Transportation Security and Resilience

INTRODUCTION

Transportation security and resilience are an integral part of regional planning. In broad terms, transportation "security" refers to infrastructure protection and emergency response, and "resilience" refers to the ability to prepare for changing conditions and withstand, respond to, and recover from disruptions.[1]

Federal requirements state that long-range transportation plans should address transportation system security by including "…emergency relief and disaster preparedness plans and strategies and policies that support homeland security (as appropriate) and safeguard the personal security of all motorized and non-motorized users."[2]

The 2015 Fixing America's Surface Transportation (FAST) Act expanded the scope of the metropolitan transportation planning process to also include improving transportation system resilience and reliability.[3] Incorporating these issues into the planning process allows transportation agencies to proactively identify projects and strategies to address system vulnerabilities and promote resilience.[4] The Federal Highway Administration encourages proactive management, which involves "developing engineering solutions, operations and maintenance strategies, asset management plans and transportation programs that address risk and promote resilience at both the project and systems level."[5]

This document addresses threats to transportation security, followed by resilience and mitigation strategies that can reduce the vulnerability of the transportation system to short- and long-term threats, and strategies in place to ensure transportation services can meet critical needs in the event of an emergency.

THREATS TO COMMUNITIES, TRANSPORTATION NETWORKS, AND SERVICES

Potential threats that can make Treasure Valley communities and transportation systems vulnerable to disruptions include extreme weather events (especially snow), floods, dam failure, wildfires, and incident-specific disruptions to transportation services, such as vehicle crashes or road construction on major routes.

Snow

Ada and Canyon Counties receive an average of 21 inches of snow in a typical winter, which can disrupt travel and lead to significant snow removal and maintenance costs.

However, these costs and disruptions can multiply quickly during years with higher-than-average snowfall. For example, in the winter of 2017, the Treasure Valley experienced one of the most severe winter seasons in recent memory, with nearly 40 inches of snow from November 2016 to March 2017; over half of that fell in the month of January. This snowfall limited access to jobs, schools, daycare centers, retail, and other activities.

Snow removal is expensive and extended snowfall combined with freezing and thawing can be problematic. As an example, the Idaho Transportation Department (ITD) had to move up maintenance work on Interstate 84 to repair huge potholes that resulted from the 2017 winter storms (Figure 1). Similarly, a few months after completion of the reconstructed Broadway Bridge in the City of Boise in fall 2016, heavy snowfall forced ITD to advance maintenance activities a few years ahead of schedule to protect the longevity of the bridge.

Figure 1. ITD had to advance maintenance work on Interstate 84 to repair huge potholes that resulted from the 2017 winter storms. Photo credit: ITD.

Floods

Flooding can disrupt transportation when the Boise River overflows its banks to cover pathways, roads, or bridges. Historically, flooding along the Boise River has been associated with heavy snowpacks and early thaws. Serious floods have been alleviated by construction of dams in the Boise River upstream of the valley. The three major dams—Anderson Ranch, Arrowrock, and Lucky Peak—serve a dual purpose of flood control and water retention for irrigation, while the Boise River diversion dams redirect water for irrigation. However, very long-term climate forecasts indicate a possibility of earlier snowmelts and more winter precipitation in the form of rain.[6] This pattern could affect the timing and volume of dam releases to balance flood control with retention for agricultural and recreational purposes.[7]

The Treasure Valley roadway system includes 136 major bridges (20 feet or longer) within the 500-year floodplain in Ada and Canyon Counties (Figure 2). Of these, 32 cross the Boise River and are built to accommodate 100-year flood events. The main threat to these bridges during a flood is the pile-up of debris against their upstream sides, which can add stress to the structures and cause even more flooding upstream.

In 2017, the Treasure Valley experienced extensive flood damage due to near-record snowfall, as discussed above (Figure 3). According to the US Army Corps of Engineers, the official flow rate of the Boise River is measured at Glenwood Bridge. Flood stage is considered to be river flow of 7,000 cubic feet per second (cfs). In March 2017, the flow at Glenwood Bridge reached 9,000 cfs.

Dam managers in the Treasure Valley estimate there is a one percent chance in any given year that the river flows will reach 16,600 cfs on the Boise River, and a two percent chance in any given year of flows exceeding 11,000 cfs.[8] Bridges at Eagle Road and Parkcenter Boulevard could become inundated at 10,500 cfs.

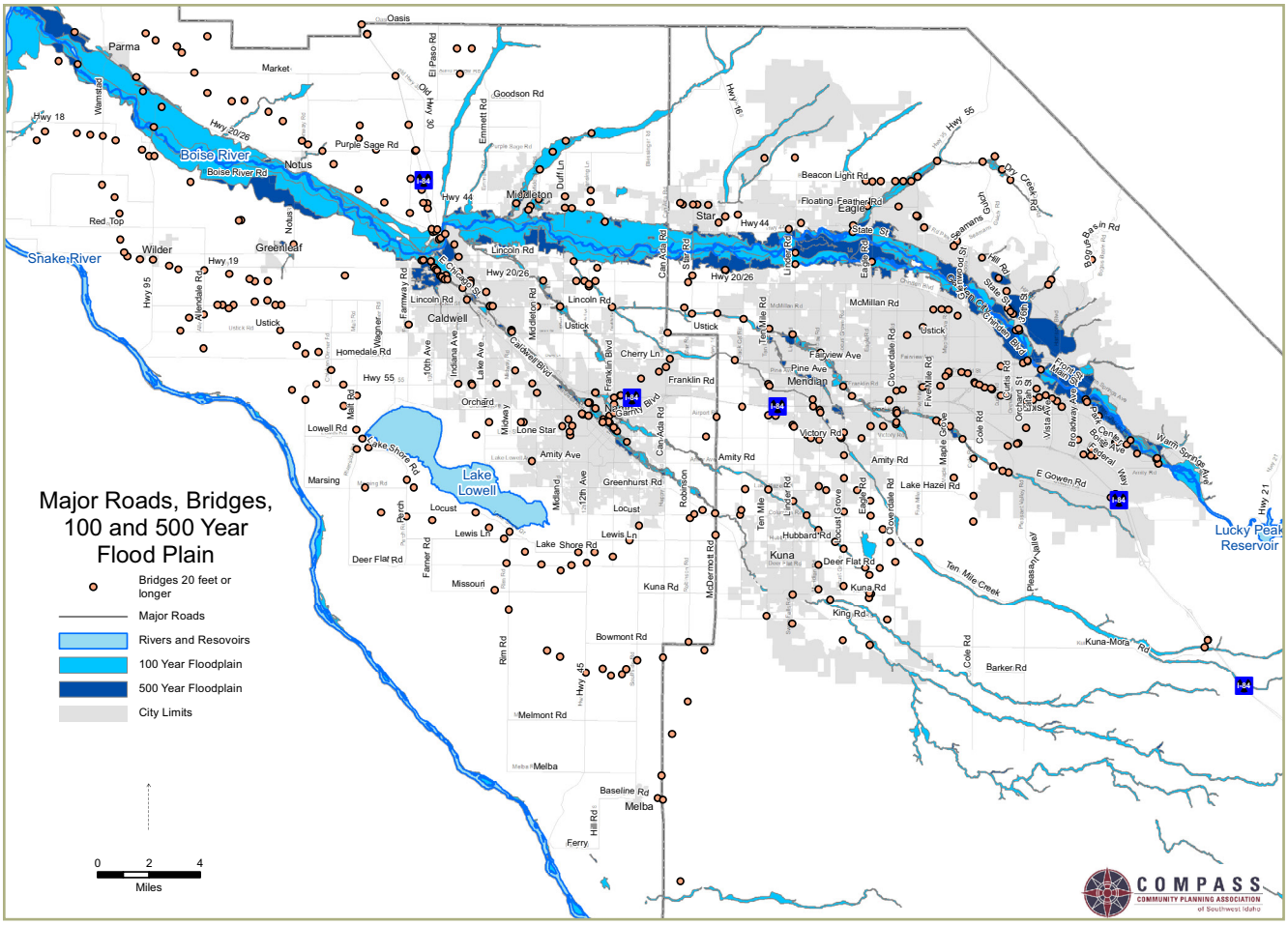

Figure 2. Major roads and bridges in the 100- and 500-year floodplain

Figure 3. 2017 flooding along the Boise River caused extensive damage. Photo credit: Idaho Foundation for Parks and Lands.

In addition, the Interstate 84 Exit 27 interchange at Centennial Way in Caldwell is vulnerable to flooding. Although the on/off ramps provide ample separation from the river, the interstate bridge itself does not.

Another security issue is that key transportation administrative and maintenance facilities are located in or near the 500-year flood plain, including Ada County Highway District's headquarters, maintenance yard, and traffic operations center; ITD's headquarters; and offices of the Federal Highway Administration, Local Highway Technical Assistance Council, Notus Parma Highway District, and Treasure Valley Transit. Recovery after a major flood could be hampered by loss of equipment and records.

Drainage from the foothills along the north end of the valley is also a source of concern. Over the past 50 years, development has encroached on the foothills' drainage and outflow areas, placing more homes in the path of flooding. Foothills floods tend to be localized events and not a cause for major evacuations.

The Snake River is remote from most development and transportation corridors within the planning area. However, significant crossings in Canyon County include State Highway 45, State Highway 55, US 95, and US 20/26.

Dam Failure

As discussed above, three dams on the Boise River upstream of the valley—Anderson Ranch, Arrowrock, and Lucky Peak—alleviate serious seasonal flooding. The three corresponding reservoirs (Anderson Ranch, Arrowrock, and Lucky Peak) hold a combined 309 billion gallons of water, which translates into 40.3 billion cubic feet. A failure of the dams would present a catastrophic flood event requiring immediate evacuation of much of downtown Boise and the Cities of Garden City, Eagle, Star, Middleton, Caldwell, Notus, and Parma.

The Idaho Department of Water Resources' dam safety program[9] includes a hazard classification based on the potential consequences to downstream life and property that would result from a dam failure and sudden release of water. (Note that this classification is based on the *consequences* of failure, not the *likelihood* of failure.) Anderson Ranch, Arrowrock, and Lucky Peak Dams and Boise River diversion dams are all classified as "high hazard." The Deer Flat Embankments at the western end of Lake Lowell in Canyon County are also high-hazard dams (Figure 4).

Wildfires

Wildland fires pose major threats to property, lives, and ecosystem integrity. The wildlands around the Treasure Valley and the Boise Foothills have experienced wildfires that increase the likelihood of adverse impacts, including flooding, erosion, and loss of key wildlife habitat. When homes are built near or among lands prone to wildland fire, fire departments must fight fires along the wildland-urban interface.[10] Providing adequate emergency access and evacuation routes to such areas is a transportation challenge. For example, in the summer of 2008, a small field fire coupled with 50 mph wind gusts spread to a neighborhood in southeast Boise, leveling 10 homes, damaging 9 others, and prompting the evacuation of 50 homes. Onlookers were attracted to the neighborhood, making it difficult for evacuees to flee the area and for emergency vehicles to access the fire.

One of the greatest fuel sources for wildfires in the Treasure Valley is the overabundance of cheatgrass. This invasive grass burns nearly four times more frequently than any native vegetation type and can double the amount of vegetation burned.[11] Changes to natural vegetation can impact how public right-of-way is managed to avoid or limit grass fires.

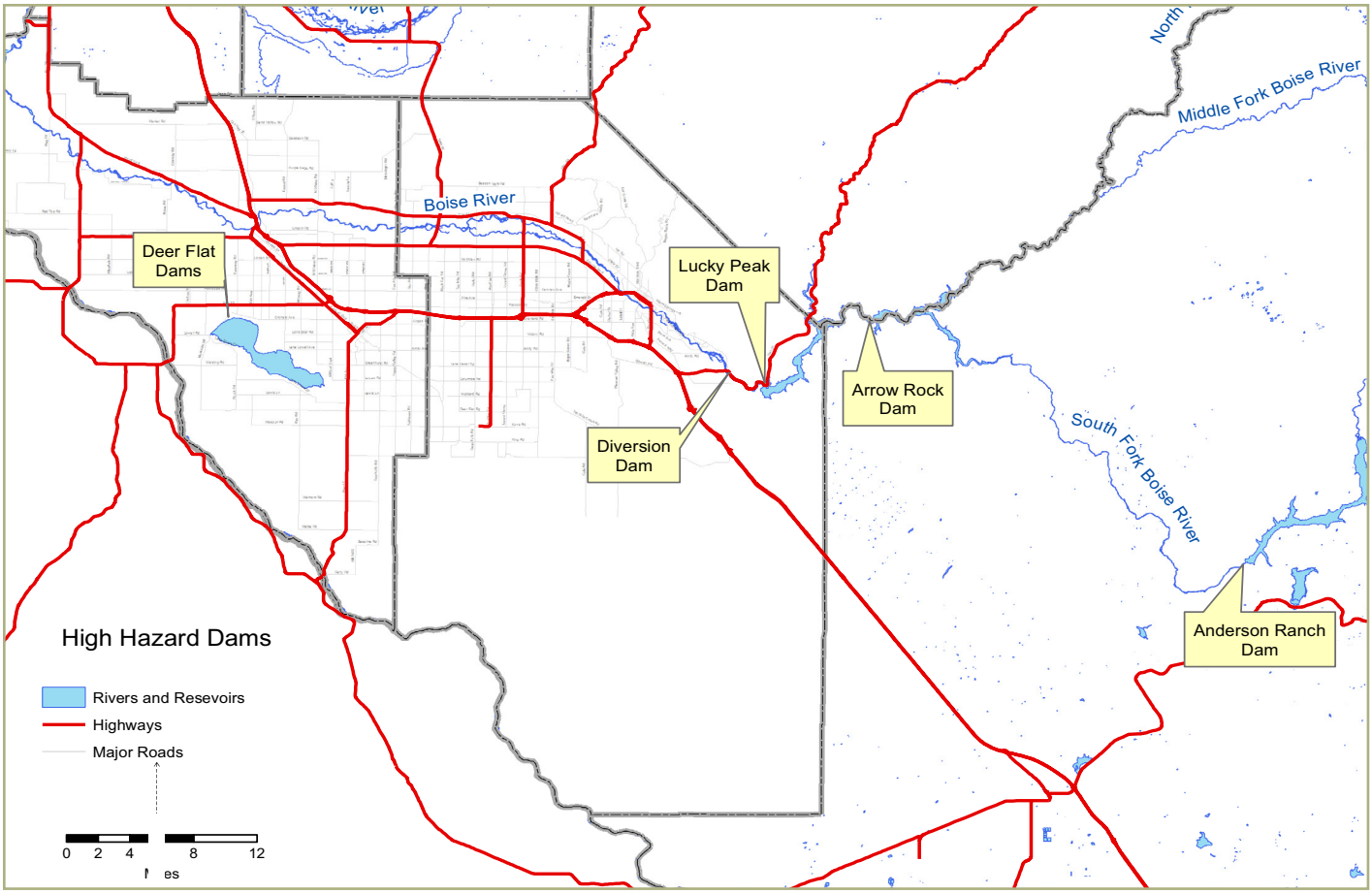

Figure 4. High-hazard dams in the Treasure Valley

Disruptions to Transportation Services

Vulnerability assessments of roadway networks focus primarily on major routes. Regionally, Interstate 84 serves as a main transportation route, connecting the Treasure Valley to other population centers and serving as a key route for truck freight in the northwestern US. In addition to I-84 and the state highway network, the region's roadway network has nearly 3,000 centerline miles of road and 400 bridges that provide local connectivity.

Interstate Closure

The interstate is the most heavily used transportation route in the Treasure Valley, so incidents on the interstate can have ripple effects throughout the regional system. Detour routes, as discussed below, redirect traffic away from and around closures, whether they are planned, such as construction, or unexpected, such as traffic crashes.

Freight Deliveries

Interruption of freight deliveries can be a result of local or regional disruptions to the roadway network or difficulty in getting goods into the area. The ability to deliver products where they are needed in an emergency is a key feature of a secure transportation network and service. In an emergency, local resources

may not be usable, or local agencies may not be able to distribute available goods, and transportation services beyond the local area may need to be called upon to assist.

Public Transportation Services

Security assessments of public transportation services and facilities consider two main factors: threats to public transportation passengers and facilities and disruption to services in the event of a natural or human-caused catastrophe. Anything that would disrupt service could be a threat to the public transportation providers and passengers in an emergency. For example, if bus routes cross several bridges, the absence of even a single bridge would lead to detours, causing delays and disruption of services.

RESILIENCE AND MITIGATION STRATEGIES

In simple terms, transportation resilience means the ability of a transportation system to quickly return to normalcy. Resilience and mitigation strategies aim to reduce the vulnerability of existing transportation infrastructure and services to both short-term security disruptions such as described above and longer-term alterations, such as changes in climate, which can lead to more extreme weather events, floods, or wildfires.

The following short- and long-term mitigation strategies applicable to a variety of vulnerabilities can be found in the *Ada County Multi-Hazard Mitigation Plan*[12] and the *Canyon County, Idaho, All Hazards Mitigation Plan*.[13]

Short-term Strategies

- Locate or relocate critical facilities outside of hazard areas.
- Warehouse critical infrastructure components.
- Post and publicize evacuation routes.
- Create an inventory of structures, including elevation data, within the floodplain.
- Develop and adopt a continuity of operations plan.
- Incorporate retrofitting or replacement of critical system elements in capital improvement plans.
- Maintain existing data and gather new data needed to define risks and vulnerability.
- Provide redundancy for critical functions and infrastructure.

Long-term Strategies

- Implement stormwater management regulations and master planning; adopt a stormwater management master plan.
- Integrate floodplain management policies into other planning mechanisms within the planning area.
- Consider the probable impacts of climate change on the risks associated with floods.
- Consider the residual risk associated with structural flood control in future land-use decisions.
- Promote open space in identified high-hazard areas by implementing planned-unit developments, easements, setbacks, greenways, and sensitive-area tracks.
- Improve infrastructure to make it more flood-resistant via a bridge replacement program.
- Adopt land-development criteria such as planned-unit developments, density transfers, and clustering.
- Acquire vacant land or promote open space in developing watersheds to control increases in runoff.

In May 2016, COMPASS hosted a technical workshop on green stormwater infrastructure. The workshop focused on the latest techniques for achieving green and sustainable streets, from installation to operations and maintenance. Local applications include permeable pavement on the parking lot of the building housing COMPASS in the City of Meridian, permeable pavers and silva cells in the City of Boise, and permeable pavers at The Riverside Hotel in the City of Garden City[14] (Figure 5).

Figure 5. Permeable pavers at The Riverside Hotel

Because much of the floodplain that once absorbed excess water is now filled with homes, offices, businesses, schools, and roads, undeveloped parts of the floodplain are used as floodways as much as possible. For example, parks and riverside paths act as natural floodways to absorb water and prevent flooding downstream. Habitat, groundwater, and wetlands benefit from this passive flood control.

The canals, ditches, and laterals that are plentiful in the Treasure Valley are assets that can potentially help direct water when necessary. For example, opening diversion gates on local canals and ditches can be a resilience tactic for the Treasure Valley, especially in the flood plain (Figure 6). With the flooding in the winter and spring of 2017, the New York Canal was used to channel flood water to Lake Lowell. *The Canyon County All Hazards Mitigation Plan* identified engineered dikes and irrigation canals as facilities that can protect people and property during a high-water event.[15]

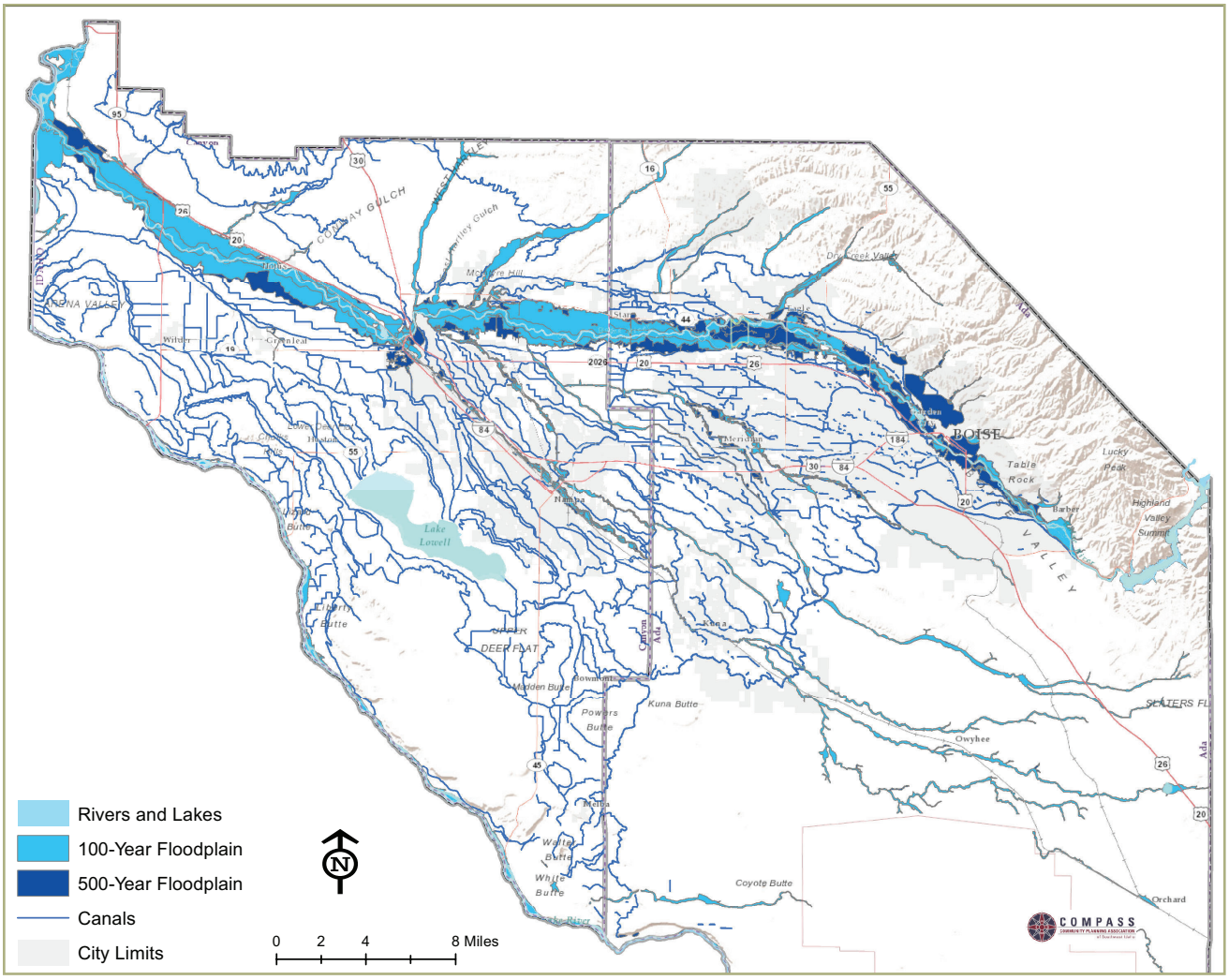

Figure 6. Canals in 100- and 500-year floodplains. *Data sources*: ESRI, DeLorme, US Gelogic Survey, and the National Park Service.

RESILIENCE AND TRANSPORTATION SERVICES

Public transportation services and delivery of goods are a critical part of community resilience. To plan ahead for potential interstate closures, the Treasure Valley Incident Management Operations Manual and Detour Route Plan[16] was updated in 2017. The detour route plan provides incident management personnel with pre-established alternate routes to direct traffic flow away from a road closure, whether from an unexpected crash or planned road construction. The detour route update includes 29 road segments with 93 detour maps (Figure 7).[17] Each map can be downloaded in PDF directly from the interactive detour map website.[18]

To address the needs of the most vulnerable populations, such as the elderly and individuals with disabilities, the *Ada County Flood Response Plan*[19] identifies emergency support functions for Valley Regional Transit and other owners of buses, especially those with lift equipment, in evacuation planning. The primary focus is to first help disabled persons, including those in nursing homes and hospitals, the elderly, and others with limited transportation options.

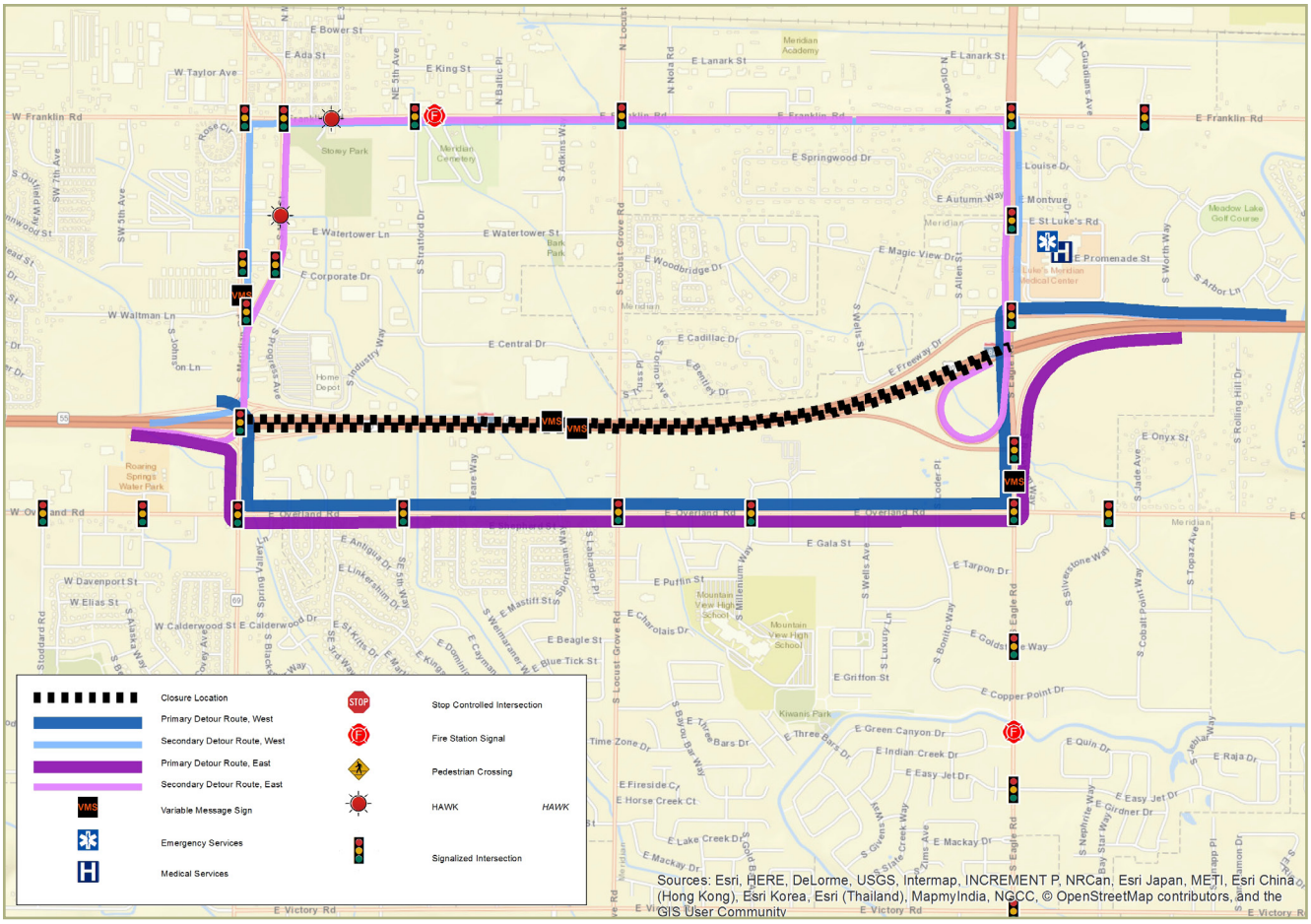

Figure 7. Detour route example from the 2017 Treasure Valley Incident Management Operations Manual and Detour Route Plan

Transportation organizations work to enhance the security of the current transportation system and build resilience into future projects. For example, Main Street Station, a transit center in downtown Boise, incorporates visual surveillance and communications technology and a police substation. Technology applications, such as automatic vehicle location systems (AVL) in Valley Regional Transit buses and Boise State University shuttles provide the ability to track vehicle movements in real time and allow dispatchers to identify the exact location of buses during an emergency. Examples of improving security and resilience of roadway projects include crash-rated barriers and bollards and slope stabilizations in areas prone to landslides (Figure 8).

Figure 8. Goose Creek slope stabilization along State Highway 55 near McCall. Photo credit: ITD.

SUMMARY

Transportation security refers to infrastructure protection and emergency response, and resilience refers to the ability to prepare for changing conditions and withstand, respond to, and recover from disruptions. By identifying threats; developing strategies to mitigate, prepare for, and manage those threats; and ensuring transportation services are in place to meet critical needs in the event of an emergency, the Treasure Valley's transportation system can reduce vulnerabilities to future hazards.

NOTES

1 "Transportation System Resilience to Extreme Weather and Climate Change," US Department of Transportation Federal Highway Administration, https://ops.fhwa.dot.gov/publications/fhwahop15025/index.htm

2 "Development and content of the metropolitan transportation plan." *Code of Federal Regulations*. Title 23, 450.324 (h). https://www.ecfr.gov/cgi-bin/text-idx?SID=6c5b5cc9d7ea61d5cb2734130e00f48b&mc=true&node=se23.1.450_1324&rgn=div8

3 "Metropolitan Planning Fact Sheet," US Department of Transportation Federal Highway Administration, https://www.fhwa.dot.gov/fastact/factsheets/metropolitanplanningfs.cfm

4 "Resilience and Transportation Planning," US Department of Transportation Federal Highway Administration, https://www.fhwa.dot.gov/environment/sustainability/resilience/publications/ratp/index.cfm

5 FHWA Order 5520: Transportation System Preparedness and Resilience to Climate Change and Extreme Weather Events, US Department of Transportation Federal Highway Administration, https://www.fhwa.dot.gov/legsregs/directives/orders/5520.cfm

6 "Key Messages About the Northwest from the National Climate Assessment," GlobalChange.gov, https://www.globalchange.gov/explore/northwest

7 *Climate Change Impact Assessment for Surface Transportation in the Pacific Northwest and Alaska*, Washington State Department of Transportation, 4-6, http://www.wsdot.wa.gov/research/reports/fullreports/772.1.pdf

8 *Ada County Flood Response Plan 2017*, Ada County Emergency Management, https://adacounty.id.gov/Portals/Accem/2017%20Flood%20Plan%20-Web_1.pdf

9 "Dam Safety Program," Idaho Department of Water Resources, https://www.idwr.idaho.gov/dams

10 "What is the Wildland-Urban Interface?", International Association of Fire Chiefs, http://www.wildlandfirersg.org/About/Wildland-Urban-Interface

11 *Introduced annual grass increases regional fire activity across the arid western USA (1980–2009)*, Global Change Biology, https://onlinelibrary.wiley.com/doi/abs/10.1111/gcb.12046

12 *2017 Ada County Multi-Hazard Mitigation Plan Volume 1*, prepared by Tetra Tech for Ada County Emergency Management, https://adacounty.id.gov/Portals/Accem/2017HazMitPlan_Volume1_1-FrontAndPart1.pdf

13 *Canyon County, Idaho All Hazards Mitigation Plan Volume I*, https://www.canyonco.org/wp-content/uploads/2016/03/Canyon-Co-AHMP-20060626-0730.pdf

14 *Leadership in Practice, Private Business: The Riverside Hotel,* COMPASS, http://www.compassidaho.org/documents/comm/LIM/2016/Riverside.pdf

15 Ibid.

16 *Treasure Valley Incident Management Operations Manual and Detour Route Plan – Update 2017*, prepared for COMPASS by McFarland Management, LLC, in association with IBI Group, http://www.compassidaho.org/documents/prodserv/reports/TVIMReport_Final12-29-17.pdf

17 I-84 Detour Maps City of Caldwell to Boise City, COMPASS, http://swidrdc.org/pdfs/DetourMapbook.pdf

18 Incident Detour Interactive Map, COMPASS, http://www.arcgis.com/apps/webappviewer/index.html?id=608419d084424972aadad0580f0a8d3e&extent=-13045821.2525%2C5345986.0136%2C-12850142.4601%2C5469508.2513%2C102100

19 See note 8.