



Artists' conception of apartment complex, superimposed onto runout of path-7 on CBJ's 2013 LiDAR point cloud.

20231220 Runout apartments

In the wake of Wrangell's fatal landslide, and this summer's outburst flood on Wooch Eel' 6ox'u héen, *river that's murky together* (Mendenhall) it's been surprising to hear of proposals for a 72-unit apartment complex on the runout cone of a mapped and fairly well recognised landslide path in city-center. Hopefully, this collection of aerial imagery and commentary, sprawling across the site's temporal and spatial context, will help Assembly and CBJ staff reconsider risk factors.

I have no training or professional background in any aspect of mass wasting risk assessment; only the ability to synthesize from related disciplines, and to storytell with maps. As with my previous 'bare-earth' mapping of the 20220926 'flying-tree' landslide in path-3, 200 yards NW of this proposed development, LiDAR for path-7 is sobering. Historical cartography is equally discomfoting. If path-7 is a bowling lane, the Trucano lot is its center pin.

In 2013, CBJ's farsighted GIS staff commissioned the first broad-scale LiDAR dataset in Lingit Aani. LiDAR has subsequently revolutionized our

ability to measure, visualize and understand landscapes. ¹ I use GIS every day, but only as a '*painting-&-storytelling*' tool. Others better qualified use it for calculation and prediction—even modeling, for example, the forces of lateral and terminal wind blast.

After catastrophic events, which seem to be accelerating throughout Lingit Aani, LiDAR allows us—especially when 'before-&-after' missions are flown—to quickly investigate the biotic (point cloud) & abiotic (bare earth) contexts. Since 2020, I've applied these techniques to aftermaths

¹ As a member of Bosworth Botanical's Juneau-Wetlands team in 2014-15, I was part of the first field crew to make intensive use of CBJ's 2013 LiDAR and orthophotography. Over the ensuing decade I used these resources for more than a hundred bio-geo-cultural educational and research projects.

Two pending deliveries from summer 2023 will make priceless additions to this raster library. Quinn Tracy tells me CBJ orthophotography is due ~April 2024, and USGS LiDAR is expected around July. On receipt of 2023 LiDAR, 'minus tools' can compare surface elevations with 2013, revealing subtleties of erosion and deposition in slide paths. This could show soil movements during the past decade otherwise undetectable through conifer canopies.

of 4 newsworthy events. Two were tragic, while the other 2 were 'near-misses' in terms of human life. All had expensive and traumatic consequences:

- [20201202 BRLS \(Beach Road Landslide\), Jilkoot Aani](#). Initially mapped for Lynn Canal Conservation and Takshunuk Watershed Council; expanded analysis for UAS Geo393 course, fall, 2022.
- [20220926 Gastineau Ave landslide](#). Historical series and 'cookie-count' for UAS landforms class.
- [20230805 Jökulhlaup on Wooch Eel' 6ox'u héen](#). Mapping and photo-essay for friends along the river.
- [20231120 Landslide on Zimovia Highway \[noTN?\]](#) Pageflippers prepared for colleagues in the avalanche-&-mass-wasting community. *

For local landform delineations, I've long used a manual tracing from RD Miller's masterful 1975 surficial geology map—finely-tuned by adjusting his polygon boundaries to features on CBJ's 2013 terrain model on a case-by-case basis. Zooming in to downtown colluvial slopes, I 'wove-in' the conceptual structure from Tetrat-ech's 2022 "*initiation*" and "*runout zones*." As noted in last fall's analysis of the Gastineau-Avenue landslide, I disagree with some details of their slide-path placement, and have adjusted my start & ending zones accordingly. Mapping future mudslides—as far as I can tell from over here in the bleachers—is more art than science.

Path numbers on the following hillshade map are mine, and don't correspond to other systems. Path-8 is where the 1936 release happened, initiating at the AJ railway bench. Path-7 aims directly at the proposed apartments.

As a naturalist and lover of Áak'w & T'aakú Aani, I consider high density housing to be the most respectful way for two-leggeds to 'make room' for our wild



and dogs. (She snickers at humans on anything $>40^\circ$.) In path-3, only the flying tree's launching cliff exceeded 55° .

Comparing lower reaches of path-3 to path-7 on these transects, there's a greater distance of moderate slope on path-7, only $\sim 33^\circ$, where smallish debris flows could come to rest before reaching the proposed apartments. ² That's small comfort in view of Wrangell's mudslide, which ran the last 500 yards at only $\sim 10^\circ$, or the Beach Road slide (BRLS) in Jilkoot Aani, at $\sim 10^\circ$ for the final 300 yards. Crest of the Wrangell slide was at about 1,400 feet, versus 860 feet for BRLS. Does that partially explain the lengthier shallow-slope carry at Wrangell? ³

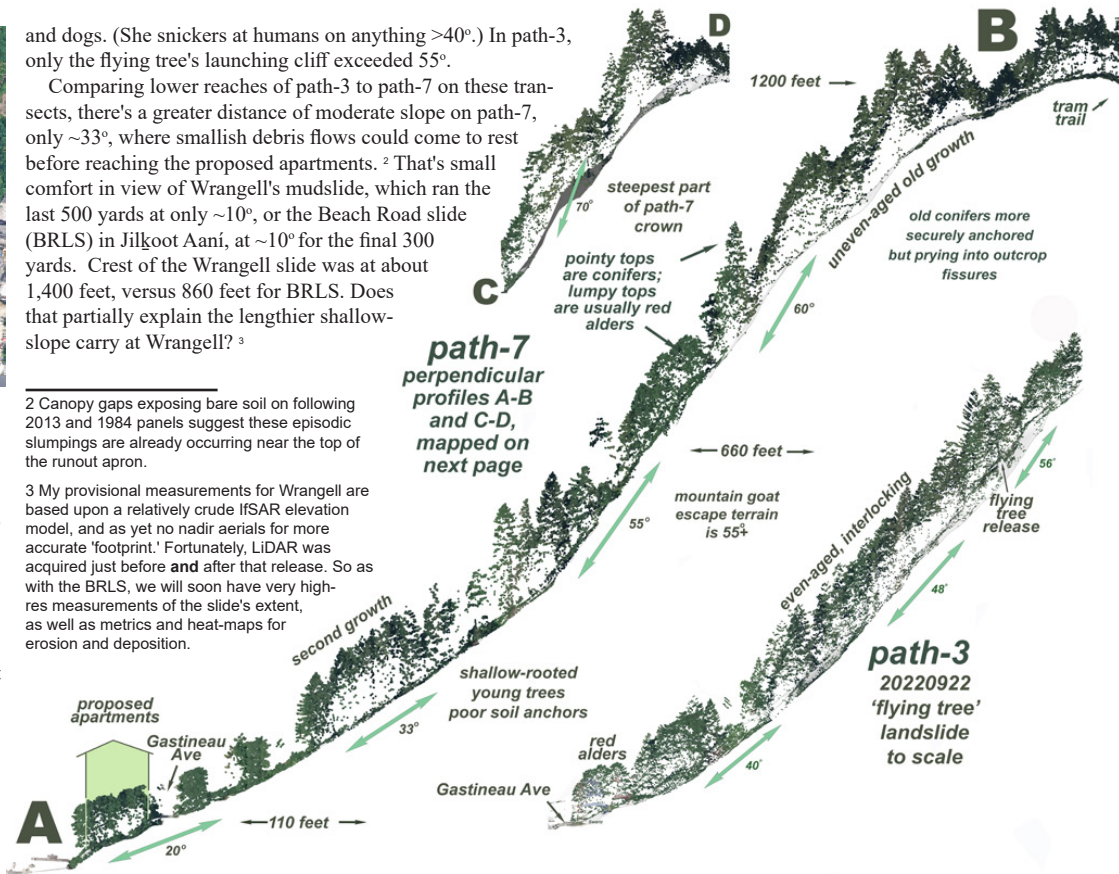
neighbors, and to enhance our own quality of life. I commend the City for promoting this approach, and would happily assist in the search for safer and environmentally rational locations.

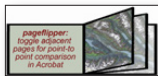
My previous historical series for last autumn's house-crunching debris flow in path-3 included a point-cloud profile, carried over here at scale, for comparison with the much higher and steeper path-7. Profile A-B runs SW to NE from proposed apartments up and over onto Wooshkeenax Deiyyi, trails above each other (Mt R-word trail).

Profile A-B doesn't show the steepest part of path-7's headwall, so I've added north-south profile C-D, with almost sheer faces up to 70° degrees. For context, the Dept of Fish & Game considers anything $>55^\circ$ to be terrain where Jánwu, *mtn goat*, feels safe from wolves, bears

² Canopy gaps exposing bare soil on following 2013 and 1984 panels suggest these episodic slumpings are already occurring near the top of the runout apron.

³ My provisional measurements for Wrangell are based upon a relatively crude IFSAR elevation model, and as yet no nadir aeriels for more accurate 'footprint.' Fortunately, LiDAR was acquired just before **and** after that release. So as with the BRLS, we will soon have very high-res measurements of the slide's extent, as well as metrics and heat-maps for erosion and deposition.

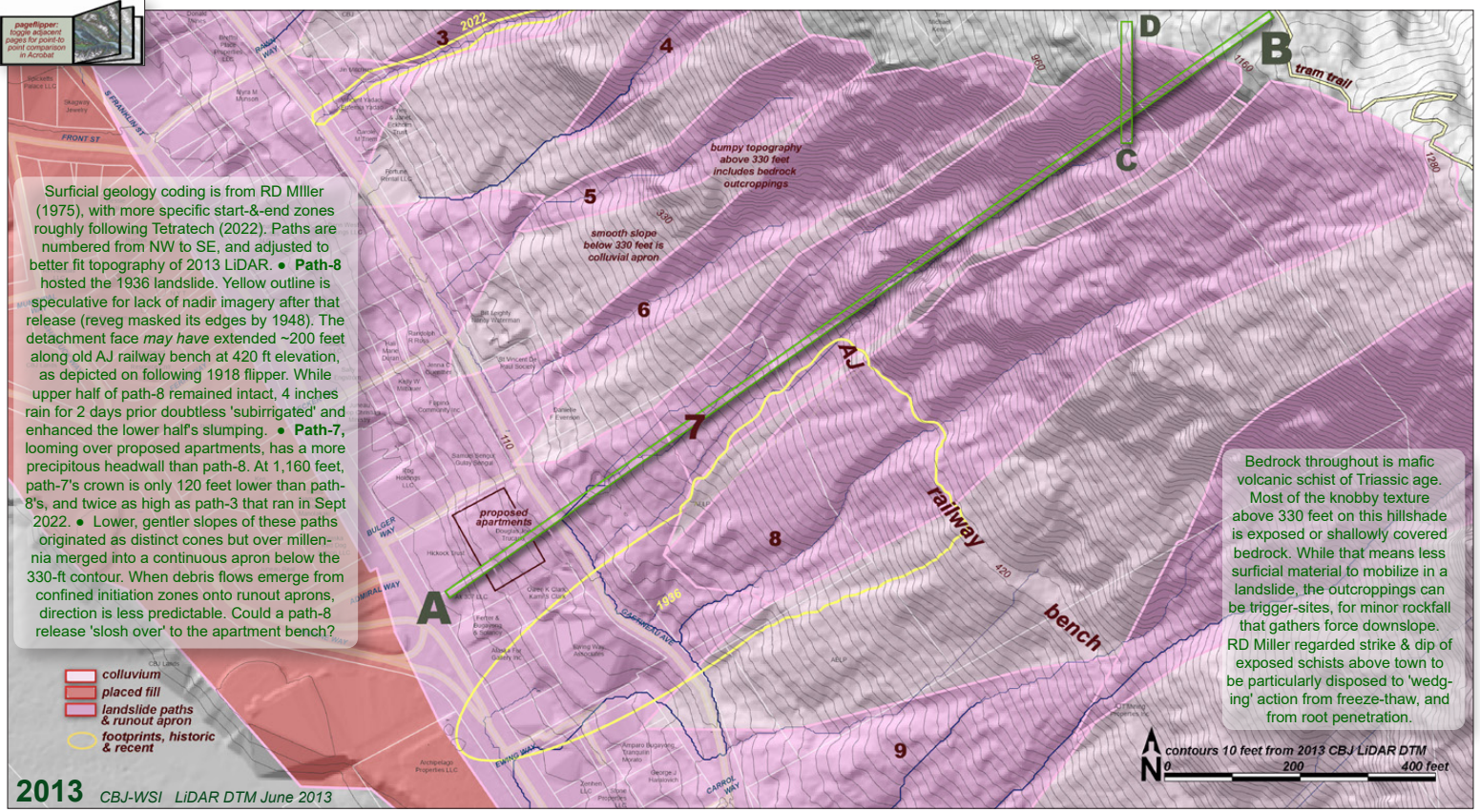




Surficial geology coding is from RD Miller (1975), with more specific start-&-end zones roughly following Tetratich (2022). Paths are numbered from NW to SE, and adjusted to better fit topography of 2013 LiDAR. • **Path-8** hosted the 1936 landslide. Yellow outline is speculative for lack of nadir imagery after that release (reveg masked its edges by 1948). The detachment face *may have* extended ~200 feet along old AJ railway bench at 420 ft elevation, as depicted on following 1918 flipper. While upper half of path-8 remained intact, 4 inches rain for 2 days prior doubtless 'subirrigated' and enhanced the lower half's slumping. • **Path-7**, looming over proposed apartments, has a more precipitous headwall than path-8. At 1,160 feet, path-7's crown is only 120 feet lower than path-8's, and twice as high as path-3 that ran in Sept 2022. • Lower, gentler slopes of these paths originated as distinct cones but over millenia merged into a continuous apron below the 330-ft contour. When debris flows emerge from confined initiation zones onto runout aprons, direction is less predictable. Could a path-8 release 'slosh over' to the apartment bench?

- colluvium
- placed fill
- landslide paths & runout apron
- footprints, historic & recent

2013 CBJ-WSI LiDAR DTM June 2013



bumpy topography above 330 feet includes bedrock outcroppings

smooth slope below 330 feet is colluvial apron

Bedrock throughout is mafic volcanic schist of Triassic age. Most of the knobby texture above 330 feet on this hillshade is exposed or shallowly covered bedrock. While that means less surficial material to mobilize in a landslide, the outcroppings can be trigger-sites, for minor rockfall that gathers force downslope. RD Miller regarded strike & dip of exposed schists above town to be particularly disposed to 'wedging' action from freeze-thaw, and from root penetration.

contours 10 feet from 2013 CBJ LiDAR DTM
 0 200 400 feet

Pageflippertoggle adjacent pages for point-to-point comparison in Acrobat



CBU-WSI orthos

2013

Color infrared distinguishes paler deciduous from darker conifers. Brightest pink line is from repeat disturbance in powerline corridor.

- Toggle back against previous hillshade in Acrobat for relationship of canopy texture to terrain. Largest crowns are on narrow buttress separating headwalls of paths 7&8.
- Compare opening at asterisk to following 1984 aerial, and to preceding hillshade. Raw surface is concerning.

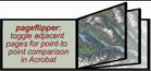


USFS unrectified

1984

exposed ravine?

Toggle against previous 2013 ortho, we swap today's parking garage for old cold storage building, touched by toe of 1936 mudslide. • In center are 2 raw looking openings in path-7, directly upslope from proposed apartments. Although they closed-in a little by 2013, this ravine must run a bit in every gullywasher. It should be walked to see if that reach is eroding or depositing.



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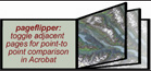
herbaceous
& sparse scrub
alder? compare
1984

barrens

Toggle against next 1926 aerial, this oval-shaped barrens is smaller. But for several years after 1936, it probably spanned the upper, flattish rail-bench end of our yellow 'bullet'. A quarter century of succession (1936-to-62) failed to cover the debris lobe with brush. • Ultra slow healing on mobile colluvial slopes should be considered when we assess risk above homes & roads. Lower half of the Wrangell slide was clearcut to ~800 feet in 1965. AJ miners did much the same, albeit earlier, above J-town. • Old-growth conifers with massive sprawling roots, interlocked with those of younger generations, are unthanked guardians of our schools & businesses. Think of that, next time you hug one.

USFS unrectified

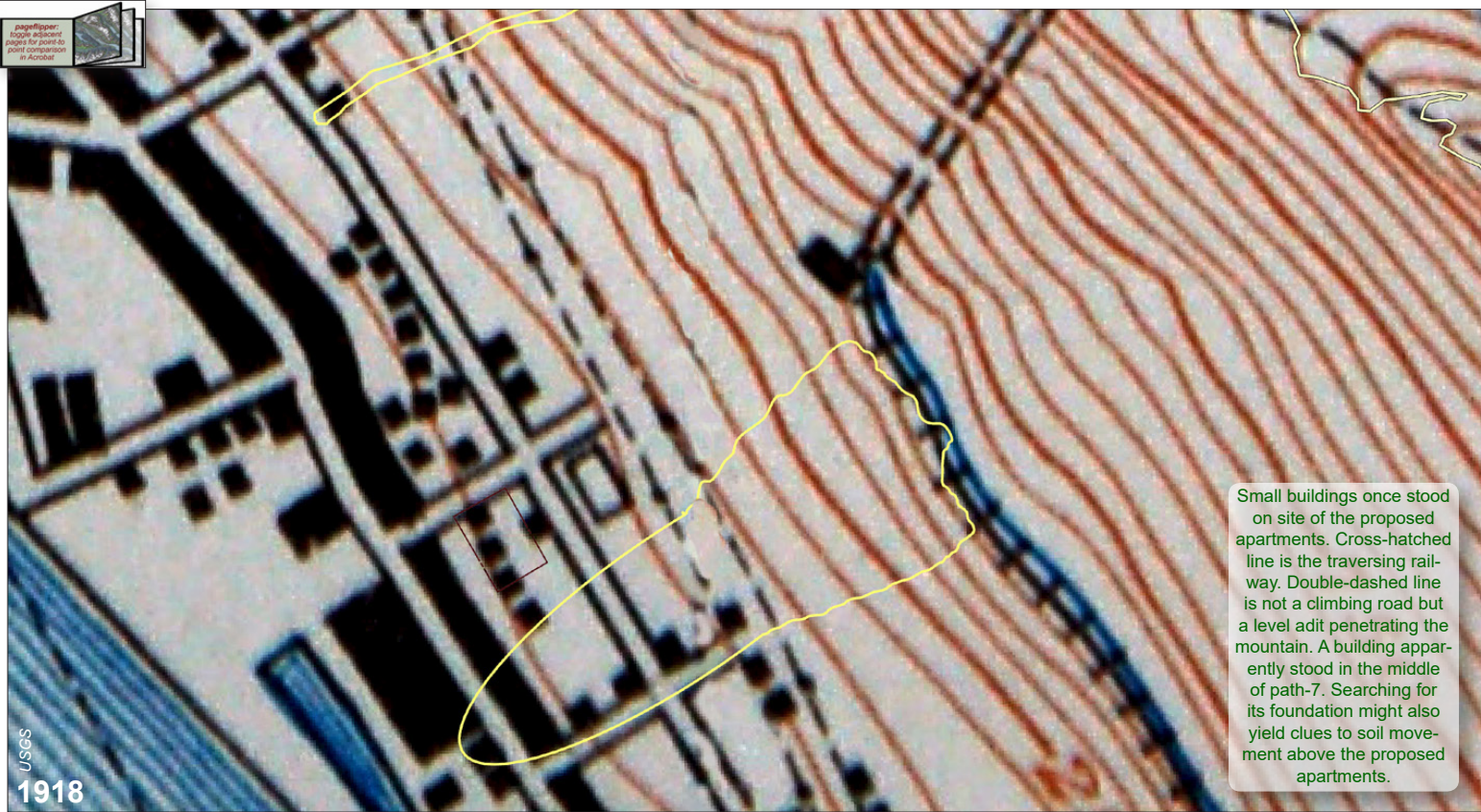
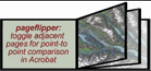
1962



USFS unrectified

1926

Early aerials have a lot of slope-induced distortion, and my georeferencing here required pretty severe 'rubbersheeting.' Barrens below the railway were known to be unstable, and even displayed a tension crack just before the fatal 1936 release.



USGS

1918

Small buildings once stood on site of the proposed apartments. Cross-hatched line is the traversing railway. Double-dashed line is not a climbing road but a level adit penetrating the mountain. A building apparently stood in the middle of path-7. Searching for its foundation might also yield clues to soil movement above the proposed apartments.