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By Electronic Mail

Representative Susan Fisher  
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Thank you for this opportunity to comment on the draft Mountain Slope Construction Act. These comments are submitted on behalf of the Southern Environmental Law Center.

At the outset, we want to express our gratitude to each of you for your leadership on this issue which, as you know, is tremendously important for the people and environment of Western North Carolina.

We have specific suggestions for elements of the draft bill as currently written as well as proposals for additions to the bill, including provisions addressing density on steep slopes, buffers for streams and hazard areas, revegetation of steep slopes, and protection for new homes from landslide hazard areas upslope from their property. SELC also has analyzed land use and topographical data for several counties in Western North Carolina to provide you with information that may be useful as you craft this bill. I hope these comments are useful to you and I encourage you to contact me if I can answer any questions about the following.

**The Scope of the Problem**

Each of you has demonstrated your understanding of the risk that slope failure poses to the people and homes of western North Carolina, as well your commitment to find a solution. Nonetheless, some examination of the scope of the problem is useful as we seek to define an effective solution.

Of course, the main objective of this bill is to protect the lives of mountain residents, which is a value beyond measure. Nonetheless, there are consequences of slope failure that can be quantified and which put into perspective the costs associated with programs to prevent slope failures. According to USGS estimates, landslides cause damages between \$1.6 billion and \$3.2 billion annually in the United States.<sup>1</sup> FEMA has estimated that between 1973 and 1983, North Carolina suffered an average loss of \$7.2 million/year (adjusted to 2006 dollars from \$4.5 million in 1989 dollars) to roads and

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<sup>1</sup> <http://landslides.usgs.gov/learning/faq/#q03>.

private property because of landslides.<sup>2</sup> Within Western North Carolina, the cost to stabilize the Hunters Crossing slope failure alone has been estimated at approximately one million dollars. The clean-up efforts after the Peaks Creek landslide cost approximately \$1.3 million, not including the value of the lost homes. As you know, home insurance policies in North Carolina exclude losses attributable to earth movement from their coverage, meaning that these losses are borne by homeowners, communities, and lending institutions.

These are not isolated events. The U.S. Geological Survey (USGS) has determined that much of North Carolina has a high susceptibility and incidence of landslides.<sup>3</sup> On average, a major, catastrophic debris flow-producing storm event occurs somewhere in the southern Appalachian region every three years.<sup>4</sup> The database of historical slides identified by the North Carolina Geological Survey (NCGS) indicates that 28 homes or other structures were severely damaged or destroyed between 1990 and 2005 by landslides where slope modifications were contributing factors. This number does not include damage to structures caused by landslides initiated on undisturbed slopes, like the Peaks Creek debris slide, which damaged or destroyed 15 homes but which initiated on an undisturbed slope above the development.

Across Western North Carolina, the rate of steep slope development is increasing. In the 2002 and in 2003, on average, 60 new homes constructed in Macon County each year were on slopes greater than 25%. In 2004 and 2005, that rate jumped to 90 homes per year (27.5% of all new residential structures over those two years). In Watauga County, 10% of new residential structures were built on slopes steeper than 25% in the 1970s. Since the 1990s, 50-55% of new residential structures have been built on slopes steeper than 25%. Similarly, in Haywood County, the rate of construction of new residential structures on the steepest slopes has increased nine-fold since the 1950s and has more than doubled since the early 1990s.

This boom in steep slope development means that an increasing number of homes are exposed to landslide hazards. The North Carolina Geological Survey has completed landslide hazard mapping for only one county to date, Macon County. Between 2001 and 2005, 27 new homes were constructed per year in areas mapped as landslide hazard areas in Macon County. It is important to acknowledge that this statistic does not capture the full scope of the risks from slope failures. The data collected by NCGS indicate that human activities on steep slopes can render them susceptible to slope failures even in areas that are not mapped as naturally prone to slope failure.

In addition, the NCGS predictive hazard mapping does not fully capture the risk of property loss attributable to slow-moving slope failures. The hazard mapping project is currently focused on areas at risk for relatively fast-moving, catastrophic landslides and areas in the downslope path of those landslides. The NCGS hazard mapping does not

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<sup>2</sup> Federal Emergency Management Agency, *Landslide Loss Reduction: A Guide for State and Local Government Planning*, FEMA 182/August 1989.

<sup>3</sup> <http://landslides.usgs.gov/learning/nationalmap/index.php>.

<sup>4</sup> *Environmental and Engineering Geoscience*, Vol. VI, February 2000 (winter) pp. 3-23, at 4.

currently predict areas of relatively slow-moving (e.g., inches per year) earth movements (or “big slow movers”) which can push homes off their foundation and render them uninhabitable, as recently happened in the Hunters Crossing subdivision in Haywood County. NCGS identifies and maps areas of slow-moving slope failure that are currently known and the NCGS team is working to develop methods to predict areas that may be prone to this type of slope failure in the future. A predictive model, even when one is available, however, will not take the place of an on-the-ground site specific assessment. Although there may be significant overlap between areas at risk for fast-moving landslides and slow-moving slope failure, we must be aware that the hazard mapping currently available for Macon County and expected for other counties is not yet a comprehensive picture of slope hazards. To protect the homes of Western North Carolina from slow-moving slope failures, site-specific evaluations by qualified professionals are needed before steep slope areas are developed.

### **The Scope of the Act**

*Applying a Threshold Based on Slope:* One of our primary concerns is the geographical reach of the measures implemented by the Act. At a minimum, the Act must apply to areas at risk for slope failure to be effective.

As currently drafted, the Act applies to areas on “affected mountains” with elevation greater than 1000 feet above the adjacent valley floor. Elevation in relation to the valley floor is not a reliable indicator of slope hazard areas. In the rugged terrain of Western North Carolina, steep slopes can occur at relatively low elevations. For this reason, most laws addressing hazards from slope failure are triggered by slope gradient, rather than elevation.

Most regulatory programs to address the hazards of steep slope development begin regulating development on slopes greater than 15%, while some jurisdictions begin regulating development on slopes greater than 25%. In a national survey, the American Planning Association found that 60% of local hillside ordinances regulate development on slopes greater than 15%.<sup>5</sup> In our region, Waynesville, Buncombe County, and the proposed Asheville ordinance all regulate activities on slopes 15% or greater. Knoxville, TN, White County, GA, and Boone, NC (30%) have all chosen to begin regulating development at slopes of approximately 25%. The ordinance recently adopted by the Haywood County commissioners is primarily focused on the creation of cut and fill slopes and is triggered by the steepness of those artificial slopes rather than by the natural slope of the site.

Data collected by NCGS in the preparation of its landslide hazard mapping provides some insight into the minimum slopes that must be included in the Act. NCGS maintains a database of historical landslides they have identified pursuant to their work. For some of those landslides records, NCGS has identified the point at which the slide initiated and has taken accurate measurements of slope at that point with a device known

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<sup>5</sup> Robert B. Olshansky, Planning for Hillside Development, Planning Advisory Service Report Number 466 (1996).

as an inclinometer. Other landslide records in the database include slope statistics for initiation points that are based on other less-accurate and less-reliable measurements of slope. Based on this data, a statutory threshold of 35% (approximately 20°) slope would be needed to include the initiation points of nearly all of those historic landslides for which very accurate (inclinometer) slope measurements are available. Thus, at a minimum, the Act must apply to artificial slope construction on natural slopes in excess of 35%.

To be truly effective at addressing the landslide hazards associated with steep slope development, however, a statutory threshold of 25% (approximately 15°) is required.

First, when the full database of NCGS landslide records is considered, which includes records where slope is measured by less-accurate computerized mapping techniques, a threshold of 25% is needed to ensure that all or nearly all initiation points for historic landslides would be included in the scope of the Act. Because similar computerized mapping techniques may play a role in identifying property subject to the provisions of the act, a 25% threshold is advisable to ensure that at-risk slopes are captured.

Second, the 25% threshold represents the more modest of the two regulatory approaches (15% and 25%) currently employed by jurisdictions in our region, consistent with the stated objective for this Act of establishing a reasonable minimum standard across western North Carolina.

Third, slope failures, and especially catastrophic landslides, are hazardous not only at their initiation point, but also in areas downslope from the point of initiation. In the disastrous Peeks Creek landslide, for example, the slide initiated upslope of the subdivision on undisturbed ground but destroyed homes downslope of the initiation point. In the sections that follow, I have proposed a number of new provisions to minimize the threat to homes downslope of hazardous areas. One such proposal would require that a slope construction plan required by this Act assess landslide hazard areas upslope of the development site. That requirement would enable designers to locate residences on lots so as to minimize their exposure to landslides that might originate on steeper ground. The threshold for slope construction plans under this statute must be set so that homes constructed on steep slopes beneath potential initiation points for landslides are afforded the protections of this bill. A threshold of 25% slope would include steep slope development in closest proximity to high-risk landslide initiation zones.

Fourth, human activities on steep slopes can render them susceptible to slope failures even in areas that are not naturally prone to slope failure. The increasing intensity of steep slope development in our region means that steep slope areas are being exposed to greater destabilizing forces and loading than ever before. A threshold of 25% is needed to minimize the risk of slope failure attributable to an unprecedented intensity of development on steep slopes.

It is possible to analyze the approximate impact of a 25% threshold on property in western North Carolina. Across the 22 counties of Western North Carolina, 70% of private land is on a slope less than 25%. It is also property to estimate the number of individual lots that will be affected by the Act. Each county maintains a database of subdivided parcels and SELC has mapped those parcels against maps that identify the slope of the site. Unfortunately, currently available maps do not show the location of a building footprint on each parcel, so the following analysis is based on the slope at the center point of each subdivided parcel. For large parcels this approach may not accurately represent the slope on the building site, but when aggregated across large numbers of lots, this approach provides a reasonable basis for estimating development levels at various inclinations of slope. We have analyzed data for Macon, Haywood, Watauga and Madison counties as reflected in the following table.

	Percent of existing structures on slopes > 25%	Approximate number of new structures per year built on slopes > 25%
Macon	12%	90
Haywood	24%	60
Watauga	48%	120
Madison	48%	Unknown

Thus, if this bill were enacted last year, a combined total of approximately 270 new homes would have been required to comply with the provisions of the Act in Macon, Haywood and Watauga counties. This is a modest impact for the security provided by this bill against the significant threat to human safety and to homes attributable to landslides.

Proposal: Amend § 262(1) to delete the definition for “affected mountains” and insert the following new definition for “steep slope areas.”

“Steep slope area means any area with slope in excess of 25% in the counties of Ashe, Avery, Buncombe, Burke, Caldwell, Cherokee, Clay, Cleveland, Graham, Haywood, Henderson, Jackson, Macon, Madison, McDowell, Mitchell, Polk, Rutherford, Swain, Transylvania, Watauga, Wilkes, or Yancey.”

*Addressing land-disturbing activity on steep slopes:* The definition of “artificial slope construction” provided in the draft bill is well crafted to capture the full range of slope construction activities that contribute to slope instability. The definition articulated in the draft bill should be carried over to the final version. In particular, the bill must not exclude logging roads from the scope of the statute. The landslide records collected by NCGS provide sufficient reason to preserve the current definition. The Lands Creek Debris Flow in Swain County initiated where a private logging road crossed a hillside hollow. The resulting debris flow destroyed a mobile home and the chlorinator for the Swain county water supply. Similarly, the Starnes Cove debris flow originated along a logging road and flowed down hill, destroying a home. As with roads built for development, logging roads involve grading that disrupts natural slopes, alter the natural hydrology of a site, and contribute to slope instability. Downslope property owners will

not be safe from landslide hazards if logging roads are excluded from the planning and geotechnical review requirements of the Act.

### **Mitigating Landslide Hazards**

Nationwide, state and local laws designed to mitigate landslide hazards employ some combination of three principal strategies: (1) limit causes of slope failure by regulating development and ground disturbance in steep slope areas, (2) limit exposure to slope failure by restricting density of development and infrastructure investment in steep slope areas, and (3) provide special protections to areas known to be naturally prone to slope failure. An effective legislative solution to landslide hazards in Western North Carolina must incorporate each of these strategies.

#### **(1) Limiting Activities that Increase Slope Hazards**

Both within known hazard areas and on steep slopes generally, development activities can increase the risk of slope failure or create a risk where little risk existed before. NCGS has found that the majority of historic landslide events they have documented in Macon County occurred on slopes that had been disturbed by human activities. Grading and the creation of artificial cut and fill slopes in particular are significant risk factors for triggering slope failure events. Excavations that are too high or steep in thick unconsolidated deposits or deeply weathered bedrock are common contributing factors to slope failures.

A variety of human activities in addition to grading can contribute to slope failure including removing slope support (by excavating cuts or undercutting the slope), increasing the load on the slope (by building new structures), and increasing underground water pressure (by concentrating stormwater runoff or building septic systems). Human activities can also decrease stabilizing forces by removing vegetation (root systems stabilize slopes and remove excess water) and regrading slopes with poorly consolidated and compacted fill material.

As currently drafted, the Mountain Slope Construction Act addresses many of these slope destabilizing activities. By requiring submission of plans and geotechnical review on steep slope areas, the draft bill takes important steps to protect homeowners from the hazards of building on steep slopes. Some risk factors, however, are not addressed by the draft legislation. Other elements of the draft bill should be strengthened to ensure that the legislation effectively addresses steep slope hazards.

*Requirements for Plans and Geotechnical Analysis:* Because each construction site is unique and because slope stability is affected by a wide range of factors, the most responsible approach to landslide hazards is to require geotechnical analysis for development on steep slopes, in the form of a geologic survey of the existing conditions followed by an engineering survey of the completed design. We are grateful that the draft bill takes this important step by requiring plans by qualified professionals for land-

disturbing activity on steep slopes and by requiring engineering review for steep cut and fill slopes.

Plans must be prepared by professionals with adequate training and experience to ensure safe construction. Many professions involved with development on steep mountain slopes lack the necessary geological and engineering expertise to assess slope stability and geological hazards.

Proposal. Amend the list of approved professions in § 266(d) to delete land surveyor, landscape architect, and architect from the list of professionals that may prepare a plan as required by the Act.

Even a qualified professional with geotechnical training may not have experience with assessing risk factors for landslides in Western North Carolina. Local ordinances should set standards for key factors that contribute to slope instability. The Act contemplates that local ordinances will set such standards for some causes of slope instability, but under its current structure, nowhere states explicitly that local governments should do so. For example, the Act refers to compaction standards set by the “agency with jurisdiction,” but does not identify the agency with jurisdiction or require that local ordinances set compaction standards. The Act should be amended to require local ordinances to set standards for factors that we know contribute to slope instability.

Proposal. Amend § 265 to set required elements for local ordinances to address, which should include:

- Content and composition of embankment fills including concentration of woody debris, concentration of sulfite-rich rock and compaction standards;
- Setbacks from known hazard areas and from surface waters;
- Prohibitions on removal of vegetation from steep slopes generally and hazardous slopes specifically;
- Standards for drainage of stormwater away from artificial slopes or vulnerable natural slopes;
- Limits on septic fields in hazard areas;
- Limits on density of residential construction, impervious surface, and site grading on steep slopes; and
- Limits on height and construction of retaining walls.

The great benefit of requiring a plan from a qualified professional for land-disturbing activity in steep slope areas is to ensure that the site plan is developed in a manner that does not contribute to landslide hazards. That result will depend on choices made about the design and location of lots, building footprints and roads among other factors. To achieve that result, plans submitted pursuant to this Act must be prepared early in the development process and must be submitted early in the local government permitting process for a given land-disturbing activity. As currently drafted, a plan must be submitted 30 days before land disturbing activity begins.

Proposal: Amend section § 266(a) to require submission of a Plan pursuant to this act *at the earlier of* (1) submission of a subdivision plat, (2) request for a building permit, or (3) 30 days in advance of land-disturbing activity. Plans submitted pursuant to subdivision plat approval must encompass the entire subdivision tract.

*Composition of fills:* The composition and compaction of fill slopes is an important factor in slope stability. Slope stability increases with the level of compaction. NCGS found in its survey of historic landslide hazards in WNC that the composition of fills can also contribute to slope instability. When large woody debris is incorporated into fills, it degrades over time leaving voids that decrease the stability of slopes and allow water to infiltrate and destabilize slopes. Inadequate clearing of areas before building fill embankments, which can leave stumps and other woody debris behind, can undermine stability for the same reasons. Similarly, incorporation of untreated sulfide-rich rock, which is common in some areas of WNC, into fill embankments can contribute to slope instability because those rock types degrade over time with exposure to water, undermining slope stability.

As drafted, the Mountain Slope Construction Act mentions methods of compaction for “subdivision roads and shoulders” (§ 268(2)) and for “all fill slopes” (§ 268(5)) approved by the “agency having jurisdiction.” The draft bill does not describe standards for compaction, identify the “agency having jurisdiction,” or explicitly require local ordinances to set compaction standards. Because compaction and composition of fill slopes are important elements of slope stability, the final bill must set standards for composition and compaction of fill slopes or require local ordinances to do so.

Proposal: Amend § 265 to set required elements for local ordinances to address, which should include “standards for the composition and compaction of fill slopes including standards for clearing sites for fill slopes, restrictions on the placement of large woody debris or untreated sulfide rich rock in fill materials.”

*Critical Slopes:* The draft bill defines “critical slope” in § 262 as slopes upon which failure would be a hazard to “human safety, property, surface waters, or use of a public road.” The draft bill does not, however, treat critical slopes differently from other artificial slopes governed by the bill. Even with the best of engineering design, mistakes will be made, and the consequences of error are higher on steep slopes. For this reason the Haywood county steep slope ordinance provides additional protections for artificial slopes that are deemed “critical” because of the consequences that would result upon their failure. The Mountain Slope Construction Act must do the same.

Proposal: Amend § 266(c)(3)(b) to require plans submitted pursuant to the statute to identify critical slopes – “. . . delineation of all cut and fill slopes, identification of critical slopes . . . ;” and provide higher stability standards for critical slopes in the final table entitled “Minimum Factors of Safety Against Mass Instability.” The long-term factor of safety for critical slopes should be no less than 1.7.

*Vegetation removal on steep slopes:* Removal of vegetation significantly increases the risk of slope failures. Trees stabilize the soil with their root systems and remove moisture that would otherwise reduce the resistance of a slope to failure. The root system of existing vegetation adds structural strength to the soil. The NCGS includes the structural support provided by root systems in their calculation of soil resistance to slope movement. Without the additional support provided by root systems, more areas would be categorized by NCGS as having a higher probability for slope failure. Revegetation with grass and shrubs does not restore the same structural strength to the soil.

For these reasons, any effort to address slope hazards must address the hazards associated with removing vegetation from steep slopes. Other jurisdictions have taken this approach. Georgia passed a law in 1981 limiting development on “affected mountains” which are defined as areas greater than 2,200 feet in elevation that maintains a 25% or greater slope for at least 500 vertical feet. Within those affected mountain areas, the Georgia state legislature has prohibited the removal of more than 50% of existing trees with a diameter 8” or greater from a site, unless they first submit a plan of reforestation developed by a registered forester. OCGA § 12-2-8(10). Similar requirements are found locally and throughout the country, from White County, GA to Bainbridge Island, WA. Western North Carolina needs similar requirements to minimize threats to homes and families from landslides and other slope failures on cleared land.

Proposal: Create new subsection for § 266(c).

“The plan shall include a plan to replant trees and other vegetation when more than 50% of the existing trees which exceed 8 inches in diameter, as measured at a point on such a tree four and one-half feet above the surface of the ground, are removed from any parcel in steep slope area. This plan must be prepared by a registered forester, landscape architect, or arborist and will specify the species, types, quantities, and method of re-establishing trees and/or other vegetation.”

*Buffers for Streams:* Because of the significant role of water in landslide events and because stream channels follow the lowest point in the terrain, landslide events often follow stream channels, as occurred in the Peeks Creek landslide. In addition, the diversion of streams alters the hydrology of a site, increasing the risk of a landslide caused by saturated soil. Boone, NC addressed this risk by prohibiting the diversion or channelization of perennial streams on slopes greater than 30% unless the property is unusable without such channelization or diversion. Boone also prohibits construction or disturbance of soil within a 35 foot vegetated buffer around streams. Similar restrictions are needed region wide to minimize the risk of repeating the kind of loss suffered at the Peeks Creek landslide.

Site-specific requirements will vary, and some areas will require larger buffers than others. Nonetheless, the bill should establish minimum standards for buffers from perennial streams to minimize the risks to homes from landslide hazards.

Proposal: Amend § 268(8) to add the following language: “The agency having jurisdiction shall require vegetated setbacks from surface waters and public rights of way. Such setbacks shall include a vegetated setback of not less than 50 feet from perennial streams on steep slopes. Plans submitted to this Act shall identify buffer areas and identify buffers which, in the professional opinion of the qualified professional who prepared the plan, buffers in excess of the minimum standards of this Act are necessary to ensure the stability of the site. Slope construction shall not be allowed within required setbacks.”

## **(2) Reducing Exposure to Steep Slope Hazards**

Even with the best exploration and geotechnical analysis of a site, mistakes happen. The earth is naturally heterogeneous and design and construction errors inevitably occur despite the best engineering intentions. Steep slopes are less forgiving of error than are level sites. Furthermore, when steep slope areas fail they generally cause more significant problems. For these reasons, many jurisdictions restrict the intensity of development in steep slope areas and reduce the extent of public investment in such areas through infrastructure including roads and water and sewer lines.

*Reducing Density on Steep Slope Areas:* The most basic approach to minimizing landslide hazard risk is to reduce construction on steep slopes. This approach minimizes human disturbances which can trigger landslides and also minimizes the exposure of homeowners to slope failures. The Georgia legislature placed a maximum density on protected mountain slopes of 1 unit per acre. White County, Georgia has expanded that prohibition to require minimum lot size of 1.5 acres on any property with average slope in excess of 25%. Buncombe County allows a maximum of 1.6 units per acre on lots with septic and slope of 25% or greater and 9 units per acre on lots with sewer service and slope greater than 25% (Buncombe adjusts allowable density depending on slope). Waynesville, North Carolina takes a similar approach.

Many jurisdictions also place limits on the amount of grading allowed in steep slope areas. Because of the inherent uncertainty involved with engineering stability on disturbed slopes, limits on grading restrict the possibility for error in steep slope areas. White County, Georgia sets a maximum of 30% disturbance for lots on 25% or greater slopes, reduced on a graduated scale to a maximum of 17% of area graded on a lot of 40% slope or higher. Similarly, Pittsburgh, PA provides that no more than 30% of total area may be graded in slope of greater than 15%, and no more than 15% of the area may be graded in areas of slope greater than 25%. Asheville’s proposed ordinance provides that no more than 45% grading shall be allowed on sites with historic grade of 15% or greater, reduced on a graduated scale to no more than 35% of a site may be graded in areas with a historic grade of greater than 25%. Waynesville follows the same structure.

Restrictions on the amount of impervious surface allowed in steep slope areas are also common. Impervious surface channels stormwater runoff concentrating water runoff in the remainder of the lot. Water is a significant destabilizing force on steep slopes.

Proposal: Amend the Act to provide:  
 Land-disturbing activity is limited to specific areas within a parcel not to exceed amounts as shown in Table 1. This area does not include setbacks, buffers, easements, etc. There must be an adequate amount of buildable land for proposed structure(s) and all land disturbing activities (i.e., roadways, driveways, septic/sewage areas, public structures, etc.). Once the buildable area is determined, the location of the development is left to the landowner, subject to compliance with all other applicable regulations.

Table 1

Average Slope of Lot	Minimum Lot Size (acres)	Maximum Percent of lot that may be disturbed	Maximum Percent of Lot that may Be Impervious Surface
25-29%	1.5	30%	20%
30-34%	2	25%	15%
35-39%	2.5	20%	10%
40% or more	3	17%	5%

*Clustering of development:* Stability requirements vary from site to site and qualified design professionals must have the freedom to cluster development on more suitable areas of the site, leaving steeper, less suitable areas undisturbed. Clustering also reduces the road network necessary to serve a development, minimizing any slope instability attributable to road cuts and fills on steep slopes. For this reason, the best approach is to allow the flexibility to cluster development even if that means development at a density higher than otherwise would be permitted.

Proposal: Amend the Act to provide:  
 “A plan submitted pursuant to this Act may propose, and the agency with jurisdiction may approve, clustering of land-disturbing activities incident to subdivision residential development such that the lots and residential development are clustered in a specific area of the development tract, with the balance of land in that development tract being designated as permanent undisturbed green space. The agency having jurisdiction shall establish and publish standards for the approval of clustering requests when clustering of subdivision residential development will contribute to the overall stability of the subdivision tract or minimize exposure of residential structures to upslope landslide hazard areas. The agency with jurisdiction may approve clustering proposals that exceed the maximum grading, or impervious surface standards of this Act or that fall short of the minimum lot size standards of this Act, subject to restrictions imposed by any other applicable law.”

*Utilities on Hazardous Slopes:* Roads and building footprints are not the only land-disturbing activities that can contribute to site instability. The installation and operation of utilities can be significant destabilizing forces. The only fatal landslide in WNC to have initiated on a disturbed slope in the past 15 years was triggered at the site of a water line installed in a steep slope below a roadway in Maggie Valley.

Proposal: Amend § 266 to include a new subsection.

“Any utility line, pipe or conduit carrying or delivering a fluid or a gas, and which is designed to be in or placed in a steep slope area, must be placed or constructed within stable slopes. A utility line design or professional inspection shall be provided to the agency with jurisdiction and shall include a statement that the work has been designed or constructed in accordance with applicable standards of practice in western North Carolina at the time of design or construction. All reasonable technologies should be utilized in the design and construction of the fill slope so as to consider prevention of slope saturation resulting from a sewer line or water line leakage. The person financially responsible for the work will provide adequate certification of this installation or construction to the agency with jurisdiction within 60 calendar days of completion of the work.”

### **(3) Providing Additional Protections in Known Hazard Areas**

Land disturbing activity in known hazard areas significantly increases the risk of catastrophic loss of life and property attributable to slope failure, both by serving as a trigger for those failures and by exposing more people and homes to the hazard area. If one of the principal objectives of this bill is to prevent loss of life caused by disasters like the Peeks Creek debris flow, the final bill must do more than regulate the artificial slope construction activities in steep slope areas. The Peeks Creek slide originated on undisturbed land. The subdivision unknowingly was constructed in a downslope hazard, area, however. Unless the final bill restricts development in known hazard areas, including areas downslope of hazard areas, it will not prevent a repeat of the Peeks Creek tragedy. Although hazard mapping is available only for Macon County, our analysis of the Macon County maps demonstrates that, in the past two years, an average of 27 new homes are constructed each year in areas now mapped by NCGS as high risk for landslides or in the potential path of landslides originating from such hazard areas.

Jurisdictions all around the country have recognized the need to restrict development in known hazard areas. Such provisions are found in jurisdictions from Vancouver Washington (50 foot vegetated buffer from the sides of landslide hazard area and 25 foot vegetated buffer from the top of landslide hazard area) and Kitsap County, Washington (40 foot setback from top of slope, and 200 foot setback from bottom of slope absent geotechnical certification) to Yarmouth Maine (requiring 10 foot setback for each 5% of slope, which would require a 50 foot setback on a 25% slope). An effective landslide strategy must minimize development in known hazard areas and require setbacks from slopes identified by NCGS or other qualified surveys as at risk for slope failure.

Proposal: Amend § 268 to insert a new subsection providing additional restrictions for development in mapped hazard areas:

Slope construction shall not be allowed within a landslide hazard area as designated on maps prepared by the North Carolina Geological Survey or within a 40 foot vegetated buffer from the top of a hazard area, within a 200 foot vegetated buffer

from the bottom of a slope in a hazard area, or within a 50 foot vegetated buffer from the sides of a hazard area, absent certification in a slope construction plan submitted pursuant to this Article and approved by an agency having jurisdiction, that the slope construction will not contribute to the instability of the site or increase hazards to downslope property owners. Slope construction within mapped landslide hazard areas or within setbacks from mapped landslide hazard areas shall be inspected by a licensed engineer or other professional approved by the agency having jurisdiction to certify that the slopes will not contribute to the instability of the site or increase hazards to downslope property owners.

Cut slopes, fill slopes or retaining walls constructed within mapped landslide hazard areas or within setbacks from mapped landslide hazard areas shall have a factor of safety against mass instability that is greater than or equal to the factors of safety shown in the following table:

[Factors of safety in landslide hazard areas should be substantially higher than in other steep slope areas.]

Plans submitted pursuant to the Act should disclose whether land-disturbing activity will take place within a mapped landslide hazard area or within the setback from a mapped landslide hazard area.

Proposal: Amend § 266(c)(3)(c) to insert the clause “mapped landslide hazard areas and setbacks from mapped landslide hazard areas.”

*Considering landslide hazards in downslope developments:* The plans and geotechnical analysis required by the Act must be broad enough to address the hazards associated with activities upslope of development when development is conducted in a downslope hazard area identified on NCGS maps.

Proposal: Amend § 266 to insert a new subsection providing the following.  
Plans submitted pursuant to this section for slope construction activity in an area designated as a downslope hazard area on maps prepared by the North Carolina Geological Survey shall include an assessment of landslide hazards areas, as designated on maps prepared by the North Carolina Geological Survey, upslope of the project area. The plan shall document consideration of upslope landslide hazards and best efforts to site residential structures so as to minimize risks to human health and safety attributable to possible slope failure upslope of the development. The agency having jurisdiction may disapprove a slope construction plan under this subsection upon a making a determination that upslope landslide hazards present an unacceptable risk to safety or property.

### **Other Proposals for the Act**

#### **Real estate disclosure requirement**

As currently structured, the draft bill requires real estate disclosures only for lots in areas mapped by NCGS as having a higher vulnerability to slope failure. As you

know, NCGS hazard mapping is currently available only for Macon County and mapping for additional counties is expected to be available over a multiple-year period. Limiting the disclosure requirement to areas identified by NCGS mapping means that this real estate disclosure requirement will have no impact in many WNC counties for years to come. In addition, as discussed above, the NCGS mapping project is not currently structured to predict some forms of slope movement, especially slow-moving landslides. Finally, NCGS is not the only form of hazard mapping available. The Town of Boone, for example, has commissioned a geologist to conduct hazard mapping for its jurisdiction.

In addition, site-specific geotechnical analysis, whether conducted pursuant to the requirements of this Act or for other reasons, may identify slope hazards not identified by other forms of mapping. For these reason, the real estate disclosure requirement must apply to known geological hazards beyond those identified by the NCGS mapping project. In addition, NCGS has noted that slope failures can be triggered on otherwise well-engineered and stable slopes if fill slopes and drainage systems are not adequately maintained. Artificial slopes like other essential home systems require attention and maintenance over the life of a home. To increase the probability that homeowners will undertake required maintenance and monitoring of important artificial slopes, home sellers should be required to disclose “critical slopes” identified pursuant to this Act.

Proposal: Amend Section 2 of the Act.

“(7) The location of the property within a landslide hazard area as designated on maps prepared by the North Carolina Geological Survey or another government survey conducted to identify landslide hazard areas.

(8) The presence of geologic or slope instability hazards on the property identified as the result of a geotechnical analysis conducted by a registered civil engineer, soils engineer, soil scientist, geotechnical engineer, or engineering geologist licensed, registered or certified by the State of North Carolina.

(9) The presence and location on the property of critical slopes as identified in a slope construction plan prepared pursuant to the Mountain Slope Construction Act.

In addition, homebuilders must be informed about the presence of graded slopes on a development site before building new structures on the site. Because development often proceeds in stages, with a developer laying out the roads, utilities and lots, which can require substantial grading, and subsequent purchasers building structures on the pre-graded lots, developers must disclose cut and fill slopes to subsequent purchasers.

Proposal: Insert new section providing the following.

“On any pre-graded lot in a subdivision, the owner selling the lot shall disclose to the person buying the lot all filled-in areas prior to the first time the lot is sold. This disclosure shall be in the form of a notarized statement bearing the legal description of the applicable areas.”

*Approval of Slope Construction Plans:* As currently drafted, the Act provides that failure of an agency with jurisdiction to approve a plan within 30 days of submittal

constitutes approval of the plan. The hazards to life and property associated with landslide risks are too great to allow plans to go into force without review by an uninterested party. In most cases, the developer and the qualified design professional retained by the developer to evaluate the stability of a site will create a conscientious plan that complies with the standards of this Act. The consequences of those few cases when developers and the professionals they retain do not comply with the requirements of the Act in good faith can be dire. Automatic approval of plans that have not been reviewed by a disinterested party creates an unacceptable risk for homeowners. Several alternative approaches are available. Instead of automatic approval, a more desirable approach would be to treat failure to act as disapproval, which would entitle the applicant to an appeal pursuant to § 266(g).

Proposal: Amend § 266(b) of the Act to make the following change “Failure to approve, approve with modifications, or disapprove a completed slope construction plan within 30 days of receipt shall be deemed *disapproval* of the plan.” [Note the sentence appears twice in the current draft.] Amend § 266(i) to make the following change “Failure to approve, approve with modifications, or disapprove a revised slope construction plan within 30 days of receipt of a completed plan shall be deemed *disapproval* of the plan.

The draft bill provides a resident of a local government with a cause of action against the government for adopting an ordinance that fails to meet the standards of this Act and against land-disturbers for failing to comply with the requirements of the Act. Aggrieved landowners also need recourse, however, against a local government for failure to enforce the standards of the Act. It is not clear under the current draft whether an aggrieved neighbor will have recourse under § 270 if the land disturber acted in accordance with a slope construction plan approved by an agency having jurisdiction, but which should not have been approved because it does not meet the minimum standards of this Act. A principal lesson of our experience in Western North Carolina with landslide hazards is that activities upslope of a home can significantly increase the risk of catastrophic slope failure to downslope homes and residents. Just as developers need recourse when an agency having jurisdiction erroneously disapproves a slope construction plan, neighboring landowners need recourse when the agency having jurisdiction erroneously approves a plan that falls short of the standards of this Act.

Proposal:  
Amend § 265(h) to insert the following provision: “Any person injured by a local government’s failure to enforce the provisions of this Act, may bring a civil action against the local government, contesting a decision to approve a slope construction plan that does not meet the standards of this Act. If the slope construction plan is found not to meet the minimum standards of this Act, the local government may be compelled to act on its authority to require a revision to the plan pursuant to § 266(i) of this Act. For purposes of this section, a person injured includes but is not limited to neighboring landowners downslope of land-disturbing activity alleged to be in violation of this Act.”

For the same reasons, a neighboring landowner's right to recourse against a developer who violates the standards of this Act must be clear. As currently drafted the bill provides a cause of action for a "person injured" by a violation of the Act. To avoid confusion about whether a neighboring landowners standing to seek a remedy for violations of this act, the draft bill should be clarified to ensure that neighboring landowners have standing.

Proposal: Amend § 270 of the Act to insert the following sentence.  
"For purposes of this section, a person injured includes but is not limited to neighboring landowners downslope of land-disturbing activity alleged to be in violation of this Act."

*Revision of Inadequate Plans:* Under the draft bill, a local government is empowered to require revisions to approved slope construction plans if they subsequently are found to be inadequate. Local governments must be empowered with authority to stop land-disturbing activity pursuant to the previously-approved slope construction plan until a revised plan is submitted and approved.

Proposal: Amend § 266(i) to add the following.  
Upon a determination by the agency having jurisdiction that a previously-approved plan is inadequate to meet the requirements of this Article or the rule adopted pursuant to this Article, land-disturbing activity conducted pursuant to the inadequate plan must stop upon receipt by the financially responsible person of written notice of the agency's determination.

*Defining terms in the statute:* A number of terms are used in the draft bill without clear definition. Currently the statute does not define "person", "Secretary", "agency having jurisdiction", "area of special environmental concern" and "land-disturbing activity".

Proposal: Amend § 262 to include the following.  
'Land-Disturbing Activity' means any use of the land by any person in residential, industrial, educational, institutional or commercial development, highway and road construction and maintenance that results in a change in the natural cover or topography.  
'Person' means any individual, partnership, firm, association, joint venture, public or private corporation, trust, estate, commission, board, public or private institution, utility, cooperative, interstate body, or other legal entity.  
'Secretary' means the North Carolina Secretary of Environment and Natural Resources.  
'Agency having jurisdiction' means a commission, agency, department of body designated by a North Carolina locality with jurisdiction that includes a property.

*Other suggested changes to language of the draft bill:*

Amend § 267(a) to delete the clause “or they may be too restrictive.”

Clarify reference in § 266(c)(3)(b.) [line 25] with respect to the words “accurate estimates.” As currently drafted, it is not clear what estimates are referred to.

Clarify § 266(a). The draft bill references the prospect of an “approved express permit program.” The bill provides no guidance, however, as to the nature of an express permit program under this Act or how such a program may be approved or disapproved. If an express permit program is desired, it must be carefully defined with the understanding that an effort to speed review of slope construction plans inevitably will reduce the thoroughness of review. One approach is to require agencies having jurisdiction to audit a defined percentage (20%) of applications submitted pursuant to an express permit program and to maintain a list of design professionals eligible for the express permit program. Design professionals that submit plans under the express permit program that are subsequently found to be inadequate, pursuant to an audit or a challenge by an aggrieved landowner, must be removed from the list of professionals approved for the express permit program.

Again, thank you for the opportunity to comment on the draft Mountain Slope Construction Act and thank you for your leadership on this issue of great importance to the people and environment of Western North Carolina. I would be happy to speak with you about these comments or to provide any additional information.

Thank you,

A handwritten signature in black ink that reads "DJ Gerken". The signature is written in a cursive, flowing style.

Austin DJ Gerken