National Landslide Hazards Reduction Program

Advisory Committee on Landslides (ACL)

March 4th–5th, 2026, The Flatiron Hotel, Asheville, North Carolina

Attendees

ACL Members

- Bill Haneberg, William C. Haneberg, LLC
- Nina Oakley, California Geological Survey
- Josh Roering, University of Oregon
- Gabriel Taylor, Washington State Department of Transportation
- Joe Wartman, University of Washington
- Leslie Jones, Alaska Division of Geological & Geophysical Surveys
- Bill Burns, Oregon Department of Geology and Mineral Industries
- Jennifer Bauer, Appalachian Landslide Consultants, PLLC
- Casey Hannell, Washington State Department of Natural Resources
- Lorna Jaramillo Nieves, University of Puerto Rico at Río Piedras

Agency Representatives

- Jonathan Godt, U.S. Geological Survey (Designated Federal Officer)
- Jenny Riker, U.S. Geological Survey
- Kelli Baxstrom, U.S. Geological Survey
- Stephen Slaughter[1], U.S. Geological Survey

Speakers and Guests

- Matthew Fogleman[2], ECS Southeast, LLC
- Jody Kuhne[2], Access Limited/GeoStabilization International
- David Korte, North Carolina Geological Survey
- Martin Woodard[2], Geospecialties
- Alex Willis[2], Anchor QEA of North Carolina, LLC
- Gari Mayberry[1,2], U.S. Geological Survey
- Andria Ellis[1,2], U.S. Geological Survey
- Anne Witt[1,2], Virginia Geological Survey
- Linda Rowan[1,2], Congressional Research Service (in personal capacity)
- Alice Pennaz[1], U.S. Geological Survey
- Martha Kopper[1,2], Arkansas Office of the State Geologist
- Lori Peek[1], Natural Hazards Center, University of Colorado Boulder

[1] Virtual attendee
[2] Public guest

- Paige Ambord, University of North Carolina at Asheville
- Matthew Reihl[1,2], GeoStabilization International
- Katherine Scheip, Henderson County Emergency Management
- Kevin Madsen, Helene Recovery Office, Buncombe County
- Patrick Moore, National Weather Service
- Trevor Rhodes[1,2], Federal Emergency Management Agency (in personal capacity)
- April Fontaine[1], U.S. Army Corps of Engineers
- Mary Mullusky[1], National Weather Service
- Vanessa Bateman[1], U.S. Army Corps of Engineers
- Robert Emberson[1], National Aeronautics and Space Administration
- Jason Marineau[1], Department of the Interior Office of Emergency Management
- Joseph Schultz[1,2], Pennsylvania Department of Environmental Protection
- Al Handwerger[1,2], National Aeronautics and Space Administration
- Lei Wang[1,2], University of Cincinnati

Meeting materials, including presentation slides, are available on the Advisory Committee for Landslides website.

[1] Virtual attendee
[2] Public guest

ACL Meeting Minutes—Day 1

March 4th, 2026, 9:00 a.m.—5:30 p.m. EST

1. Welcome

Bill Haneberg, Chair of the Advisory Committee on Landslides (ACL, or Advisory Committee, or Committee), opened the meeting at 9:00 a.m., EST. and noted that the meeting was being held in Asheville as part of the Committee's desire to learn from people in places that have been affected by landslide problems. The Chair welcomed members of the public in attendance. Nina Oakley, ACL Co-Chair discussed meeting logistics and conversation engagement considerations, and upcoming facilitated discussions. Committee members, speakers, and guests were invited to introduce themselves (see "Attendees" above).

2. USGS Landslide Hazards Program Updates

Jonathan Godt, Designated Federal Officer and USGS Program Coordinator for Landslide Hazards, and Jenny Riker, Associate Program Coordinator for Landslide Hazards, updated the ACL on USGS and Federal interagency activities and accomplishments related to the National Landslide Hazard Reduction Program (NLHRP).

Godt reviewed the status of National Landslide Preparedness Act (hereafter NLPA, or the Act) reauthorization. He noted that Senate Bill 1626 (S. 1626) passed the U.S. Senate by unanimous voice vote on January 5, 2026, and is awaiting action in the U.S. House of Representatives. The Senate-passed bill largely maintains the activities of the original NLPA while adding direction to establish regional partnerships to coordinate landslide research and monitoring efforts and expanding landslide grant eligibility to include Native Hawaiian organizations and institutions of higher education—a significant expansion of current grant eligibility requirements.

Godt also summarized provisions in the 2026 Interior, Environment, and Related Agencies Appropriations Act, which provides $14.5 million for the USGS Landslide Hazards Program in FY26, an increase of $100,000 from the FY24 enacted budget. This includes directed funding for work on landslides in Alaska, including landslide monitoring systems in high-risk areas, and continuation of the landslide grants program. Report language directs continued collaboration with the Federal Emergency Management Agency (FEMA), community groups in Southeast Alaska, and Alaskan State and local government entities. The report also encourages continued prioritization of postfire debris-flow hazard assessments and requests information on the costs of creating an Interagency Landslide Observing System. Godt noted alignment between ongoing program activities and partnerships and executive branch priorities to enhance state and local preparedness (i.e., E.O. 14239, Achieving Efficiency Through State and Local Preparedness).

Godt and Riker invited the ACL to ask questions and give input.

Discussion

- The Advisory Committee asked about the timeline for implementing enhanced postfire debris-flow (PFDF) assessments. Program staff responded that new assessments would include inundation modeling beginning this year's fire season; these will become part of LHP's standard operational response product offering.
- The Advisory Committee asked if enhanced PFDF assessments would assess landslide runout beyond Federal lands. Staff confirmed that inundation assessments will extend beyond Federal land boundaries and will be available for use by State and other partners.
- The Advisory Committee asked for additional information on regional partnerships proposed in the NLPA reauthorization. Staff noted that the proposal remains in the conceptual stage and welcomed input from the Committee.
- The Advisory Committee asked whether FY26 appropriations included funding for landslide work at agencies other than the USGS. Staff indicated they were not aware of appropriations for other Federal agencies specifically directed to landslide hazards.
- The Advisory Committee requested clarification of language related to atmospheric rivers in the NLPA reauthorization bill. Staff explained that the S. 1626 includes language recognizing atmospheric rivers and extreme rainfall as landslide triggers, which could guide future program emphasis if enacted.
- The Advisory Committee asked whether proposed regional landslide observatories might include a centralized data platform integrating multiple data sources, such as satellite observations and lidar. Staff responded that while such a platform represents a longer-term goal, near-term efforts are focused on developing the monitoring system concept and improving monitoring and detection capabilities.
- An Advisory Committee member noted related efforts in Federal geospatial advisory groups to move toward cloud- and AI-native data formats and improved management of remote sensing and satellite data. They suggested potential coordination opportunities with agencies such as the National Aeronautics and Space Administration (NASA).
- The Advisory Committee asked whether potential future landslide monitoring systems would focus only on slow-moving landslides or assess conditions leading to rapid debris-flows. Staff explained that the "landslide observatory" concept is broad as written and could include monitoring, detection, and hazard information for multiple landslide types.
- The Advisory Committee asked whether regional landslide observatories could incorporate PFDF monitoring. Staff indicated that the system is currently envisioned as an umbrella framework that could include PFDF hazards as well as other landslide monitoring activities.
- The Advisory Committee requested an update on the Cooperative Landslide Hazard Mapping and Assessment Grants Program, including project types and funding levels. Program staff explained that the grants program is entering its third year and distributes approximately $1 million annually, primarily to State geological surveys. Demand for funding exceeds available resources, and at the time of meeting, the FY26 Notice of

Funding Opportunity is currently delayed due to administrative review processes. Program staff demonstrated a new, interactive public dashboard displaying award information.

- The Advisory Committee asked whether grant eligibility for universities in the proposed NLPA reauthorization would require partnership with State geological surveys. Staff clarified that, should the current bill become law, universities would be eligible to apply for grants directly and would compete for funding with State, Tribal, territorial, and local government agencies.
- The Advisory Committee suggested outreach to local governments through professional organizations such as the International Association of Emergency Managers and the American Public Works Association to broaden participation in the grants program.
- The Advisory Committee asked how publicly reported staffing and budget changes affecting agencies such as NOAA could affect proposed regional landslide monitoring partnerships. Staff noted that USGS landslide monitoring activities have largely continued without major disruption, though some regions have faced staffing and operational challenges, particularly in Alaska.
- The Advisory Committee asked about progress toward national standards for landslide databases and data structures. Staff noted that an interest group of the National Landslide Hazard Risk Reduction (NLHRR) Working Group is compiling database schemas from State surveys to identify common elements and develop standard recommendations.
- An Advisory Committee member suggested that citizen science could play a role in future landslide research and hazard mitigation efforts by helping engage communities and expand data collection.
- The Advisory Committee asked how monitoring priorities might evolve if the program shifts from research-focused monitoring toward operational systems designed to address human consequences in high-risk areas. Staff noted this may require rethinking current monitoring strategies and designing systems around user and hazard communication needs.
- Finally, the Advisory Committee requested information on current interest groups of the NLHRR Working Group. Program staff gave a brief overview of eight active topical and regional groups that meet regularly and are open to professional participation. Details are available on the working group's website. Program staff added that the working group was drafting an annual proceedings document for publication.

3. Landslide Science and Technology Gaps Subcommittee Report and Discussion

Joe Wartman, Chair of the ACL Subcommittee on Landslide Science and Technology Gaps, shared an overview of the subcommittee's report, findings, and suggested recommendations, followed by group discussion.

The subcommittee met five times and prepared a concise report assessing key gaps in landslide science and technology relevant to advancing implementation of the National Landslide Hazard Reduction Program. The report identifies current challenges related to landslide hazard assessment and response, including mapping and modeling, forecasting and weather prediction, and early warning systems, as well as needs related to coordination, training, policy, planning, and mitigation. The report also highlights emerging technologies to support future advances, including high-resolution topographic data, national-scale hazard products from the USGS, improvements in precipitation monitoring and forecasting, next-generation satellite observations such as NASA-ISRO Synthetic Aperture Radar (NISAR), fiber-optic sensing technologies, and artificial intelligence (AI).

The subcommittee's report proposes three recommendations for the ACL to consider: enhancing national landslide data infrastructure, including a dynamic landslide inventory and monitoring network; developing a national forecast-based landslide warning system; and strengthening community resilience through education and mitigation. The Subcommittee Chair posed several questions to guide Committee discussion, including how warning systems should address both rapid and slow-moving landslide hazards, how to evaluate the operational readiness of emerging monitoring technologies, and how AI tools might be responsibly integrated into Federal and State hazard programs.

Discussion

- Advisory Committee members discussed the challenges of developing landslide warning systems that address both rapid and slow-moving landslides. Several members noted the relatively coarse scale of current susceptibility mapping and forecasting efforts. Accurately predicting the timing and location of specific events remains a longer-term goal.
- Advisory Committee members discussed ongoing efforts to develop debris-flow early warning approaches based on precipitation thresholds and susceptibility mapping. Members noted that such systems are often designed to inform emergency managers of increased likelihood of rapid, high-consequence events.
- Several members highlighted the need for clearer guidance on communicating landslide hazards to communities, including how to distinguish between slow-moving hazards and rapid debris-flows when developing warnings and preparedness strategies.
- Advisory Committee members discussed the challenge of prioritizing limited resources across susceptibility mapping, monitoring, and forecasting efforts. Members suggested that future strategies consider population exposure and societal impacts as a means of prioritization.
- An Advisory Committee member representing emergency management interests emphasized the need for more actionable predictive information, including improved rainfall thresholds, clearer guidance on protective actions, and better integration of landslide hazard assessments and operational weather forecasting. Landslide hazards may persist for many years after wildfires and existing thresholds may not capture long-term risks.

- Program Staff encouraged Advisory Committee members to consider agency missions when framing recommendations and re-emphasized the imminent operationalization of enhanced PFDF hazard models for the western U.S.
- Several Advisory Committee members highlighted the uncertainties associated with rainfall thresholds used in warning systems, stressing a need to better understand rainfall intensity, antecedent conditions, and regional differences that influence landslide initiation.
- Advisory Committee members noted the importance of monitoring and understanding failure mechanisms of slow-moving landslides, which can pose significant infrastructure risks.
- Advisory Committee members discussed the need for improved landslide inventories and higher temporal resolution data to better correlate landslide occurrence with rainfall conditions and other triggers.
- Advisory Committee members discussed emerging technologies to support landslide monitoring and forecasting, including remote sensing, higher frequency satellite interferometry (i.e., NISAR), lidar data, and other high-resolution imagery. Members noted that some of these technologies are already operational while others are in earlier stages of development.
- The Advisory Committee discussed potential applications of AI for landslide monitoring and analysis, including mining media reports for landslide observations and extracting insights from large geospatial datasets. Members stressed the need to consider operational readiness, data standards, validation, and ethics when integrating AI into hazard datasets.
- Advisory Committee members highlighted the importance of social science research and community engagement in the development of landslide warning systems, noting that effective communication and understanding community response behaviors are critical for translating hazard information into protective action.
- Finally, the Advisory Committee discussed balancing investments in technological solutions with improvements in hazard communication, noting that some communication challenges might be addressed more quickly than long-term technological development.

4. <u>Advancing Landslide Science Applications for Public Safety Subcommittee Report and Discussion</u>

Leslie Jones, Chair of the ACL Subcommittee on Advancing Landslide Science Applications for Public Safety, provided an overview of the subcommittee's report, findings, and suggested recommendations, followed by group discussion.

The Subcommittee Chair reminded Advisory Committee members of the intended audience for the subcommittee's suggested recommendations: Federal agencies, namely those represented on the Interagency Coordinating Committee on Landslide Hazards (ICCLH), Congress, and key

public safety partners (e.g., local emergency managers). The subcommittee's suggested recommendations centered on five priorities: landslide assessment (i.e., standardizing landslide inventories, susceptibility modeling, and monitoring through joint working groups); landslide planning (i.e., providing science to relevant decision makers to inform policy); landslide response and recovery (i.e., improving timely, actionable community alerts and ensuring access to landslide technical expertise); landslide technologies, data, and integration (i.e., ensuring standardization and ease of access to large datasets); and landslide awareness and education (i.e., increasing public understanding of landslide hazards and alerts). A common theme throughout the subcommittee's report is the need for coordination, consistent data standards, and trusted information. One subcommittee member noted that although some suggested recommendations extend beyond Federal agency purview (i.e., building code development), they are important for signaling potential applications of NLHRP information.

Discussion

- The Advisory Committee noted the importance of developing actionable science that could inform building code development, analogous to USGS seismic design standards.
- An Advisory Committee member emphasized the importance of including landslide hazard education in earth science curricula, noting that most people understand what landslides are, but may not know that landslide hazard exists locally or how to address it.
- An Advisory Committee member commented on the challenges of translating technical risk information to communities, citing an example in which debris-flow runout assessments were narrower than mapped flood zones, leading to a perception that debris-flow risk was superseded by flood risk.
- The Advisory Committee discussed how broad recommendations could be effective. Program staff cited examples of broad advisory committee recommendations accompanied by illustrative or priority examples, an approach that allows agencies to be responsive to recommendations while maintaining mission and resource alignment.
- The Advisory Committee discussed challenges of adapting existing landslide educational materials (often locally developed) for wider use. They suggested that USGS national products include user guides to facilitate application by local practitioners and emphasized the need for plain-language guidance for first responders and decision makers.
- An Advisory Committee member recommended including decision trees in product guidance to simplify their use. They noted the importance of clear, non-technical language and stressed that communities already know their local environment well. Effective outreach requires translating complex science into familiar terminology.
- The Advisory Committee noted the importance of developing USGS products and information that state surveys and emergency managers can interpret and use within their local jurisdictional structures. The 2024 National Landslide Susceptibility Model was highlighted as an example of a USGS product providing internally consistent landslide information across jurisdictions with varying capacity and resources.

- The Advisory Committee highlighted the link between landslide insurance and landslide risk reduction efforts. Gaps in understanding landslide frequency and losses currently limit landslide insurance coverage in the U.S.
- The Advisory Committee noted that existing technical working groups, such as NLHRR Interest Groups, are a mechanism for aligning recommendations with community needs. They suggested regular report-outs to and from these groups to help define priorities, standardize communication, and identify key datasets for landslide risk assessment.
- An Advisory Committee member commented on the importance of readability and tone in drafting recommendations. They praised the Landslide Applications Subcommittee report's clear, accessible language.

5. Draft Recommendations Report Overview and Discussion

The ACL Chairs provided an overview of the draft consolidated recommendations report, which integrated findings and suggestions from the two subcommittee reports. The Chairs described the process by which they condensed subcommittee reports into a high-level summary highlighting outstanding challenges in NLHRP implementation and 17 potential recommendations. Committee members were asked to identify priority recommendations aligned with the four goals of the National Strategy for Landslide Loss Reduction (Assess, Coordinate, Plan, and Respond) as a starting point for drafting final recommendations.

- The Advisory Committee discussed the importance of developing recommendations that are specific enough to guide action while remaining flexible.
- The Advisory Committee discussed whether recommendations should emphasize near-term actions or longer-term goals. Several members suggested that recommendations could incorporate both short- and long-term objectives with different implementation timelines.
- The Advisory Committee discussed the intended audiences for the report, including the USGS, the ICCLH, Executive Branch leadership, and Congress.
- The Advisory Committee emphasized that recommendations should focus on desired outcomes and strategic priorities rather than prescribing specific research activities. USGS staff noted that high-level recommendations can help guide program direction and resource allocation while allowing flexibility to implement under operational constraints.
- Advisory Committee members discussed opportunities to strengthen collaboration among federal agencies, states, and universities, for example, cooperative training and mapping programs that build technical capacity while addressing landslide hazards on both Federal and private land.
- Advisory Committee members discussed how to structure recommendations to encourage collaboration across ICCLH agencies, while recognizing that the USGS is ultimately responsible for implementation and reporting under the Act.

- Advisory Committee members noted the value of aligning recommendations with other Federal initiatives related to data standards and geospatial infrastructure. Improving landslide data availability and integration is a foundational need that supports many of the recommendations under consideration.
- The Advisory Committee considered organizing recommendations around broader themes, such as landslide data infrastructure (e.g., inventories, monitoring networks, and loss tracking) to help consolidate related ideas and identify building blocks for future programming.
- Advisory Committee members asked about the expected timeline for issuing subsequent recommendations. USGS staff noted that the Act does not specify a timeline for ACL reporting. Updates to recommendations will likely occur periodically as the Committee's membership rotates and as the ICCLH evaluates progress.

Following discussion, the Advisory Committee conducted a short exercise in which each member identified their priority recommendations from the consolidated list, then broke into small groups to draft one or two summary recommendations under each strategic theme for the full committee to consider.

6. Panel Discussion: Landslide Risk Science and Applications

The Advisory Committee participated in a panel discussion on the role of social science in advancing landslide hazard characterization, communication, and risk reduction under the National Landslide Hazard Reduction Program. While NLHRP authorities and resources are primarily directed toward Federal science and technical agencies, landslide risk reduction requires integration of both physical and social science research and practice. Panel discussion was intended to provide insights to inform future ACL recommendations regarding Program implementation. The Advisory Committee heard contributions from three panelists:

- **Lori Peek**, Director of the Natural Hazards Center and Professor of Sociology at the University of Colorado Boulder.
- **Paige Ambord**, Assistant Professor of Sociology at the University of North Carolina Asheville.
- **Alice Pennaz**, Director of the Office of Risk and Resilience in the USGS Natural Hazards Mission Area.

Lori Peek highlighted the need for convergent and participatory research approaches to integrate the social and physical sciences for landslide risk reduction, noting risk reduction is both a scientific and a social process involving individuals, organizations, institutions, and policy systems. Key outstanding questions include how people perceive and act on landslide risk, how landslides impact communities, what landslide policies are in place, and how effectively those policies reduce risk. Peek shared examples of initiatives that could support landslide research and program development, including interdisciplinary research networks, social science working groups leveraged from other hazards, and programs to support rapid-response disaster re-

search and data sharing. She highlighted a successful example of convergent, participatory landslide hazards work in the wake of Hurricane Maria, which yielded an updated landslide inventory and susceptibility model for Puerto Rico and a landslide safety guide for residents, demonstrating how trusted relationships and bottom-up engagement can ensure useful and accessible products. Peek closed by identifying specific barriers that NLHRP activities could help address: that landslides remain one of the least studied natural hazards within the social sciences; and that there is currently no coordinated cohort of landslide-focused social science researchers comparable to those working on other hazards like earthquakes or hurricanes.

Paige Ambord discussed her work on landslide risk perception and communication during Hurricane Helene. She distinguished acute risk—such as an approaching storm—from chronic risk associated with living in a landslide-prone area. She described "filters" through which landslide risk awareness and preparedness develop (i.e., exposure to landslide inventories and susceptibility maps; opportunities for mitigation through property improvements or land-use decisions; community-level engagement with hazard information) and emphasized the importance of hazard communications during the chronic risk phase. Ambord also identified key challenges for landslide risk communication, including low baseline awareness of landslide hazards; difficulties communicating landslide risk during multi-hazard events (such as hurricanes, when landslide warnings may be perceived as secondary to flood warnings); and a disconnect between official warning sources and sources of information people trust and rely on, such as social media. To advance landslide risk reduction, Ambord recommended improved coordination with those who disseminate hazard information (e.g., emergency managers and communication platform developers); redundant hazard communication methods (i.e. if cellular infrastructure fails); and community engagement to identify effective, actionable hazard communication approaches.

Alice Pennaz discussed the importance of integrating social science approaches throughout the research and development cycle. Pennaz explained how surveys, user needs assessments, and observational studies of decision-making processes can identify the information end users need and how they use it, ensuring products are relevant to real-world decision making. She highlighted a recent USGS user needs assessment to inform the development of postfire debris-flow inundation assessments as a standout example. Observational studies and simulations can further show where "expressed" preferences for complex tools differ from "revealed" preferences—the information decision makers ultimately rely on in time-critical situations. Social science approaches can also inform resource prioritization, for example, by integrating demographic analyses of where people are vulnerable with landslide susceptibility assessments of where landslides are likely. Likewise, evaluating existing hazard products and communication strategies is key; tools may exist, but they may not be widely known or used effectively. Finally, social science approaches are essential for assessing how people perceive and respond to risk, how they share and use hazard information, and how risk communication translates to protective actions. Pennaz concluded by recommending "easy wins" to advance NLHRP implementation: exposure analysis to prioritize efforts, user needs assessments in the research development phase, evaluation of existing landslide hazard products, and continued collation of landslide loss data.

Discussion

- The Advisory Committee asked how to reach non-traditional stakeholders beyond dashboards or map servers. Peek and Ambord noted that effective communication requires understanding the audience and their preferred mediums, emphasizing that there is no single most effective approach. Creative strategies, such as materials for children or community-specific messaging, can help reach broader audiences, and trust is foundational for effective outreach. Godt suggested that engaging communities in defining their own needs is critical to ensure communication efforts are appropriately targeted.
- The Advisory Committee asked about social science programs related to hazard communication, citing existing wildfire education initiatives. Panelists clarified that current USGS social science efforts focus on organizational learning and participatory approaches, in contrast to educational programs like Firewise. Pennaz noted that understanding where people obtain hazard information can inform communication strategies. Committee members discussed their experiences of top-down messaging, emphasizing that programs must align with community decision-making frameworks to be effective.
- The Advisory Committee asked how general landslide hazard awareness materials can be integrated with real-time warning systems, particularly given that landslide warnings in the U.S. are often distributed via NWS flash flood alerts. Panelists emphasized the importance of combining core risk communication principles with research on compounding hazards. They noted that landslide risk communications can be obscured by communications on concurrent hazards, such as flooding, citing examples from Hurricane Helene. Additional research could determine when and how messaging should be updated during evolving, cascading events.
- The Advisory Committee asked how social science methods could inform adaptive, community-based hazard management in regions with varied landslide hazards, such as Alaska. Panelists noted that user needs assessments, participatory exercises, and work with local decision-makers are essential to tailor information and enhance its applicability. Examples include USGS postfire debris-flow inundation hazard assessments, where early engagement with stakeholders helped refine scientific tools for operational use.
- The Advisory Committee asked how historical knowledge and memory of past landslide events can be incorporated into hazard management and risk communication. Panelists noted that community memory is a powerful tool for sustaining awareness and motivating protective behaviors. They recommended community-led initiatives for memorialization and knowledge preservation, allowing residents to guide form and focus.
- The Advisory Committee asked about strategies for communicating landslide risk across spatial and temporal scales. Panelists noted that susceptibility maps and landslide inventories can convey risk at multiple scales, but reaching individuals in locations where they live, work, and travel remains a challenge. Effective communication should emphasize actionable guidance.
- The Advisory Committee discussed the need to learn from existing programs and frameworks, particularly in designing tools and dashboards targeted to end users. Panelists

emphasized the importance of engaging stakeholders early in the tool development process and designing communication platforms to meet their needs.

- The Advisory Committee noted limitations in tracking landslide losses and asked how social science could support better understanding of affected populations. Panelists described ongoing USGS efforts to develop landslide loss databases and explore the use of AI and large language models to collect post-disaster information, including USGS collaboration with state departments of transportation.
- The Advisory Committee asked about the effectiveness of temporary versus permanent signage in hazard communication. Panelists emphasized that signage should convey clear, actionable instructions and that temporary, context-specific guidance may be more effective than permanent signs in some circumstances.
- The Advisory Committee asked whether AI and proprietary methods used for loss tracking by other agencies could be applied to landslides. Panelists highlighted challenges due to the smaller scale and compound nature of landslide events, noting that data collection and aggregation require careful design to account for these complexities.

7. Public Comment

Two members of the public delivered remarks during the public comment period. Written statements and materials shared for public comment are included in the appendix.

Alex Willis, a geotechnical Engineer in Training (EIT) from Swannanoa, North Carolina, shared a personal account of how landslide hazard maps have impacted his residential clients and his own community before, during, and after Hurricane Helene. Swannanoa was particularly hard hit by landslides and flooding from this event. A debris-flow in his neighborhood tragically killed two people, injured others, and destroyed multiple residences. Willis cited the isolation, panic, and lasting trauma of that event for his community, where landslide risk persists.

Although existing hazard maps correctly identified the pathway of the fatal debris-flow, risk awareness among residents was limited and local ordinances applied only to part of the affected area. Willis noted that local mapping initiatives often face pushback due to concerns about property values or unnecessary alarm. He explained that in his experience, concerns regarding hazard mapping may be based on misunderstanding that can be resolved in conversation, and the community benefits of such mapping outweigh the risks. In a buyer-beware state where landslide insurance is not available, Willis stressed that hazard assessments enable individuals and businesses to secure housing investments and avoid catastrophic losses, including loss of life. They can also bring work to local consultants. Moreover, during community-organized search and rescue efforts, hazard maps were an invaluable tool for targeting response.

Willis urged the USGS to fund and support landslide hazard mapping initiatives in Western North Carolina. He acknowledged mapping and building ordinances alone are not enough—many developments predate hazard maps, and many residents are unaware of their landslide exposure. He suggested the ACL help close the gap between assessments and public awareness by recommending a database of residences in mapped landslide hazard zones. Such a

database could be used to target homeowners for outreach and to focus future disaster response efforts.

- The Advisory Committee and USGS staff thanked the commenter for sharing his experience and discussed ongoing efforts to use debris-flow runout models and mapped deposits to inform zoning and development guidance. The commenter offered to share photographs, videos, and lidar data collected shortly after the event to support ongoing runout modeling efforts. The USGS noted that education and outreach efforts related to landslide hazard maps are ongoing but remain limited in scale, including efforts to communicate risk information through real estate professionals.
- The Advisory Committee noted that resistance to hazard assessments is often initially driven by concerns about property values but can change through community engagement and education. Members discussed parallels in other states where landslide hazard information exists but there is no requirement to disclose risks to property buyers. The Committee also discussed whether high-quality national susceptibility maps could support broader insurance coverage for landslide hazards. The USGS noted that insurance actuaries have indicated that detailed national-scale hazard information would be necessary to support such coverage.
- The Advisory Committee reflected on the experiences of other communities that have experienced fatal debris-flow events (e.g., Alaska, California), noting that hazard mapping and notification practices can influence both evacuation decisions and insurance coverage. Members acknowledged the lasting community impacts of such disasters, including trauma experienced by responders and residents, and suggested connecting affected communities to share experiences and lessons learned.

Matthew Rhiel, a licensed engineer at Geostabilization International, described his work with states and other agencies to provide efficient, cost-effective landslide mitigation and emergency response services. Rhiel noted challenges related to multi-agency coordination and landslide losses associated with flood events. He expressed concern that FEMA funding eligibility requirements can discourage landslide inventory work or preventative maintenance. For example, he emphasized the importance of being able to conduct Federally funded work that distinguishes between landslide-related damage and damage caused by other factors such as construction. He thanked the Advisory Committee for its work serving communities affected by landslides.

- The Advisory Committee thanked Rhiel for his public comments.

8. Day 1 Adjournment

The Chairs and DFO thanked attendees for their attention and participation and adjourned the meeting for the day at 5:30 p.m. EST.

ACL Meeting Minutes—Day 2

March 5th, 2026, 9:00 a.m.—5:00 p.m. EST

9. Welcome and Day 1 Reflections

Chair Haneberg and Co-Chair Oakley opened Day 2 of the meeting at 9:00 a.m., EST. Riker invited Advisory Committee members to share any reflections from yesterday's discussions.

- The Advisory Committee discussed its role in relation to the National Strategy for Landslide Loss Reduction, noting that existing strategic priorities are already well developed. Members agreed that the ACL's role is to prioritize and refine these existing efforts, with a focus on identifying near-term, actionable next steps.
- The Advisory Committee noted that some draft recommendations are interdependent and may need to be implemented in sequence. They emphasized the importance of focusing on actions that are achievable within a realistic timeframe.
- The Advisory Committee discussed how its recommendations might inform future strategy updates and the value of capturing lower-priority draft recommendations for this purpose. They considered how to disseminate their findings to the broader research community to guide future work.

10. Panel Discussion: Local Landslide Preparedness and Impacts

The Advisory Committee participated in a panel discussion with local landslide and emergency management practitioners who shared their experiences addressing landslide hazard and risk before, during, and after Hurricane Helene. Helene caused widespread, damaging landslides throughout the Southern Appalachians, with particularly severe impacts in Western North Carolina. The Advisory Committee heard contributions from four speakers:

- **David Korte**, Landslide Hazards Program Manager, North Carolina Geological Survey
- **Kevin Madsen**, Helene Recovery Officer, Buncombe County, North Carolina
- **Katie Scheip,** Planning and GIS Specialist, Office of Emergency Management, Henderson County, North Carolina
- **Pat Moore,** Lead Meteorologist, National Weather Service Greenville-Spartanburg Weather Forecasting Office

David Korte described the North Carolina Geological Survey's role in landslide hazard assessment and related decision support through coordination with county officials, emergency managers, and Federal partners. He highlighted the agency's collaboration with the USGS and Appalachian Landslide Consultants to map landslides and conduct outreach in the aftermath of Hurricane Helene. Immediately after the storm, aerial reconnaissance in coordination with Federal partners provided rapid situational awareness of landslide impacts, at a time when NCGS' own

staff were still dealing with the personal impacts of this event. Local response efforts included addressing hundreds of landslides impacting infrastructure and communities, often triggered by rainfall well in excess of established landslide thresholds. NCGS has since identified over 3,400 Helene-triggered landslides using aerial imagery and expects that lidar analysis will further refine this inventory. Korte emphasized the importance of field-based assessments in prompting mitigation actions. He also noted ongoing collaboration amongst state, Federal, and local entities to improve the integration of landslide science into emergency management and planning.

Kevin Madsen discussed the structure and priorities of Buncombe County's Helene Recovery Office, which he leads, emphasizing its role in coordinating long-term landslide recovery and mitigation. He outlined the county's ongoing efforts to address high-priority landslides selected based on community risk. He described how lidar has enabled a better understanding of landslide initiation, often revealing more complex failure patterns than initially expected. Madsen emphasized the importance of considering downslope risk (e.g., runout) when implementing mitigation measures and noted challenges securing funding for landslide stabilization efforts. He also highlighted the county's coordination with FEMA, the use of cost-benefit analyses in hazard mitigation grants, and the importance of broader investments in landslide resilience, including housing and long-term planning. He stressed the need to balance response actions with longer-term mitigation strategies for both public and private infrastructure.

Katie Scheip provided a perspective on county-level emergency response and recovery operations. She described post-event landslide data collection efforts, including field-based damage assessments and aerial imagery analysis, which were critical for understanding impacts and informing recovery decisions. Approximately 100 properties in Henderson County were impacted by landslides during Hurricane Helene. Scheip stressed the importance of early data collection and the challenges of communicating risk to varied populations, particularly those without access to digital communication channels. She discussed work the County is doing to integrate geologic data into public-facing mapping tools and the use of hazard mitigation grant programs to support private landowners. She identified the need for better understanding of landslide initiation conditions, improved public messaging, clearer landslide recurrence information, and more consistent mitigation funding mechanisms.

Pat Moore explained the role of NWS Weather Forecasting Offices (WFOs) in forecasting and communicating landslide risk, noting that landslides are a leading weather-related hazard in the region. He described how the NWS incorporates landslide warning information into its existing flash flood guidance products. Using a framework of escalating alerts, the NWS integrates landslide messaging into flash flood watches and warnings based on established rainfall thresholds and coordinates extensively with local partners ahead of major storm events. In the case of Hurricane Helene, Moore noted that the NWS provided several days advanced warning of significant landslide threat and coordinated that messaging across regional and national levels. He highlighted successes in threat recognition and interagency coordination ahead of Hurricane Helene; he also acknowledged the challenges of effectively communicating landslide risk during impactful multi-hazard events. Moore identified opportunities for improved evacuation planning and public outreach, and the potential development of more targeted, impact-based forecasting tools integrating landslide susceptibility modeling, in collaboration with other scientific agencies.

Discussion

- The Advisory Committee asked about land ownership in landslide impacted areas. Panelists responded that affected areas were primarily on private land, including managed timber lands, and noted the role of road construction in slope instability.
- An Advisory Committee member asked how lidar data was acquired and applied before, during, and after Helene. Panelists described state-led lidar acquisitions (in 2017 and post-event in 2025) and their use in landslide inventory development, change detection, mitigation design, and stakeholder communication. Lidar was used for both technical analysis and public engagement.
- The Advisory Committee asked about the impacts of changes to FEMA's Building Resilience Structure in Communities program on ongoing work. Korte, Madsen, and Scheip noted disruptions to funding and project timelines and emphasized the importance of such programs for supporting landslide mitigation and inventory development efforts.
- An Advisory Committee member asked how landslide data and mapping products are shared with stakeholders and who uses them. Panelists identified intended users including local officials, planners, and the public, and highlighted challenges related to public awareness and accessibility of hazard information.
- The Advisory Committee asked about the level of public awareness of landslide hazard and risk. Panelists responded that many residents are unaware of landslide risk, particularly in growing and newly urbanized areas, and emphasized the need for improved public messaging and education.
- An Advisory Committee member asked about the coordination and use of post-disaster imagery from multiple sources. Panelists described challenges with incomplete spatial coverage, cloud interference, large data volumes, and limited awareness of available datasets, and identified opportunities for improved interagency coordination.
- The Advisory Committee asked about local alerting and communication methods during Hurricane Helene. Panelists described the use of social media, traditional media, and in-person notifications, while noting limitations due to infrastructure disruptions and the voluntary nature of evacuations.
- The Advisory Committee asked a guest attendee from FEMA who had participated in the Hurricane Helen response how Federal agencies were engaged in response efforts. The guest described mission assignments, interagency coordination bodies, and the integration of operational capabilities (i.e. aerial reconnaissance) with technical expertise as mechanisms for engaging Federal partners.
- The Advisory Committee asked about opportunities to improve landslide risk communication. Panelists reflected on the strengths and limitations of embedding landslide messaging within flood products.

- The Advisory Committee asked how landslide hazard data could inform future land use planning and risk reduction. Panelists described ongoing discussions with planners and local administrators on potential ordinance updates, setbacks from high-risk areas, and property acquisition for mitigation purposes.
- The Advisory Committee asked panelists to identify future actions, tools, or products that could reduce community risk. Panelists highlighted the need for landslide early warning tools, expanded monitoring networks (e.g., rainfall and soil moisture), improved integration of weather forecasts and landslide susceptibility information, and more effective public communication strategies.
- An Advisory Committee member asked about approaches to improving public education and awareness, including potential materials and campaigns. This prompted discussion of messaging strategies, incorporation of local history, and the concept of a statewide landslide awareness initiative.

11. Discussion: Recommendations Report Finalization

The ACL refined the consolidated recommendations identified on Day 1 of the meeting and provided input on the final content and format of the recommendations report. Each topical breakout group shared its revised, consolidated recommendations for discussion by the full Advisory Committee. Members then worked iteratively to incorporate feedback, merge overlapping concepts, and align recommendations with the National Strategy.

Assess

The “Assess” breakout group consolidated multiple subcommittee recommendations into a single recommendation focused on developing a national landslide inventory database, specifically, standardizing data collection methods and incorporating loss and impact data to enable consistent national-scale analysis. Draft recommendations related to monitoring, detection, and susceptibility were framed as dependent on inventory and foundational data development.

- The Advisory Committee flagged coordination as a cross-cutting theme across multiple draft recommendations.
- USGS staff reminded ACL members of the existing National Landslide Inventory, Susceptibility Model, and Damage and Loss Database. The Advisory Committee acknowledged the need to clarify how its proposed recommendation would build on existing products.
- Some Advisory Committee members noted that elements of the proposed recommendation were already statutorily mandated and requested the final recommendation clarify what is distinct from the NLPA and National Strategy.

Coordinate

The “Coordinate” breakout group consolidated multiple subcommittee recommendations under two themes: 1. Improving communication through standardized terminology and messaging,

and 2. Enhancing coordination through interagency collaboration, data standards, and data sharing. The group identified both near-term opportunities to support consistent messaging (e.g., landslide awareness initiatives) and the need for longer-term data coordination through existing federal frameworks.

- The Advisory Committee discussed overlap between coordination and planning-related recommendations, particularly regarding communication and public-facing materials.
- Advisory Committee members asked whether standardization should be framed as specific to communication efforts, or as a standalone concept.
- The Advisory Committee suggested removing qualifying terminology (e.g., “geospatial”) to avoid unnecessary constraints on the final recommendation.
- The Advisory Committee discussed the importance of articulating desired outcomes in its recommendations, rather than specific actions or mechanisms.
- The Advisory Committee noted that some proposed coordination-related recommendations provide useful specificity beyond the National Strategy.

Plan

The “Plan” breakout group consolidated multiple subcommittee recommendations under two themes: 1. Prioritizing public education, awareness, and standardized messaging related to landslide risk and protective actions, and 2. Improving data and research to inform mitigation best practices. They noted alignment with strategic actions in the National Strategy related to guidance tools, training, and hazard planning. They also suggested integrating mitigation-related data into national databases but acknowledged challenges of doing so comprehensively.

- The Advisory Committee suggested aligning components of draft Planning and Coordination recommendations related to the development of standardized language and communication tools. They discussed whether elements of the Planning recommendations should be merged with Coordination recommendations due to their interdependence.
- The Advisory Committee discussed the role of susceptibility and risk data within planning efforts and whether such language should be simplified or broadened.

Respond

The “Respond” breakout group consolidated multiple subcommittee recommendations under two themes. The first focused on advancing a national landslide early warning system, starting by defining its key components, such as triggering thresholds, monitoring systems, and evidence-based communication strategies. They emphasized the need to collaborate with the NWS to build on existing alerting frameworks. A second consolidated recommendation focused on standardizing post-event response protocols.

- The Advisory Committee discussed the feasibility of and timeline for developing a national landslide warning system and emphasized the need for realistic, phased implementation.

- The Advisory Committee discussed opportunities to leverage existing NWS frameworks and terminology for alerts and warnings.
- The Advisory Committee discussed agency roles and responsibilities, noting that some recommended actions may fall outside the primary authority of certain agencies and require interagency collaboration.
- The Advisory Committee discussed overlap between Respond recommendations and those in Assess, Plan, and Coordinate, and considered consolidation of related elements.

The Advisory Committee then discussed cross-cutting themes to further consolidate draft recommendations.

- The Advisory Committee agreed to merge draft recommendations relating to post-event response protocols with those under the Assess objective.
- The Advisory Committee agreed to incorporate elements of the recommendation related to landslide warning systems under the Plan and Coordinate objectives.
- The Advisory Committee agreed to merge recommendations under the Plan and Coordinate objectives related to communication, recognizing their interdependence.
- The Advisory Committee agreed that recommendations should align with existing coordination structures where possible, suggesting priority actions for established interagency groups.
- The Advisory Committee discussed the need to avoid overly prescriptive guidance.
- The Advisory Committee discussed the feasibility of collecting data on mitigation.

12. ACL Dialogue with the Interagency Coordinating Committee on Landslide Hazards

The Advisory Committee participated in a dialogue with representatives from the USGS-led Interagency Coordinating Committee on Landslide Hazards (ICCLH), which facilitates Federal coordination of NLHRP implementation. ICCLH representatives provided an overview of Federal operational and response capabilities related to landslide hazard and risk. The Advisory Committee heard contributions from five speakers:

- **Mary Mullusky**, Chief, Programs Coordination Unit, National Centers for Environmental Prediction Ocean and Tsunami Center, National Weather Service
- **Robert Emberson**, Associate Program Manager, Disasters Program, National Aeronautics and Space Administration
- **Jason Marineau**, Emergency Management Specialist, Office of Emergency Management, Department of the Interior

- **Vanessa Bateman**, Chief, Civil Works Engineering, Engineering and Construction Division, U.S. Army Corps of Engineers
- **April Fontaine**, National Geotechnics Policy Advisor, U.S. Army Corps of Engineers

Mary Mullusky provided an overview of the NWS, including its mission, organizational structure, and role in landslide hazards. She described the network of Weather Forecasting Offices (WFOs), River Forecast Centers (RFCs), and National Centers for Environmental Prediction (NCEPs) that support continuous, nationwide weather monitoring and forecasting. Within this framework, landslide hazards are addressed primarily through their relationship to rainfall and, in some cases, tsunami generation. She emphasized the importance of collaboration with the USGS to improve situational awareness and predictive capabilities, noting that advancements in landslide modeling are increasingly informing NWS operations. She also highlighted the role of longer-term forecasting products, such as seasonal outlooks and drought monitoring, in understanding antecedent conditions that contribute to landslide risk. She stressed the importance of effective hazard communication to science application, noting that the value of forecasts depends on whether users understand and act on information provided.

Robert Emberson described NASA capabilities and efforts related to landslide hazards within its Earth Sciences Division and Disasters Program. He outlined a multi-scale approach including exposure analysis, mapping, forecasting, and modeling. He highlighted emerging tools such as landslide proxy maps derived from synthetic aperture radar (SAR) data, as well as efforts to monitor slow-moving landslides using airborne and satellite capabilities. He also discussed advances in automated damage and debris mapping, including the use of machine learning and multi-modal datasets to accelerate post-event analysis. He emphasized NASA's strong collaboration with the USGS, particularly during recent hurricane events, and noted ongoing work to improve forecasting tools such as the Landslide Hazard Assessment for Situational Awareness (LHASA) model.

Jason Marineau described his role in the DOI Office of Emergency Management as a DOI liaison to FEMA, where he works to connect state, Tribal, and territorial partners with Federal resources during disaster response and recovery. He explained how Stafford Act authorities enable FEMA to deploy support from partner agencies through mission assignments funded by the Disaster Relief Fund. Marineau's role in landslide preparedness and response involves ensuring that partners are aware of available technical and operational resources, and helping to coordinate support for landslide hazards, particularly in the context of infrastructure impacts and long-term recovery needs.

Vanessa Bateman described the role of USACE in landslide hazard management with support from **April Fontaine**. Bateman explained that USACE operates both as an infrastructure owner and as a provider of technical expertise, managing assets such as dams, levees, and navigation systems that are often affected by landslides. The agency supports emergency response through FEMA mission assignments, contributing to debris removal, recovery operations, and technical assessments. She emphasized the importance of coordination across federal agencies, noting that USACE relies on data and science from partners such as NOAA, NASA, and the USGS. She highlighted the value of shared datasets and standardized data structures,

drawing parallels to existing national infrastructure databases. Bateman also emphasized the importance of preparedness, including clear communication pathways, defined roles, and practiced coordination, to ensure effective interagency response during disasters. She noted her role in leading landslide-related efforts within USACE, coordinating technical expertise across the agency to support these missions.

Discussion

- The Advisory Committee asked what types of recommendations or priorities would be most useful for the ICCLH. ICCLH representatives noted the importance of demonstrating return on Federal investment with metrics such as lives saved, property protected, or economic benefit. They also highlighted the need to shift from reactive response to proactive risk identification and mitigation, improve pre-event planning and exercises, and prioritize tools and systems that support infrastructure resilience and risk reduction.
- The Advisory Committee asked about the future of collaboration between the USGS and the NWS. Mullusky responded that the partnership is essential, with USGS providing foundational science and monitoring and NWS integrating that information into forecasts, warnings, and communications. She emphasized the importance of strengthening end-to-end integration across monitoring, operations, and dissemination.
- The Advisory Committee asked what additional data, tools, or capabilities are needed to support landslide risk reduction. ICCLH representatives noted gaps in social science research on how users receive and act on hazard information, as well as the need for improved predictive capabilities, impact-based forecasts, and planning tools such as emergency action plans. Panelists emphasized the importance of communicating both hazards and potential impacts to support decision-making.
- The Advisory Committee asked how to demonstrate the value of landslide risk reduction in the absence of comprehensive loss data. ICCLH representatives acknowledged this challenge and suggested local risk assessment and hazard mitigation planning could be effective at identifying and communicating landslide risk and losses. They suggested local assessments could be integrated into state and Federal systems provide a more comprehensive national understanding of landslide risk.
- USGS staff asked where gaps exist in accessing USGS data, tools, and information. ICCLH representatives emphasized the need for accessible, well-structured datasets, including landslide inventories, susceptibility maps, and recurrence information. They highlighted the importance of metadata, standardized data formats, and datasets that distinguish between different types of landslides. Additionally, they noted usability challenges with existing platforms and stressed the need for more user-friendly, decision-focused tools that clearly communicate impacts.
- The Advisory Committee asked about challenges related to scale, resolution, and standardization of landslide data. ICCLH representatives discussed difficulties integrating datasets across jurisdictions, ensuring consistency at different spatial scales, and developing products that can be used effectively at both national and local levels. They emphasized the importance of standardized data structures and scalable mapping approaches.

- The Advisory Committee raised the importance of rainfall thresholds and monitoring systems. ICCLH representatives emphasized the need for long-term, ground-based observations, expanded rain gauge networks, and rapid deployment of monitoring equipment in high-risk areas. They also noted limitations of satellite-derived precipitation data at fine spatial scales and the importance of clearly communicating monitoring data limitations.
- The Advisory Committee discussed gaps in landslide detection, particularly the need for improved methods to identify landslides at appropriate spatial and temporal resolution. ICCLH representatives suggested emerging technologies, including NISAR data and AI, may help address these gaps.
- The Advisory Committee asked about the potential for community-based landslide reporting. ICCLH representatives acknowledged the value of existing public reporting systems for earthquakes and wildfires, while noting that efforts to develop similar systems for landslides have faced challenges due to Paperwork Reduction Act constraints and low public participation, in part due to the nature of the hazard.
- The Advisory Committee asked about exercises and simulations to improve preparedness and coordination. ICCLH representatives said scenario-based exercises and after-action reviews can identify gaps and improve performance. However, translating lessons learned into action can be challenging, because national-scale coordination requires engagement across multiple agencies and jurisdictions.
- The Advisory Committee asked about opportunities to convene stakeholders for regional or national collaboration. ICCLH representatives noted challenges related to travel and funding and suggested leveraging existing meetings, interdisciplinary efforts, and academic partnerships as pathways for improved multi-level coordination.
- The Advisory Committee asked if there is a coordinated, interagency plan for landslide response and recovery. ICCLH representatives described existing mechanisms, including FEMA Emergency Support Functions and mission assignments, but noted limitations related to agency activation authorities and funding. They stressed the need for improved awareness by local and state entities to request and utilize available Federal resources.

13. <u>Discussion: Recommendations Report Finalization</u>

The ACL continued their section-by-section draft report review and worked as a group to reach consensus on final report recommendations, content, and format. The Committee broke into small groups to propose final language for each recommendation.

<u>Assess</u>

The “Assess” breakout group proposed revised language to emphasize integration and advancement of existing datasets and efforts, such as the national landslide inventory and national loss and damage database, over development of new systems.

- In deliberation, the Advisory Committee added language on data gaps in regions with poorer baseline landslide datasets and included sub-bullets on post-event data collection, including perishable data (e.g., rapid lidar acquisition) and sensor deployment.

Coordinate

The "Coordinate" breakout group proposed revised language on improving data discovery, accessibility, and standardization, particularly for remote sensing datasets. Members debated wording, ultimately emphasizing coordination with existing standard-setting bodies, such as the Federal Geographic Data Committee, rather than assigning new responsibilities beyond the IC-CLH's purview.

- In deliberation, the Advisory Committee agreed that challenges related to data governance, metadata standards, and long-term implementation extended beyond what would be actionable in the near-term. They chose to include language in the report noting the importance of data governance to broader NLHRP objectives but did not specify recommendations at this time.

Plan

The "Plan" breakout group proposed revised language supporting the development of nationally consistent landslide terminology and complementary educational materials and public awareness campaigns.

- In deliberation, the Advisory Committee accepted these revisions and emphasized the importance of incorporating social science and research-informed communication practices into public awareness campaigns.

Respond

The "Respond" breakout group outlined potential supporting actions, including integration of monitoring networks, development of precipitation thresholds, consistent alert language, and coordination with emergency management and social science communities.

- The Advisory Committee discussed the feasibility of tasking interagency efforts and the importance of actionable, implementable recommendations.

The Advisory Committee engaged in a broader discussion on the level of completeness needed to move forward with its recommendations. Members acknowledged ongoing challenges, particularly related to data standards and governance, but agreed their priority was to issue recommendations within the limited lifetime of the ACL rather than delay for full resolution of all topics.

The Advisory Committee reached consensus that the content and substance of recommendations was sufficient to proceed. Members agreed to allow the ACL chair and co-chair to finalize recommendation language to ensure clarity, consistent tone, and logical flow, provided they made no substantive changes to recommendation content. The Advisory Committee also agreed to include a statement noting that data standards and governance remain important topics for future consideration in lieu of a formal recommendation.

The Advisory Committee held a vote to approve the recommendations as discussed. All members voted in favor.

The Advisory Committee held a vote to authorize the ACL chair and co-chair, with support from a member with expertise in data governance, to make final revisions of the language on data governance considerations to be included in the report. All members voted in favor.

14. <u>Open ACL Discussion</u>

The Advisory Committee discussed report dissemination and a preferred tempo for future meetings. Members expressed a desire to meet quarterly to continually advance their work, alternating between in-person meetings in the spring and fall and shorter, virtual meetings in the summer and winter. Members discussed availability and agreed to plan towards the following dates, pending Department of the Interior approval:

- June 2nd, or alternatively June 30th, 1:00 p.m.—5:00 p.m. EST (virtual)
- November 17th—18th in Golden, Colorado (in person)

15. <u>Day 2 Adjournment</u>

The Chairs and DFO thanked the Advisory Committee for their work, and the meeting was adjourned at 5:00 p.m. EST.

We certify that to the best of our knowledge the foregoing minutes are accurate and complete:

- Jonathan Godt, Designated Federal Officer, 8/3/2026
- William Haneberg, Chair, 8/3/2026
- Nina Oakley, 8/3/2026

Appendix. Written Public Comments

Alexander Willis, EIT

Swannanoa, North Carolina

3/3/2026

USGS Advisory Committee on Landslides (ACL)

Public Comment for March 2026 ACL Meeting in Asheville, NC

Dear members of the ACL,

My name is Alexander Willis, and I am a geotechnical Engineer in Training (EIT). I have worked in the engineering consulting industry of Western North Carolina for about 6 years now, with a substantial portion of my work involving landslide hazard consulting for construction in mountainous terrain. I live in what is widely considered an epicenter of destruction from Hurricane Helene, Swannanoa, NC, where multiple landslides caused catastrophic damage, casualties, severe economic disruption, and ongoing trauma. During the hurricane I helped my community navigate landslide hazards, I worked with a search and rescue team to help interpret landslide hazard maps and identify areas of concern, and I provided reconnaissance support in the field with unmanned aerial vehicles. Since the hurricane I have worked on recovery projects on both a volunteer and professional level. I would like to share a brief anecdotal account of how landslide hazard maps have impacted my residential clients and my community before, during and after Hurricane Helene.

As discussed in the MSN news article, Lost ground: Politics stalled North Carolina landslide mapping years before Helene slides killed 31 (Morabito, 2026), the history of landslide hazard mapping in Western North Carolina is bumpy and nuanced. Mapping initiatives have historically been met with resistance, often from those who are under the impression that newly documented hazards may conflict with preconceived property values, make construction more difficult, or even just cause unnecessary worry in the public. However, from working with dozens of residential clients over the years, I find those concerns to be based mostly on misunderstandings, and they fall short compared to the benefits that landslide hazard maps provide.

When comprehensive landslide hazard maps are available, they help builders, owners, sellers, and buyers secure their investments by avoiding unexpected, catastrophic loss to a material hazard. In my experience, the cost of a proper geotechnical engineering assessment for landslide hazard consulting in mountainous terrain is often just a few percent of a home's cost, including the cost for subsurface explorations, laboratory soil testing, and engineering reporting. Landslide hazard maps often contain valuable information that helps geotechnical engineers plan for site investigations, design proper foundations and retaining systems, as well as to provide recommendations for homesite locations.

Often, landslide hazards can be avoided or mitigated with slight adjustments to site plans. In the worst case, a project may not get far after a landslide hazard assessment, but that may be what saves the occupants' lives, or in the very least, their finances. It is important to recognize that North Carolina is a buyer-beware-state, and there is also no available insurance coverage for landslides, so these maps are crucial for people to inform themselves and make good decisions about their homesites. Lastly, landslide hazard maps help support the local geotechnical engineering community so that we can provide consulting services tailored to our region and clients in a variety of contexts. While I have focused on residential examples in this comment, the same considerations are true for critical infrastructure projects. I urge that the USGS fund and support hazard mapping initiatives in Western North Carolina. However, this mapping alone is not enough.

During Hurricane Helene, a debris flow landslide occurred in my neighborhood, Grovemont, Swannanoa, NC, which destroyed multiple residences, injured multiple people, and killed two. The current mapped extent of this debris flow, as documented by the NCGS Post Helene Landslide Inventory, is shown in Figure 3. These numbers and maps do not capture the horror of that event. By the numbers, you cannot hear the debris flow, which reportedly sounded like a high-speed train coming down the mountain as it blended tree trunks, massive boulders, soil, water, and homes into a high-energy, momentous slurry. By the numbers, one cannot feel the ensuing panic as neighbors dug each other out of the sludge and called out for their missing loved ones. Metrics also poorly capture the echoes of trauma. Where one home was situated, 231 Westwood Ave, there is now only a building pad (Figures 1 and 2). The entire home was swept away by the debris flow with the occupants still inside. Concrete steps now lead up from the street to an empty space that people used to fill. Standing at the top of the steps, one sees only a scar on the mountain, where the forest was cleaved and the bedrock scrubbed clean. This scar trails out of sight as it steepens. It is there that, months after the event, I found a small children's toy, a letter block, still sitting in the mud. In that landslide, our community lost neighbors and peace of mind. The trauma lingers, and other homes are at risk. All of this happened in an area that has been previously mapped.

While working with search and rescue (SAR) after Helene, I reviewed the landslide hazard maps for our neighborhood and valley, which were invaluable for helping target areas where residential structures might be impacted by debris flows. After my involvement with SAR activities concluded, I then separately performed a lidar scan of the debris flow at 231 Westwood Ave, and I performed an informal field reconnaissance up to the initiation zone and along the adjacent mountainside. While I have not completed a full geotechnical study - here is some information to consider.

1) The debris flow appears to have initiated at the location of steep cuts and fills associated with a road on the upper side of the mountain, which I identified in person and is also visible on the hillshade rendering and debris flow outline shown in Figure 3.

2) The road and initiation zone are in a defined Buncombe County Slope/High zoning overlay (Figure 4), which refers to the most thorough building ordinance in our state to protect the public from increased landslide hazards resulting from new development in steep terrain.

3) High-quality landslide hazard maps for the area (Buncombe County) predate Helene.

4) The actual debris flow closely followed the potential debris flow pathway shown on the hazard maps incorporated in the Buncombe County GIS website, as seen in Figures 5 and 6.

5) The maps show several residences within and near the potential debris flow pathway, and some of those residences are located below the Slope/High zoning overlay, as seen in Figures 4 and 5.

6) Discussion with one of the landslide survivors occupying 231 Westwood Ave during the landslide event indicated that prior to Helene they were unaware of the potential debris flow pathway traversing their property.

This event illustrates that even when landslide hazard maps are available for an area, and building ordinances are in place to partially address those hazards for new development, information gaps exist which can have a significant impact on public safety. Many existing residential developments predate hazard maps, with a large population of Western North Carolina residents unaware that they live in hazardous areas.

In our neighborhood, an effective preventative solution to reduce landslide casualties during Helene would have been closing the gap between available maps and public awareness. One way the committee could potentially help close this gap is by recommending the creation of a database of residences that currently exist in mapped hazard areas. For example, for lower valley areas, this database could be created by matching property lines and building polygons available in public GIS databases with points of intersection at potential debris flow pathway outlines provided in the current iterations of landslide hazard maps. An offset buffer from the potential debris flow pathway outlines can account for modeling and mapping uncertainty. This database can then be used to contact property owners with mailings to their physical address to connect them with landslide hazard resources so that they can understand their risk, including information for what kind of storm event they should consider evacuating for. Their risk can potentially be quantified on a relative scale by a factor of the surface area and stability ranking of the unstable terrain contributing to the potential debris flow pathway connecting to their property. The number of contributing potential debris flow pathways that coalesce with the primary one(s) impacting their property could indicate whether the property occupants are at a higher risk of experiencing multiple debris flow pulses at their location during a storm event. While this methodology is unrefined and conceptual, closing the information gap between existing hazard maps and residences currently at risk and then directly

notifying the occupants of their risk could be a fast-acting, cost-effective solution to help improve public safety, and a solution that is scalable across the region in area with existing landslide hazard maps. This database would also be valuable for disaster response as it would provide search and rescue teams with a list of vulnerable properties and potentially a hazard ranking for each property, which could reduce response time and responder risk.

I hope that this anecdotal account, the information I have provided, and my humble suggestions are helpful for the committee. Thank you all for the excellent work you have done to increase public safety and economic resilience regarding landslide hazards in our region.

Thank you again for the opportunity to make a public comment.

Best regards,

Alexander Willis, EIT

Figures

Figure 1

231 Westwood Ave, Pre-Helene, Buncombe County GIS Property Records.



Figure 2

231 Westwood Ave, Post Helene, photo taken October 3, 2024, by Alex Willis, EIT.



Figure 3

Debris Flow Outline at 231 Westwood Ave.

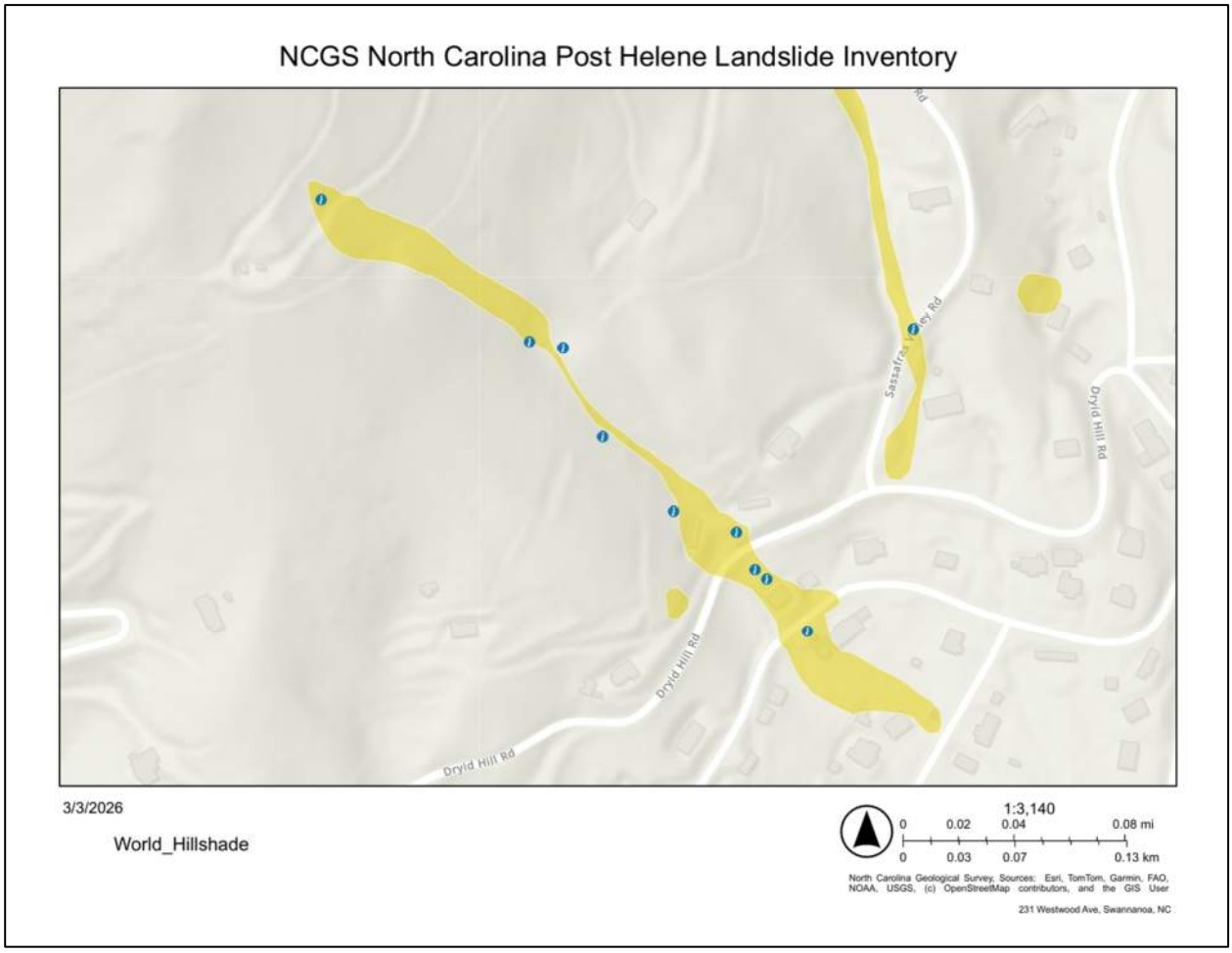


Figure 4

231 Westwood Ave (outlined in light blue) as shown on Buncombe County GIS (Slope/High Zoning Overlay).

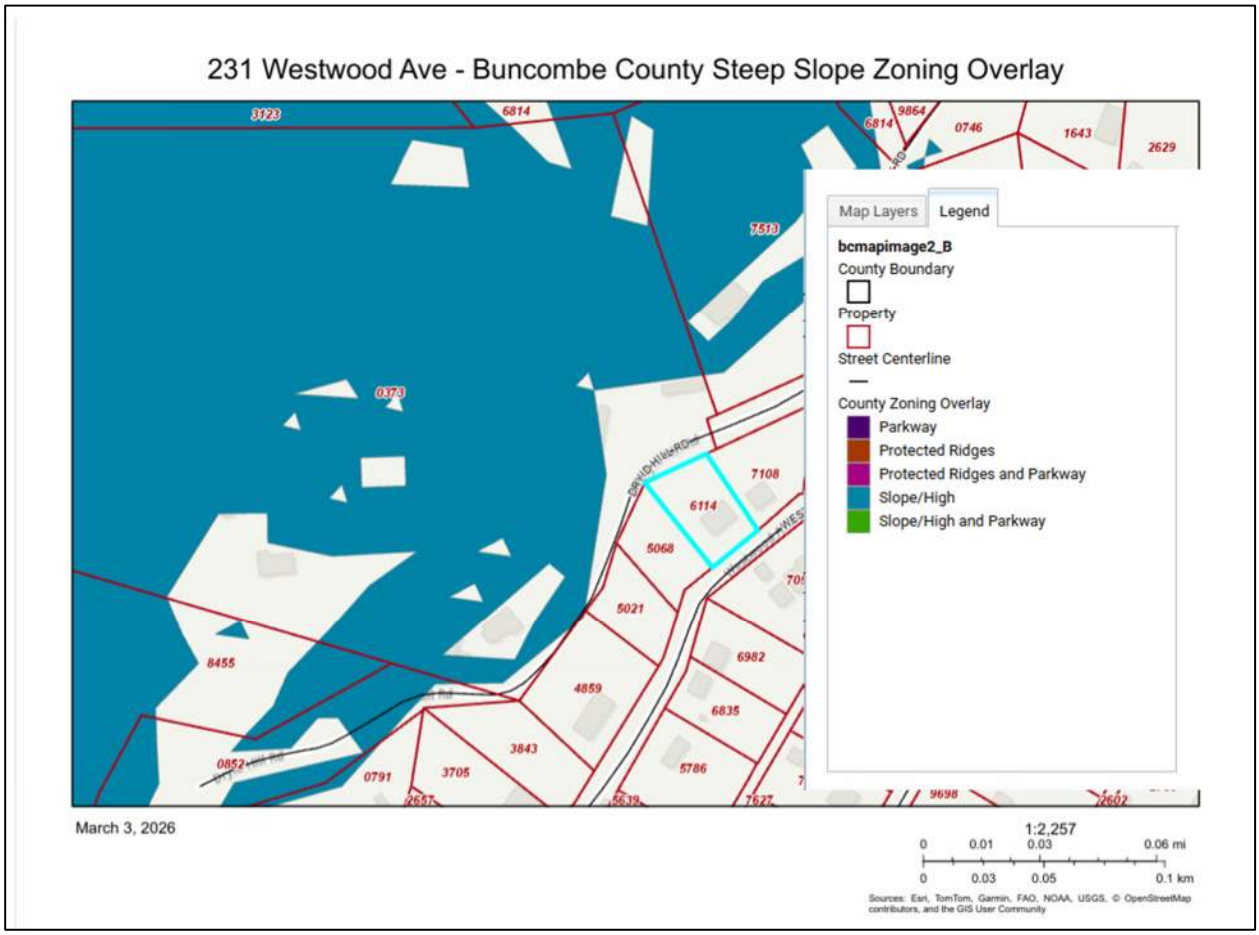


Figure 5

231 Westwood Ave (parcel outlined in light blue) as shown on Buncombe County GIS with potential debris flow pathways layer from hazard mapping data that predates Helene.

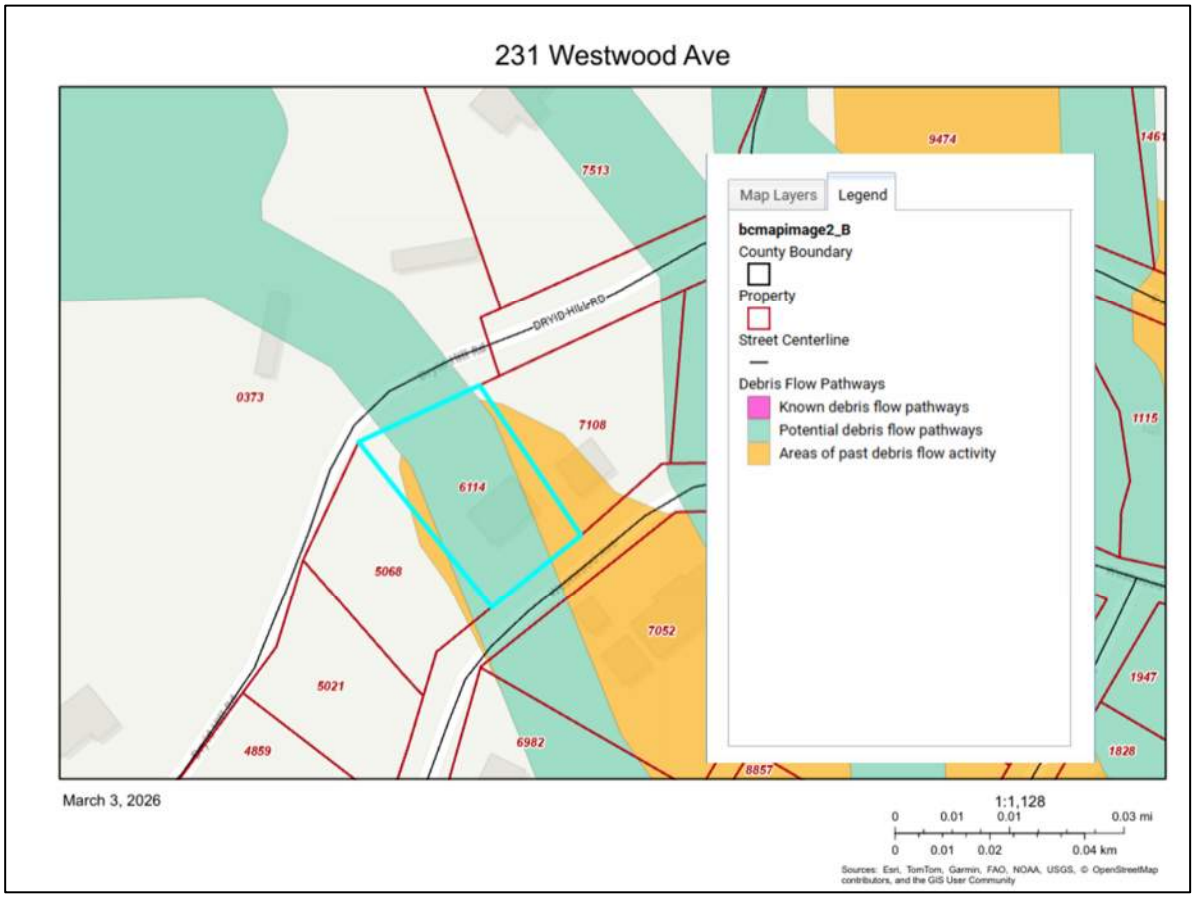
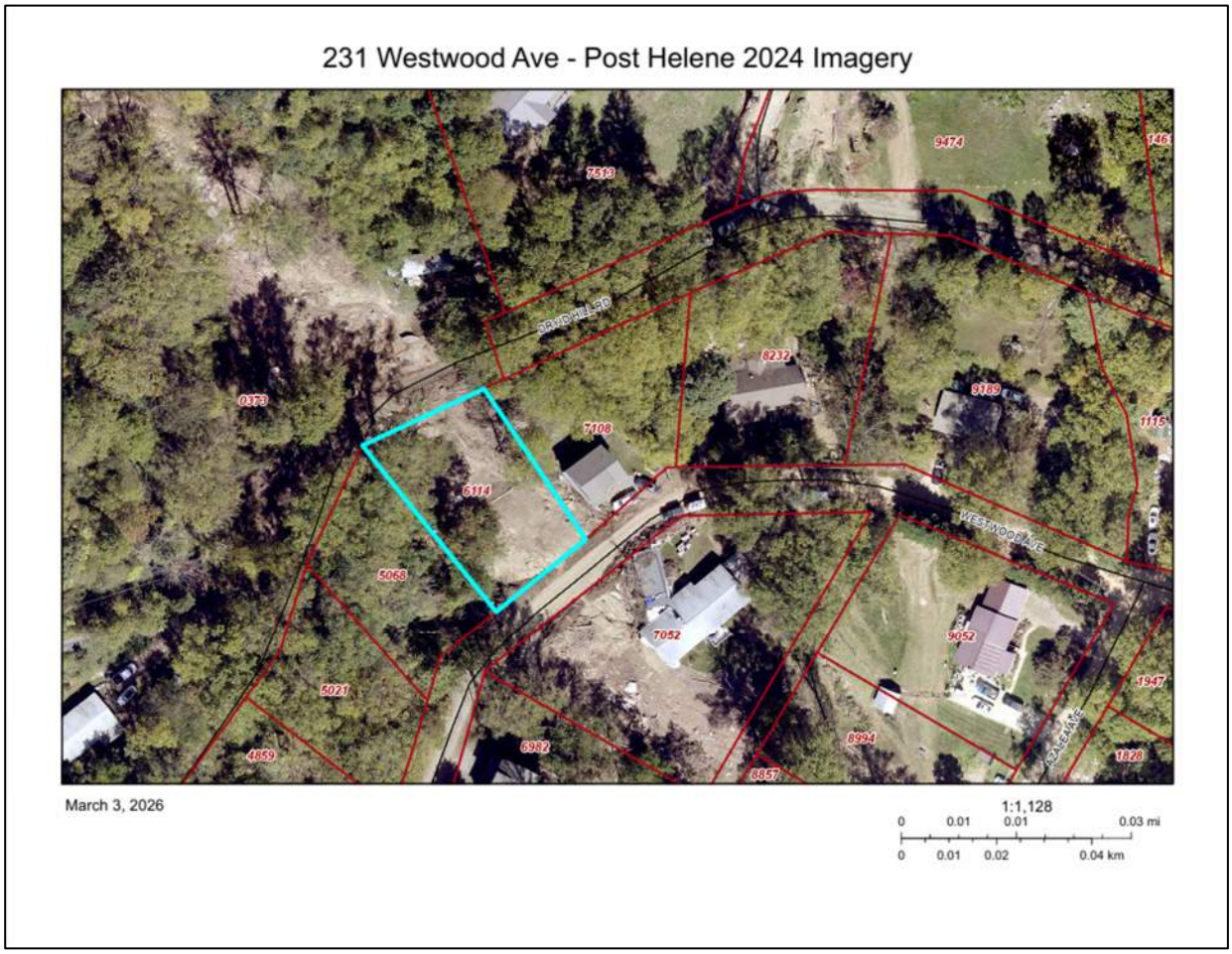


Figure 6

231 Westwood Ave (parcel outlined in light blue) as shown on Buncombe County GIS with Post-Helene 2024 Imagery basemap.



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Includes data from: Esri Community Maps Contributors | Buncombe County, NC | State of North Carolina DOT | © OpenStreetMap, Microsoft | Esri | TomTom | Garmin | SafeGraph | GeoTechnologies, Inc | NASA | NGA | USGS | METI/NASA | FEMA | EPA | NPS | US Census Bureau | USDA | USFWS | North Carolina Geological Survey