



# MEETING REPORT

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**SUBJECT:** Cambridge Vulnerability Assessment's Technical Advisory Committee

**DATE, LOCATION:** December 2, 2013, City Hall Annex, Cambridge, MA

**WRITTEN BY:** Eric Roberts and Stacie Smith, Consensus Building Institute

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The Cambridge Vulnerability Assessment's Technical Advisory Committee (TAC) met on December 2, 2013. The purpose of the meeting was to provide an update on the overall Cambridge Climate Change Vulnerability Assessment (CCVA), demonstrate how key assets will be analyzed by key stakeholders for the risk and vulnerability assessment; and practice identifying, scoring, and ranking critical components using the vulnerability assessment tool to prepare for self-assessments of key assets. Members of the Expert Advisory Panel (EAP) were also invited at the meeting. The project is being led by a team of consultants led by Kleinfelder and a steering committee of City staff. Participants are listed in Appendix A. Meeting materials are available at the project's website at <http://www.cambridgema.gov/CDD/Projects/Climate/climatechangeresilianceandadaptation.aspx>

## **Executive Summary of Key Outcomes:**

- *Identifying critical components of key assets is challenging.* The exercise proved helpful for stakeholders to understand better the process of assessing their critical components. Clear guidance, scoring criteria, assumptions, and key questions should be provided to assessing organizations. It is agreed that appropriate technical and substantive staff who should participate needs to be identified in advance for their timely contribution. Assistance from Cambridge city liaisons and Kleinfelder should be available before and during the process.
- *It is agreed that the Vulnerability and Risk Assessment must provide for a comprehensive approach integrating regional issues and social aspects.*
  - *Assessments must include analysis from both a systems perspective and from a components and asset level perspective, and examine impacts on assets from outside jurisdictional boundaries.*
  - *Physical infrastructure and social components are strongly linked.* Assessments should examine and consider both the impacts on physical infrastructure as well as the needs of residents and workers.
- *Analysis needs to consider impacts at different timescales, not limited to the duration of a specific event.* Long-term cumulative impacts on infrastructure may result from asset degradation, which is hastened by specific events and the choices made to protect people during those events.
- *Sensitivity and adaptive capacity scores might be quite different in different climate scenarios, which could get lost if these scores are added or averaged across scenarios.*

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## ***Welcome and Introductions***

Mr. John Bolduc, City of Cambridge Environmental Planner and Assessment Project Manager, welcomed the TAC and EAP members and thanked them for their participation. Mr. Bolduc reviewed the work the assessment team completed over the past year. Highlights from his update include:

- The EAP met several several times to review and vet the methodology protocols, and provide feedback for the best integration of science in the project and its applicability in the Vulnerability & Risk Assessment.
- City of Cambridge staff members presented information about the vulnerability assessment and received early input from 891 community members at 39 community group meetings. A paper and online survey collected input from 307 respondents.
- The CCVA team members are coordinating efforts with several state and regional organizations. Team members are on the Metropolitan Area Planning Commission (MAPC) advisory committee on the development of a regional adaptation strategy. Team members attended the Executive Office of Energy and Environmental Affairs' (EOEEA) Adaptation Subcommittee meetings, and meetings with the Massachusetts Environmental Policy Act (MEPA) Advisory Group to discuss the development of guidelines for climate change preparedness in environmental impact reports. Team members have also met with the Boston Water Sewer Commission (BWSC), Massachusetts Department of Transportation (MassDOT), and the Department of Conservation and Recreation (DCR) to discuss the use of consistent assumptions in climate change related projects and analysis.
- The team is also working on technical analysis in collaboration with several partners. Initial technical analysis by Katharine Hayhoe of Texas A&M was completed to inform development of the climate change scenarios. More analysis will be completed soon. The team is completing an urban forestry vulnerability assessment with the Army Corp of Engineers to understand how the urban canopy may be impacted by heat stress and flooding. The economic and public health impact analyses will begin soon.
- Coastal flooding analysis will be completed with ADCIRC instead of SLOSH as initially planned. Teams from the Cambridge Climate Change Vulnerability Assessment (CCVA) met with MassDOT, the Boston Sewer and Water Commission, consultants, and academics to coordinate modeling efforts. To use the ADCIRC model, the Cambridge CCVA team aligned the project timeline with MassDOT's project schedule.

Ms. Stacie Smith, Senior Mediator from the Consensus Building Institute briefly reviewed the agenda, meeting goals, and operating procedures. She clarified that Kleinfelder would complete the vulnerability assessment for all the critical assets for which they had essential information, but that TAC members would complete the assessment for infrastructure for which they have more information. A city liaison and a representative

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from Kleinfelder will be available to TAC members when they conduct the assessments in January.

## ***Project Update and Review of Recent Products***

Ms. Lisa Dickson, Kleinfelder Principle in Charge, reviewed the overall approach, the existing conditions report, and the climate scenarios that will be used in the assessment. Highlights from the update are below. More detail is available in the November 2013 memorandum, which was handed out at the meeting.

- The CCVA consists of three phases: Climate scenarios development and critical infrastructure identification; the vulnerability and risk assessment; and adaptation planning and design. The climate scenarios will focus on temperature, precipitation, sea level rise (SLR), storm surge and extreme events. Down scaled projection data will be used in combination with historic events data and expert opinion to form the final climate scenarios. Critical infrastructure and services will be identified and indicators from infrastructure, public health, economic resources, and environmental justice will be selected for analysis.

## ***Vulnerability Assessment Group Activity***

Ms. Dickson described the vulnerability assessment activity for the day, in order for TAC members to practice and improve the assessment methodology to be able to use the described approach in their organization. The approach is based on the ICLEI<sup>1</sup> process. Two mock climate change scenarios, not the final scenarios for the final assessment, were selected for the activity. The scenarios are drawn from historic events, and used as examples for the day's exercise. The heat wave scenario assumes ten consecutive days with temperatures at greater than 90 degrees Fahrenheit. The inundation scenario assumes flooding from a category 2 hurricane. Group members were divided into four focal areas to assess the vulnerability of assets from the perspective of an associated infrastructure manager or operator. The four groups and associated infrastructure operators included:

- Energy / NSTAR Energy Substation
- Transportation / Alewife MBTA Station
- Public Housing / Jefferson Parks Apartments
- Public Health / Mt. Auburn Hospital

Once in the small group session, members first identified the critical components

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<sup>1</sup> ICLEI is a leading association of cities and local governments dedicated to sustainable development. His members represent 12 mega-cities, 100 super-cities and urban regions, 450 large cities as well as 450 medium-sized cities and towns in 86 countries. They have developed the ADAPT tool for Vulnerability and Risk assesment at the urban scale. <http://www.iclei.org/>

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necessary for basic operation. They next scored the components' sensitivities and adaptive capacities. Sensitivity was defined as the degree to which the functionality of a system is affected by a specific climate change impact, whether directly or indirectly. Adaptive capacity was defined as the ability or potential of a system to respond successfully to climate variability and change, and includes adjustments both in behavior and in resources and technologies. As a final step, group members ranked the critical components using a vulnerability matrix.

## ***Vulnerability Assessment Group Reports and Methodology Discussion***

Upon return to the full group setting, Ms. Dickson described the themes she and others heard while observing the breakout groups completing the activity. Her observations are summarized below.

- *Groups struggled to select the top three most critical components of the infrastructure pertaining to their group.*
- *Groups noted the challenges of examining the assigned infrastructure from both a systems perspective and from an asset level perspective.* The current intent of the CCVA is to first understand the key breakdown points from an asset level, then scale up to a systems perspective, and then scale up again to an interconnected systems perspective.
- *Many participants expressed the need to include more technical oriented people in the activity.*
- *Physical infrastructure and social components are strongly linked.* The physical infrastructure supports the people of Cambridge and the ability to make the physical infrastructure more resilient impacts the residents.
- *The timescale of impact may not be limited to the duration of a specific event.* Long-term cumulative impacts on infrastructure may result from asset degradation, which is hastened by specific events and the choices made to protect people during those events.

The small group facilitators presented the results from each group and the observations and comments they heard about the vulnerability assessment methodology. The following section synthesizes the comments from the small group facilitator presentations, the typed notes from each breakout group, and the final group discussion about the activity.

**Systems Level vs. Asset Level Assessment:** Many comments focused on how or when either a systems level or asset level assessment should be completed.

- Some participants commented on the challenge of identifying small infrastructure components that would lead to the failure of a larger system, especially if the infrastructure is comprised of many smaller components. For example, the MBTA system is large and interconnected and there are several infrastructure components that could cause it to fail. But, if energy were considered an asset

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class of the transportation system, then it might be the most critical component because the system cannot function without it.

- Some group members suggested the component scale assessment was less useful than an assessment of the major system breakdown points. One participant suggested approaching the assessment first from a systems perspective and secondly from the asset level given the knowledge and understanding of the systems possessed by those in the room. Once the system was assessed, small groups of experts who know the details of the system could be asked about the vulnerability of key assets in the system, and about new assets that could be added to the system to reduce vulnerability.
- Other group members said the assessment methodology might require the opportunity to look at components both holistically and individually since small impacts to several components may result in a failure but a small impact to one individual component may not cause failure.
- A member suggested some focus be given to the identification of interdependencies with the surrounding communities since many of the systems cross jurisdictional boundaries.
- A participant suggested that some system managers view assets in different modes and sensitivity for each mode is likely to differ. Three potential modes for viewing assets are asset protection, asset recovery, and asset vulnerability in relation to nonstop operation.

*Materials, Assistance, and Information Needs for Completing the Assessment:* Group members suggested the following considerations be completed before or at the beginning of the vulnerability assessment in January or February.

- Some participants suggested providing a summary of the known and unknown considerations associated with a particular facility or system to provide the foundation from where discussions will begin.
- A participant suggested providing training or additional guidance to the assessment teams to help them understand how to execute the assessment, including examples of the level of detail to which components should be assessed. Related to this, another commenter suggested providing system managers with detailed scenarios for review in advance of the vulnerability assessment activity. This may allow them to do focused research about the vulnerability of specific components in anticipation of the assessment process.
- Some participants commented that providing the assessment participants with a set of assumptions for each scenario might help them dive deeper into the details of a particular infrastructure. For example, an assumption may be that the electrical supply would be disrupted.
- Another participant suggested providing the assessing organizations with clear guidance about who should participate and what information will they need. For example, members of an organization's finance team might need to be included in addition to facilities managers.

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- A participant suggested providing the assessment teams with a detailed agenda and questions to help frame and guide the conversations around the assessment.

Scoring Sensitivity and Ranking Critical Components: Several commenters suggested considerations that could change the sensitivity scoring and ranking process.

- Sensitivity scores would vary depending on the duration of the impact. Short-term impacts might cause temporary service disruption or emergency management issues, but long-term impacts, such as the degradation of the infrastructure, would cause longer disruptions.
- Some members requested examples and descriptions of the vulnerability score definitions.
- A member suggested the framework should explicitly address the social systems/networks that are impacted by failures of vulnerable infrastructure systems. Networks in the education system, the health system, welfare system, or elderly services, and networks of friends, family, and neighbors are critical assets to community members. For some demographic groups in particular, the vulnerability and adaptive capacity of the social system or network is dependent upon the connectedness provided by the infrastructure systems. An additional column could be added to the critical component scoring sheet to identify the vulnerable populations that rely on the systems impacted in each scenario. Including this social element into the methodology would prevent the analysis and resiliency strategies from focusing only on engineered solutions while simultaneously facilitating the identification of social systems to target during the eventual implementation plan.
- Several participants questioned the usefulness of adding the sensitivity and adaptive capacity scoring components across scenarios. It was suggested the only time adding across scenarios may be useful is when a multi-faceted event is occurring (for example, a high heat and flooding scenario). Participants also suggested reordering the ranking of either the sensitivity or adaptive capacity scales so that all low numbers are negative and all high numbers are positive, or vice versa.
- Another member commented that generating a vulnerability score is an excellent idea, but vulnerability is sometimes measured on a sliding scale with more than one tier of outage that could occur. Capturing the nuance surrounding the different tiers is valuable.

Other Comments:

- Consideration should be taken with regard to the cumulative impacts of climate related events. Some members indicated that incremental thresholds might exist after which greater impact to the infrastructure would occur. For example, an asset may be able to withstand one flooding event, but three or four flooding events may cause significant deterioration of the infrastructure.

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- Dedicated note takers or recorders should be present in the assessment meetings to capture all the subtle information as well as bullet points.
- A participant cautioned against strong reliance on the models to create the scenarios. He stated that models do not predict variability well and suggested the scenarios should represent situations from the tails of the event probability distribution. The participant also noted that models presume the modern variability may be constant, but it may not actually be constant.
- Could there be changes to the methods of assessing property value to better address vulnerability issues?

To conclude this segment, Ms. Dickson said the CCVA team anticipated creating a list of key components they anticipate may be within each entity's system. This list would be provided to the system manager for refinement. She indicated the assessment process would likely be an iterative process between the CCVA team and the system managers.

## **Next Steps**

The CCVA team will be in contact with TAC members to refine the guidelines for each sector in the coming weeks and months. The Risk and Vulnerability assessment however is dependent upon the completion of the ADCIRC model for climate projections for flooding. The ADCIRC model should be completed in January or early February. The CCVA team will also be developing existing conditions maps and seeking TAC input on these as well for the identifications of critical assets. TAC and EAP members are encouraged to contact the CCVA team with any additional comments or questions that were not addressed during the meeting.



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## APPENDIX A: Participants

### TAC Members

Joe Gifun (for Richard Amster), MIT Facilities, Campus Planning, Engineering & Construction  
Andrew Brennan, MA Bay Transportation Authority (MBTA)  
Andrew Winters (for Penni Conner), NSTAR  
Peter Crawley, Environmental Consultant and resident  
Mark DiOrio, The Bulfinch Properties  
Christian Lanphere (for Barry Hilts), Cambridge Health Alliance  
Ben Myers (for Bryan Koop), Boston Properties  
Michael Johnston (James Comer?) (for Gregory Russ), Cambridge Housing Authority  
Terrence Smith, Cambridge Chamber of Commerce  
Steven Miller (For Kevin Walsh), MassDOT Environmental Services  
Andy Reinach, Alexandria Real Estate Equities  
Richard Zingarelli, MA Department of Conservation and Recreation Hazard Mitigation

### EAP Members

Henry Jacoby, MIT Sloan School of Management  
Ramon Sanchez, Harvard School of Public Health  
Jack Spengler, Harvard School of Public Health  
Dan Shrag, Harvard University

### STC Members

John Bolduc, Cambridge Community Development Department  
Brian Murphy, Cambridge Community Development Department  
Owen O'Riordan, Cambridge Public Works Department  
Susanne Rasmussen, Cambridge Community Development Department  
Sam Lipson, Cambridge Public Health Department  
Jim Wilcox, Cambridge Department of Public Works

### Others Attendees

Evan Hazelett, MBTA  
Laura Smead, Cambridge CDD  
Jennifer Lawrence, Cambridge CDD  
Alex Reisman, Cambridge Community Development Department  
James Comer, Cambridge Housing Authority  
Steve Lenkauskas, Cambridge Electrical Department

### Kleinfelder and CBI Team Members

Nathalie Beauvais, Lisa Dickson, Indrani Ghosh, Vijay Kesavan, Nasser Brahim - KLF  
Eric Roberts and Stacie Smith, Consensus Building Institute