THE DELINEATION OF LANDSLIDES IN THE LINCOLN COUNTY, OREGON COASTAL ZONE

by

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THE DELINEATION OF LANDSLIDES IN THE LINCOLN COUNTY, OREGON COASTAL ZONE

ABSTRACT: A study conducted along the Lincoln County, Oregon coast delineated the exact location of 153 landslides. The landslides were found through the interpretation of aerial photographs. Each landslide was verified in the field and its class (ancient, historic, recent), type (slump, debris slide or flow, planar slide), and status (stable, potential, active) was determined. Each slide was numbered and mapped at scales of 1:4800 and 1:62500.

The study area was divided into seven homogeneous reaches based on lithologic and morphologic differences. The number of slides occurring in the differing geologic units was then analyzed.

It was found that most landslides occur in conjunction with siltstone materials of Tertiary age. Areas with similar morphology but of sandstone materials are less likely to have landslides. Structurally, landslides occur in areas with steeply dipping Tertiary bedding planes or in areas with steep slopes such as river valleys.

A large portion of the landslides in the study area occur at contact zones between Tertiary and Quaternary materials. Most of these slides are ancient, stable slides and are larger than other slides in the study area. The only active ancient landslides in the coastal zone take place in the Nye mudstones near Beverly Beach State Park.

Those slides in the study area classed as historic and recent are predominantly active or likely to become active in the near future.

Only 11 of these slides remain stable.

Landslides will continue to be a geologic hazard in Lincoln County, Oregon. However, knowledge of landslide location, lithology and morphology will reduce their impacts.

INTRODUCTION

Landslides are a frequently occurring geologic hazard. In the past, they have caused extensive damage to homes, highways, and other properties. Concern over geologic hazards is apparent at all levels of government. Federal, state and local authorities are attempting to identify potential hazards in an effort to anticipate and lessen damage to life and property.

The Coastal Zone Management Act (1972) mandates that each state initiate research toward the goal of providing local planning agencies with information necessary for the protection of future landowners in the coastal zone (Knuth, 1975).

In 1974, the Oregon Land Conservation and Development Commission (LCDC) set forth a comprehensive statewide plan issuing goals and guidelines for future development within the state. Areas subject to particular hazards such as flooding, erosion, landsliding, etc., were to be determined under comprehensive plans at the county level.

Toward this goal, Lincoln County, Oregon has initiated several research projects. This paper reports the findings of one research project undertaken during the summer of 1978.

The purpose of this study was to delineate the exact location of every landslide occurring along the Lincoln County coast. This would be accomplished by interpretation of aerial photographs and subsequent field verification. Landslides from ancient, historic, and recent times would be differentiated and mapped at a scale of 1:4800. Information concerning the status of the slide, stable, active, or potential, would also be determined from field evidence. For the purpose of this study, landslides were considered as those movements of earth materials occurring as deeply seated mass failures. This would exclude normal bluff erosion and most highway construction failures, as well as rock falls, soil creep, and other types of mass failures. An evaluation of the types of lithology and morphology most conducive to landslides would also be made.

The results of this study will provide land use planners with the information necessary to devise development plans which would restrict development to areas presenting the least threat to individuals and property. Although landslides are likely to be a continuing geologic hazard in Lincoln County, knowledge of their location and likelihood will help to reduce their impacts.

LITERATURE REVIEW

The study of landslides is of particular concern to geomorphologists, civil engineers, and land use planners. The general literature

pertaining to landslides is found in a wide variety of sources. A review of this literature indicates that the study of landslides enables the geomorphologist to reconstruct past land forming sequences, and is an aid in the comprehension of present and future topographic processes. Whereas the civil engineer is concerned primarily with the safety factors of natural or artificial slopes, and with landslide prediction, prevention, and control, geomorphologists are concerned basically with their causes, courses of movement, and resulting surface formations. The information gained from geomorphologists and civil engineers is important to land use planners in their efforts to identify potential hazard areas.

The earth materials involved in landslides differ greatly, as do the rates of movement and amount of mass moved. As a result, a large variety of landslide types are produced under varying processes and causative factors. Numerous classification systems are found throughout the literature. These have been devised in an attempt to provide an orderly arrangement to the variety of landslide types. These systems are diverse in their characteristics and points of emphasis, including kinds of material, rate and type of movement, water content, as well as dimension of mass and initiating causes. Such systems have been developed by Ladd (1935), Sharpe (1938), Varnes (1958), and Zaruba and Mencl (1969).

In addition to differentiating between landslide types, the literature contains extensive information of landslide causes, mechanisms, and dynamics. Terazghi (1950) presents a detailed, comprehensive analysis of landslide mechanisms. Numerous authors (eg. Ladd [1935],

Sharpe [1938], Terazghi [1950], Varnes [1958]) discuss the many causes of landslides, their dynamics, and identifiable features. Excellent summaries of landslides in general are presented by Schlicker (1956) and Morton and Streitz (1972).

Several studies concerning landslides along the Oregon coastline have been conducted. North (1964), in his masters thesis, developed a classification system for landslides occurring along the northern Oregon coast. His classification system is based principally upon the materials involved in a slide and its type of movement. Some of the major slides in Lincoln County were described in great detail and can be quite useful in understanding the dynamics of individual slides. The results of North's study indicate that the type of landslide is controlled by lithology.

Byrne (1963), in a study on coastal erosion, considered landsliding the primary type of bluff retreat. This study focused principally on the frequency and rates of erosion. Stratigraphy, structure, and lithology were determined as the factors controlling erosion rates. In this study, Byrne provides a general description of the Lincoln County shoreline, such as heights of cliffs, lengths of beaches, sizes of bays, and lithology of landforms.

North and Byrne (1965) described the general geology of the northern Oregon coast, and the dynamics and mechanisms of landslides. They also provide a simplified classification system. The general landslide topography along the northern coast of Oregon was mapped by lithology and type of landslide area.

Other studies of Oregon coast landslides are initiated as a result of a catastrophy. For example, Allen and Lowry (1944) describe the 1943 landslide at Jumpoff Joe in Newport, and Schlicker, et. al. (1961) describe the landslide at Ecola Park.

A report done by the State of Oregon Department of Geology and Mineral Industries on the Environmental Geology of Lincoln County, Oregon (Schlicker, et. al., 1973) provides a description of the geology of Lincoln County and environmental hazard areas. Hazards discussed include: flood prone areas, compressible soils, transient shorelines, earthquakes, high water tables, and landslide topography. This study provides the general background information needed by land use planners to begin delineating hazard areas. The section of the Bulletin dealing with landslides divides them into three categories; 1) ancient, 2) recent, and 3) active. These differences are not differentiated on the maps which accompany the Bulletin. Rather, landslides as a hazard in Lincoln County are mapped only as general landslide topography areas. Individual landslides are not mapped; however, photographs of the major slides in Lincoln County are included with the text.

FACTORS CONTRIBUTING TO LANDSLIDE PRODUCTION

Many times it appears that a landslide occurs as a surprise, without prior warning. However, it is often possible to predict the occurrence of a landslide by having sufficient knowledge of the conditions favorable to their production as well as observing visible evidence of movements which precede the final failure. The conditions favorable to a landslide may exist for long periods of time without any apparent

movement. When given the proper impetus, a slide may be touched off within a relatively short period of time. The initiating factor is not usually simple however. Generally, several combined factors are responsible for landslide production. What may appear as a sole cause is in fact commonly only a contributory factor or trigger.

Slopes are generally stable when the shearing stress is less than the shearing resistance or strength (Diagram 1). When the shearing stresses acting upon a potential surface of sliding become equal to or greater than the shearing resistance a landslide develops. Likewise, a failure occurs if the shearing resistance decreases and becomes equal to the shearing stress. Therefore, landslides result from causes which either increase shearing stress or decrease shearing resistance (Terzaghi, 1950).

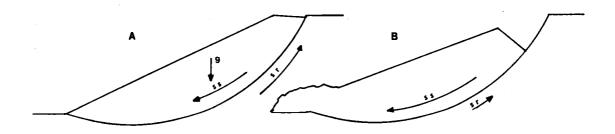


Diagram 1. ILLUSTRATION OF THE FORCES ACTING ON A SLOPE.

- A) SHEAR STRESS & SHEAR RESISTANCE ARE EQUAL.
- B) SHEAR STRESS EXCEEDS SHEAR RESISTANCE.

(g-normal stress)

. High Shear Stress

Increases in shearing stress result from several factors. One of the most common causes of landslides is the removal of underlying or lateral support. This is usually the result of undercutting by rivers or waves, or subaerial weathering. Man's activities, such as mining or highway construction, are also factors in removing support.

Other factors which contribute to high shear stress include overloading by rain, snow, talus, or buildings, etc.; and creation of a new slope by previous landslides, faulting, or subsidence. Tectonic stresses from earthquakes or blasting vibrations, and regional tilting which increases slope angle also increase shearing stress.

Low Shear Resistance

Internal Factors

The state of the material itself may be favorable to landslides. The material may have inherently low shearing resistance. These factors are part of the geologic setting and failures due to them may not occur for very long periods of time. The factors commonly involved are the stratigraphic, lithologic, and structural components of the material.

Stratigraphic causes consist of massive materials overlying weak or plastic materials, strata that is inclined toward a free face, and alternation of permeable beds with weak impermeable beds.

Lithologic conditions favoring landslides exist within inherently weak formations or those which may become weak from changes in external conditions. This is particularly common in clay, siltstone, and shale sediments, or decomposed rock.

Often the structural properties of materials are conducive to slope failures. These include such discontinuities as faults, bedding planes, joints, cleavage, and foliation.

External Factors

External factors which contribute to a reduction of shearing resistance and consequent slope failures include those which reduce cohesion and frictional resistance. Cohesion reduction results from the various forms of chemical and mechanical weathering, such as the breaking of soluble binders and expansion, contraction, and physical disintegration. A rise in water content, pressure, and ground water levels are factors which result in a reduction of frictional resistance. This occurs when air in voids is displaced by water, when slip surfaces are lubricated, when pressure is exerted on soil particles, or when subsurface erosion occurs.

METHODOLOGY

In order to determine the exact location of landslide occurrences along the Lincoln County coast, aerial photographs dated 1972 and 1977 were stereoscopically viewed and compared. The locating of landslides on aerial photographs was accomplished through the identification of characteristic features exhibited by landslides.

The most readily identifiable landslides are those which have had recent or historic movement. These slides generally show distinct scars, usually in an arcuate pattern, and are often devoid of vegetative

growth. The jackstraw arrangement of trees, sag ponds, and debris areas remain visible on aerial photos.

In contrast, time has obscured most of these features where ancient landslides are concerned. These failures are identifiable on aerial photographs by the remaining arcuate features and the hummocky nature of the deformed surface area.

Recent slides are sometimes visible on aerial photos through the displacement of cultural features such as buildings or highways. Recently repaired stretches of highway, debris remaining on beaches or roadsides, and leaning or fallen trees are also indicative of these slides.

Based on these factors, each slide within the study area was classified as either ancient (originating several hundred years ago), historic, or recent.

When a landslide was identified by photo evidence its exact location was plotted on contact photo maps according to its age classification. These maps, at a scale of 1:4800, correspond to a strip of the Lincoln County coastline approximately 1.3 miles in width. This area was delineated as the study area. These contact photo maps were numbered consecutively (1-25) from south to north.

Each slide was then field checked to insure accuracy of aerial interpretation. Field evidence used for verification of slides included cracked building foundations, tension cracks on surface areas, scarps devoid of vegetation, leaning trees, trees with curved trunks, seep lines, sag ponds, displaced stratification, debris accumulations, hummocky land surface, and arcuate patterns.

Utilizing this evidence, the slide's status was determined to be stable (showing no signs of recent movement), potential (currently not moving but likely to do so in the near future), or active.

After Schlicker (1956, 1973) landslides were determined to be of three types: 1) rotational slump - backward tilting blocks of earth material moving downslope on a curved slip plane; 2) debris slides or flows - highly deformed mass of earth material moving downslope on a straight slip plane (a debris slide is differentiated from a debris flow by the water content in the mass); 3) planar slide - a detached block of undeformed material moving downslope along a bedding plane.

For the purpose of this study, failures occurring in construction or highway cuts were not considered as landslides. Likewise, sloughing by erosion along the bluff edge was also excluded. These types of failures are not considered to be characteristic of deep-seated landslides.

Once a landslide was verified, its location was plotted on a topographic sheet at a scale of 1:62500. Information concerning the size of the slide was determined from aerial photographs and the 1:4800 contact maps. This included the slide's length and width in meters and areal hectares.

It was hypothesized that the number of landslides would correlate with the differing types of lithologies along the coastline. Therefore, the study area was divided into sections based on geologic materials. Each of these geologic units (reaches) was given a number (1-7) from north to south and mapped on the topographic sheet.

For the purpose of landslide reference, a five digit number was assigned to each landslide within the study area. This number was derived by combining the geologic reach number, the 1:4800 contact map number, and the number of the slide on the area covered by the contact map. For example, the number 5-13-05 corresponds to the landslide located in Reach 5, contact map number 13, slide number 5 in this area. The format of the number (reach-map-slide) affords quick recognition of the geologic unit as well as the location of the slide.

RESULTS

There are 153 landslides within the zone studied in Lincoln County. Each of the slides is delineated on a map which can be found in Appendix B. A table which accompanies this map (Appendix A) provides information on each slide's size (length/width, areal hectares), type (slump, debris slide, planar slide), class (ancient, historic, recent) and status (stable, potential, active). The table also gives a verbal description of each slide's location.

There are 73 ancient landslides within the study area (Table 1).

Of these slides, 67 are stable at this time; however, seven of them show signs of potential movement. Only six of the slides classed as ancient are active. All six of these occur in Nye Mudstone materials in Reach 5 (Table 2).

Table 1. The evaluation of landslides by class and status.

STATUS				
	Ancient	Historic	Recent	Total
ACTIVE	6	32	7	45
POTENTIAL	7	26	4	37
STABLE	60	11	0	71
Total	73	69	11	153

Table 2. Comparison of landslide status by class and reach.

REACH	EACH ANCIENT				STORIC	2		RECENT			
	Act.	Pot.	Sta.	Act.	Pot.	Sta.	Act.	Pot.	S <u>t</u> a.		
1	0	0	3	5	1	0	2	0	0		
2	0	2	12	1	4	1	0	1	0		
3	0	0	1	0	0	0	0	0	0		
4	0	2	12	1	7	0	0	2	0		
5	6	3	6	16	8	7	4	1	0		
6	0	0	19	9	1	1,	1	0	0		
7	0	0	7	0	5	2	0	0	0		

Of the 153 landslides, 69 are classed as historic. About one-half of these (32) remain active, while 26 show potential movement and 11 remain stable. Most of the historic slides (31) are found in Reach 5 where 16 of these are active (Table 3). The remaining slides (11) in the study area are recent. Four of these are potential and seven are active.

Table 3. Landslide numbers by class and reach.

REACH			CLASS		
	Linear (Km)	Ancient	Historic	Recent	Total
1	2.3	3	6	2	11
2	14.7	14	6	1	21
3	5.3	1	0	0	1
4	10.6	14	8	2	24
5	14.4	15	31	5	51
6	32.5	19	11	1	31
7	6.1	7	7	0	14
Total	85.90	73	69	11	153

Table 4 indicates the status of the Lincoln County landslides by reach. Notably, Reach 5 contains 58 percent of the active landslides and 34 percent of the potential slides in the study area. Forty-six percent of the landslides in the entire study area are stable.

Table 4. Landslide numbers by status and reach.

REACH		STATUS	<u> </u>	
	Active	Potential	Stable	Total
1	7	1.	3	11
2	1	7	13	21
3	0	0	1	1 .
4	1	11	12	24
5	26	12	13	51
6	10	1	20	31
7	0	5	9	14
Total	45	37	71	153

The Lincoln County shoreline was divided into seven homogeneous reaches. A reach was considered to be a continuous, uninterrupted extent of the shoreline area based upon similar lithologic and morphologic characteristics. The length of each reach can be found in Table 3. Five of these reaches are north of Yaquina Bay and two are to the south. The reaches are differentiated on the map in Appendix B.

Reach 1 is from the mouth of the Salmon River (Lincoln - Tillamook County line) south to the north end of the village of Roads End. This reach is characterized by high cliffs protected in places by resistant igneous dikes of late Eocene age. Elevations in Reach 1 are such that high, near vertical cliffs (122 m) are formed at the ocean interface. Where this occurs, the siltstones of the Nestucca Formation are subject to mass failure. The ancient landslides within this area moved as rotational slumps and are currently stable. These slides occured on the upper portion of the bluff and are found approximately 300 meters inland of the bluff edge. The remainder of the slides in this reach are debris slides which remain active. The recent activity is indicated by the lack of vegetation on the bluff and the debris cones formed on the beach.

Reach 2 extends from the north end of Roads End to the southern end of Siletz Bay, near Gleneden Beach. This reach consists primarily of Quaternary marine terrace deposits overlying seaward dipping Tertiary siltstones of the Yamhill and Nestucca Formation. The majority of the slides in Reach 2 are ancient, stable slides. Most of these are found along the contact zone between the Quaternary and Tertiary

materials. The slides which are active are rotational in nature and occur primarily along the coast.

Reach 3 extends from Gleneden Beach south to Fishing Rock. Reach 3 is distinquished from Reach 2 by a difference in underlying Tertiary material. In Reach 3 the material underlying the marine terrace deposits is sandstone of the Yaquina Formation rather than a siltstone. There is only one landslide in Reach 3. However, this occurs in an area where the marine terrace deposits have contact with a siltstone. Therefore, no deepseated slides in this reach have taken place in the marine terrace deposits underlain by sandstone.

Reach 4 stretches from Fishing Rock south to and including Otter Crest State Park. Lithologically, Reach 4 is composed of Cape Foulweather and Depoe Bay basalts of middle Miocene age, Tertiary sandstones, and pockets of Quaternary marine terrace deposits. In this region, most of the slides occur in the sandstone where it comes in contact with the basalt. Several slides also occur in the weathered basalt regolith along Otter Crest Loop. These are evidenced by the tension cracks and repairs along this road.

The basalt in this region is exposed as outcrops along the coast. The resistance of this basalt protects the overlying marine terrace deposits from undermining. However, in Boiler Bay and Whale Cove the Quaternary deposits are unprotected and slides have occured as a result. Whale Cove contains a large ancient slide which is currently stable. Boiler Bay has experienced three slides, now stabilized by riprap, but the potential for further movement still exists.

Reach 5 includes the area between Otter Crest State Park and Yaquina Bay. This reach has experienced the most intensive landsliding activity along the Lincoln County coastline. Although the reach comprises only 16 percent of the study area, it contains 33 percent of the landslides. Generally, Reach 5 is composed of Quaternary marine terrace deposits underlain by Nye Mudstone, a siltstone of the early Miocene epoch. The continuity of this area is interrupted by a basalt headland, Yaquina Head. There are also sandstone outcrops along the coast, north of Yaquina Head.

Within the study area, excluding Reach 5, all the ancient landslides are stable, although a few show signs of potential future movement. In Reach 5, several large ancient slides occur in the Beverly
Beach area. These slides are in the Nye Mudstone and remain active.
The movements of these landslides toward the ocean contribute to a
large number of mass failures in the marine terrace deposits along the
bluff edge. The ancient slides which do remain stable within this
reach are located in Yaquina sandstones.

Highway 101 is often damaged as a consequence of the seaward movement of the active ancient landslides. An interesting landslide (5-14-06) occurs along Highway 101, between Beverly Beach State Park and Coal Creek. This slide originated as an ancient rotational slump. The horizontal strata, through backward tilting, has been displaced to nearly vertical. Highway 101 is built atop this tilted detached block and lateral splitting of this block in both directions causes continual damage to the highway.

The city of Newport has been subjected to extensive landsliding. Eleven landslides have been delineated within the city's coastal region, ten of which remain active or show signs of potential movement. The best known of these slides occurs at Jumpoff Joe. This slide involves 1.9 areal hectares to the north of the point (5-12-04) and 2.8 hectares to the south (5-12-05). This failure has been attributed to ground-water lubrication and slippage along bedding planes of the Astoria and Nye complex (Allen and Lowry, 1944).

Reach 6 stretches from Yaquina Bay south to Starr Creek, just north of Yachats and is the largest reach in the study area. This area is 32.5 kilometers long and has 31 individual landslides. The entire length of the reach is composed of marine terrace deposits. The underlying materials are similar to those in Reaches 2 and 3, sandstone and siltstone. However, the lower relative relief and the more horizontal dip of the underlying materials are reason for distinction.

A few small landslides along the coast occur in marine terrace deposits underlain by sandstone, but the majority (28) are in siltstones and occur in the river valleys where the relief is higher. In this reach the slides are primarily located along the contacts between the terrace deposits and the siltstones. An exception to this is a unique slide in the vicinity of Hidden Lake (6-06-01). This slide is a large detached block of Alsea siltstone which is migrating along a slip surface toward the ocean. The block remains relatively intact but is subject to wave attack at its toe during high tides.

Drainage in the area has been diverted around the block since the

siltstone is comparatively impermeable. There is also evidence of seepage through the weathered material on top of the block.

The final reach, Reach 7, includes the area between Starr Creek and the Lincoln-Lane County line. This reach is in the basalt of Yachats found in the Cape Perpetua area. Much of this late Eocene material has developed into a thick regolith. Landslides in this reach are found in areas with steep slopes. Here the regolith is subject to saturation during heavy rains and movements occur mainly as debris flows or torrents. Two such slides are worth noting.

Landslide 7-01-04 developed in an area that had been harvested of timber several years before. Residents in this area indicate that several debris jams developed in the drainage system and caused increased ground-water saturation. During a period of heavy rains, soils and other debris cascaded down this valley causing damage to Highway 101 and moving a house eight inches off its foundation. Debris from the slide is still pushed up against the back of the house. There are no deep scars in recent air photos of this area; however, barren patches of land indicate that this slide began as a sheet wash accumulating debris as it moved and developed into a rapid flow. The path of this slide is obvious on recent air photos since the channel is cleared of debris and vegetation. Debris jams are still forming in this area and residents fear a recurrence is likely.

Slide 7-01-05 occurred in the Cape Perpetua campgrounds. This slide also developed during heavy rains and moved as a debris flow; however, there is evidence of a deep rotation at the source of the slide.

The remaining active and potential slides in Reach 7 are either debris slides or debris flows depending on water content.

CONCLUSIONS

The results of this study indicate that Lincoln County, Oregon has experienced extensive landslide activity in its coastal region.

Many of these slides occurred in the distant past, many are currently active, and others are likely to become active in the near future.

It is apparent that the combined influence of lithology, stratigraphy, and structure determine the location and number of landslides in the study area. Reach 5 is by far the most sensitive to landslides with one-third of the slides in the entire study area. In fact, the only active ancient landslides occur in this reach. In Reach 5, as in most of the study area, the materials involved in the slides are marine terrace deposits overlying inclined siltstones. Siltstones, particularly the Nye mudstone seem most conducive to landslide activity. In areas where the marine terrace deposits overlay sandstones, landslides are less likely to occur even if the dip of the Tertiary beds is similar. This is obvious in Reaches 2 and 3. Reach 2, underlain by siltstone, has numerous landslides, while Reach 3, similar to Reach 2 except for the sandstone lithology, has only one landslide and this slide occurs in an outcrop of siltstone material.

The structure of Reach 6 causes considerable variance in the number of slides. This reach is similar to Reaches 2 and 3 in lithology but the dip of the Tertiary materials is less than in the other

reaches as is the total relief. Slides which do occur in Reach 6 are smaller by comparison or occur in river valleys where the slopes are steeper.

Most of the landslides in the study area occur either along the coast or at contact zones where two materials come together. Landslides occuring at the contact zones are usually larger than the other slides in the study area. Ground water seepage and the differing porosities of the materials may be a factor in this case.

It is difficult to differentiate landslides from erosion along the coast. The primary difference is in the contributing causes. Whereas sloughing or erosion is primarily due to undercutting, landslides are usually in conjunction with steeply dipping strata toward an open face.

Reaches 1, 4, and 7 are principally composed of basalt. In Reaches 1 and 4 the basalt acts to protect the coastline from wave attack. However, in places where this material has been breached, wave energy is concentrated and damage is intense. This is also the case in Reach 7. However, most of the slides occur further inland in this reach. These slides are involved in deeply weathered basalt regolith. Slides in this reach are probably the most devastating when they occur since they are usually triggered in periods of high rainfall and take the form of rapid debris flows or torrents.

The ancient landslides are the largest in the study area. Most of these slides are located inland from the coast. It is probable that smaller slides also occured in ancient periods; however, evidence of these slides has long since disappeared. Most of the ancient landslides in the study area are stable, however, some show signs of potential

movement. Any movements in these slides are likely to be smaller than the original slides. This is not the case with those active ancient slides in Reach 5. The size of these slides approximates the original slide. These slides are moving as soil creep and are impetus for extensive landslide activity in the Beverly Beach area.

It is likely that landslides will always be a hazard in Lincoln County, Oregon. By knowing where landslides have occurred in the past and what materials are most conducive to landslides, it is possible to anticipate where slides are most likely to occur in the future. This information will enable land use planners to implement programs which will lessen the impact of landslides in the future.

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APPENDIX A

Location, size, and nomenclature of landslides in the Lincoln County study area.

SLIDE	LOCATION		SIZE		N	OMENCLATUR)	ર
NUMBER		Length	Width	Hectares		Class	Status
		(m)	(m)		V -		
	coast, 1159 m south of	31-5	73	1.8	debris slide	historic	active
1-25-02 256 m	n inland from slide 1-25-01	293	85	1.6	slump	ancient	stable
1-25-03 Along	; coast, 1464 m south of	317	98	2.1	debris slide	historic	active
	nd 252 m from slide 1-25-03	207	98	1.6	slump	recent	active
1-25-05 Inlan	id 365 m from slide 1-25-03	366	268	9.1	slump	ancient	stable
1-25-06 Along	; coast, 2074 m south of	220	171	3.8	iebris slide	historic	active
	s south of slide 1-25-06	195	31	.6	debris slide	historic	active
	inland from slide 1-25-07	159	61	•7	slump	ancient	stable
	inland from slide 1-25-10 th 35°	2111	98	1.8	slump	recent	active
1-25-10 Nong	coast, 295 m south of 1-25-07	L ₁ 27	85	2.6	debris slide	historic	active
	coast, at north end of	146	67	•7	slump	historic	potential
	d of Meptune Drive, Roads south of slide 1-24-01	122	73	.3	slump	historic	potential
			1.4 (1966) i majur ar districantes al 				
	hern section of Roads End, nd of slide 1-24-01	647	220	10.9	slump	historic	stable
	een Neptune Dr. and Port Rd. m inland from 69th St. Roads E	85 Ind	61	• 4	glump	historic	potential
	m inland of slide 2-24-04	390	305	10.1	-	ancient	stable
	the end of Port Lane north	683	98	4.4	-	ancient	
	50th and Neptune Ave. north	525	122	4.3	-	ancient	stable
	39th St. north to 50th St. Logan Rd., Roads End	756	378	20.6	-	ancient	potential
3-24-09 Along	g coast, within slide 2-24-08	317	21,	.8	slump	recent	potential
	West Devils and Holms Rd.	549	280	9.7	-	ancient	stable
2-23-02 From	arf Dr., near 35th St. Lincoln Keel Ave. and 22nd St. to	671	146	6.3	-	ancient	stable
2-23-03 From	er and 30th, Lincoln City Lake View Dr. and Alder Way	488	281	10.5	-	encient	stable
Lineo	ss Devils Lake Rd. to Alice St oln Citý	•					
	M. 8th and N. Harbor Ave. n to 21st and Harbor Ave., Lin	720 coln Cit	4 1 5 Y	20.5	-	ancient	stable
	or Ave. and N. 15th St.,	37	12	.1	slump '	historic	active
	nity of Inlet Ave. and ed St., Lincoln City	183	49	.6	slump	historic	potential
	n of S.14th St. near S. Car Lincoln City	476	122	3.9	-	ancient	stable

	244 m north of Thorpe Road,	415	1 34	3.5	-	ancient	stable
	Lincoln City 488 m south of S. 23rd St.,	732	159	3.8	-	ancient	staole
2-22-04	Lincoln City From S. 31st St. to S. 37th	622	1 22	5.2	· · ·	ancient	stable
2-22-15	St., Lincoln City Along S. Beach Ave., from S.40th	732	95	4.3	slump	ancient	potential
2-21-01	St. to S. 51st St., Lincoln City 800 m off Hgwy 101 on Oregon 229 north side of Siletz Bay	73	37	.1	slump	historic	potential
2 21 42		183	37	•4	slumo	ancient	stable
	Along Fogarty Creek, 1300 m east	439	21 ₁ 14	7.6	- Craing	ancient	
	of Hgwy 101						•
·	North face of Fishing Rock	122	24	٠ أناً م	slump		potential
,	South face of Fishing Rock	244	49	•7	slump		potential
	Along coast, 333 m south of Fishing Rock	146	31	•4	slump	ancient	potential
4-18-01	Along coast, azimuth 33°,1165m from Boiler Bay Park rest room	85	21;	.3	debris slide	historic	potnetial
4-18-02	Along coast, north side of Boiler Bay	1 34	. 51	-4	debris slide	historic	potential
½ -1 9 - 03	Where Boiler Bay undercuts Hgwy 101	. 98	37	.8	slumo	historic	potential
•	From Boiler Bay rest room, azimuth 83°, 1037 m		183	5.2	-	ancient	stable
L-18-05	Adjacent to slide 4-18-04	403	171	6.5	-	ancient	stable
· ·	Mear the fork in North Depoe Bay Creek	732	427	24.9	-	encient	stable
4-17-01	Between Hgwy 101 and South Depoe Bay Creek	561	220	7.5	-	ancient	stable
						2 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	
	North of Whale Cove, Between	378	329	10.4	-	ancient	stable
	Along Rocky Creek, off Hgwy 101	342	5 5 .	1.3	_	ancient	stable
: 4-16-01	Alon; Otter Crest Loop, 1.15 km north of Cape Foulweather	1.34	61	.8	slump	recent	potential
<u> </u>	Along Otter Crest Loop, 1 km north of Cape Foulweather	~73	37	.2	slump	historic	potential
<u>4</u> -16-03	Alon; Otter Crest Loop, .8km north of Cape Foulweather	2144	122	1.2	slump	historic	active
4-16-C4	East of Howy 101 .37km, azimuth	647	586	31.9	, -	encient	stable
4-16-05	Along coast, .3km north of	195	134	• 7	debris slide	historic	potential
4-16-06	Cape Foulweather Along Otter Crest Loop, .3km	427	61	3.6	-	ancient	potential
	north of Cape Foulweather	41. 20	5111	27.9	_	ancient	stable
	Due east of Cape Foulweather, .8km		146	3.0	_	ancient	
	Along Otter Crest Loop, .5km	366	145	J.0			
the state of the s	south of Cape Foulweather	l. 27	49	1.5	_	ancient	stable
4-16-09	Along Otter Crest Loop, .9km	1;27	47	1.0			
•	south of Cape Foulweather	549	207	7.4	_	ancient	stable
		-110	207	1 •4			
	1km northeast of the junction of	247					
	Hgwy 101 and Otter Rock Rd.			'o h	_	anctent	stable -
	H ₃ Wy 101 and Otter Rock Rd. .7km north of the junction of	522	49	2.14	-	enctent	stable -
4-16-11	Hgwy 101 and Otter Rock Rd.	5 22	49 49	2.14	- slump	enctent	stable -

	5-15-01	Azimuth 55%, .67km from the south	7 93	159	7.0	-	ancient	stable
### ### ### ### ### ### ### ### ### ##		junction of Hawy 101 & Otter Crest	Loop					
Section Sect	5-15-02	-	207	31	•3	slump	recent	active
Simple S		- •						
Second	~ 4~ 24	the state of the s		400	44.3			
S-15-0, A. Limith 1959	5-15-03			163	11.2	-	anclent	active
Second Second Hypy 101 and Otter Creek Loop	~ 4~ AL			4.21	3 %			
S-15-05 Along coast, 305m south of Devils 13k 31	ラー・ラールは			1 34	. 3.2	-	ancient	active
### Second State Se	♂ _1 ≓_೧⊏			21	2	Johnia	historia	atable
### F-15-05 Along coart, 1988m south of Deviis 98	2-12-02		1 24	יכ	• -		HISTOPIC	302016
Punch Soul	5_15_06		98	21,	. 2		historic	stable
### F-15-07 Mong Hymy 101, 193m south of south 244	J-1J-175	_	73	++	• •		1115 001 10	500010
Junction of Hywy 101 & Otter Creat Loop 5-15-08 366m south of south junction of 195 98 1.3 slump historic setive Hywy 101 & Otter Creat Loop 5-15-09 .73km nw of Beverly Beach State 732 146 7.2 -	F-15-07	•	علناد	232	3.5		historic	active
5-15-08 356m south of south junction of 195 98 1.3 slump mistoric active Hymy 101 & Other Crest Loop 5-15-09 736m mm of Beverly Beach State 732 166 7.2 - sncient active Park ranger station 5-15-10 Along Hymy 101, 16m south of south 122 24 .2 slump mistoric active junction of Hymy 101 & Other Crest Loop 5-15-11 Arimuth 160°, 98m from the 1159 171 10.7 - ancient active entrance of Severly Seach State Park 5-15-12 Along Hymy 101, 356m south of 134 31 .3 slump recent active Deverly Beach State Park entrance 5-15-14 Along Hymy 101, 736m south of 110 24 .2 slump historic active Beverly Beach State Park entrance 5-15-14 Along Hymy 101, .67am south of 146 31 .3 slump historic active Peverly Beach State Park entrance 5-15-15 Along Hymy 101, .17am south of 146 31 .3 slump historic active Peverly Beach State Park entrance 5-15-15 Along Hymy 101, .17am south of 244 73 1.1 slump historic active Peverly Beach State Park entrance 5-15-16 Along Hymy 101, 1.12m south of 244 73 1.1 slump historic active Peverly Beach State Park entrance 5-14-01 17.6m south of Wate Creek mouth 98 85 7.7 slump recent active Peverly Beach State Park entrance 5-14-02 Along Coal Creeks 5-14-03 Adjacent to slide 5-14-02 (south) 500 232 5.8 - ancient active Wade and Coal Creeks 5-14-03 Adjacent to slide 5-14-02 (south) 500 232 5.8 - ancient active Perland Along Coal Creeks Hymy 101 268 37 7 encient stable 5-14-05 Hym N3 of Coal Creek Hymy 101 268 37 7 encient stable 5-14-05 Hym N3 of Coal Creek Hymy 101 268 37 7 encient stable 5-14-06 Along Engr 101, 122m S of Coal Creek13 37 4.4 slump historic active 5-14-07 Along Hymy 101, 122m S of Coal Creek23 49 1.3 slump historic active 5-14-09 Just N of Moolack Creek mouth 85 24 2.2 slump historic active 6-14-09 Just N of Moolack Creek mouth 85 24 2.2 slump historic stable 6-14-01 366m S of Moolack Creek, along 744 232 9.5 slump ancient potential 8 Hymy 101 5-14-10 36m S of Moolack Creek mouth 85 24 2.2 slump historic stable 6-14-11 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1				-2-	J.,			
### 15-09 .73km nw of Sevenly Seach State	5-15-08			98	1.3	slumo	historic	active
Tank renger station S-15-10 Along Rays 101, 10m south of south 122 24 .2 slump historic active function of Rays 101 & Otter Crest Loop S-15-11 Azimuth 140°, .9km from the 1159 171 10.7 - ancient active entrance of Severly Beach State Park 171 10.7 - ancient active entrance of Severly Beach State Park 124 31 .3 slump recent active Deverly Reach State Park entrance 124 31 .3 slump historic active 15-12 Along Rays 101, .73km south of 110 24 .2 slump historic active 15-14 Along Rays 101, .03km south of 146 31 .3 slump historic active 15-14 Along Rays 101, .03km south of 146 31 .3 slump historic active 15-15-15 Along Haws 101, .13km south of 244 .73 1.1 slump historic active 15-14-01 Rays 101, .13km south of 244 .73 1.1 slump historic active 15-14-01 Rays 101, .13km south of 244 .73 1.1 slump historic active 15-14-02 Rays 101, .13km south of 244 .73 1.1 slump historic active 15-14-02 Rays 101, .15km south of 244 .73 1.1 slump historic active 15-14-02 Rays 101, .15km south of 244 .73 1.1 slump historic active 15-14-02 Rays 101, .15km south of 245 .7 slump recent active 15-14-02 Rays 101 .10km Rays 101, .15km south 98 85 .7 slump recent active 15-14-02 Rays 101 .10km Rays 101 .10km Rays 101 .10km Rays 101 .20km Ra		-				•		
5-15-10 Along Hymy 101, 1km south of south 122	5-15-09	.73km nw of Beverly Beach State	732	146	7.2	-	ancient	active
Junction of Hymy 101 % Otter Crest Loop 171 10.7 -		Park ranger station						
5-15-11 Arimuth 140°, .9km from the entrance of Severly Beach State Park 134 31 .3 slump recent active 5-15-12 Along Hyry 101, .32km south of July Beach State Park entrance 10 24 .2 slump mistoric active 5-15-12 Along Hyry 101, .37km south of Beach State Park entrance 110 24 .2 slump mistoric active 5-15-14 Along Hyry 101, .57km south of Beach State Park entrance 146 31 .3 slump historic active 5-15-15 Along Hyry 101, .57km south of Park entrance 24h 73 1.1 slump historic active 5-15-15 Along Hyry 101, .1km south of Park entrance 8 85 .7 slump historic active 5-15-15 Along Hyry 101, .1km south of Park entrance 98 85 .7 slump historic active 5-15-16 Along Hyry 101, .1km south of Park entrance 98 85 .7 slump historic active 5-14-01 17,6m south of Nade Creek mouth Park entrance 85 .7 slump historic active 5-14-03 Adjacent to slide 5-14-02 (south) 500 232 5.8 - ancient activ	5-15-10	Along Hgwy 101, 1km south of south	122	24	.2	slump	historic	active
### S-15-12 Along Hgwy 101, 366m south of 134 31 .3 slump recent active Deverly Reach State Park entrance 5-15-12 Along Hgwy 101, 736m south of 110 24 .2 slump historic active Deverly Beach State Park entrance 5-15-14 Along Hgwy 101, .67km south of 146 31 .3 slump historic active Deverly Beach State Park entrance 5-15-15 Along Hgwy 101, .67km south of 146 31 .3 slump historic active Deverly Reach State Park entrance 5-15-15 Along Hgwy 101, 1.1km south of 244 73 1.1 slump historic active Deverly Beach State Park entrance 5-14-01 17.6m south of Wide Creek mouth 98 85 .7 slump recent active Nade and Coal Creeks 90 85 .7 slump recent active Nade and Coal Creeks 90 85 .7 slump recent active Nade and Coal Creeks 90 90 17.6 - ancient active Silies 5-14-02 (south) 500 232 6.8 - ancient active of Hgwy 101 5-14-05 244m N3 of Coal Creek & Hgwy 101 268 37 .7 - ancient stable of Hgwy 101 5-14-05 244m N3 of Coal Creek & Hgwy 101 268 37 .7 - sncient stable 5-14-06 Along Coast, 1.2km sof Coal Creek 3 37 .4 slump historic active Silies 5-14-08 Along coast, 122m S of Coal Creek 35 12 .1 acons recent active slide 5-14-08 Along Coast, 1.2km S of Coal Creek 85 12 slump historic stable Hgwy 101 5-14-10 356m S of Moolack Creek mouth 85 24 .2 slump historic stable Mgwy 101 5-14-11 Directly E of landfill, N of 793 177 9.0 - ancient stable Moolack Beach		junction of Hgwy 101 & Otter Crest	Loop				•	
5-15-12 Along Hgwy 101, 366m south of 134 31 .3 slump recent active 2-verly Reach State Park entrance 5-15-13 Along Hgwy 101, 73km south of 110 24 .2 slump historic active 2-verly Reach State Park entrance 5-15-14 Along Hgwy 101, 1.87km south of 146 31 .3 slump historic active 2-verly Reach State Park entrance 5-15-15 Along Hgwy 101, 1.1km south of 244 73 1.1 slump historic active 2-verly Reach State Park entrance 5-15-15 Along Hgwy 101, 1.1km south of 244 73 1.1 slump historic active 2-verly Reach State Park entrance 5-14-01 17.6m south of Wade Greek mouth 98 85 .7 slump recent active 2-14-02 .85 km east of Hgwy 101, between 610 110 4.3 - ancient active 3-14-02 .85 km east of Hgwy 101, between 610 110 4.3 - ancient active 3-14-03 Adjacent to slide 5-14-02 (south) 500 232 5.8 - ancient active 3-14-04 Along Coal Greek, 1.8km east 403 500 17.6 - ancient active 3-14-04 Along Coal Greek, 1.8km east 403 500 17.6 - ancient active 3-14-05 244m NE of Coal Greek & Hgwy 101 268 37 .7 - ancient stable 5-14-05 244m NE of Coal Greek & Hgwy 101 268 37 .7 - ancient stable 5-14-05 Along Hgwy 101, 122m S of Coal Greek183 37 .4 slump historic active 5-14-09 Just N of Moolack Greek mouth 85 12 .1 active 5-14-09 Just N of Moolack Greek mouth 85 24 .2 slump historic stable 3-14-09 Just N of Moolack Greek mouth 85 24 .2 slump historic stable 3-14-10 36km S of Moolack Greek mouth 85 24 .2 slump ancient potential 48wy 101 5-14-11 Directly E of landfill, N of 793 177 9.0 - ancient stable 5-14-12 Along coast, 1.78km S of Moolack 49 24 .1 debris historic stable 5-14-13 Along coast, 1.1km S of Moolack 153 49 .5 debris historic stable 5-14-14 Along coast, 1.3km S of Moolack 153 49 .5 debris historic stable 5-14-15 Along coast, 305m S of Johnoner 122 37 .3 debris historic potential 5-14-15 Along coast, 1.0km S of Moolack 153 49 .5 debris historic potential 5-14-15 Along coast, 1.0km S of Moolack 153 49 .5 debris historic potential	5-15-11	Azimuth 140°, .9km from the	1159	171	10.7	-	ancient	active
Beverly Reach State Park entrance S-15-12 Along Hawy 101, 173km south of 110 24 .2 slump historic active Beverly Beach State Park entrance S-15-14 Along Hawy 101, .67km south of 146 31 .3 slump historic active Beverly Beach State Park entrance S-15-15 Along Hawy 101, 1.1km south of 244 73 1.1 slump historic active Park Beverly Beach State Park entrance S-14-01 17.6m south of Wade Creek mouth 98 85 .7 slump recent active S-14-02 .55km seast of Hawy 101, between 510 110 4.3 -		entrance of Beverly Beach State Par	k					
5-15-13 Along Egwy 101, .73km south of 110 24 .2 slump historic active Beverly Beach State Park entrance 5-15-14 Along Egwy 101, .67km south of 146 31 .3 slump historic active Beverly Beach State Park entrance 5-15-15 Along Egwy 101, 1.1km south of 244 73 1.1 slump historic active Beverly Beach State Park entrance 5-15-15 Along Egwy 101, 1.1km south of 244 73 1.1 slump historic active Beverly Beach State Park entrance 5-14-01 7.6m south of Wade Creek mouth 98 85 .7 slump recent active Wade and Coal Creeks 100 110 4.3 - ancient active Wade and Coal Creeks 100 110 4.3 - ancient active Beverly 4 Along Coal Creeks 100 110 4.3 - ancient active Wade and Coal Creeks 100 110 4.3 - ancient active Wade and Coal Creeks 100 500 232 6.8 - ancient active Wade and Coal Creeks 100 500 17.6 - ancient active Wade and Coal Creeks 100 500 17.6 - ancient active Wade and Coal Creek Egwy 101 500 17.6 - ancient active Wade and Coal Creek Egwy 101 268 37 .7 - ancient active Silve Of Egwy 101 122m S of Coal Creeks 3 37 .4 slump historic active Wade Along Egwy 101, 122m S of Coal Creeks 3 37 .4 slump historic active Silve Silve Wade Along Coast, 122m S of Coal Creek 85 12 .1 deoris recent active Silve Highly 101 122m S of Moolack Creek mouth 85 24 .2 slump historic stable Highly 101 121m Sof Moolack Creek, along 744 232 9.5 slump ancient potential Highly 101 12 Moolack Beach 11 Moolack Beach 11 Moolack Beach 11 Moolack Beach 11 Moolack Beach 12 Moolack Beach 12 Moolack Beach 13 Moolack Beach 14 Moolack Beach 15 Moolack	5 -15-1 2	Along Hgwy 101, 366m south of	1 34	31	• 3	slump	recent	active
Severly Reach State Park entrance Severly Reach Reach Severly Reach State Park entrance Severly Reach Se		Beverly Beach State Park entrance						
5-15-14 Along Hawy 101, .67km south of 146 31 .3 slump historic active Beverly Beach State Park entrance 5-15-15 Along Hawy 101, 1.1km south of 244 73 1.1 slump historic active Beverly Beach State Park entrance 5-14-01 17.6m south of Wade Creek mouth 98 85 .7 slump recent active Made and Coal Creeks 5-14-02 (south) 500 232 6.8 - ancient active Made and Coal Creeks 5-14-02 (south) 500 232 6.8 - ancient active 5-14-04 Along Coal Creek, 1.9km east 403 500 17.6 - ancient stable of Hawy 101 - ancient stable 5-14-05 Along Hayy 101, 122n S of Coal Creeke3 37 .7 - sncient stable 5-14-06 Along Hayy 101, 122n S of Coal Creeke3 37 .7 - sncient stable 5-14-08 Along Coast, 122m S of Coal Creeke 85 12 1 acors 5-14-09 Just N of Moolack Creek mouth 85 24 .2 slump historic potential 5-14-09 Just N of Moolack Creek, along 744 232 9.5 slump ancient potential Hayy 101 5-14-10 Jinectly E of landfill, N or 793 177 9.0 - ancient stable Moolack Beach 5-14-12 Along coast, 1.3km S of Moolack 49 24 .1 debris historic stable 5-14-13 Along coast, 1.3km S of Moolack 49 24 .1 debris historic stable 5-14-14 Along coast, 1.3km S of Moolack 49 24 .1 debris historic stable 5-14-15 Along coast, 305m S of Boolack 49 24 .1 debris historic stable 5-14-15 Along coast, 1.3km S of Moolack 153 49 .5 debris historic stable - Creek 5-14-15 Along coast, 1.3km S of Moolack 153 49 .5 debris historic stable - Creek 5-14-15 Along coast, 1.2km N of Yaquine 96 24 .3 debris historic potential	5-15-13	Along Hawy 101, .73km south of	110	314	.2	alump.	historic	active
### Sevenly Reach State Park entrance 5-15-15 Along Hawy 101, 1.1km south of 244 73 1.1 slump historic active Peverly Beach State Park entrance 5-14-01 17.6m south of Wade Creek mouth 98 85 .7 slump recent active ***Made and Coal Creeks** 5-14-02 Adjacent to slide 5-14-02 (south) 500 232 6.8 - ancient active ***Wade and Coal Creeks** 5-14-03 Adjacent to slide 5-14-02 (south) 500 232 6.8 - ancient active ***Of Hawy 101		-						
5-15-15 Along Hawy 101, 1.1km south of 244 73 1.1 slump historic active severly Beach State Park entrance 5-14-01 17.6m south of Nade Creek mouth 98 85 .7 slump recent active made and Coal Creek mouth 98 85 .7 slump recent active made and Coal Creeks 5-14-02 .85 km east of Hawy 101, between 510 110 4.3 - ancient active Made and Coal Creeks 5-14-03 Adjacent to slide 5-14-02 (south) 500 232 6.8 - ancient active made and Coal Creeks 5-14-04 Along Coal Creek, 1.5km east 403 500 17.6 - ancient stable of Hawy 101 5-14-05 244m N3 of Coal Creek & Hawy 101 268 37 .7 - encient stable filter of Hawy 101, 220m N of Coal Creek23 49 1.3 slump historic active slide 5-14-07 Along Hawy 101, 122m S of Coal Creek 85 12 .1 slump historic potential recent active slide 5-14-08 Along coast, 122m S of Coal Creek 85 12 .1 slump historic stable filter of Hawy 101 5-14-10 366m S of Moolack Creek mouth 85 24 .2 slump historic stable highy 101 5-14-11 Directly E of landfill, N of 793 177 9.0 - ancient stable Moolack Beach 5-14-12 Along coast, .73km S of Moolack 244 49 .7 slump ancient potential Creek 5-14-13 Along coast, .11km S of Moolack 153 49 .7 slump ancient potential Creek 5-14-14 Along coast, 1.3km S of Moolack 153 49 .5 debris historic stable Creek 5-14-15 Along coast, .1.3km S of Moolack 153 49 .5 debris historic potential Creek 5-14-15 Along coast, .1.3km S of Moolack 153 49 .5 debris historic potential Creek Mouth 5-13-01 Along coast, .1.2km N of Yaquina 96 24 .3 debris historic potential	5-15-14		146	31	•3	slump	historic	active
### Peverly Beach State Park entrance 5-14-01 17.6m south of Wade Creek mouth 98 85 .7 slump recent active #### Wade and Coal Creeks 5-14-02 .85 km east of Hgwy 101, between 610 110 4.3 - ancient active ### Wade and Coal Creeks 5-14-03 Adjacent to slide 5-14-02 (south) 500 232 6.8 - ancient active ### State		Beverly Beach State Park entrance						
### Peverly Beach State Park entrance 5-14-01 17.6m south of Wade Creek mouth 98 85 .7 slump recent active #### Wade and Coal Creeks 5-14-02 .85 km east of Hgwy 101, between 610 110 4.3 - ancient active ### Wade and Coal Creeks 5-14-03 Adjacent to slide 5-14-02 (south) 500 232 6.8 - ancient active ### State			21.1.	72	1 1	alumn	historic	active
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Rd., Azimuth 206° 610m	6 - 08-01-		1.03	1 3/1	3.6		ancient	stable
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	6-08-05	•	h 27	<u> 1,15</u>	15 B		ancient	stable

		.6km S of Beaver Greek Rd. on	360	281	7.6	-	ancient	stable
		Hgwy 101, Azimuth 150° 512m Along coast, .5km N of Seal Rock	179	31	•5	debris	historic	active
		State Park				slide		
		N of Hill Creek, at Seal Rock State Park	195	37	•5	debr is slide	recent	active
		Along coast, .6km S of Seal	220	55	•7	debris slide	historic	stable
		Rock Rd.	171	·55	.6	debris	historic	potential
	6-07-02	Along coast, .8km S of Seal	1;1		,	slide		
		Rock Rd.	E4 2	ąę	3.6	planar	historic	active
		Mong coast, N end of Sandpiper Vg.		-	.3	• · · · · · · · · · · · · · · · · · · ·	uncient	stable
		- TUNA OTT 11210 101 11 11 11 11 11 11 11 11 11 11 11	159	21 ₁ 1.	2.8	_	ancient	
	6-06-03	Along M side of Bay View Dr. 2.7km from Hgwy 101, Alsea Bay	610	73				
	5-05-04	inland of slide 6-06-03	510	500	27.5	-	ancient	
		East side of Lint Slough, Waldport	403	158	4.5	-	ancient	
		East side of Lint Slough, Waldport	500	427	17.9	-	ancient	
		Retween Big Greek and Blodgett Rd. 1km east of Hgwy 101	466	281	10.4	-	ancient	stable
	5-03-02	Between the S fork of Big Greek &	500	281	10.7	-	ancient	stable
	6-03 - 03	Vingle Oreek, 1.2km E of Hgwy 101 Retween the S fork of Big Greek &	610	244	8.5	-	ancient	stable
	5-02-01	Vingle Greek, 1.5km E of Hgwy 101 South of Vingle Greek, 1.4km	488	500	21.0	-	ancient	stable
	4_02_02	inland of Howy 101 South of Vingie Greek, .9km	366	207	5.5	-	ancient	stable
		inland of Hyur 101 Along coast, S of Starr Creek 244n	779	19	.1	debris	histori	active
	5-02-03	Along coast, 3 of Starr Greek epp.	•• · · · · · · · · · · · · · · · · · ·	,. <u></u>		slide		
	7-02-04	Along N side of Yachats River Rd., 1km off Hgwy 101	708	207	11.0	-	ancient	stable
	7-02-05	Along N side of Machats River Rd., .6km off Hgwy 101	244	342	7.9	-	ancient	stable
:	7-02-05	Along the Yachats River, 427m from Hgwy 101	21,14	61	•7	slump	historic	potential
	7-02-07	Along coast, 427m N of Yachets R.	183	49	.5	deoris slide	historic	potential
	7-02-08	Along coast, 183m N of Yachats R.	85	12	.3	debris slide	historic	potential
		and the second second	640	1. 20	23.4	-	ancient	stahle
		Along N side of Yachats River Rd., 1.6km from Hgwy 101	510	439				
	7-02-10	Along N side of Yachats River Rd. 2.2km from Hgwy 101	915	366	26.5	-	ancient	stable
	7-01-01	.Skm S of Yachats River along Hgwy 101, east side	512	195	6. 8	-	ancient	stable
	7-01-02	488m W of slide 7-01-01	525	214	8.3	-	ancient	stable
	•	460m W of slide 7-01-02	268	220	4.5	-	ancient	stable
		and the control of th	256	122	1.7	debris		potential
	<i>'</i>	122m S of slide 7-01-03				flow		
	7-01-05	East end of Cape Perpetua Campgrounds	171	61	9.1	debris flow		potential
	7-01-06	Above Devils Churn, N of Hgwy 101	329	110	3.0	debris flow	historic	stable
	7-01-07	Above Devils Churn, N of Hywy 101	28 1	37	1.1	debris slide	historic	stable

APPENDIX B

Map of landslide locations in the Lincoln County study area.