PATH/AWARE:

Prioritization Analysis Tool for All-Hazards/ Analyzer for Wide Area Restoration Effectiveness

A Toolset for Prioritizing Critical Infrastructure and Allocating Resources for Wide Area Restoration

Presenter: Lynn Yang

Developers: Bob Knowlton, Mark Tucker, Wayne Einfeld, Brad Melton, Dave Franco, Lynn Yang, Karim Mahrous, Kim Grommes

Sandia National Laboratories

Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

Following a wide-area incident, to develop a Recovery Strategy, decision-makers need:

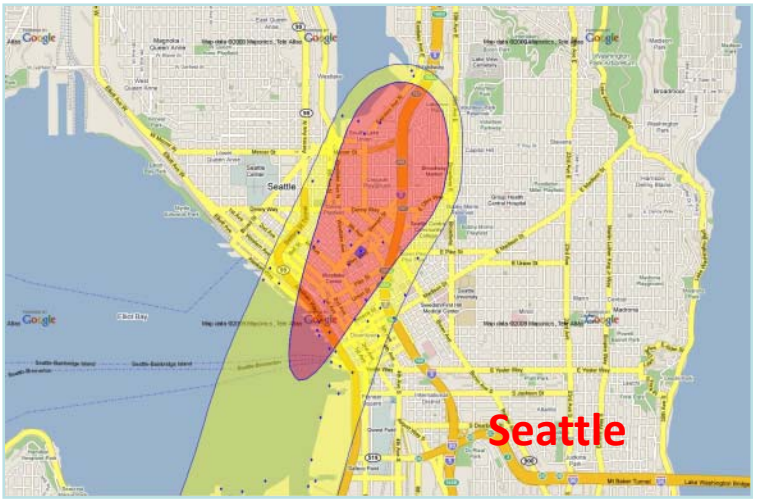
- **Information/Situational Awareness**
- Structure (e.g., Incident Command System)
- **Process**
- Relationships

PATH/AWARE tool provides **information** and an **analysis-based process** for recovery planning.

Interagency Biological Restoration Demonstration (IBRD) for Wide-Area Biological Incident

IBRD project objectives:

- Develop comprehensive guidance for restoration and recovery following a National Planning Scenario 2 attack, considering civilian/military cooperation
- Evaluate the technology gaps that exist today
- Develop technology, where appropriate, to fill these gaps, with an emphasis on saving time and money in the restoration process



IBRD Program Managers:

- Chris Russell, DHS-S&T
- Ryan Madden, DoD-DTRA

National Laboratory Participants:

- Sandia National Laboratories
- Lawrence Livermore National Laboratory
- Pacific Northwest National Laboratory
- Los Alamos National Laboratory

Project funded by:
Department of Homeland Security - Science & Technology, and
Department of Defense – Defense Threat Reduction Agency

As part of IBRD, Seattle OEM, Pierce County DEM, King County OEM have provided critical feedback and ideas in the development of PATH/AWARE.

Sandia National Laboratories

In a wide area incident, development of an effective Restoration Strategy will be complex

Following a wide-area incident:

- Loss of functionality across many systems
- Limited restoration resources
- Lengthy restoration time, possibly years
- High visibility

Decision makers will want to know:

- Which assets and functions have been impacted?
- How long will the cleanup take? When will critical functions be restored?
- What are the dependencies? How will these be factored into the restoration strategy?
- How much money and resources can the federal government provide? Where do those resources get applied?
- If additional resources were available, could the restoration be done in less time? What are the chokepoints in the process?

Laboratory Analysis

Environmental Sampling

Decontamination

PATH/AWARE helps answer these questions

HOMELAND SECURITY & DEFENSE

Sandia National Laboratories

PATH/AWARE supports the development of a Restoration Strategy based off of prioritized Recovery Objectives

The toolset helps decision-makers:

- identify critical infrastructure in damage area;
- assess impacts on critical functions and services;
- assess and analyze critical infrastructure dependencies;
- develop an integrated, unified prioritization strategy;
- determine resource requirements for restoration operations;
- identify chokepoints in the process; and
- allocate and manage resources effectively

Gain situational awareness

Prioritize

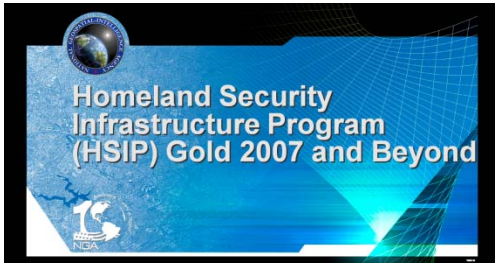
Allocate resources

… during planning and operational phases.

PATH/AWARE utilizes multiple asset and facility datasets

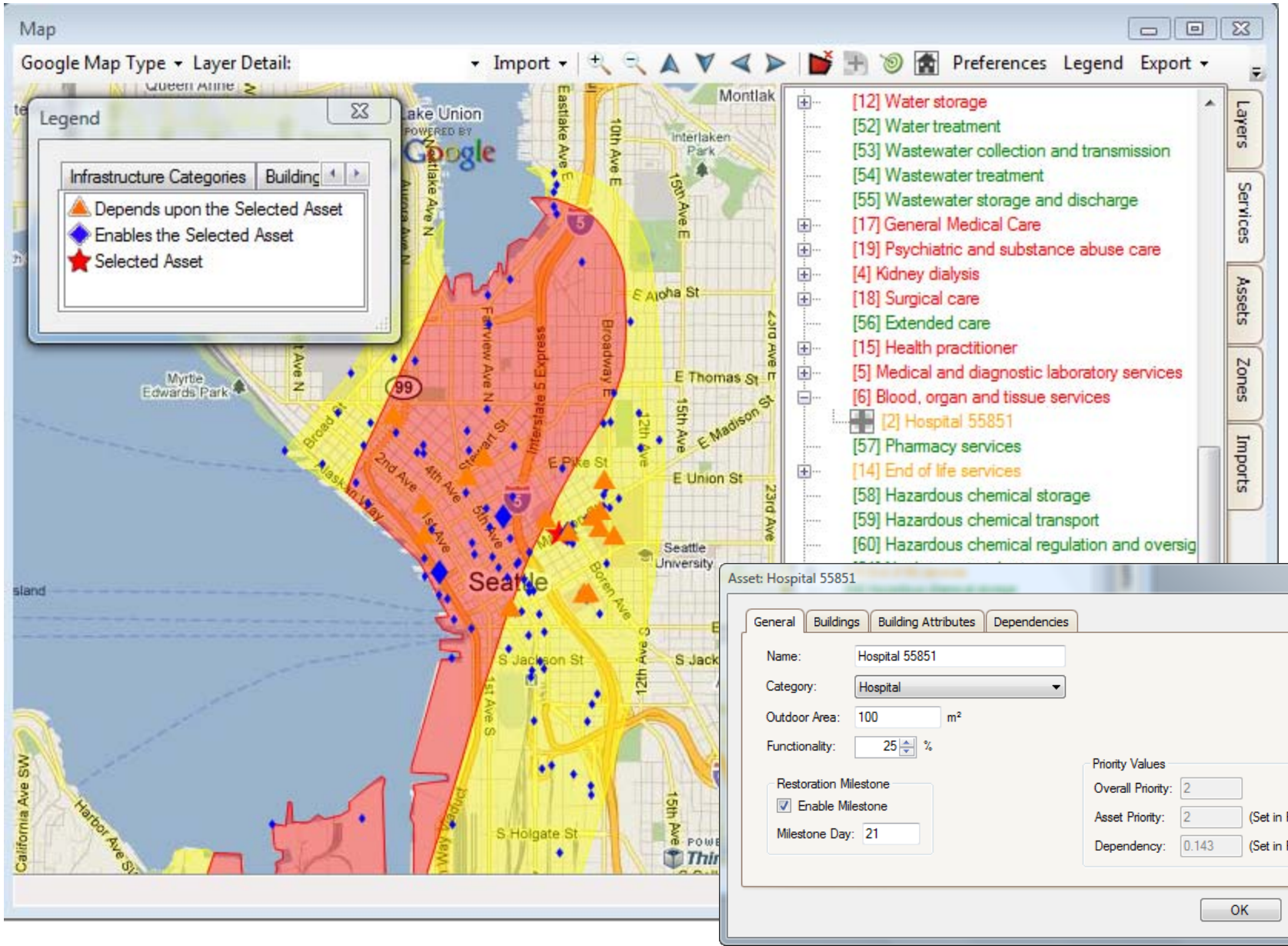
- **King/Pierce County GIS (as a specific urban example…)**
  - Virtually all county-wide buildings and structures
  - Additional useful attributes (use description, assessed value, plot sizes, building footprints)
  - We have access to these databases -- similar access expected for other urban areas
- **DHS Homeland Security Infrastructure Program (HSIP)**
  - Geo-located critical assets and infrastructures
  - Gold and Freedom levels, restrictions on Gold level use
- **FEMA HAZUS-MH**
  - Residential and non-residential geo-located building inventories
  - Nationwide coverage
  - Transportation infrastructure is also included
- **Emporis**
  - US and Canadian cities
  - Major buildings (>5 floors) in database
  - Many key attributes (size, age, type of HVAC, use, floor space etc.)

KCGIS Center

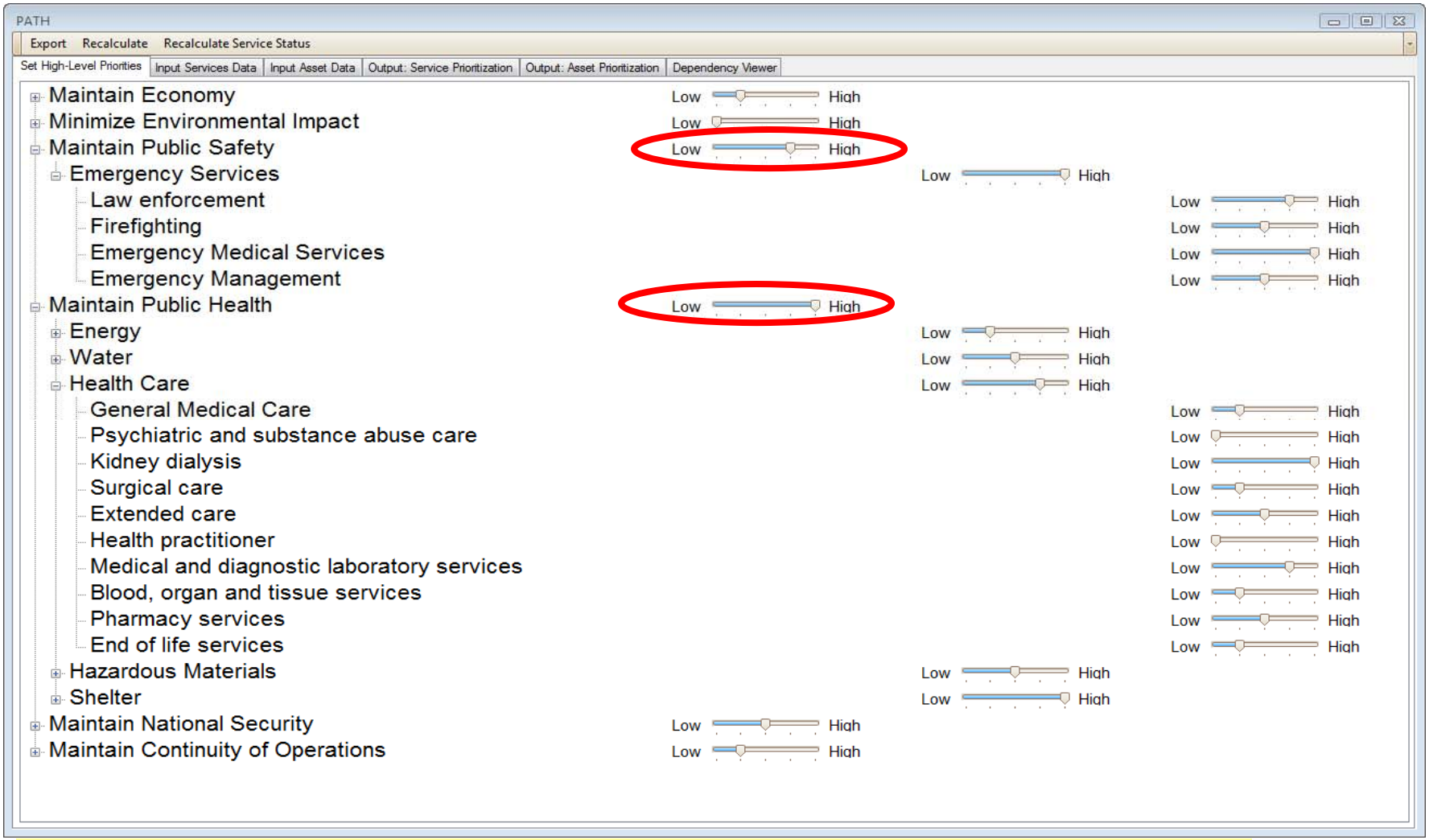


EMPORIS RESEARCH

Front end GIS provides situational awareness including regional service and asset status, properties, and dependencies



User inputs weightings on recovery objectives, key functions, and services



Maintain Public Health and Public Safety are weighted high priority objectives. Within these objectives, Water and Health Care are weighted high priority functions.

HOMELAND SECURITY & DEFENSE

Sandia National Laboratories

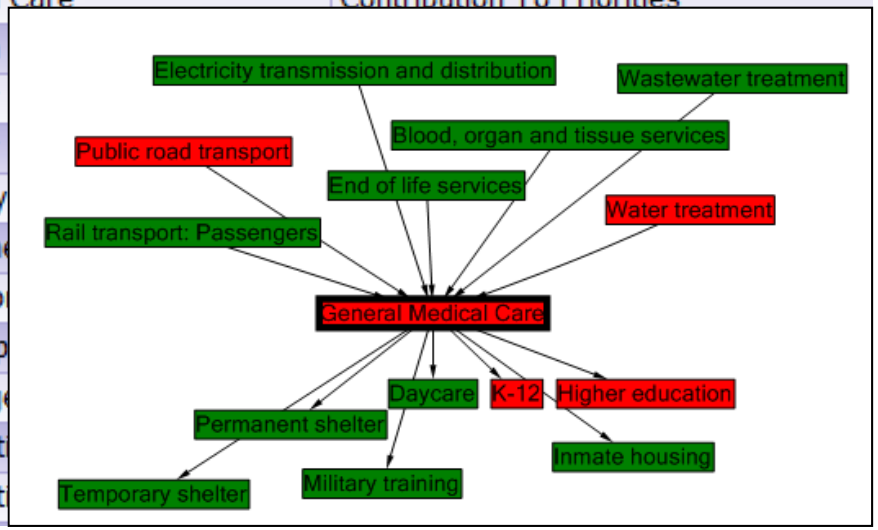
PATH/AWARE outputs an objective, analysis-based prioritized list of services optimized to meet multiple objectives and account for functional complexities

PATH (Beta-Release -- Not for public distribution)

Export Recalculate

Set High-Level Priorities | Input Services Data | Input Asset Data | Output: Service Prioritization | Output: Asset Prioritization | Dependency Viewer

	Service Name	Function Name	Reason
1	Public road transport	Transportation	Enabling Service
2	Water treatment	Water	Enabling Service
3	General Medical Care	Health Care	Contribution To Priorities
4	Psychiatric and substance abuse care	Health Care	Contribution To Priorities
5	Medical and diagnostic laboratory services	Health Care	Contribution To Priorities
6	Kidney dialysis	Health	
7	Water storage	Water	
8	Water transmission	Water	
9	Fossil fuel electric power generation	Energy	
10	Retail services	Comme	
11	Wireless telecommunications	Teleco	
12	Air traffic control	Transp	
13	Firefighting	Emerg	
14	Higher education	Educat	
15	K-12	Educat	



A logical, transparent priority service list provides a starting point for prioritization planning; dependencies analysis informs the prioritization output.

HOMELAND SECURITY & DEFENSE

Sandia National Laboratories

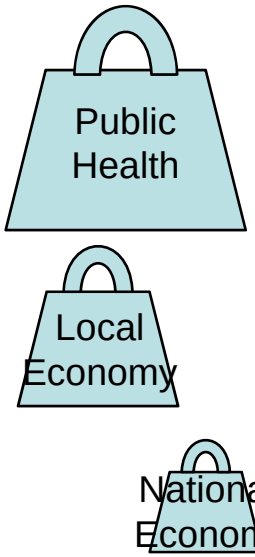
Prioritization algorithm generates a rank-ordered list of assets by applying user-weighted Recovery Objectives and Functions to asset metrics

(User-input Weightings on Recovery Objectives, Functions ✖ Pre-populated Asset Metrics = Calculated Score for Contribution to Recovery Objectives)

✚ User-input Subjective/ Qualitative Considerations (e.g., dependencies)

⬇

Rank-ordered Asset List



✖

Hospital metrics, e.g.,:
For Public Health: # staffed beds
For Local Economy: # employed

=

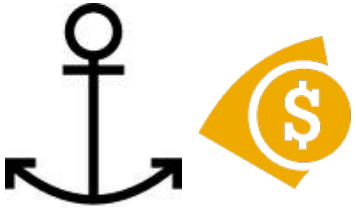
Hospital A (0.5)
Port (0.3)
Hospital B (0.2)

✚

Hospital B: unique capability.
All assets depend on Hwy I-5.
Hospital A has a work-around.
Port depends on railyard.

⬇

1. Highway I-5
2. Hospital B (0.2)
3. Port railyard
4. Port (0.3)
5. Hospital A (0.5)



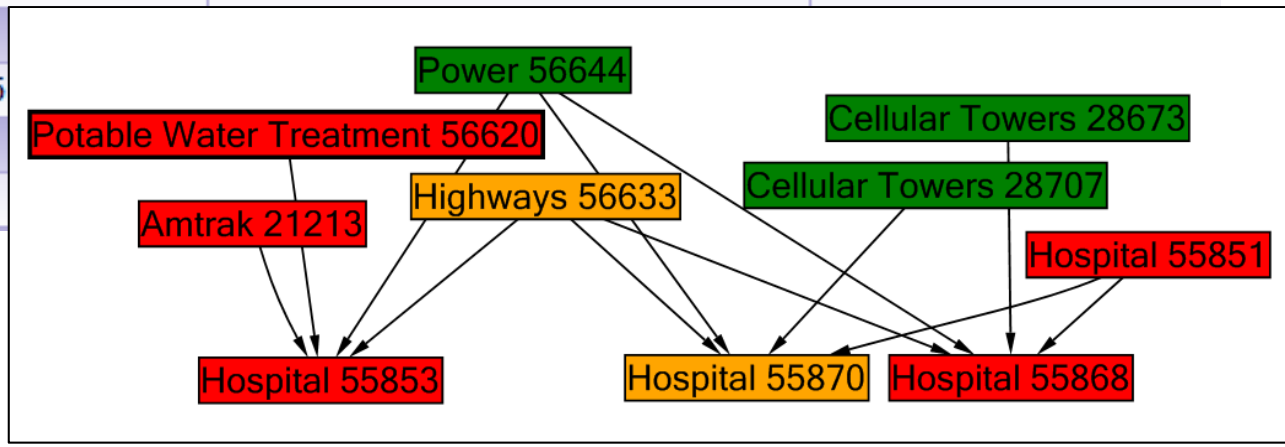
Port metrics, e.g.,:
For National Economy: shipping volume
For Local Economy: revenue

HOMELAND SECURITY & DEFENSE

Sandia National Laboratories

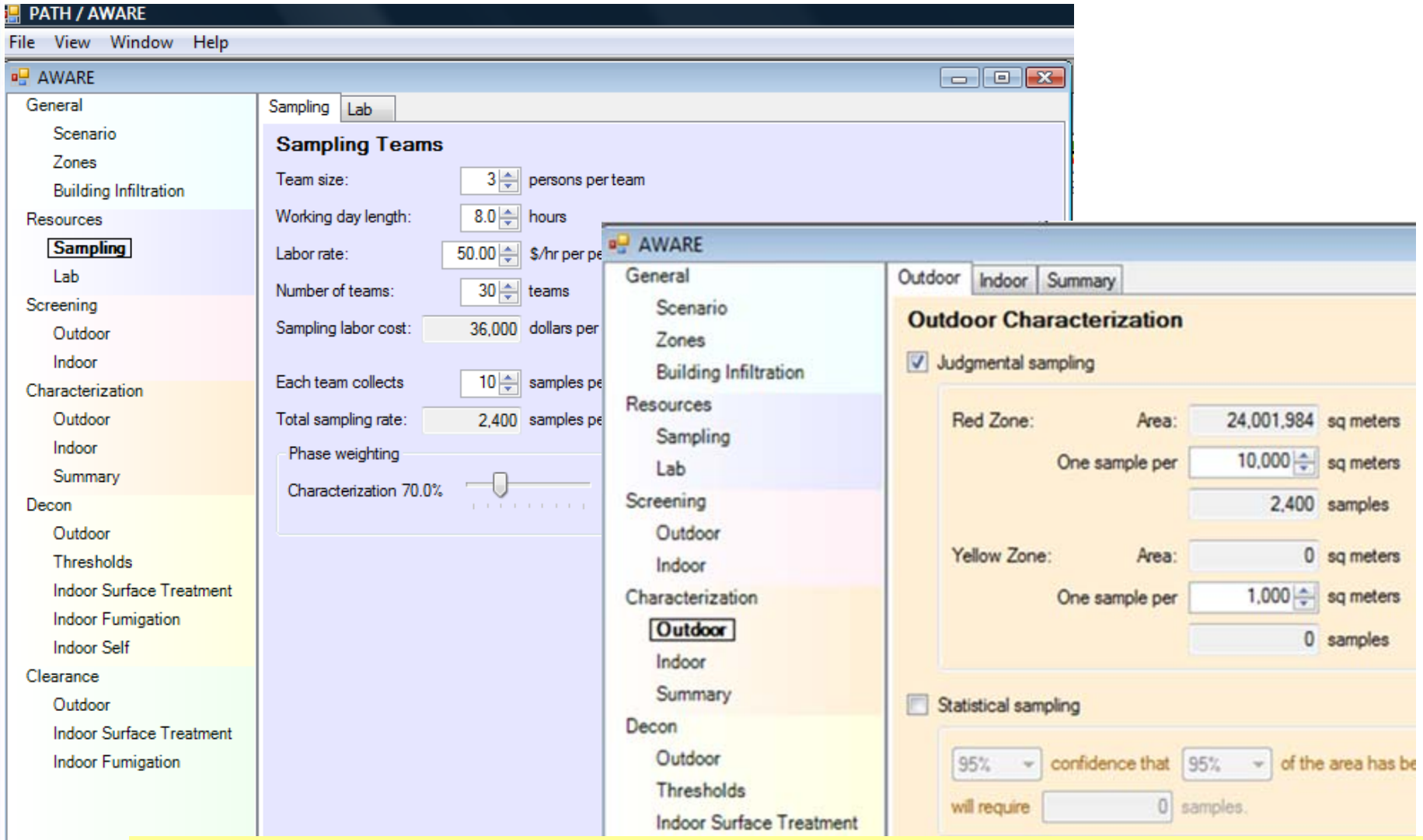
Based on the previous algorithm, PATH/AWARE outputs an objective, analysis-based prioritized list of assets for operations and planning

Pri...	Asset Name	Infrastructure Category Name	Reason
1	Highways 56633	Highways	Enabling Asset
2	Hospital 55851	Hospital	Enabling Asset
3	Fire 55729	Fire	Enabling Asset
4	Public Health 55980	Public Health	Enabling Asset
5	Hospital 55870	Hospital	Contribution To Prio
6	Primary Care Clinic 116610	Primary Care Clinic	Enabling Asset
7	Highways 56635	Highways	Enabling Asset
8	Hospital 55852	Hospital	Enabling Asset
9	Hospital 55868	Hospital	Contribution To Prio
10	Amtrak 21213	Amtrak	Enabling Asset
11	Potable Water Treatment 56620	Potable Water Treatment	Enabling Asset
12	Hospital 55853		
13	Misc Care Facility 117716		
14	Transit Link 117194		
15	Commercial 56636		



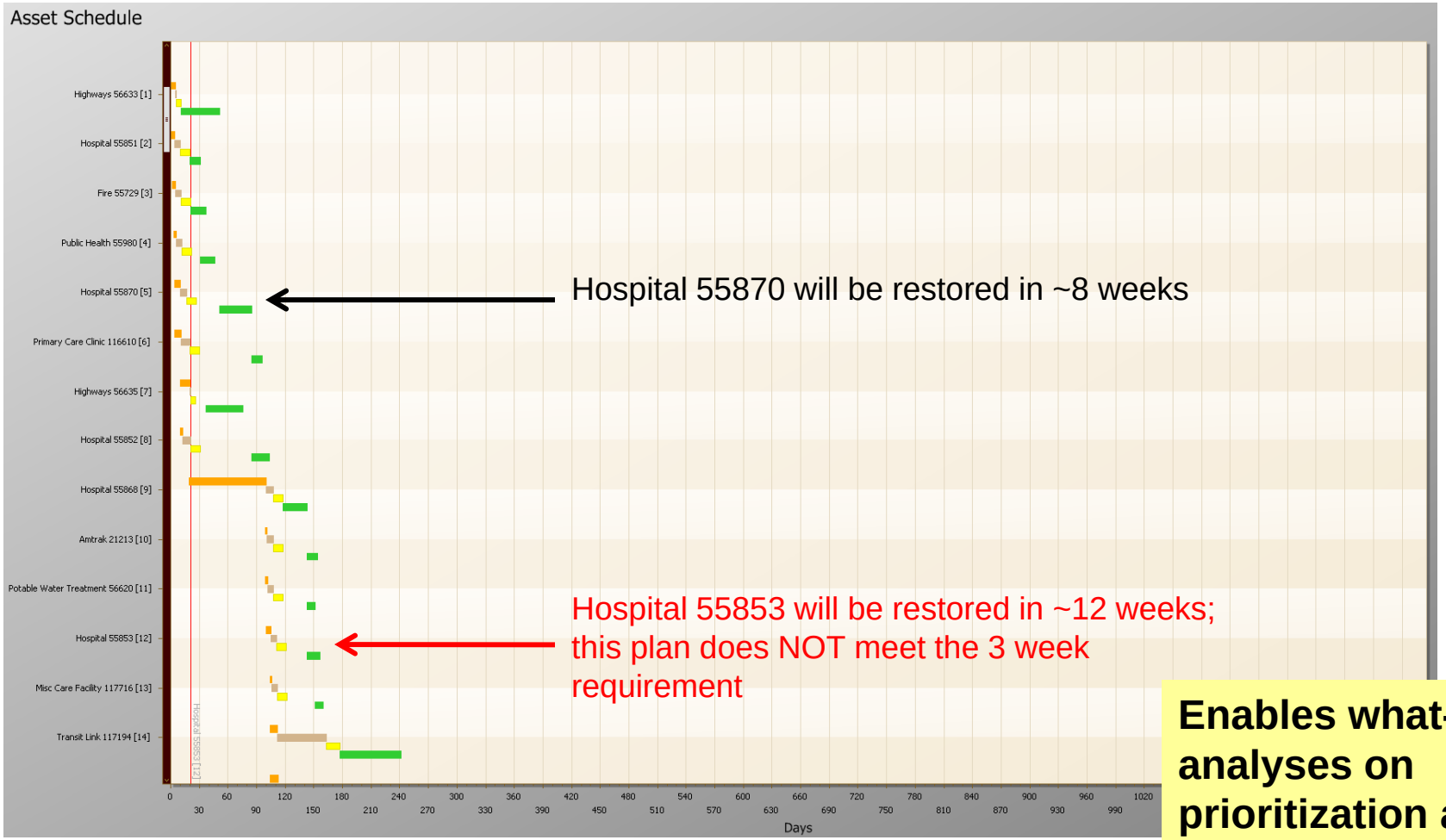
The outputted priority asset list provides the operational detail (e.g., identifies assets needed to restore critical services)

For PATH/AWARE to calculate recovery timelines, the user enters remediation strategies (e.g., characterization and decontamination approaches), resource availability and throughput



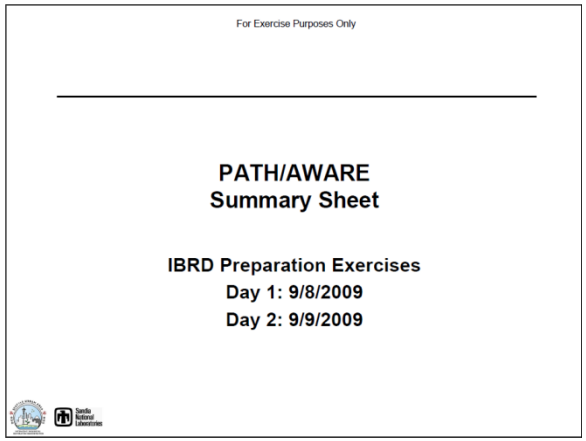
Decision-makers can vary parameters to reflect different scenarios (e.g., additional resources and alternate sampling strategies)

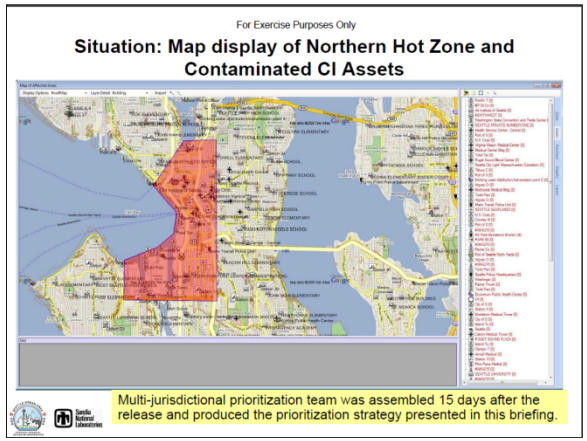
PATH/AWARE outputs restoration timelines for the prioritized assets and overall area, enabling decision makers to identify when critical services will be restored

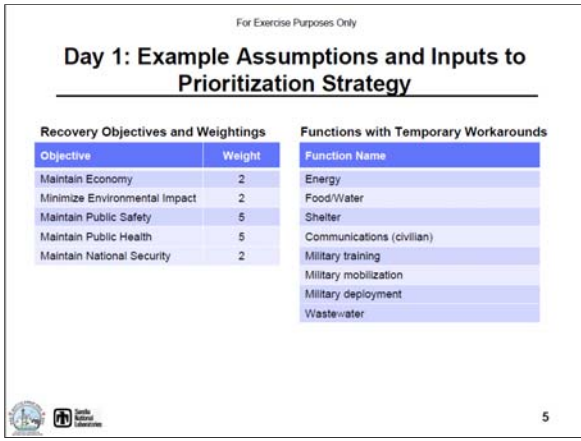


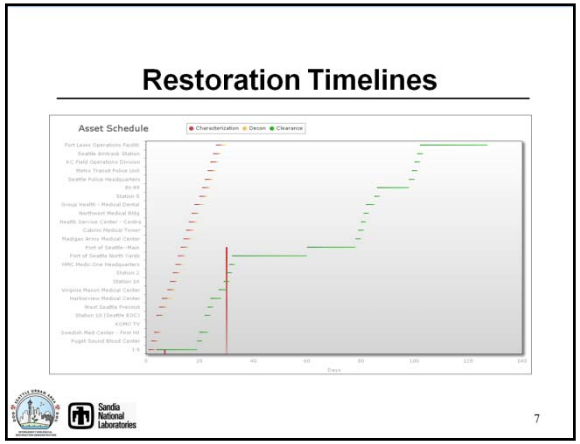
Enables what-if analyses on prioritization and remediation strategies

PATH/AWARE automatically generates summary slides of the situation, assumptions, strategy and timelines









Summary slides can be used to quickly present decisions to Executives and Commanding Officers

PATH/AWARE Summary

- Provides INFORMATION and a PROCESS
- Replaces paper-based planning
- Enables recovery planners to use data that sectors already have
- Provides situational awareness data on local infrastructure to support long-term recovery decisions
- Gives a basis for more efficient response and recovery (e.g., reducing cost and time)
- Helps recovery planners respond to political pressure to restore everything quickly, by showing trade-offs and timelines for recovery
- Can lead to policy changes

A transition path for PATH/AWARE is being defined and will begin in 2011.