



## **CRITICAL INFRASTRUCTURE INTERDEPENDENCIES WORKSHOP**

**Focus: Potential Flood Impacts and Short and Longer Term  
Regional Risk Mitigation Associated with the Green River**

**Held November 12, 2009 in Seattle, Washington**

*Summary Report*

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## **EXECUTIVE SUMMARY**

Local government agencies, private stakeholders and other key organizations convened on November 12, 2009 in Seattle, WA to discuss potential impacts from a major flood in the Green River Valley and identify ways to mitigate consequences for public health and safety and the region's economy. The workshop was a collaborative initiative by the Washington Homeland Security Region 6 Critical Infrastructure Protection Working Group, the Pacific NorthWest Economic Region (PNWER) Center for Regional Disaster Resilience, and the Puget Sound Partnership for Infrastructure Security and Resilience in cooperation with the City of Tukwila and King County Office of Emergency Management.

The workshop was designed to highlight key infrastructure dependencies and interdependencies and to facilitate discussion among critical infrastructure owners and operators on associated challenges to preparedness, response, and particularly recovery and long-term restoration. The first session provided background on the Howard Hanson Dam, including a detailed status report on repairs associated with the Dam and downstream levees, and a short overview on infrastructure dependencies and interdependencies and types of associated vulnerabilities and impacts. The second session provided interdependencies "snapshots" of critical infrastructure sectors in the region and their preparations, interests, and issues involved in developing a flood mitigation measures and restoration plan. The workshop concluded with discussion of additional short-term mitigation measures that could be undertaken and development of a longer-term regional mitigation strategy to deal with potential flood impacts.

### **Workshop Outcomes**

The workshop resulted in a number of observations regarding infrastructure dependencies, interdependencies and potential flood impacts; threat assessment and mitigation measures; multi-jurisdiction and cross-sector coordination and cooperation; alert and warning; communication and information sharing; response and recovery/restoration; logistics and supply chains; public information; and exercises and training.

- Interdependencies of greatest concern include electric power and fuels, all modes of transportation, critical IT and telecommunications, water and waste water, financial systems, and shipping and supply chains.
- There remain many unknowns regarding potential flood scenarios and still rudimentary understanding of regional interdependencies and economic costs of different levels, extent, and duration of flooding.
- Development of a multi-agency/multi-jurisdiction coordination and decision-make structure is necessary to address regional preparedness, response and particularly long-term recovery.
- Priority needs include improved alert procedures and systems and a clear understanding of "triggers" for emergency activities; also procedures for:
  - Addressing environmental safety, security and fraud issues;
  - Certification to facilitate access for essential personnel; and
  - Debris cleanup and removal.

- Assurance and rapid restoration of disrupted logistics and supply chains are essential to public health and safety, business and operational continuity, and economic resilience.
- Updated information should be provided on a continuous basis to the public and media and forums provided for stakeholder information sharing.
- Further collaborative activities beyond the workshop should be undertaken that can illuminate interdependencies, impacts, and identify mitigation measures for implementation.
  - A potential follow-on initiative for 2010 is a regional resilience initiative that would build on jurisdictional, regional, and organizational activities to develop a risk mitigation strategy (action plan) that could be undertaken by local and state agencies in cooperation with interested stakeholders. This effort would further identify and assess economic and other consequences associated with interdependent infrastructures, as well as test and improve pre-disaster preparedness, response and recovery/long-term restoration capabilities to address major flooding associated with the Howard Hanson Dam.

# **CRITICAL INFRASTRUCTURE INTERDEPENDENCIES WORKSHOP**

## **Focus: Potential Flood Impacts and Short and Longer Term Regional Risk Mitigation Associated with the Green River**

### ***SUMMARY REPORT***

More than 140 essential service providers and owners and operators of Green River Valley stakeholder organizations met with local, state, and federal government officials on November 12, 2009 in Seattle, WA to discuss potential impacts from a major flood in the Green River Valley and identify ways to mitigate consequences for public health and safety and the region's economy. The workshop was a collaborative initiative by the WA Homeland Security Region 6 Critical Infrastructure Protection Working Group, the Pacific NorthWest Economic Region (PNWER) Center for Regional Disaster Resilience\*, and the Puget Sound Partnership for Infrastructure Security and Resilience, in cooperation with the City of Tukwila and King County Office of Emergency Management. The workshop focused on both short-term actions to enhance regional and organizational resilience and laid the groundwork for development of a risk mitigation strategy of collaborative activities in 2010.

### **Workshop Purpose, Objectives, and Scope**

The primary purpose of the workshop was to allow infrastructures, essential service providers, and dam owners and operators to contribute to an analysis of interdependencies and cascading impacts resulting from a major flood in the Green River valley.

Workshop objectives were to:

- Gain an understanding of potential flooding scenarios and issues involved;
- Examine interdependencies, impacts, and preparedness gaps;
- Identify short and longer term potential mitigation measures and other activities to enhance preparedness and rapid reconstitution of services;
- Facilitate networking and identify points of contact from public and private sector critical infrastructures;
- Lay the groundwork for a potential initiative in 2010 by local governments, stakeholders, and federal partners to develop a regional risk mitigation strategy focusing on the Green River flood threat.

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\* PNWER is a cross-border consortium comprised of Washington, Oregon, Alaska, Montana, Idaho, Alberta, British Columbia, Northwest Territories, Saskatchewan, and The Yukon. The Center for Regional Disaster Resilience (CRDR) works with key public and private stakeholders to create and implement practical solutions to improve preparedness and resilience. For this workshop, the CRDR utilized its extensive experience developing and conducting the Blue Cascades regional exercise series and other interdependencies events, including the 2009 Dams Sector Exercise Series – Columbia River Basin (DSES-09). DSES-09 brought cross-sector stakeholders together in the Tri-Cities Area of Washington State to develop a regional disaster resilience and preparedness strategy that can be expanded to the broader Columbia River Basin.

The geographic scope of the workshop was the area below the Howard Hanson Dam in the Green River Valley, where potential major flooding is a concern, and the broader Seattle area and beyond where infrastructure interdependencies extend. Key jurisdictions directly affected by potential floodwaters include parts of Auburn, Kent, Renton, South Seattle, and Tukwila.

## **Format and Process**

The day-long workshop was designed to highlight key infrastructure dependencies and interdependencies and to facilitate discussion among critical infrastructure owners and operators on associated challenges to preparedness, response, and particularly recovery and longer-term restoration in the event of major flooding in the Green River valley. The proceedings were divided into three sessions featuring informational panel presentations followed by interactive discussion based on issues questions. There was a working lunch featuring a presentation by the U.S. Army Corps of Engineers (USACE) on dam sector resilience activities and the Dams Sector Exercise Series – Columbia River Basin (DSES-09) pilot project.

The first session provided background on the Howard Hanson Dam, including a detailed status report on the repairs associated with the dam and the status of downstream levees, as well as a short “tutorial” on infrastructure dependencies and interdependencies and types of associated vulnerabilities and impacts. The second session provided interdependencies “snapshots” of critical infrastructure sectors in the region and their preparations, interests, and issues involved in developing flood mitigation measures and restoration plans. Sectors addressed included transportation systems, energy (electric power, natural gas, and fuels), telecommunications, information technology, and water/waste water systems. The final session focused on response and recovery organizational decision-making structures and issues related to state, federal, private sector, and other aid that could be available for long-term recovery/restoration. The workshop concluded with a review of outcomes of the previous sessions, discussion of additional short term mitigation measures that could be undertaken, and development of a longer-term regional mitigation strategy to deal with potential flood impacts over the next few years as the repairs associated with the dam and other mitigation measures are implemented. (*See Appendix A for detailed workshop agenda.*)

## **Workshop Highlights**

The workshop welcome was provided by the Hon. Jim Haggerton, Mayor of Tukwila, and Brandon Hardenbrook, Deputy Director of PNWER. Both underscored the importance of involvement of the region’s infrastructures and other stakeholders in addressing interdependencies that will have a major impact in the event of serious flooding. Mayor Haggerton emphasized that continued economic development was crucial to the region and that improving economic resilience was essential to forestall flood-related loss of businesses and tax revenues. He noted that regional stakeholders needed to know how to get prepared and “back up and running” as soon as possible.

Opening remarks were provided by Robin Friedman, Director of the King County Office of Emergency Management, who pointed to the significance of the potential flooding in terms of scale, complexities, and costs associated with economic damage and people displaced and in need of long-term shelter. He cited the importance of knowing what decisions to make and how

to make them rapidly and that determining how to deal with recovery is the “big problematic issue.”

### ***Session 1: Green River and Howard Hanson Dam Situation Update for Critical Infrastructures***

**Dam and Levees — Local and Regional Mitigation Activities and Status.** *LTC Jim Rollins, Deputy District Engineer for Howard Hanson Dam, Seattle District USACE,* provided background on the evolution of the Howard Hanson Dam situation and an update on repairs and the potential flood threat. He noted that there was a lot of misunderstanding on how the USACE operates the dam. The dam has different functions, including flood risk mitigation, augmenting the reservoir and eco- system habitation. He said the dam itself is fine. However, after the winter storms of January 2009, when 15 inches of rain fell in 24 hours, depressions were seen on the Dam’s right abutment, and water seeping through the abutment was full of sediment, indicating internal erosion. The USACE has been working to secure the abutment with the installation of a grout curtain. The curtain, the first stage of which is installed, was created by drilling holes deep into the abutment and filling it with concrete grout. So far 500,000 gallons of grout have been injected by the USACE into the abutment, and they have completed 10% of their final design solution. He concluded with the observation that there is “very complex geology” involved and that the USACE needed “time to figure out the best way to proceed.”

Following Rollin’s presentation, *Hillman Mitchell, Emergency Management Coordinator for the City of Tukwila,* briefed on the efforts taking place downstream to protect the levees. He began by describing possible flood scenarios and levee issues, including overtopping of banks and levees, degradation of banks and levees, debris-related damage to levees, and levee catastrophic failure due to seepage, underflows, overtopping, slumping, and erosion. Potential conditions that could cause major floods include a series of winter storms (streaming in “atmospheric rivers” from tropical latitudes toward the Pacific northwest), long periods of sustained rain, a high river flow for extended periods, rapid drawdown of river levels, and weak portions of levees. If the levees overtop or fail, the resulting inundation could be as much as seven miles wide and displace 27,000 to 30,000 residents and businesses. Infrastructures impacted would be all modes of transportation, power, telecommunications, water and wastewater, fuel, food, hospitals and health care, and medical supplies. He noted that the region affected was the second largest warehouse district on the West Coast (next to Long Beach, CA). Long-term needs would include rebuilding housing and retaining businesses, which may not want to return to the area because of flood risk. To mitigate these risks, the City has undertaken a number of efforts, including planning, training and exercises, increasing the capacity of levees (adding 3-4 feet to each of them), identifying and bolstering vulnerable levees with sandbags; patrolling levees during high river flows, working with the Red Cross, and improving surface water systems to prevent flooding through street drainage. Among the challenges the City faces in the event of major flooding are identifying where the most vulnerable populations are located, dealing with a shortage of housing and lack of insurance for low-income families, facilities for sheltering displaced families and supporting services, and staff resources. Lastly, he observed that the DSES-09 Tri-Cities risk mitigation planning project provided a good model that the Green River Valley stakeholders could use to identify how to lessen the impacts of interdependencies and resulting damages and expedite recovery and long-term restoration.

**Infrastructure Dependencies and Interdependencies Challenges.** *Dr. Paula Scalingi, Director, PNWER Center for Regional Disaster Resilience,* provided a brief overview of interdependencies, pointing out the types and pervasiveness of the interconnections among energy, telecommunications, transportation, water and waste water systems, etc., and how these linkages could cause simultaneous and cascading failures that went well beyond the immediate region, exacerbating response and impeding economic recovery. (*See Appendix B: Infrastructure Interdependencies Background*).

## ***Session 2: Interdependencies and Associated Economic Disruptions That Could Impact Recovery, Restoration, and Resilience***

**Energy (Electric, Gas, Fuel).** *Mark Wesolowski of Puget Sound Energy (PSE)* outlined the preparations being taken to assure electric and natural gas systems in the valley in the event of flooding. Puget Sound Energy has a major supply warehouse and 35 transmission and distribution substations, supplying about 75,000 electric and 35,000 natural gas customers in and around the valley. He estimated that wherever there was flooding, power outages could occur. Natural gas systems fare better, though standing water that is a foot or more higher than the gas meter could disrupt gas service at most residences. PSE has identified sites to relocate materials, has communicated with residents of area mobile home parks about the possibility of having to disconnect natural gas service in advance of flooding, and has a plan to reconfigure the electric system, hoping to limit electric outages to the area the water has inundated. However, depending on the severity of flooding, service disruptions could be of significant duration, given they will not be able to restore power until all flood waters have subsided, and equipment was dried out. Also, customers may be required to have service inspections. Important interdependency concerns for PSE are evacuation coordination with the affected jurisdictions, post-flood coordination with public health, impacts to telecommunications systems (including supervisory control and acquisition systems (SCADA)), roads for transportation, credentialing of personnel to gain access to the affected area to expedite service restoration, availability of the Washington State Department of Labor and Industries (L&I) inspectors, availability of private contractors for repairing customer equipment. The restoration process will likely be “slow, tedious, and methodical.”

*Tim Barrett, BP Pipelines,* spoke about the Olympic Pipeline, which runs directly through the Kent Valley, supplies western WA State with most of its fuel needs, and provides all the fuel for Sea-Tac Airport and the Port of Seattle. The main hub for pipeline operations is in Renton and would be forced to shut down during a flood. They have created an alternate command center in Tacoma to run the pipeline should this happen. Without the Renton hub, operations would be down to 70%. A barrier has been built around the Renton facility, and critical staff will stay on as long as it is safe.

*Mike Condon, continuity manager for the West Coast for BP,* noted that a three-day supply of product was typical. After three days, there would be a need to transport fuel by means other than through the pipeline, using trucks and barges, but these capabilities would be limited and dependent on weather. Sea-Tac airport keeps enough fuel on hand for three days; however, if distribution were disrupted for longer than that, this would have far reaching effects. Should the pipeline segment to Sea-Tac be shut down when transporting product other than jet fuel, the line would have to be cleared once operations were running again, causing further delay in providing

jet fuel. If there were significant flooding, it could take several weeks to months to get facilities repaired, rebuilt, and back on-line. Important dependencies and interdependencies include power, telecommunications, financial systems, transportation, and local emergency services. The biggest concerns are coordination with local jurisdictions and the need for a multi-area command system, and impacts on employees with residences in the flood zone.

**Transportation and Supply Chain Impacts and Management (Bridges, Rail, Public Transportation, Freight, Storage, Distribution, etc.)** *Harold Taniguchi, representing King County Transportation*, pointed out that this would not be a normal flood and that many transportation routes would be impassable. There is concern that debris traveling down the river could damage bridges. Thirty transit routes would be affected, and a “game plan” has been outlined to handle evacuations and re-routing transportation and public transit systems. King County would work closely with utilities on outages and local jurisdictions on debris management. At the first sign of floodwaters, road crews will be patrolling the roads ensuring they are passable and closing those routes that are not. Signs have been posted for directing citizens out of the flood area. Identifying special needs populations poses a challenge. Those who have passes for the METRO bus pick-ups have been contacted by METRO. All people seeking assistance evacuating are being asked to contact their own jurisdiction for assistance.

*Kathy Gleaves of the Port of Seattle* gave an overview of steps that had been taken to protect business at the Ports and Airport. Electric power and jet fuels are major dependencies, as are Port employees, half of whom live in the potential flood area. The Port has purchased generators for Sea-Tac capable of running 100% of the electrical systems to avoid national flight disruptions. A one-day shut down of the airport would take three days to get air flights back to normal. Also, the airport is the major hub for the State of Alaska, which is dependent on air cargo supply chains. In the event of a flood, the airport is prepared to request that flights coming in from nearby locales and then returning to lose locales carry enough fuel for the whole trip, rather than fueling at Sea-Tac. This should preserve some of the stored fuel, but will be costly for some airlines because it is less expensive to fly planes with minimal weight. Regarding shipping the Port focus is on keeping operations moving by clearing away any debris that comes down the river and keeping rail and road transportation operational. 70 percent of cargo moves by rail, and there is not much room to store containers. Keeping the airport and ports running is not just important to the economy of Washington, which depends on tax revenue from these locations, but the world over. An example is grain exports from the Port grain terminal, which are relied on heavily in other countries. Yet another concern of the Port is to address marine issues such as vessels breaking loose from moorings, silt build-up impacting large ships, and alerting mariners to debris and other flood-related hazards.

*Barb Ivanov, Washington State Department of Transportation Freight Systems Division*, provided an overview of WSDOT preparatory and flood response actions to keep highways open as long as possible and re-open disrupted routes as soon as possible. Based on flood scenarios, highway 18 will probably remain open, but highway 167 will be impacted. There would be high volume on I-5. This, in conjunction with an evacuation, would cause major traffic disruptions and interrupt the trucking industry. The WSDOT focus will be on “goods getting where they need to go” and helping truckers get information on safe storage facilities if necessary. A warning system has been developed to inform residents of what flood threat level they are facing and when and how to evacuate.

**Working Lunch Presentation.** *Yazmin Seda-Sanabria, Critical Infrastructure Security Program Manager, USACE,* spoke about the USACE role in addressing dam sector infrastructure protection and related all-hazards threats and emergencies, including natural disasters, structural deficiencies, accidents, equipment malfunctions, and aggressive acts. A particular area of focus is on identifying impacts to critical infrastructures and interdependencies, as well as risk-based mitigation strategies to improve regional resilience. The USACE currently is undertaking a dam sector regional resilience pilot project with the U.S. Department of Homeland Security and PNWER in conjunction with local, state, and federal agencies and regional stakeholders to address major flood scenarios. The focus of the DSES-09 project is to develop an overall risk mitigation strategy focused initially on the Tri-Cities area that can be expanded to the broader Columbia River Basin region. The project involves a series of tabletop exercises with pre-exercise training seminars and follow-up action planning workshops. This exercise approach is designed to provide dam and levee owners and operators, local and state governments, and critical infrastructures and other essential service providers with an action plan of activities from the respective exercises to improve regional preparedness and resilience. Such an approach could be customized to address the Howard Hanson Dam-related potential flood scenarios.

**Communications and IT Systems.** *Shad Burcham, King County Office of Emergency Management,* said there are \$12 billion worth of assets in the Green River Valley and the unincorporated areas, where there is an issue of how to warn the population in the region. One of the challenges they are facing in using current flood warning systems is obtaining personal information from residents who are reluctant to provide it. Auburn has been able to convey its emergency messages via a radio station.

*Kathleen Miller, Qwest,* gave an overview of the preparedness steps Qwest is taking. Qwest has five central offices in the region, including a cyber center in Tukwila, an MRI warehouse in Kent, and cables, equipment, garages, and controlled environmental vaults. Qwest serves the FAA, 911, local emergency services and law enforcement, schools, and hospitals. If their assets are inundated, telephone service will be disrupted to Qwest customers. Qwest is addressing how to provide back-up capabilities and restore disrupted service as soon as possible.

*Mikel Hansen of Sabey Corporation* noted the importance of taking interdependencies into account in flood contingency planning and that restoration of telecommunications services could take weeks in the event of major flooding and would follow power restoration.

**Drinking Water and Sewer Systems.** *Jim Henriksen of Public Health – Seattle/King County* said that planning for the Green River flooding is being addressed in two public health areas: medical and environmental health. On the environmental public health side, regional planning efforts have included mobilizing several planning task forces focusing on hazardous materials mitigation, public safety environmental monitoring of floodwater/sediments, disaster debris management, and mass care and sheltering. Each of these task forces is responsible for creating a flood action plan.

*Allen Alston of the King County Wastewater Treatment Division,* which is the treatment provider for the local sewer agencies in the potential flood area, said that their system is only capable of handling routine wastewater flows and would not be able to handle the additional flows that

would come from the interior drains of inundated homes and businesses. The conveyance system in the area of concern is a gravity system that flows to the King County South Treatment Plant in Renton, which treats the wastewater for approximately 750,000 people who live in the metropolitan area East of Lake Washington. The system in essence would become a sump for the inundated areas and would quickly be overwhelmed. Also, because of concerns over the potential to loss of power to the treatment plant, they have staged additional emergency generators so that they can continue to pump and treat wastewater, even during an extended power outage. In the event of major flooding, each city in the flooded area would need to test their potable water to ensure that it was not being contaminated. At this time, King County is developing a mechanism for informing citizens about drinking water safety. Waste water systems in the inundation area will not be fully operational for some time because of contamination, lack of power for pumps, and the need to drain, flush, and test the system. Another pressing issue is lack of staff to handle multiple, continuous emergencies and system recovery demands.

*Jim Henriksen, Public Health – Seattle/King County*, observed that there are a number of areas associated with public health concerns related to major flooding. The Health Department is now engaged in major efforts dealing with H1N1 and seasonal flu outbreak prevention and response. Public Health is responsible not just for health and medical issues but also environmental public health aspects of potential flooding. The Department is focusing on potential mitigation measures to address the public health impacts from potential flooding that include mobilizing and facilitating public-private partnerships, and developing ways to inform and educate the public. Areas of environmental health concern associated with flooding include: hazardous materials co-mingling with floodwaters; sewage collection, conveyance and treatment system impacts and sewage overflows; drinking water system integrity/safety; solid waste/debris management; rodents/vectors; dead animals, household chemicals; and other substances. Other concerns being addressed are food safety and sanitation, food warehousing and distribution, and mass care sheltering.

*Gregory B. McKnight II of the Washington Department of Health* commented that 90 percent of the population was served by four primary water utilities and all these systems have interties. Service to customers would be affected by contamination and backflow issues. In the event of major flooding, each city in the flooded area would need to test their potable water to ensure that it was not being contaminated. Water systems in the inundation area may not be fully operational for some time because of loss of power and pressure.

### ***Session 3: Transition from Incident Response to Long Term Restoration***

*Dennis Story and Andrew Hendrickson of FEMA Region X* gave an overview of FEMA assistance, reminding participants that FEMA works in partnership with the State and other federal partners. FEMA is not able to provide all restoration funding, and looks to what other agencies can provide. In past years the State has supplemented FEMA money; however, with the current economy that may not be possible. Jurisdictions would need to prepare a case for FEMA assistance. It is important to keep thorough track of expenditures and to begin communicating with the State from the first day of the emergency. Participants were referred to Emergency Support Function (ESF) 14 for information on the long-term recovery process. This process may last for years and require environmental studies, procuring contracts, etc. While

FEMA assistance was for public organizations, in special cases private sector entities, such as a utility, could be considered. Businesses can apply for Small Business Administration loans.

## **Observations and Outcomes**

The following workshop results are based on comments on participant feedback forms (*see feedback questionnaire at Appendix C*), on note cards provided for informal observations, and highlights of the interactive discussions during respective sessions. These comments fell into the following broad topic areas: interdependencies and dependencies; threat assessment and mitigation; coordination and cooperation; alert and warning, communications and information sharing; response and recovery/restoration; logistics and supply chains; public information; and exercises and training.

***Interdependencies and Dependencies.*** Linkages that participants cited as being of greatest concern reflected their particular organizational mission or service, and covered most infrastructures. As one participant expressed, the protection of facilities depended on many other organizations. Interdependencies most often cited included electric power and fuels, all modes of transportation, critical IT and telecommunications, water and waste water, financial systems, and shipping and supply chains.

***Assessing and Mitigating the Threat.*** While participants were appreciative of the respective briefings by LTC Rollins and Hillman Mitchell, there appeared to be general consensus that many unknowns remain regarding potential flood scenarios, as well as still rudimentary understanding of regional interdependencies and economic costs of different levels, extent, and duration of flooding. A Port official commented on the need to also pay attention to the long-term threat, rather than look only at the current situation. The repairs associated with the dam will take a few years and the viability of area levees is problematical under certain scenarios. It was noted that local officials and many medium and larger businesses have either developed or are in the process of developing flood continuity plans and undertaking preparedness activities. For example, utilities and service providers were developing back-up plans and systems, including operating from remote facilities and procedures for employees to telecommute. However, as one local government official remarked, “There remains an awful lot of work to be done to mitigate regional interdependencies-related potential impacts.” Another participant observed that assuming telecommuting would be effective was unrealistic based on IT capacity limitations and the possibility that telecommunications and IT infrastructure could be impacted by the flood. Another participant underscored that mitigation measures needed to be cost-effective because of limited resources, while another pointed out the importance of testing mitigation measures to assure their effectiveness.

***Coordination and Cooperation.*** Many participants raised the need for multi-agency/multi-jurisdiction coordination. A USACE official questioned who would be the leaders for long-term recovery. A city official commented that procedures for long-term economic recovery were not well developed and that this was the biggest issue. Another participant pointed to the need for coordinated decision-making on credentialing, public messaging, evacuation routes, and restoration priorities. A financial sector representative noted the need for the four cities that would be impacted by potential flooding to work together and to “speak in one voice” with King County. A DHS official pointed out that, “After everyone is gone and provided a safe area, the

three organizations that will be left behind will be the police, fire, and EMS. There doesn't seem to be any communication between the governing agencies.” On other coordination challenges, a Pierce County official observed that there were still a lot of questions to address, adding that the County was working with the State Patrol on transportation and other issues.

***Alert and Warning, Communications, and Information Sharing.*** Some participants commented on the need for improved alert procedures and systems and a clear understanding of “triggers” for emergency activities. One asked if there was a list available of zip codes for areas categorized by potential extent of flooding. Another noted the need for fire, police and EMS to be in close communication. A Port official questioned how the region could maintain a high level of vigilance and persuade individuals in flood-risk areas to evacuate if there were false alarms.

***Response and Recovery/Restoration.*** Attendees raised an array of concerns. Security issues in the aftermath of major flooding were a focus for some participants, including the potential for fraud and assuring IT security. One participant recommended that public information messaging be used to remind people to beware of con artists and provide them a mechanism and point-of-contact information to report on possible fraud situations. Another key issue was certification for essential personnel to regain access to their place of work, for first responders, utility maintenance workers, inspectors, etc. A water systems representative recommended a generic ID for all first responders. A Port official noted that debris cleanup and removal would be a primary concern, while a federal transportation official said that pipeline safety issues and hazardous materials needed more emphasis. A major grocery chain representative raised the issue of lack of dumpsters for waste material, debris, and spoiled food. A major hospital representative noted that hospital and healthcare issues, such as evacuation of patients and coordination on these issues, needed further attention. He felt that hearing from experts involved in previous disasters, such Hurricane Katrina, would be useful. Yet another participant noted the possible environmental impacts to fisheries and other wildlife either along the flood zone or downstream. A public health official commented that there needed to be more focus on human factors and potential economic impacts. Lastly, concern was expressed by various participants about businesses leaving the area, either due to damage and losses if flooding occurs or due to the ongoing risks.

***Logistics and Supply Chains.*** Several participants pointed out that public health and safety, business and operational continuity, and economic resilience are dependent on restoring disrupted supply chains as rapidly as possible. A healthcare representative underscored the importance of understanding more about supply chain impacts and how to better assure medical and food supply chains, as well as getting staff to work. A major grocery store representative commented that maintaining electric power and natural gas at warehouses was an essential need. If the duration of power outages exceeded fuel stockpiles for emergency power generation beyond 10 hours, there will be large amounts of spoiled materials that will pose a significant health hazard. These supplies in turn will be unavailable for distribution to local stores and outside the area.

***Public Information.*** A USACE representative stressed the need to keep providing updated information to the public and media. As one stakeholder put it, “I am not certain about what I am missing.” A public health official expressed essentially the same thought, commenting, “I do

not know what I do not know.” A city official observed that, “All of us need to create means/methods/tools for communicating to and with citizens, businesses, etc., and to share our bright ideas with each other.” Another official from a local jurisdiction asked whether FEMA could provide a matrix or some set of guidelines that local governments and utilities could use for preparedness planning.

***Exercises and Training.*** Participants were receptive to further collaborative activities beyond the workshop that could illuminate interdependencies and impacts and identify mitigation measures for implementation that could improve preparedness and resilience for the region. Some spoke favorably of the role of PNWER over the past several years in bringing together the broad key stakeholder community to focus on infrastructure interdependencies and related issues. Several attendees who participated in past PNWER and other cross-jurisdiction/sector activities emphasized their importance in this regard. Other participants highlighted the need for additional workshops and exercises to test and validate plans, procedures, and protection and mitigation measures.

## **Workshop Utility**

Participants in their feedback forms felt the workshop met or exceeded their expectations, rating it as very good to excellent in terms of overall impression, clarity of objectives, organization and execution, and quality of discussions. Several participants commented that they found all speakers and topics interesting and of value. Many cited the presentations by Hillman Mitchell and LTC Rollins on the flood threat to be of particular utility. Others mentioned the energy, telecommunications, and water systems panels as especially useful. Specific participant comments on the overall utility of the workshop included:

*“Plenty of information provided — good interchange and good cross-section of organizations represented.”* — FEMA representative

*“I gained a much better understanding of the issues surrounding the Howard Hanson Dam and Green River interdependencies. I also gained key contacts and a better understanding of the affected and interested parties.”* — business association representative

*“Great panel presentations and Q and A”* — USACE representative

*“Good networking; good to hear from specific infrastructure experts — utilities, port, etc.”* — Tribal organization representative

*“I have attended several Howard Hanson Dam meetings; all provided good information, but this workshop was great at giving info and addressing infrastructure issues that affect us all.”* — U.S. Postal Service representative

*“It exceeded my expectations — quality of presentations and openness of information shared.”* — City government official

*“Given the complexity of the topic and the diversity of the audience, we accomplished our goal.”* — USACE representative.

Issues that participants identified as needing additional attention included dealing with displaced residents for extended periods of time, hospital and healthcare issues/coordination, sharing additional information on local jurisdiction preparedness activities, and how long-term recovery will be handled.

While many participants applauded the broad range of organizations at the workshop, several identified organizations that were missing that they believed needed to be at subsequent meetings on the Howard Hanson Dam preparedness and resilience issues. These included railroads, more officials from local municipalities, and law enforcement, fire, and emergency service personnel.

## **Next Steps**

The workshop closed with general discussion about a follow-on initiative that could be modeled along the lines of the 2009 Dams Sector Exercise Series in the Columbia River Basin that would focus on the flood threat to the Green River Valley. This regional disaster resilience initiative would involve the affected broad key stakeholder community and PNWER. It would build on jurisdictional, regional, and organizational activities to date, as well as on results of the November 12 interdependencies workshop. The focus of the initiative would be to develop a regional risk mitigation and resilience strategy (action plan) of measures that could be undertaken by local and state agencies in cooperation with interested stakeholders. This would be a multi-jurisdiction/cross-sector effort with overlapping “tracks” (phases) and use a tabletop exercise approach to:

1. Identify and assess economic and other consequences associated with interdependent infrastructures and to identify cost-effective solutions to lesson risk and improve resilience;
2. Test and improve pre-disaster preparedness capabilities — communications, coordination, roles and responsibilities, information-sharing/situational awareness, response and mitigation procedures associated with cascading events from major flooding associated with the Howard Hanson Dam;
3. Test and improve preparedness/emergency response with focus on additional mitigation measures that can facilitate response activities;
4. Examine how to expedite long-term restoration/enhancing economic resilience through testing restoration plans, procedures, consequence assessment tools and approaches and identify prevention and mitigation measures;
5. Incorporate the results of the first four tracks into a regional risk mitigation and resilience action plan for the region for implementation by jurisdictions and regional stakeholders with state and federal partners.

Undertaking this regional, interdependencies-focused initiative would be further explored after the beginning of 2010. If there were a decision to move forward and resources and expertise were available, the initiative would begin after the winter storm season concluded and conducted over the coming months to prepare for the potential flooding challenges posed by the 2010 winter storm season.

## APPENDIX A

### CRITICAL INFRASTRUCTURE INTERDEPENDENCIES WORKSHOP Focus: Potential Flood Impacts and Short and Longer Term Regional Risk Mitigation Associated with the Green River

Location: Southcenter Doubletree

Date: November 12, 2009

**8:00 am**     **Welcome and Introductions**  
*Jim Haggerton, Mayor, City of Tukwila*  
*Brandon Hardenbrook, PNWER (Chair of Region 6 CIP Working Group)*

**8:05 am**     **Opening Remarks**  
*Robin Friedman, Director, King County Office of Emergency Management*

**SESSION I: Green River & Howard Hanson Dam Situation Update for Critical Infrastructures**  
**(This session will explore threat impacts and ongoing mitigation measures.)**

**8:15 am**     **Dam and Levee — Local and Regional Mitigation Activities and Status**  
*LTC Jim Rollins, Deputy District Engineer for Howard Hanson Dam, Seattle District USACE*  
*Hillman Mitchell, Emergency Management Coordinator, City of Tukwila*  
**Questions and Discussion**

**9:30 am**     **Infrastructure Dependencies & Interdependencies Challenges**  
*Dr. Paula Scalingi, Director, PNWER Center for Regional Disaster Resilience*

**9:45 am**     **Break**

**SESSION II: Interdependencies and Associated Economic Disruptions That Could Impact Recovery, Restoration, and Resilience (Participants will also examine capabilities to rapidly reconstitute infrastructures and critical services following a disruption.)**

**10:00 am**     **Discussion Scene Setter: Energy (Electric, Gas, and Fuel)**  
*Mark Wesolowski, Puget Sound Energy*  
*Tim Barrett, BP Pipelines*  
*Mike Condon, BP Refinery*  
**Facilitated Interdependencies Dialogue**

**11:15 am**     **Discussion Scene Setter: Transportation & Supply Chain Impacts and Management (bridges, rail, public transportation, freight, storage and distribution, etc.)**  
*Harold Taniguchi, King County Transportation*  
*Barb Ivanov, Washington State Dept. of Transportation, Freight Systems Division*  
*Kathy Gleaves, Port of Seattle*  
*Mike Lufkin, Port of Seattle (SeaTac Airport)*  
**Facilitated Interdependencies Dialogue**

**12:30 pm Lunch**  
*Yazmin Seda-Sanabria, Critical Infrastructure Security Program Manager, USACE*

**1:15 pm Discussion Scene Setter: Communications & IT Systems**  
*Kathleen Miller, Qwest*  
*Shad Burcham, King County Office of Emergency Management*  
*Mikel Hansen, Sabey Corporation*  
**Facilitated Interdependencies Dialogue**

**2:30 pm Discussion Scene Setter: Drinking Water and Sewer Systems**  
*Allen Alston, King County Wastewater*  
*Jim Henriksen, Public Health - Seattle/King County*  
*Greg McKnight, Washington Dept of Health*  
**Facilitated Interdependencies Dialogue**

**3:45 pm Break**

**SESSION III: Transition from Incident Response to Long Term Restoration**

**4:00 pm Facilitated Discussion with State, Federal, private sector, and other key stakeholders on issues of primary focus**

**Aid for Long-Term Recovery/Restoration, Resource Availability, and Constraints**  
*Dennis Story, FEMA Region 10*

**4:30pm Additional Short Term Mitigation Measures and Development of a Longer Term Regional Strategy — Next Steps**

*Hillman Mitchell, Emergency Management Coordinator, City of Tukwila*  
*Robin Friedman, Director, King County Office of Emergency Management*  
*Matt Morrison, Executive Director, PNWER*

**5:00 pm Adjourn**

## **APPENDIX B**

### **INFRASTRUCTURE INTERDEPENDENCIES**

#### ***Backgrounder***

In the past decade across the nation, the critical infrastructures and other essential service providers that enable our communities to thrive and grow have become increasingly interconnected and interdependent. These infrastructures include energy (electric power, natural gas, fuels); telecommunications, transportation (rail, road, maritime); water and water treatment systems; banking and finance; emergency services; government services; hospitals, healthcare and public health; agriculture and food; commercial facilities; nuclear reactors; materials and waste; dams and levees; manufacturing; chemical facilities; and postal and shipping. To a large degree, this trend towards ever greater linkages has been created by our growing reliance on electronic systems, computer processing, and the Internet for managing and operating these infrastructures. This interconnectivity and the resulting interdependencies can exist at multiple levels of increasing complexity and extend beyond a community, a state, and nations, creating unexpected vulnerabilities and significant consequences.

Although emergency and business continuity practitioners are beginning to focus on interdependencies, we remain limited in our understanding of them, the vulnerabilities they create, and how to prevent or lessen their impacts. Disruptions in one infrastructure can cascade, ultimately affecting more than one infrastructure, affecting essential government services, businesses, and individuals in an entire region with far-reaching health and human safety, economic, environmental, and national security consequences.

#### **Examples of Infrastructure Dependencies and Interdependencies**

Water and wastewater systems are dependent on a wide range of infrastructures and other essential services, including electric power to run pumps and control systems, petroleum fuels for transportation of repair and maintenance personnel, communications to handle the ordering of chemicals and other supplies and equipment and to direct operations, all modes of transportation for supply and shipping, and financial systems to support billing, payments, and other business services. Likewise electric power utilities depend on natural gas, coal, and petroleum for primary production or to fuel generators, as well as on road and rail transportation to deliver fuels to the generators, water for cooling to reduce emissions, and telecommunications to monitor system status and system control, e.g., supervisory control and data acquisition (SCADA) systems and energy management systems.

Similarly, infrastructures depend on water and electric power and other infrastructure services.

- Computer, process control, telecommunications, and other systems that run infrastructures depend upon water for cooling. Water systems may require electric power for operating pumps and need logistics and transportation for supplying water treatment chemicals.

- Natural gas fuels critical generators in the electric power system. Electric power in turn may be required to operate the critical systems that are essential for delivering gas (e.g., control systems, storage operations, and compressor stations).
- A substation in an electrical distribution system can provide electric power to a key telecommunications switching center, and rail transportation depends on electric power for signaling, crossing protection, monitoring, and other terminal operations. Under certain conditions, failure or loss of power in a substation, for example, directly affects operations at a telecommunications switching center.
- The telecommunications center, in turn, supports SCADA systems for natural gas and oil pipelines, as well as electric power, water, and transportation systems that support electric power.
- Agriculture and food processing, warehousing and distribution, and manufacturing are dependent on all the major infrastructures, for example power for processes and refrigeration, communications for shipping and logistics, all modes of transportation for shipping materials and products, and financial systems to support purchasing of materials and sales of goods.

When infrastructure failures occur and repair crews and replacement components are needed, service providers also depend on other infrastructures, including telecommunications/IT, petroleum fuels (for vehicle and emergency generator fuel), road transportation, and, in some cases, rail transportation. Other dependencies, because of their location or exposure to the environment, are not physically linked but are coupled. A common utility corridor that consists of overhead or underground electric power transmission and distribution lines, underground pipelines, and telecommunications cables dramatically illustrates such dependencies. In many instances, multiple infrastructure assets that are co-located, for example along bridges, roadways, or in a single location can increase susceptibility to and likelihood of simultaneous outages due to physical hazards, such as a flood, explosion, fire, or earthquake, as well as sabotage.

Another type of dependency can exist in complex systems without a direct link. The failure of a substation, for example, can lead to reconfiguration of the electric network, which, in turn, can overload a similar substation within the system if the demand exceeds capacity. In such cases, a direct link usually does not exist, and the failure occurs only when certain conditions are imposed (e.g., maximum load conditions). Natural hazards, such as earthquakes or extreme weather conditions, clearly show how threats can affect multiple infrastructures at the same time. Such threats also reveal interdependencies that can complicate or delay response and mitigation or recovery of a particular infrastructure from an incident.

### **Why a Holistic Regional Risk Mitigation Approach is Important**

Because these dependencies and interdependencies remain little understood, the emergency management plans of critical infrastructures, other service providers, and businesses are at best adequate to address localized disasters and not major incidents and disasters with regional consequences. These plans do not take into account extensive and prolonged impacts that may include disruption or destruction of critical components, systems, and facilities, causing outages of weeks or months and shortages of supplies, personnel, and capabilities to restore critical services. Such widespread and prolonged service disruptions can cause huge regional economic

and psychological impacts that can significantly diminish commerce and cause the relocation of residents in affected communities. At the same time, economic constraints pose additional challenges for states, localities, and stakeholder organizations, which have limited manpower, funds, and technical expertise to assess all-hazards vulnerabilities from interdependencies, and identify and remedy readiness gaps.

Whether a natural disaster, manmade incident, or pandemic, there is clearly a need for a holistic regional strategy to improve the resilience of our infrastructures and other essential services, as well as the communities and regions that depend upon them. This all-hazards, multi-jurisdiction, cross-sector approach to preparedness and resilience includes detection, prevention, mitigation, response, recovery/restoration, training, exercises, and community outreach. It requires utilities and other service providers to examine external linkages that affect their operational and business continuity. It also necessitates bringing together local public, private, and non-profit stakeholders with state and federal partners in collaboration to share information, and to understand and address regional vulnerabilities and consequences posed by infrastructure interdependencies.

# APPENDIX C

## Workshop Evaluation Form

Please rate each component on a scale of 1-5 (poor-excellent, not valuable-valuable)

	Excellent	Very Good	Satisfactory	Fair	Poor	N/A
Overall Impression	5	4	3	2	1	N/A
Clarity of Workshop Objectives	5	4	3	2	1	N/A
Workshop Organization	5	4	3	2	1	N/A
Workshop Execution	5	4	3	2	1	N/A
Quality of Discussion	5	4	3	2	1	N/A
Utility of Presentations	5	4	3	2	1	N/A
Next Steps	5	4	3	2	1	N/A

What agency or organization do you represent?

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Overall, do you feel that the Workshop content met your expectations?      Yes   No   Not Sure  
Why or why not?

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What were the particular topics and/or speakers that you found most useful from today's session?

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What additional information do you need for Green River Valley flooding preparation, response, and restoration that was not raised today?

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Based on the conversations today, what interdependencies is your organization concerned with?

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Based on your concerns, what still needs to be done to mitigate interdependencies related issues?

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Your comments are valuable. Please provide us with any additional thoughts, suggestions and recommendations?

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Please include me on the long-term mitigation strategy working group: Yes    No

Name: \_\_\_\_\_ Email: \_\_\_\_\_

**Thank you for your evaluation. Please make sure to return it to organizers as you leave. Your comments will be included without attribution in the Workshop Summary. If you have any further observations or reflections, please contact Steve Myers at [Steve@pnwer.org](mailto:Steve@pnwer.org), ph. 206-443-7723.**

## APPENDIX D

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