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ULSTER COUNTY TRANSPORTATION RESILIENCY PROJECT HAZARD SCREENING ASSESSMENT CRITERIA

February 2022
File No. 18.0175293.00



PREPARED FOR:
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February 21, 2022
File No. 18.0175293.00

Mr. Dennis Doyle, Director
Ulster County Planning Department
244 Fair Street
Kingston, New York 12401

Re: Hazard Assessment Screening Criteria
Critical Transportation Infrastructure Vulnerability Assessment
Ulster County, New York

Dear Mr. Doyle:

In accordance with GZA's current contract with the County of Ulster dated August 18, 2021, for the above referenced project solicited under the RFP-UC21-015 Critical Transportation Infrastructure Vulnerability Assessment and its contract terms, we are pleased to present this report containing the Hazard Screening Assessment Criteria. This document is subject to the limitations outlined in **Appendix A**.

Please contact Sam Bell, the Project Manager for GZA, at (781) 223-7091 or by email at samuel.bell@gza.com with any questions.

Very truly yours,

GZA GEOENVIRONMENTAL, INC.

Samuel J. Bell, CFM
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Consultant Reviewer/Sr. Principal

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Associate Principal

Attachment: Hazard Assessment Screening Criteria

Cc: Suseel Indrakanti, Cambridge Systematics

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1.0 INTRODUCTION

Many of the transportation assets and essential facilities in Ulster County are in areas that may be vulnerable to natural hazards including flooding, severe weather, extreme temperatures, and others. UCTC's vulnerable assets may also become increasingly exposed to natural hazards because of our changing climate. However, the degree to which the County's transportation assets are exposed to these natural hazards is highly variable. Given finite resources, it is necessary to focus the vulnerability assessment on the most significant natural hazards.

To assist the UCTC Project Team identify the natural hazards to focus upon in the vulnerability assessment, GZA has prepared this document to present the Hazard Screening Assessment Criteria for the study area for review by UCTC and the Technical Advisory Committee (TAC). The goal of this criteria is to provide a systematic approach for identifying and collecting the natural hazards data needed for conducting the vulnerability assessment. These inputs include past hazard events, current hazard data, and future hazard data based on available climate projections. It is noted that this approach is implemented on the basis of hazard exposure. In later phases of the project, we will separately evaluate the sensitivity of the County's transportation assets given an exposure to the natural hazard.

Our study area encompasses the Metropolitan Planning Area of Ulster County (including seven census blocks in southeastern Greene County).

2.0 HAZARD SCREENING ASSESSMENT CRITERIA

To determine which hazards pose the most significant risks to the County transportation assets, the hazards are assessed in the past, present, and the projected future. Indicators as noted below are used to measure or quantify the hazards. The process is summarized as follows, with additional detail for each step in the process described later in this report:

Step 1. What natural hazards have most affected the County in the past and under our current climate?

- Develop Past Hazard Events Inventory
 - Data Sources: 2017 Ulster County Hazard Mitigation Plan Update (2017 UCHMP (see Reference 1)), FEMA Declared Disasters Website (see Reference 2) and NOAA Storm Events Database (see Reference 3).
 - Indicators: Number of event days¹ and property damages (See **Appendix B** for full list).

Step 2. What natural hazard data is available to further evaluate the exposure of the County's transportation assets to the natural hazard, under the current climate?

- Develop Current Hazards Data Inventory
 - Data Sources : The Climate Explorer (See Reference 4), ASCE 7 Hazard Online Tool (See Reference 5), FEMA, Flood Map Service Center (See Reference 6), USDA Wildfire Risk to Communities (See Reference 7), average annual snowfall map.
 - Indicators: indicators vary by hazard, for example: Annual days with maximum temperature > 90 °F, annual days with maximum temperature < 32 °F, miles of roadway within 100-yr or 500-yr floodplain (see **Appendix C** for full list).

¹ Event days include the total duration of time that a hazard impacted Ulster County based on the recorded hazard events over time as documented in the 2017 UCHMP and FEMA Declared Disasters website.



Step 3. Which natural hazards are likely to worsen in the future due to climate change interactions?

- Develop Future Climate Change Interactions Inventory
 - Data Sources: Climate Explorer (See Reference 4), 2021 Observed and Projected Climate Change in New York State (NYS): An Overview (2021 NYS Climate Change Overview - See Reference 8), Responding to Climate Change in New York (2014 ClimAID Report) (See Reference 9).
 - Indicators: same as present hazards

The process for screening these natural hazards based on the answers to the questions above is visualized in **Figure 1** below. Hazards will be categorized as either being further evaluated quantitatively, further evaluated qualitatively, or

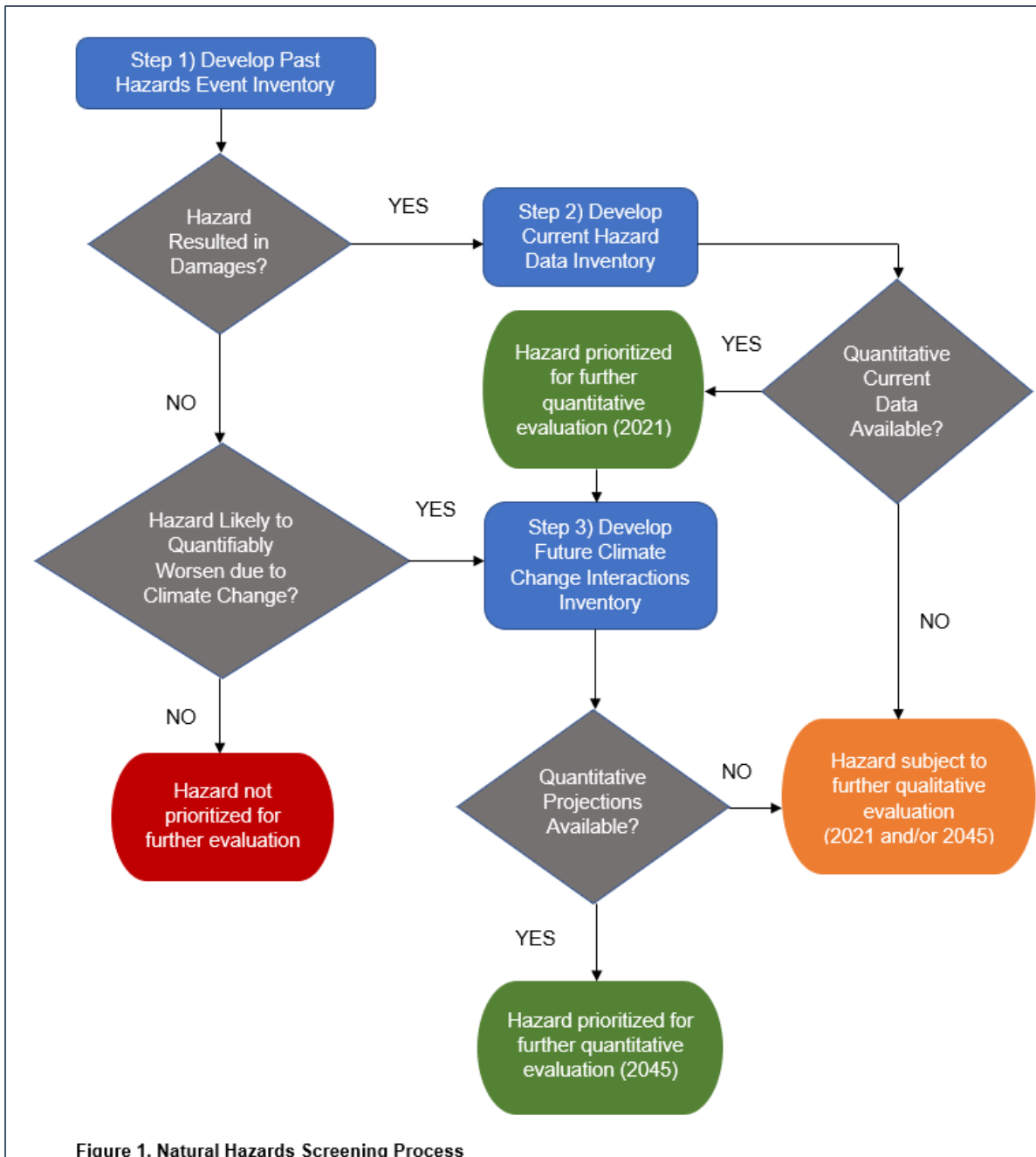


Figure 1. Natural Hazards Screening Process



not prioritized for further evaluation for present-day climate (2021) and projected climate (2045). If data is not available for 2045, we will use the time horizon of the nearest available data in relation to 2045 (i.e., 2050). Note, a limited number of specific assets with a projected design life beyond the mid-century (e.g., certain critical bridges) may also be evaluated for future planning horizons beyond 2045.

The Hazard Screening Criteria uses the three steps outlined in the questions above to develop the inventories for completing the screening process as outlined in **Figure 1**. Using these steps, the GZA Team presents the following overview of hazard data collected and indicators identified for each inventory.

STEP 1. DEVELOP PAST HAZARD EVENTS INVENTORY

GZA identified 76 hazard events (including natural and man-made hazards) that resulted in federal disaster declarations from 1952 to October 2021 in the State of New York based on an evaluation of the 2017 Ulster County Hazard Mitigation Plan Update (2017 UCHMP (see Reference 1)), FEMA Declared Disasters Website (see Reference 2) and the NOAA Storm Events Database (see Reference 3). Of those 76 disaster declarations that impacted various parts of the State, 25 occurred in or otherwise impacted Ulster County. GZA then further reviewed the hazard events to determine the number of event days, or the number of days in the assessment period that a given hazard affected the county, as well as the amount of economic loss for each hazard event.

The number of event days for each event is a qualitative way of assessing which hazards occur most frequently in the county. For instance, there were no reported hazard days for the geologic hazards (i.e., earthquake or landslide) over the assessment period. Therefore, these hazards are generally less likely to affect the county than other hazards, at least under the conditions of the current climate.

Additionally, from the past hazard events, the property damages are used as a screening criterion. Though a hazard may not have a high frequency or probability of occurrence, it can still be considered critical if it has a high cost associated with event occurrence. For instance, there were only 11 event days for tornadoes, but they resulted in the second-highest amount of property damages out of all hazards. Thus, the property damages for each hazard are considered in the screening assessment. A table of hazards with number of event days and property damages is in **Appendix B**.

STEP 2. DEVELOP CURRENT HAZARD DATA INVENTORY

The next criterion in the hazard screening assessment is available data for current hazards. Current hazard data is a relevant screening criterion because it represents the extent of the natural hazard under the current climate.

GZA reviewed several data sources to find data associated with probabilistic risk for the natural hazards. A full list of available sources for current hazard data, including those discussed herein, is provided in **Appendix C**. Data from the current hazard inventory that is geospatially available includes flooding, sea level rise, storm surge, dam failure inundation area, earthquakes, and wildfire risk data. The hazard of extreme wind varies with point peak gusts across the county, available from ASCE 7-16; however, the entire county is within the same wind zone. Relevant data that is not geospatially explicit, or also does not vary spatially across the county, includes extreme heat observations, which can be classified as annual days with maximum temperature greater than 90°F for the northern part of the state or 95°F for the southern part of the state, additionally extreme cold can be quantified by annual days with maximum temperature less than 32°F. Temperature indicators are from the 2014 ClimAID Report., 2021 NYS Climate Change



Overview, Climate Explorer, and Centers Disease Control (CDC) National Environmental Public Health Tracking Network (see Reference 10).

Note certain data may be qualitative (e.g., categorized as having a “high” or “low” probability or risk in a given location or throughout the county). These data may be carried forward in the vulnerability assessment using a qualitative evaluation basis.

STEP 3. DEVELOP FUTURE CLIMATE CHANGE INTERACTIONS INVENTORY

The final consideration in the hazard screening criteria is available data for future projections of hazards. General circulation models (GCMs) provide projections of future temperature and precipitation. For example, the NOAA Climate Explorer uses an ensemble of GCMs from the Coupled Model Intercomparison Project Phase 5 (CMIP5) to produce projections of annual and monthly temperature and precipitation. Relevant data from this tool include projected annual days with maximum temperature greater than 90 °F for the northern part of the state or 95 °F for the southern part of the state used for future extreme heat, and projected days with maximum temperature less than 32°F, for future extreme cold.

GZA also identified hazard-specific indicators to gauge the extent of the projected change in a hazard. Where possible, these indicators are the same as those used in Step 2. An example of an indicator is miles of roadway within the 100-year floodplain, for the flood hazard. Indicators for future hazards are included in **Appendix D**. While projections of temperature for extreme heat and precipitation used in flooding are readily available from the Climate Explorer, changes in extreme wind, tornadoes, or geologic hazards are harder if not currently infeasible to project, as the impact of climate change on these hazards is not yet fully understood. Thus, such hazards with a lack of reliable future data may be assessed for present-day risk, but not future risk due to climate change.

3.0 CONCLUSION

The data included in **Appendices B, C, and D** and indicators identified in Section 2 for the hazards and climate change interactions will serve as the basis for completing the hazard screening process. The GZA Team will coordinate and facilitate a meeting with the UCTC and TAC to apply the proposed hazard screening criteria for the project. This meeting will result in finalizing the hazards for conducting the vulnerability assessment as outlined in Task 4 of the scope of work.

4.0 REFERENCES

1. Ulster County, 2017 Multi-Jurisdictional Hazard Mitigation Plan Update [Multi-Jurisdictional Hazard Mitigation Plan | Ulster County \(ulstercountyny.gov\)](#)
2. FEMA, Declared Disasters Website (Accessed September 2021) [Declared Disasters | FEMA.gov](#)
3. NOAA: Storm Events Database (accessed September 2021) [Storm Events Database | National Centers for Environmental Information \(noaa.gov\)](#)
4. NOAA: The Climate Explorer [Climate Explorer \(nemas.org\)](#)
5. ASCE 7 Hazard Online Tool [ASCE 7 Hazard Tool](#)
6. FEMA, Flood Map Service Center ([FEMA Flood Map Service Center | Welcome!](#))
7. USDA Wildfire Risk to Communities [Download - Wildfire Risk to Communities](#)



8. Observed and Projected Climate Change in New York State: An Overview [Observed and Projected Climate Change in New York State 2021 \(ny.gov\)](#)
9. Responding to Climate Change in New York State (ClimAID) [Responding Climate Change in New York State \(ClimAID\) - NYSERDA](#)
10. Centers for Disease Control (CDC) National Environmental Public Health Tracking Network [Home - CDC Tracking Network](#)
11. New York Department of Environmental Conservation (NYDEC), The New York Climate Change Science Clearinghouse (NYCCSC) [New York Climate Change Science Clearinghouse \(nyclimatescience.org\)](#)
12. NYDEC, August 2020 *Flood Risk Management Guidance for Implementation of the Community Risk and Resiliency Act (CRRRA)* [CRRRA Flood Risk Management Guidance \(ny.gov\)](#)
13. NOAA: Sea Level Rise Data Download [Sea Level Rise Data Download \(noaa.gov\) \(on hold\)](#)
14. NOAA: SLOSH Model [Sea, Lake, and Overland Surges from Hurricanes \(SLOSH\) \(noaa.gov\) \(on hold\)](#)



APPENDIX A - LIMITATIONS



Use of Report

1. GZA GeoEnvironmental, Inc. (GZA) prepared this report on behalf of, and for the exclusive use of the Ulster County Transportation Council (Client) for the stated purpose(s) and location(s) identified in the Report. Use of this report, in whole or in part, at other locations, or for other purposes, may lead to inappropriate conclusions; and we do not accept any responsibility for the consequences of such use(s). Further, reliance by any party not identified in the agreement, for any use, without our prior written permission, shall be at that party's sole risk, and without any liability to GZA.

Standard of Care

2. Our findings and conclusions are based on the work conducted as part of the Scope of Services set forth in the Report and/or proposal, and reflect our professional judgment. These findings and conclusions must be considered not as scientific or engineering certainties, but rather as our professional opinions concerning the limited data gathered during the course of our work. Conditions other than described in this report may be found at the subject location(s).
3. Our services were performed using the degree of skill and care ordinarily exercised by qualified professionals performing the same type of services at the same time, under similar conditions, at the same or a similar property. No warranty, expressed or implied, is made.
4. Note that the probabilities presented in this study are approximate and uncertain. They describe future potential conditions to support planning-level decision-making. The scenarios are appropriate for use in understanding the risk of different climate change scenarios and planning. For example, applying higher amounts of inland flooding may be appropriate when considering risk mitigation for high value lifeline assets, which would merit protection against events with a low probability of occurrence.

General

5. The observations described in this report were made under the conditions stated therein. The conclusions presented were based solely upon the services described therein, and not on scientific tasks or procedures beyond the scope of described services or the time and budgetary constraints imposed by the Client.
6. In preparing this report, GZA relied on certain information provided by the Client, state and local officials, and other parties referenced therein available to GZA at the time of the evaluation. GZA did not attempt to independently verify the accuracy or completeness of all information reviewed or received during the course of this evaluation.
7. Any GZA hydrologic analysis presented herein is for the rainfall volumes and distributions stated herein. For storm conditions other than those analyzed, the response of the site's spillway, impoundment, and drainage network has not been evaluated.



ATTACHMENT A

LIMITATIONS

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8. Observations were made of the site and of structures on the site as indicated within the report. Where access to portions of the structure or site, or to structures on the site was unavailable or limited, GZA renders no opinion as to the condition of that portion of the site or structure.
9. In reviewing this Report, it should be realized that the reported condition of any features discussed is based on observations of field conditions during the course of this study along with data made available to GZA. It is important to note that the conditions noted depend on numerous and constantly changing circumstances and are evolutionary in nature.

Compliance with Codes and Regulations

10. We used reasonable care in identifying and interpreting applicable codes and regulations. These codes and regulations are subject to various, and possibly contradictory, interpretations. Compliance with codes and regulations by other parties is beyond our control.



APPENDIX B – PAST HAZARD EVENT DAYS AND PROPERTY DAMAGE



| Profile | Category | Number of Event Days (1996-2021) | Property Damages (1996-2021) | Data Source(s) |
|--------------------|------------------------------|--|---------------------------------|---|
| Atmospheric | | | | |
| | Extreme Cold | 61 | \$16,700,000 (crop losses) | 2017 UCHMP; FEMA Declared Disasters Website; NOAA Storm Events Database |
| | Extreme Heat | 47 | \$0 | 2017 UCHMP; FEMA Declared Disasters Website; NOAA Storm Events Database |
| | Extreme Wind | 276 | \$3,246,000 | 2017 UCHMP; FEMA Declared Disasters Website; NOAA Storm Events Database |
| | Hurricane and Tropical Storm | 10 within 75 nautical miles of Ulster County | - | 2017 UCHMP; FEMA Declared Disasters Website; NOAA Storm Events Database |
| | Lightning | 19 | \$675,000 | 2017 UCHMP; FEMA Declared Disasters Website; NOAA Storm Events Database |
| | Nor'easter | 6 | - | 2017 UCHMP; FEMA Declared Disasters Website; NOAA Storm Events Database |
| | Tornado | 12 | \$3,130,000 | 2017 UCHMP; FEMA Declared Disasters Website; NOAA Storm Events Database |
| | Winter Storm | 168 | \$1,400,000 | 2017 UCHMP; FEMA Declared Disasters Website; NOAA Storm Events Database |
| Hydrologic | | | | |
| | Drought | 2 | \$0 | 2017 UCHMP; FEMA Declared Disasters Website; NOAA Storm Events Database |
| | Flood | 99 | \$24,031,000 | 2017 UCHMP; FEMA Declared Disasters Website; NOAA Storm Events Database |
| Geologic | | | | |
| | Earthquake | 0 | \$0 | 2017 UCHMP; FEMA Declared Disasters Website; NOAA Storm Events Database |
| | Landslide | 0 | \$0 | 2017 UCHMP; FEMA Declared Disasters Website; NOAA Storm Events Database |
| Wildfire | | | | |
| | Wildfire | 5 | \$0 | 2017 UCHMP; FEMA Declared Disasters Website; NOAA Storm Events Database |



APPENDIX C – CURRENT HAZARD DATA



| Profile | Category | Example Indicator | Data Source(s) |
|--------------------|------------------------------|---|--|
| Atmospheric | | | |
| | Extreme Cold | Annual Days with Maximum Temperature < 32°F | NOAA Climate Explorer |
| | Extreme Heat | Annual Days with Maximum Temperature > 90°F | NOAA Climate Explorer |
| | Extreme Wind | Assets within wind zones | ASCE 7-16 Hazard Online Tool |
| | Hurricane and Tropical Storm | Covered in other hazards (Extreme Wind, Flooding) | Covered in other hazards (Extreme Wind, Flooding) |
| | Lightning | Total number of fatalities | Vaisala Lightning Fatalities by State (2008-2017) |
| | Nor'easter | Covered in other hazards (Extreme Wind, Flooding, Winter Storms) | Covered in other hazards (Extreme Wind, Flooding, Winter Storms) |
| | Tornado | Assets within area of relatively moderate to relatively high tornado risk | FEMA National Risk Index: Tornado |
| | Winter Storm | Annual Snowfall | Observed and Projected Climate Change in New York State: An Overview |
| Hydrologic | | | |
| | Drought | Palmer Drought Severity Index (PDSI) | National Integrated Drought Information System |
| | Flood | Miles of roadway within 100-yr or 500-yr floodplain | FEMA Flood Map Service Center |
| Geologic | | | |
| | Earthquake | Assets within area of seismic hazard risk | USGS New York Seismic Hazard Map |
| | Landslide | Assets within area of high susceptibility to landsliding and moderate incidence | USGS Landslide Susceptibility |
| Wildfire | | | |
| | Wildfire | Assets within area of high Wildfire Hazard Potential (WHP) Index | USDA Wildfire Risk to Communities |



APPENDIX D – INDICATORS FOR FUTURE HAZARD EVENTS



| Category | Example Indicator | Data Source(s) |
|------------------------------|---|---|
| Extreme Cold | Annual Days with Maximum Temperature < 32°F | NOAA Climate Explorer |
| Extreme Heat | Annual Days with Maximum Temperature > 90°F | NOAA Climate Explorer |
| Extreme Wind | Assets within wind zones | Projected impact of climate change not currently available |
| Hurricane and Tropical Storm | Covered in other hazards (Extreme Wind, Flooding) | Projected impact of climate change not currently available |
| Lightning | Total number of fatalities | Projected impact of climate change not currently available |
| Nor'easter | Covered in other hazards (Extreme Wind, Flooding, Winter) | Projected impact of climate change not currently available |
| Tornado | Assets within area of relatively moderate to relatively high tornado risk | Projected impact of climate change not currently available |
| Winter Storm | Annual Snowfall | Observed and Projected Climate Change in New York State: An Overview |
| Drought | Palmer Drought Severity Index (PDSI) | Observed and Projected Climate Change in New York State: An Overview |
| Flood | Miles of roadway within 100-yr or 500-yr floodplain | Considering Current and Future Inland Flood Risk: A Consumer's Guide to Flooding Tools for Communities in |
| Earthquake | Assets within area of seismic hazard risk | Projected impact of climate change not currently available |
| Landslide | Assets within area of high susceptibility to landsliding and moderate incidence | Projected impact of climate change not currently available |
| Wildfire | Assets within area of high Wildfire Hazard Potential (WHP) Index | Projected impact of climate change not currently available |



GZA GeoEnvironmental, Inc.