exceeded, no allowance exists for human sources to measurably increase bacterial pollution." How will "natural levels" of fecal coliforms be determined? No section of Burnt Bridge Creek is outside the influence of humans. If the source of the fecal coliforms is not known, other than location, how can you determine whether any change in human activities will affect fecal coliform concentrations? Also, how would you determine what change in activities would be appropriate?"

Response 2: As noted, Burnt Bridge Creek is a highly urbanized stream system. The goal of this TMDL is to bracket sources of fecal coliform in order to determine pollution sources and select best management practices to bring the stream into compliance with water quality standards. We changed the language in the section to read, "Once the concentration of fecal coliform in the water reaches the numeric criterion, human activities that would increase the concentration above the criteria are not allowed. If the criterion is exceeded, the state will require that all known and reasonable technologies and targeted best management practices be implemented to reduce human impacts and bring fecal coliform concentrations into compliance with the standard."

Comment 3: Page 21. "Top of page date range for flow data given as 1998 to 1998. Should be 1988 to 1998."

Response 3: We corrected the dates.

Comment 4: Page 21, Geology. "No mention of significant deposits of peat along stream and forming streambed."

Response 4: We added the following text to the QAPP, "However, the streambed is mostly covered with peat and silt leaving minimal areas of exposed gravel appropriate for salmonid redds."

Comment 5: Page 22, Wildlife. "Family Oncorhynchus should be Family Salmonidae or Genus *Oncorhynchus*. The only trout present are rainbow (steelhead) and cutthroat."

Response 5: We changed Family Oncorhynchus to Family Salmonidae and changed trout to cutthroat trout.

Comment 6: Page 22, Vegetation. "Black cottonwood is the species found in the watershed. *Populus nigra* should be *Populus balsamifera* ssp. *trichocarpa*."

Response 6: We changed *Populus nigra* to *Populus balsamifera.*

Comment 7: Page 22, Vegetation. "Burt Bridge Creek should be Burnt Bridge Creek."

Response 7: Thank you for catching that spelling error. It has been corrected.

Comment 8: Page 23, third paragraph. "Peterson Channel should be Peterson Ditch."

Response 8: See response to Comment 1.

Comment 9: Page 26. "Water quality data are available from the city of Vancouver from 2004 to 2007."

Response 9: At the time we compiled the City of Vancouver data, we only had data through 2006. Therefore, we will include the 2007 data in the final report, but not in the QAPP.

Comment 10: Page 26, map. "Site BBC8 at 41st Circle was monitored during 2007."
Response 10: See response to Comment 9.

Comment 11: Page 27, Table 6. "Site BBC8 missing from table."
Response 11: See response to Comment 9.

Comment 12: Page 36. "The statement "identify and characterize fecal coliform bacteria concentrations" is made. This statement suggests something more than measuring concentrations of fecal coliforms, which I believe is all that is being done."
Response 12: We removed the word "identify" from the statement.

Comment 13: Page 36. "The statement "characterize processes governing DO in Burnt Bridge Creek" is made. How will the proposed monitoring account for oxygen demand associated with the peat substrate (i.e., sediment oxygen demand)?"
Response 13: We added the following survey to the Dissolved Oxygen and Synoptic Survey Section under Study Design, "Sediment Oxygen Demand will be characterized by installing sediment flux chambers in 4 representative reaches along the creek during the synoptic surveys (Roberts, 2007). The benthic chambers will remain in place for at least 24-hours. Once deployed, grab samples will be taken for Winkler titration of dissolved oxygen at dawn and dusk." The SOP for the survey is available at: http://www.ecy.wa.gov/programs/eap/qa/docs/ECY_EAP_SOP_036BenthicFluxChambers.pdf.

Comment 14: Page 38, Figure 11. "Peterson Ditch mislabeled Peterson Channel."
Response 14: See response to Comment 1.

Comment 15: Page 39, Table 10. "Devine Greenway should be Burnt Bridge Creek Greenway. FYI, the Greenway includes several of the monitoring locations, so I suggest deleting it from the site description. Peterson Channel should be Peterson Ditch."
Response 15: We removed the word "Greenway" from the site description. Also, see response to Comment 1.

Comment 16: Page 44, last paragraph. "Misplaced semicolon. "… or estimated using; stage and rating curves,…"
Response 16: We removed the semicolon.

Comment 17: Page 56. "…data verification and vilification is completed." I believe vilification should be validation."
Response 17: Oops—good catch! We corrected the sentence.

Comment 18: Page 56, second to last paragraph. "The following statement is made: "Data validation involves a detailed examination of the data package using professional

judgment to determine whether the method quality objectives (MQOs) have been met." Why is professional judgment required? Table 12 indicates the MQOs for field instruments. Determination whether these MQOs have been met should be black or white. Similarly, MEL [Manchester Environmental Laboratory] has specified MQOs for the lab data.

Response 18: Good comment. We removed "using professional judgment" from the statement.

Cc: James Kardouni, Kirk Sinclair, George Onwumere, Kim McKee

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MEMORANDUM

TO: Dvija Michael Bertish, Rosemere Neighborhood Association

FROM: Tonnie Cummings, Water Quality Program, Southwest Region, Water Cleanup/Technical Assistance Unit
Stephanie Brock, Environmental Assessment Program, Western Operations Section, Directed Studies Unit

SUBJECT: Response to comments on the May 2008 draft Burnt Bridge Creek Fecal Coliform Bacteria, Dissolved Oxygen, and Temperature Total Maximum Daily Load Quality Assurance Project Plan

DATE: June 5, 2008

Thank you for reviewing and providing comments on the draft Burnt Bridge Creek Multiparameter Total Maximum Daily Load (TMDL) Quality Assurance Project Plan (QAPP). Your input helped us clarify and refine the sampling plan for the Burnt Bridge Creek TMDL. Our response to each of your comments is provided below. The final QAPP will be published in mid-July, and then it and our memoranda providing response to comments will be posted on Ecology's Burnt Bridge Creek TMDL website (http://www.ecy.wa.gov/programs/wq/tmdl/burnt_bridge/burnt_br-tmdl.html).

It is Ecology's intention to collaborate with stakeholders in order to develop a technically defensible and usable TMDL for Burnt Bridge Creek. Therefore, we will continue open communication with all members of the technical advisory committee throughout the data collection, technical analysis, and modeling phases of this TMDL. If you have any questions, please don't hesitate to contact Tonnie (360-690-4664; tcum461@ecy.wa.gov) or Stephanie (360-407-6498; steb461@ecy.wa.gov).

Comment 1: Page 13. "Furthermore, a portion of Vancouver's drinking water is acquired from aquifers below the Burnt Bridge Creek surface watershed (City of Vancouver, 2006)."

“In September 2006, the EPA officially designated the Troutdale Aquifer System as a federally protected Sole Source Aquifer. The Federal Register describes the Troutdale Aquifer as "the principal source of drinking water (approximately 99.4%) for the people in the Troutdale aquifer system area and there are no alternate sources which can physically, legally, and economically supply all those who depend upon the aquifer for drinking water, should it become contaminated."

“The entirity of Burnt Bridge Creek resides within the designated Sole Source Service Area, and this needs to be identified within the QAPP. The aquifer system is vulnerable to contamination because recharge occurs essentially over the entire area, the aquifer is highly permeable, and there are many human activities that have released, or have the potential to release, contaminants to the aquifers. Sources of contamination include untreated or poorly treated storm water and septic systems. According to the Mundorf study, ground and surface water regularly intermix within the basin. Contaminated groundwater, therefore, would adversely impact the creek flow. Contaminated groundwater plumes are identified by USGS reports within the Burnt Bridge Creek Basin.”

Response 1: Thank you for the clarification. We added the following language to the QAPP, “Furthermore, the City of Vancouver drinking water is supplied by the Troutdale and Sandy River Mudstone aquifers. The Troutdale aquifer underlies the Burnt Bridge Creek watershed and was designated as a sole source aquifer in 2006 (City of Vancouver, 2006 and EPA, 2006).”

Comment 2: Page 14. "Burnt Bridge Creek is a tributary to the lake; therefore, information gained and clean-up activities implemented through this TMDL will benefit the Vancouver Lake Watershed Partnership effort."

“May be necessary to add parameter of PCB's since Vancouver Lake is 303(d) listed for PCB's in fish tissue.”

Response 2: We appreciate concerns regarding the Vancouver Lake PCB listing on the 303(d) list. However, the scope of the Burnt Bridge Creek TMDL project is to address temperature, dissolved oxygen, and fecal coliform bacteria listings in the Burnt Bridge Creek basin. Therefore, sampling the Burnt Bridge Creek basin for PCBs is outside the scope of this TMDL.

Comment 3: Page 15. "However, the pH listings will more than likely be excluded from the 2008 list based on recent evidence of supporting data not passing QA analysis."

“pH listing should be added as a monitoring parameter because of the possibility of exceedences, and the trend for rising pH levels for the creek.”

Response 3: As described in the Sampling Design section of the QAPP, Ecology will be collecting pH measurements during this study.

Comment 4: Page 16. "Waste from warm-blooded animals is more likely to contain pathogens that will cause illness in humans than waste from cold-blooded animals."

“Human waste is a major contributor of pathogens to the creek.”
Response 4: Ecology left the language in the QAPP as written because the sentence prior to the one you quoted reads, “Fecal coliform in water ‘indicates’ the presence of waste from humans and other warm-blooded animals.”

Comment 5: Page 16. "While the specific level of illness rates caused by animal versus human sources has not been quantitatively determined, warm-blooded animals (particularly those that are managed by humans and thus exposed to human derived pathogens as well as those of animal origin) are a common source of serious waterborne illness for humans.”

“Human waste is a determined source that can cause serious illness.”
Response 5: Ecology recognizes that human waste is a source of water bourne illnesses. However, the quoted language was taken directly from Ecology documents supporting the water quality criteria for fecal coliform. Therefore, we left the language as written in this section of the QAPP and added language to the “Potential sources of contamination” section regarding pollution generated by failing septic systems and illegal camping.

Comment 6: Page 21. "There are 24 surface water rights on record for Burnt Bridge Creek. However, only 2 water rights are greater than 0.25 cfs, such as 1.21 cfs and 2.5 cfs. The majority of the rights allow withdrawals of no more than 0.05 cfs. Many of these water rights may no longer be active."

“Record review should indicate precisely how many water rights are still active, and any that are inactive should be voided.”
Response 6: We will clarify which water rights are still active prior to conducting the groundwater/surface water interaction analysis. However, the TMDL process will not “void” inactive water rights because water rights are outside of the jurisdiction of the TMDL program.

Comment 7: Page 22. "Burnt Bridge Creek supports fish species such as coho salmon (*Oncorhynchus kisutch*), chinook salmon (*Oncorhynchus tshawystcha*), steelhead (*Oncorhynchus mykiss*), trout (Family Oncorhynchus), sculpin (Family Cottidae), red-sided shiners (*Richardsonius balteatus*), sticklebacks (Family Gasterosteidae), leopard dace (*Rhinichthys falcatus*), and lamprey larvae (ammocoetes) (Family Petromyzontidae). These data are based on two fish surveys conducted by the Pacific States Marine Fisheries Commission for the city of Vancouver during the winter of 2002 and the spring of 2003 (Ehlke, 2003)."

“Large mouth bass and giant carp are known to be in the slough closest to Vancouver Lake. Cutthroat Trout should be identified specifically since it is a listed species.”
Response 7: The species list contained in the QAPP is based on two fish surveys conducted by the Pacific States Marine Fisheries Commission. Without a citable reference document, we cannot include large mouth bass and giant carp as species found

in Burnt Bridge Creek. We amended the paragraph to specify that cutthroat trout are in the creek.

Comment 8: Page 24. "Under the Phase II permit, the city of Vancouver must follow the prescribed guidelines to manage stormwater before it discharges to surface water"

"There are many municipal stormwater outfalls that currently discharge directly to the surface water of the creek without any form of treatment."
Response 8: As part of their NPDES Phase II permit, the City of Vancouver has specific guidelines regarding management of stormwater. According to their 2007 annual report, the city is currently mapping all stormwater outfalls. The next step under the permit is outfall discharge monitoring. Monitoring will identify problem outfalls that warrant treatment.

Comment 9: Page 24. "Limited BOD, nutrient and other water quality parameters may be sampled depending on budget. These data may be used to assign wasteload allocations (WLA) to Vancouver's stormwater management system under the Phase II permit."

"It is recommended to evaluate monitoring objectives relative to typical urban watershed pollutants (with septic systems) as well as standard nutrients, including BOD and COD in order to show whether main nutrients are being captured in analysis."
Response 9: The objective of the study is to develop a TMDL for bacteria, temperature, and dissolved oxygen. Field surveys and data collection are being performed to meet this objective. We changed the paragraph to read, "Stormwater will be evaluated as part of the TMDL. The project team will attempt to capture 5 – 10 storm events during the winter season and one storm event during the summer, low-flow season in order to characterize the impact of these events. Winter storms will be sampled for bacteria only. The summer storm will include grab samples for nutrients, sediment, bacteria, and carbon. These data may be used to assign wasteload allocations (WLA) to Vancouver's stormwater management system under the Phase II permit."

Comment 10: Page 25. "Some residences may have wastewater piped directly to waterways or may have malfunctioning on-site septic systems where effluent seeps to nearby waterways"

"A major cause of septic system malfunction may be poor soil quality (heavy clay based) that does not adequately perform aeration, as well as the presence of multiple septic systems that are too close to one another. Soil condition and septic tank proximity relative to seasonal groundwater levels should be analyzed during hydrogeologic modeling."
Response 10: Hydrogeologic modeling is outside the scope of this TMDL. The temperature and dissolved oxygen stream model we plan to use does simulate groundwater/surface water interactions. The model is not a basin or landscape model; therefore, it is not possible to model septic system proximity to the stream. The goal of the fecal coliform TMDL is to bracket sources of fecal coliform in order to determine

pollution sources and select best management practices to bring the stream into compliance with water quality standards.

Comment 11: Page 25. "Groundwater discharges can also affect DO levels and nutrient concentrations in streams. Information on groundwater inflows and water quality will be collected during this study to assess the potential influence of groundwater discharges on Burnt Bridge Creek."

"Various sections of the Burnt Bridge Creek riparian areas consist of heavy amounts of peet. It may be helpful to test whether the peat is contributing to low dissolved oxygen levels by stripping oxygen from groundwater as it migrates to the creek. If this natural phenomenon proves to be a detectable cause of lower DO levels, it would help fine tune recommendations to adjust for this problem."
Response 11: Ecology will monitor dissolved oxygen concentrations in groundwater according to the procedures described in the QAPP. If there are distinct spatial or temporal differences in dissolved oxygen concentrations (or other parameters) between different geologic substrates (peat, sand and gravel, silt, etc.) this should become apparent as sampling progresses.

Comment 12: Page 26. "The city of Vancouver collected monthly water quality data at nine stations throughout the Burnt Bridge Creek Watershed from 1998 to 1999, and from 2004 to 2006."

"The City of Vancouver, per current settlement contract, is conducting field screening of all City-owned stormwater outfalls on Burnt Bridge Creek. The screening takes place during the "dry weather" months of May through September yearly, beginning 2006 and should be completed by November 2008. The City should coordinate this data with the TMDL in order to avoid duplication of this effort and to make good use of the data. The settlement contract also calls for the City to develop and implement a long term water quality monitoring program to generate data regarding water quality in Burnt Bridge Creek. The program will include both water chemistry sampling and a biological assessment. The city's water quality monitoring efforts should currently be underway, and this up-to-date data should be used to coordinate with Ecology on the TMDL."
Response 12: Thank you for the information. We will coordinate with the City regarding the data.

Comment 13: Page 36. "Develop a model to simulate biochemical oxygen demand (BOD) and productivity in Burnt Bridge Creek. Using critical conditions in the model, determine the capacity to assimilate BOD and nutrients. Nutrient data may be used to assist the Vancouver Lake Partnership in determining nitrogen and phosphorus loads to the lake."

"Masses of blue-green algal bloom have occurred in Burnt Bridge Creek, particularly in the narrower channelized areas. It may be helpful to coordinate data analysis during similar algal blooms within Vancouver Lake."
Response 13: Data for the dissolved oxygen model will be collected during summer low-flow conditions, which should coincide with algal blooms. We will be sure to note

the blooms as we are out field sampling, and will share this information with the Vancouver Lake Watershed Partnership, as appropriate.

Comment 14: Page 39. "Table 10. Fixed-network sampling locations in the Burnt Bridge Creek watershed."

"The table shows only one sampling station on Cold Creek, which is a main tributary to Burnt Bridge Creek and has more of an impact. More sampling/monitoring locations need to be added to Cold Creek. The Peterson Channel typically has higher water quality than Cold Creek, yet there are more sampling locations in the Peterson Channel than on Cold Creek, and this should be adjusted."
Response 14: Typically, Ecology only monitors the mouths of tributaries for temperature, flow, and water quality. Peterson Channel is an exception for this study because SEH America is located at the headwaters and contributes a significant portion of the flow to the channel during summer low-flow conditions.

Comment 15: Page 41. "Groundwater and Synoptic Surveys -- For this study, groundwater and surface-water interactions will be assessed via a combination of common field techniques. Instream piezometers will be installed beginning in May 2008 at the majority of the fixed-network sites (Table 10 and Figure 11). The piezometers will be used to monitor surface water and groundwater head relationships, streambed water temperatures, and groundwater quality at discrete points along the creek. Two groundwater sampling events (scheduled to coincide with synoptic surfacewater sampling events) will be conducted to assess the quality of groundwater discharging to the creek. During the synoptic surveys, groundwater samples will be collected from those piezometers located along gaining stream reaches. The samples will be submitted to the laboratory for subsequent analysis of fecal coliform, alkalinity, chloride, orthophosphate, total phosphorus, nitrate/nitrite, ammonia, total persulfate nitrogen, dissolved organic carbon, and iron concentrations. Temperature, water level, conductivity, pH, and dissolved oxygen will also be measured in the piezometers during the surveys."

Comment 15a: "Although the draft recognizes the importance of groundwater to creek conditions, the monitoring program does not seem very sophisticated and may not comply with well installation regulations. Piezometers are to be installed at most stations but the piezometer design is poor and locations vaguely planned. The design explains driving a slotted galvanized pipe into the creek bed. There is no plan to describe the soil penetrated and there should be. Galvanized metal is a poor choice of material. There is no plan to seal the outside of the pipe above the slotted section to prevent equalization with the creek. There is no description of how to protect the installations. Piezometer installations should follow state well installation regulations.
Response 15a: The well installation and sampling protocols described in the QAPP have been used successfully during numerous prior studies by Ecology and others to assess surface water and groundwater interactions (see also response to Comment 15e). The well design has been approved by Ecology's well drilling coordinator. Ecology previously evaluated the potential influence of piezometer material type (galvanized steel, stainless steel, and polyethylene tubing) on water quality

(http://www.ecy.wa.gov/biblio/0503040.html). The evaluation showed (for the parameters of interest to this study) that wells constructed of galvanized steel yielded comparable water quality results to wells constructed from stainless steel or polyethylene.

Comment 15b: "Piezometer locations are important to understanding where the groundwater is flowing from. Since the creek is likely to be receiving discharge from both the north and south, or loosing water to the north and/or south, the specific location of a peizometer is critical to understanding the affect of groundwater on the creek. Piezometers should be located on each bank, and it may not be necessary for them to be within the creek to provide the needed data. There should be an evaluation of piezometer locations relative to potential contamination sources, especially older or potentially failing septic systems. USGS studies indicate historic locations of pockets of contaminated groundwater stemming from failed septic systems."
Response 15b: In addition to installing instream piezometers, we will also be conducting numerous seepage studies to quantify streamflow gains and losses throughout the length of Burnt Bridge Creek. The seepage studies, in combination with the hydraulic gradient measurements and streambed thermal profiles from instream piezometers, will provide a comprehensive summary of both the spatial and temporal aspects of area streamflow gains and losses.

Comment 15c: "The proposed piezometer locations are based on surface water considerations, which may capture groundwater impacts as a secondary concern. In areas with high potential for contributing contaminants to shallow groundwater, it is recommended to add piezometers at several distances from the creek. This will help the movement of groundwater and how it impacts the creek."
Response 15c: Groundwater can undergo significant geo-chemical changes as it moves from an aquifer, through the streambed sediments, and into a stream. Thus the water quality one samples in an upland well may not accurately reflect the quality of water that ultimately discharges to the stream. Our well design and placement is intended to characterize groundwater quality just prior to its discharge into Burnt Bridge Creek.

Comment 15d: "The piezometers stations should be upgraded to be monitoring wells since they will be used for groundwater sampling. A hole should be augured or cored so that the soil can be described and a well installed. The actual depth of installation may be decided by the soil penetrated. A PVC well would be installed in the hole with a clay seal above the slotted section and a locking monument installed over the well. An alternative would be to install small diameter piezometers for water level measurement as described above and seepage meters for sample collection."
Response 15d: The proposed well design and sampling protocols described in the QAPP have been well vetted by Ecology, the U.S. Geological Survey and others during numerous prior studies. The following publication describes a diverse range of case studies where these techniques have been used successfully to assess surface water/groundwater interactions, http://pubs.usgs.gov/circ/2003/circ1260/.

Comment 15e: "The groundwater survey should consider future groundwater conditions. If groundwater levels continue to decline because of pumping (documented to

the south), discharge to the creek is likely to decline. This will have an affect on both base flow rates in the creek and surface water quality, particularly temperature. Groundwater generally reduces the summer base flow temperature even where there is no tree cover. Less discharge = warmer water."

Response 15e: TMDLs are not typically conducted to address instream flow issues. However, model scenarios can be run during the TMDL evaluation process to predict the potential range of water temperatures that might result should flows decrease (or increase) in the future.

Comment 15f: "Two synoptic surveys are planned in order to analyze over ten other parameters, which are primarily nutrients. This analysis will generate data to help determine what is causing deviations from the TMDLs that will require correction. Dissolved Oxygen, temperature and fecal coliform are affected by many things -- simple monitoring them will not provide enough information to determine effective corrective steps. It would be ideal to expand the synoptic surveys in order to eliminate other chemicals from a position of knowledge rather than lack of such. Even just an evaluation of previously collected data would be useful in order to determine data gaps. It does not appear that the draft QAPP addresses data gaps."

Response 15f: Ecology intends to model stream temperature, DO, and pH with the QUAL2Kw model. Therefore, the studies/field surveys have been designed to collect the required data for model input. Refer to Table 18 in the QAPP for a listing of the state variables required for the DO and pH modules of QUAL2Kw. These variables will be collected during the synoptic and stream surveys. Additionally, a historical data review of temperature, DO, pH and fecal coliform was performed and is included in the QAPP. A similar review is being conducted for nutrients. Addressing other unspecified "chemicals" is outside the scope of this TMDL.

Comment 16: Page 41. "Temperature -- Continuous temperature data loggers (thermistors) will be deployed at each fixed-network site (Table 10 and Figure 11). Each monitoring site will have at least two thermistors; one to measure water temperature and another to measure air temperature. The thermistors will measure temperature at 30-minute intervals. Instream thermistors are deployed in the thalweg of a stream such that they are suspended off the stream bottom and in a well-mixed portion of the stream, typically in riffles or swift glides. Some sites may also have a data logger measuring relative humidity."

"For clarity, there should be a description of how many fixed sites will be in full sun, partial sun, or full shade."

Response 16: Ecology follows *Standard Operating Procedures for continuous temperature monitoring of fresh water rivers and streams conducted in a Total Maximum Daily Load (TMDL) project for stream temperature (EAP044)* for thermistor placement. The SOP is available for download at http://www.ecy.wa.gov/programs/eap/qa/docs/ECY_EAP_SOP_044Cont_Temp_Monit_TMDL.pdf.

Comment 17: Page 42. "Each piezometer will be instrumented with up to three thermistors for continuous monitoring of streambed water temperatures (Figure 12). In a

typical installation one thermistor will be located near the bottom of the piezometer, one will be located at a depth of approximately 0.5 feet below the streambed, and one will be located roughly equidistant between the upper and lower thermistors."

"This process may not provide data that accurately represents the temperature of the water outside the piezometer. Separate piezometers at each depth would be needed if this data can be shown to be important."

Response 17: Ecology evaluated this potential issue in 2003-2004 as part of our Deschutes River TMDL study. At that time, paired recording thermistors (one inside and one outside of a piezometer) were deployed at the same depth along a representative gaining and losing stream reach. There was no measurable temperature difference between the paired thermistors at either site. Therefore, we are comfortable that our temperature monitoring design for Burnt Bridge Creek is adequate.

Comment 18: Page 43. "Ecology's Freshwater Monitoring Unit (FMU) will install and maintain up to two continuous streamflow gages. These gages will help quantify streamflow conditions on Burnt Bridge Creek."

"This should be 'at least two' and the criteria for selection of the locations should be described."

Response 18: Ecology plans to install two flow monitoring gages in the basin. The Stream Hydrology Unit in Ecology is developing Standard Operating Procedures for site selection of continuous flow monitoring gages, but the SOPs are not available at this time. However, the SOPs will be consistent with Ecology's current practice of following USGS protocol for gage site selection. USGS protocol states, "The ideal gage site satisfies the following criteria:

1. The general course of the stream is straight for about 300 ft upstream and downstream from the gage site.
2. The total flow is confined to one channel at all stages, and no flow bypasses the site as sub-surface flow.
3. The streambed is not subject to scour and fill and is free of aquatic growth.
4. Banks are permanent, high enough to contain floods, and are free of brush.
5. Unchanging natural controls are present in the form of a bedrock outcrop or other stable riffle for low flow and a channel constriction for high flow that is unsubmerged at all stages.
6. A pool is present upstream from the control at extremely low stages to ensure a recording of stage at extremely low flow, and to avoid high velocities at the streamward end of gaging-station intakes or orifice lines during periods of high flow.
7. The gage site is far enough upstream from the confluence with another stream or from tidal effect to avoid any variable influence the other stream or the tide may have on the stage at the gage site.
8. A satisfactory reach for measuring the discharge at all stages is available within reasonable proximity of the gage site. (It is not necessary that low and high flows be measured at the same stream cross section.)

9. The site is readily accessible for ease in installation and operation of the gaging station."

Comment 19: Page 43. "To provide a secondary confirmation of the instream piezometer dataset, Ecology will also attempt to arrange access to a tandem network of shallow off-stream domestic wells which will be used to monitor "regional" groundwater levels, temperatures, and groundwater quality."

"The Microbial Source Tracking Study for Burnt Bridge Creek readily lists several domestic wells that were used for this purpose. Attempting to use these same wells would provide consistency in data trends."
Response 19: Ecology agrees with your suggestion. Where possible and appropriate we will attempt to access and monitor wells that were sampled during previous studies.

Comment 20: Page 44. "Stormwater monitoring -- The purpose of storm monitoring is to better characterize potential sources of fecal coliform loading to Burnt Bridge Creek. During rain events, greater than average fecal coliform loading may occur when urban surface water flushes into the creeks. Ecology will attempt to capture five to ten storm events between June 2008 and August 2009. For this TMDL, a storm event is defined as a minimum of 0.3 inches of rainfall in a 24-hour period preceded by no more than trace rainfall in the previous 24 hours. Daily rainfall data will be obtained from local sources, such as Vancouver's Pearson Field Airport weather station # KVUO and Burnt Bridge Creek weather station # KWAVANCO4."

Comment 20a: **"**The stormwater section doesn't describe the objective of the sampling. Specifics of what the study plans to learn from the sampling and the criteria for the sampling should be described. Criteria need to be defined for the conditions that precede a storm event, the intensity of the initial event, and the definition of 'first flush'. For example, first flush should require a period of dry weather for a certain amount of time prior to grabbing samples from a rain event, and it should indicate a maximum delay allotted for sample collection from the start of a rain event. Tardy collection of samples will dilute sample concentrations. It is also important to outline sampling technique -- sampling should occur from within the outfall pipe, and not from within the creek flow. It's not clear that the budget is adequate for stormwater sample analysis. With plans to monitor 5 to 10 storm events, the lab budget seems to show that only coliform will be analyzed."
Response 20a: The objective of stormwater sampling, and protocol for what qualifies as a storm event, are discussed in this section of the QAPP. Additionally, the last paragraph under the Stormwater Sources section has been changed to, "Stormwater will be evaluated as part of the TMDL. The project team will attempt to capture 5 – 10 storm events during the winter season and one storm event during the summer, low-flow season in order to characterize the impact of these events. Winter storms will be sampled for bacteria only. The summer storm will include grab samples for nutrients, sediment, bacteria, and carbon. These data may be used to assign wasteload allocations (WLA) to Vancouver's stormwater management system under the Phase II permit."

The Study Design section has been updated to read:

“Stormwater monitoring

The purpose of storm monitoring is to better characterize potential sources of fecal coliform loading to Burnt Bridge Creek. During rain events, greater than average fecal coliform loading may occur when urban surface water flushes into the creeks. Ecology will attempt to capture five to ten storm events between June 2008 and August 2009. For this TMDL, a storm event is defined as a minimum of 0.3 inches of rainfall in a 24-hour period preceded by no more than trace rainfall in the previous 24 hours. Daily rainfall data will be obtained from local sources, such as Vancouver’s Pearson Field Airport weather station # KVUO and Burnt Bridge Creek weather station # KWAVANCO4.

During the wet season, Ecology will try to sample all sites twice during one storm event. However, the majority of storm event sites will only be sampled for bacteria once during the duration of the storm. When grab samples are collected, streamflow will be measured with a flow meter, or estimated using stage and rating curves, relationships with other monitoring locations, or filling a known volume over a certain amount of time. Local weather forecasts will allow anticipation of significant storm events suitable for sampling.

Ecology will attempt to sample one summer storm event. During this storm event, sites and representative outfalls will be monitored for bacteria, total organic carbon (TOC), dissolved organic carbon (DOC), total suspended solids (TSS), nutrients (ammonia, nitrite-nitrate, total persulfate nitrogen, orthophosphate, and total phosphorus).

The stormwater sampling sites will include all fixed network sites plus approximately 10 representative outfalls under NPDES. Stormwater NPDES permits are required to have corresponding Wasteload Allocations (WLAs) set in TMDL studies.”

Comment 20b: “It may be helpful to consider at least one comprehensive analysis for pesticides, metals, surfactants, and other urban chemicals that may have a significant affect on aquatic life. If there is no comprehensive analysis to generate background data, there should at least be a compilation of existing data to develop background urban contaminant levels that could stem from municipal stormwater facilities.”
Response 20b: Sampling the Burnt Bridge Creek basin for pesticides, metals, surfactants, and other urban chemicals is outside the scope of this TMDL.

Comment 21: Page 44. "The purpose of storm monitoring is to better characterize potential sources of fecal coliform loading to Burnt Bridge Creek."

“Stormwater contributes more than fecal coliform load to the creek. Many contaminants, such as surfactants, contribute to the failed water quality standards. Municipal stormwater outfalls have been known to add vast swaths of white detergent-like foam to the creek flow.
Response 21: See response to comment 20b.

Comment 22: Page 49. "Table 12. Summary of measurement quality objectives and manufacturer measurement limits of field equipment."

Measurement/ Instrument Type	Accuracy (% Deviation from True Value)	Required Resolution
Water Temperature and Specific Conductivity/Hydrolab MiniSonde®	+/- 0.1°C (temp) +/- 0.5% (conductivity)	0.01°C (temp) 0.1 umhos/cm (conductivity)

"The Hydrolab Minisonde does not meet the required resolution."
Response 22: Thank you for catching that typographical error. We changed the required resolution in Table 12 to the correct value of 0.1°C.

Comment 23: Page 50. "Table 13. Groundwater sampling parameters including test methods and detection limits."

Parameter	**Equipment Type and Test Method**	**Reporting limit**
Field Measurements		
Water level	Calibrated E-tape	0.1 foot

"The water levels in the piezometers should be measured to an accuracy of 0.01 feet, not the 0.1 feet specified on Table 13."
Response 23: We agree. Table 13 has been updated.

Comment 24: Page 52. "This is comparable to the 23% mean RSD between field replicates for twelve Environmental Assessment (EA) Program TMDL studies using the membrane filter method, suggesting that a longer (i.e., 24-hour) holding time has little effect on fecal coliform results processed by MEL. "

"Fecal coliform has a short hold time. It may be more effective and cheaper (transportation costs) to analyze samples locally rather than shipping them to the Machester lab. Furthermore, membrane filtration methodology for fecal coliform detection is predominately useful for studying waters with heavy presence of shellfish. Urban streams such as Burnt Bridge Creek do not support shellfish in a measurable quantity. Since this urban stream is known to have adverse impacts from human-related e.coli microbes, it would be far more cost effective and far more efficient to test for e.coli (rather than fecal coliform) using the EPA approved Quanty-tray method. Or, at least the Quanty tray method could be employed to further define problem stretches where septic tank intrusion is of concern. The Burnt Bridge Creek Microbial Source Tracking Study has been submitted to Ecology as reference material. The identification of coliform sources should be based on evaluation of where detected, using the Microbial Source Tracking Study as a model, rather than actual analysis of the coliform. Downstream locations in the Microbial Study indicate the highest presence of human-related e.coli. The Quantry Tray method is faster, cheaper, easier, more precise, and is currently being used all over the state of Oregon. The suggestion is not to replace

the fecal coliform membrane filtration tests, but to add Quanty-tray methods where useful."

Response 24: In response to your comment, "The Department of Health Office of Shellfish Programs (DOH) and the U.S. Food and Drug Administration only recognize FC [fecal coliform] results using the MPN method [Most Probable Number] for assessing shellfish harvest areas (APHA, 1970)." The Membrane Filtration (MF) Method is most commonly used on freshwater systems. The Samish Bay Fecal Coliform Bacteria TMDL QAPP explains, "Ecology typically uses the membrane filtration (MF) method in streams because of its practicality and precision. Joe Joy compared MF and MPN methods during the Nooksack TMDL Study (Joy, 2000). MPN results showed a wider confidence interval than MF, and a built-in positive statistical bias. The overall relationship between MPN and MF pairs was significant after lognormal transformation, but not highly correlated (R^2=0.533) (Swanson, 2006)."

In 2003, Ecology published the *Final Environmental Impact Statement – Washington State's Changes to the Surface Water Quality Standards* (http://www.ecy.wa.gov/programs/wq/swqs/2003_rule_rev_docs/final-eis.pdf). The document outlines proposed alternatives to the bacteria standards, including continuing to use the current fecal coliform criteria. The following excerpt from the Final Environmental Impact Statement suggests that fecal coliform is an adequate bacterial indicator, "The existing water quality standards use fecal coliform. In EPA's studies, they found no statistical relationship between the fecal coliform concentration in the water and illness rates of swimmers. However, fecal coliform is a more sensitive indicator than *E. coli*. Fecal coliform is a group of bacteria made up of *E. coli* and other organisms. Therefore, the concentration of fecal coliform would always be equal to or higher than the concentration of *E. coli*. As described earlier in the section, the correlation between *E. coli* and fecal coliform in Washington is quite high. Based on an Ecology study E.coli makes up typically between 90-99% of the measured fecal coliforms."

The detailed analysis of bacteria issues in the water quality standards is available in Ecology's *Setting Standards for the Bacteriological Quality of Washington's Surface Water – Draft Discussion Paper and Literature Summary* (Department of Ecology publication number 00-10- 072). This document is available for download at http://www.ecy.wa.gov/pubs/0010072.pdf. This study compiled and analyzed bacteria data from studies conducted around the world to determine the appropriate bacterial indicator for the surface water quality standards. "The technical work-group found little reason to conclude that any one indicator bacteria was sufficiently superior in all respects to justify their absolute support. The work-group could support the use [of] fecal coliform at concentrations below 100/100mL, or *E. coli* and enterococci at or below the EPA recommended levels of 126/100mL and 33-35/100mL. It is believed any of these criteria would be adequately protective of swimming in both fresh and marine waters."

Based on the information provided above and the fact that we are able to achieve the 24 hour holding times, we will continue to use the bacteria sampling methods established for this QAPP.

APHA, 1970. Recommended Procedures for the Examination of Seawater and Shellfish, 4th Edition. American Public Health Assn., Washington, D.C.

Joy, J., 2000. Lower Nooksack River Basin Bacteria Total Maximum Daily Load Evaluation. Publication Number 00-03-006. Washington State Department of Ecology. 60 pgs. Olympia, WA. www.ecy.wa.gov/biblio/0003006.html

Swanson, T., 2006. Samish Bay Fecal Coliform Bacteria Total Maximum Daily Load Study Quality Assurance Project Plan. Publication Number 06-03-102. Washington State Department of Ecology. 53 pgs. Olympia, WA. http://www.ecy.wa.gov/pubs/0603102.pdf

Comment 25: Page 52. "MEL accepts samples Monday through Friday, which means Ecology can sample Sunday through Thursday."

"What happens if planned storm event sampling occurs on a Friday or Saturday?"
Response 25: Ecology only conducts water quality sampling during Sunday through Thursday.

Comment 26: Page 57. "During periods of active data collection, quarterly progress reports will be prepared and distributed to the technical advisory committee by the project manager. At the end of the field study, the data will be compiled in a formal data summary report."

"The content of the quarterly progress reports is not specified but should be."
Response 26: Typically, quarterly reports contain information regarding data collection and correspondence with stakeholders.

Comment 27: Page 58. "The field lead will verify that all measurement and other data quality objectives have been met for each monitoring station. The field lead will make this determination by examining the data and all of the associated quality control information. Data that does not meet the project data quality criteria will be qualified or rejected as appropriate. The field investigator will produce a station quality assurance report that will include: site descriptions, data quality assurance notes, and graphs of all continuous data."

"The Data Quality (Usability Assessment) is to be completed by the Field Lead. It might be advisable (providing it is allowed by management structure) to give this responsibility to the project manager, while the field lead would be responsible for the leg work."
Response 27: It is the field lead's responsibility to complete this portion of the project; however, the project manager is available for consultation at all times throughout the process.

General Comment:
"This Bibliography may be helpful as reference material that is not listed in the TMDL bibliography."
Response: Thank you for the bibliography.

Cc: James Kardouni, Kirk Sinclair, George Onwumere, Kim McKee