U.S. Department of the Interior U.S. Geological Survey Photograph of a pair of stacked colluvial -1 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 wedges (W1 and W2 of West, 1993 and 1994) exposed in original 1983 Lester Ranch trench, located about 30 meters north of the 2016 trench. A vertical-to-overturned normal fault juxtaposes colluvium against Wasatch Formation (Tw) bedrock. Red Scarp colluvium, undifferentiated—Includes — Contact—Solid where accurately located, arrows bracket apparent shears (marked material remobilized in debris slide dashed where approximately located with pink nails) that cut the upper colluvial — — Internal contact—Accurately located wedge (correlative with colluvial debris 4al Alluvium (Pleistocene) unit 2csd in 2016 trench) and represent ------ Internal contact—Approximately located possible evidence of the third, younger Tw Wasatch Formation (Eocene) faulting event identified in our study. The Base of soil A horizon thick, organic-rich deposit at the toe of the **Fault**—Solid where accurately located, slope may be correlative with the debrisslide deposit (1ds) in the 2016 trench. Red dashed where approximately located flags on string are 1 meter apart. ———— Slide plane—Solid where accurately located, dashed where approximately located. Arrows indicate direction of movement of slide mass Photograph of a camera mounted on a Helikite, a tethered helium-kite -1 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 Simplfied log of the south wall of Lester Ranch trench colored to differentiate scarp-related deposits (csu) from Pleistocene alluvium (4al) and bedrock (Tw). 380–320 cal. yr B.P. (29%) Photograph of scarp at 2016 Lester Ranch Orthophotomosaic (left) and digital surface model (DSM, 0.25-m resolution; right) of the Lester Ranch trench site before trench site created using structure-from-motion (SfM) photogrammetry and balloon-based imagery. Yellow dots on orthophotomosaic along the south side of the 2016 trench are global positioning system (GPS) points used to obtain a profile of the scarp (shown at lower left). 0 25 50 75 100 FEET Perspective view of the Lester Ranch trench site illustrating the method of collecting photographs from a balloon-mounted camera for use in structure-from-motion photogrammetry. From changes in camera position (T1-T3) and matching of ground features in overlapping photographs (yellow and red dots) depth is calculated. Lines of site are represented by the black lines. From the depth data, a shaded relief is created—plotted here DESCRIPTION OF TRENCH UNITS EXPLANATION OF TRENCH SYMBOLS 1ds Debris-slide deposit (earthquake event 1 evidence?)—Semi-coherent mass of scarp Krotovina—Queried where uncertain colluvium (2csw) moved downslope from concave head scarp at meter 12.75 Colluvial block containing organic matter 2csw Scarp colluvium, mainly wash facies (earthquake event 2 evidence)—Poorly stratified and moderately sorted silty clay loam with coarse sand; locally gravelly. **Contact**—Solid where accurately located, dashed where approximately located, Grades laterally into basin deposits (2/3bd) at meter 18–19 queried where uncertain 2csd Scarp colluvium, debris facies (earthquake event 2 evidence)—Unstratified, matrix-supported and poorly sorted gravelly silt loam with coarse sand; uneven Soil horizon boundary distribution of carbonate (detrital origin); contains darker blocks, possibly derived Base of A horizon developed in Pleistocene alluvium (4al)—Queried where from the A horizon of a since-eroded soil developed in the upthrown block east of fault zone F2 3cs Scarp colluvium (earthquake event 3 evidence)—Poorly stratified silty clay loam, Top of buried A horizon gravelly along base and at east end (meter 14–15); uneven distribution of Base of buried weathering zone (bleached A horizon?)—Developed in the carbonate (detrital origin); grades laterally into basin deposits (2/3bd) at meter scarp colluvium (3cs) and Pleistocene alluvium (4al) between faults 2/3bd Basin deposits—Poorly stratified silty clay loam. Grades laterally into scarp Base of reddened (B?) horizon—Developed in Pleistocene alluvium (4al) on colluvium (2csw, 3cs) at meter 17–19 downthrown side of fault F3; sharpness of contact with carbonate-rich zone 4al Alluvium (Pleistocene)—Deposited on erosional surface cut on underlying bedrock; and lack of pedogenic structure may be an effect of shallow ground water poorly stratified, mostly clast-supported, poorly to moderately sorted, very to Slide plane—Solid where accurately located, dashed where approximately extremely gravelly loamy medium to coarse sand, slightly indurated moderate (stage II+) carbonate morphology located, queried where uncertain. Arrow indicates direction of movement of the sliding unit (1ds) 4alb Basal facies—Base of alluvium, where it is less gravelly and less carbonate rich **EXPLANATION** Light-colored zone along slide plane than rest of unit (weak stage 1 carbonate morphology); siltier texture at meter 6–9 and meter 11.5–13.5, possibly reflecting incorporation of eroded unit Tw, also Elevation, in meters (m) extensively bioturbated; visible inclusions of Tw at meter 2–3 and 12.5–13.5 Tw Wasatch Formation (Eocene)—Variegated (yellow, tan, red, and orange) very Fault with significant displacement—Numbered sequentially from east to fine-grained sandstone, siltstone, and claystone with local gravelly lenses; west. Arrows indicate direction of relative movement. Solid where accurately generally friable, locally indurated; extensively fractured at meter 12.5–13.5 located, dashed where approximately located **Fracture or minor fault**—Solid where accurately located, dashed where approximately located, queried where uncertain Distance, in meters (m) **Dated sample**—All ages are 2-sigma ranges rounded to nearest decade; GPS point radiocarbon calibration from Stuiver and others (2017). Probabilities are VERTICAL EXAGGERATION ×2 shown for multimodal radiocarbon age ranges Radiocarbon-dated charcoal fragments with calibrated age—Fragments Profile of scarp along the south side of the Lester Ranch trench. Yellow dots show GPS points; see orthophotomosaic to right for locations. Vertical separation of the ground surface here is ~6 m. Note south-looking perspective. 0 10 20 30 40 METERS Grid-node tag placed during trenching 0 25 50 75 100 FEET **Trench grid**—Horizontal and vertical distances denoted in meters (arbitrary

Lester Ranch Trench—South Wall Photomosaic and Site Geomorphology, Bear River Fault Zone, Wyoming

Editing and cartographic design by Monica Erdman

reference frame). Interval is 1 meter