

**ALBERTA TRANSPORTATION  
GEOHAZARD ASSESSMENT PROGRAM  
PEACE REGION – PEACE-HIGH LEVEL  
2020 INSPECTION**



<b>Site Number</b>	<b>Location</b>	<b>Name</b>	<b>Hwy</b>	<b>km</b>
PH032	Judah Hill	Makeout Landslide	744:04	57.924
<b>Legal Description</b>		<b>UTM Co-ordinates</b>		
NE¼ 20-083-21 W5M		11U E 483171	N 6229947	

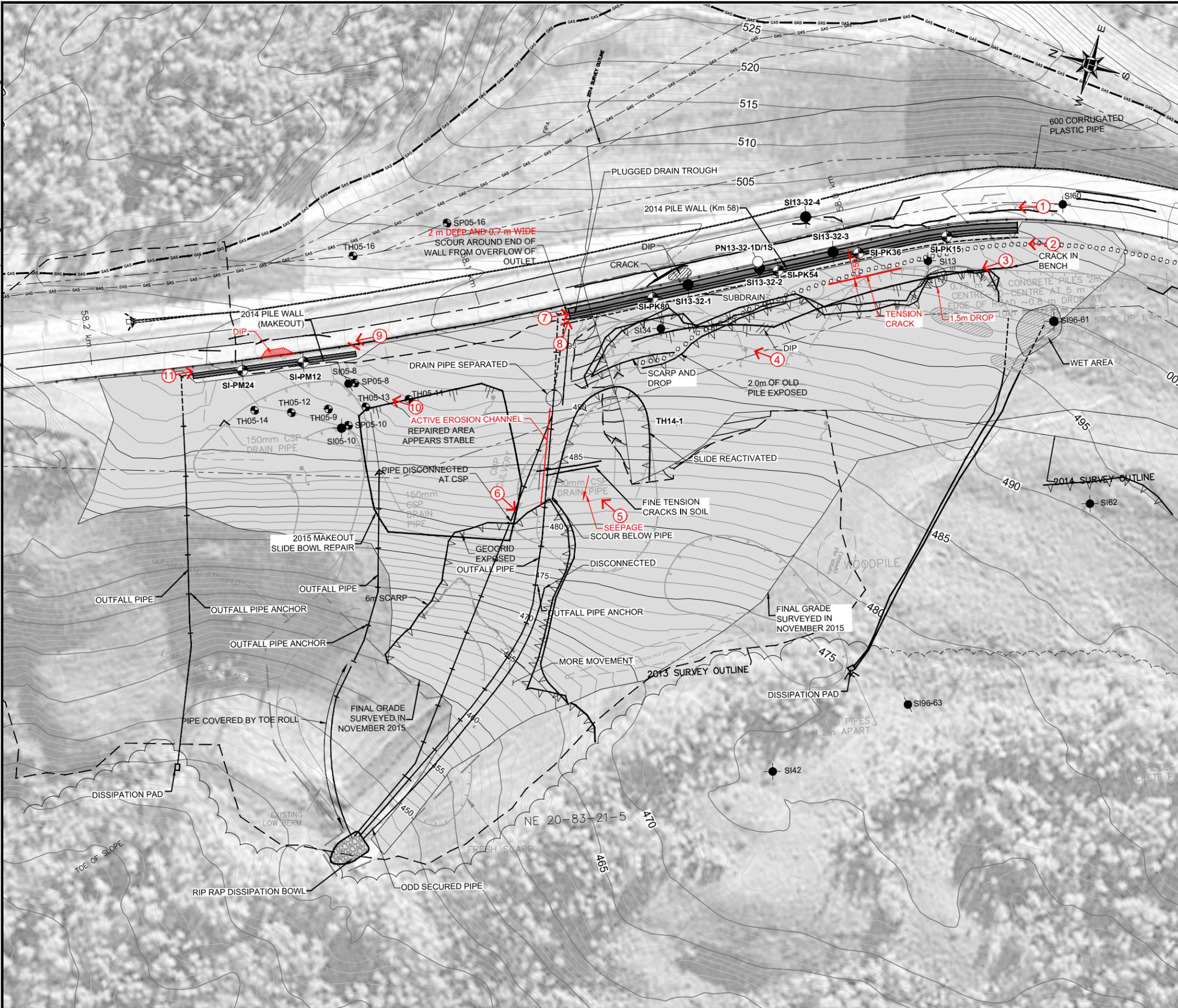
	<b>Date</b>	<b>PF</b>	<b>CF</b>	<b>Total</b>
<b>Previous Inspection:</b>	5-June-2019	5	6	30 (Highway)
		14	2	28 (Downslope)
<b>Current Inspection:</b>	10-June-2020	5	6	30 (Highway)
		14	2	28 (Downslope)
<b>Road WAADT:</b>	630		<b>Year:</b>	2019
<b>Inspected By:</b>	Rocky Wang, TRANS Ed Szmata, TRANS		Don Proudfoot, Thurber Tyler Clay, Thurber Bruce Nestor, Thurber	
<b>Report Attachments:</b>	<input checked="" type="checkbox"/> Photographs <input checked="" type="checkbox"/> Plans   <input checked="" type="checkbox"/> Maintenance Items			

<b>Primary Site Issue:</b>	<p>In 1997, this section of the highway was partially realigned into the backslope, which was flattened, the highway embankment was rebuilt with shredded tire lightweight fill and was stabilized with a buried anchor pile retaining wall.</p> <p>In 2001, a 40 m wide landslide occurred affecting both highway lanes. Repair work was conducted in the form of a toe berm and drainage improvements in the upslope ditch. In 2005, the road was re-aligned to the east into the backslope and re-grading/off-loading of the sideslope was conducted below the highway.</p> <p>Between 2006 and 2013, slides developed to the south of the re-graded area and erosion occurred along the lined channel for the subdrains at the toe of the sideslope. Subsequently, cracking and slope movement occurred below the drains and below the previously installed pile wall.</p> <p>In October 2013, several crack features were observed in the ACP observed above the 1997 pile wall and the 2005 repair with a landslide bowl feature developed about 20 m downslope of the highway at km 58.12 below the outlet of a subdrain pipe. As part of Contract CON0015153, two cast-in-place concrete pile walls (Makeout and km 58) supported with tieback soil anchors were installed in 2014/2015 below the cracks in the ACP and the landslide bowl feature was excavated and rebuilt with uniaxial geogrid reinforced clay fill.</p>
<b>Dimensions:</b>	<p>Prior to construction, the cracks in the ACP above the km 58 pile wall extended over an area of about 120 m in length and of about 35 m in length at the Makeout pile wall. The slide bowl that occurred in the sideslope above km 58.12 measured approximately 40 m in diameter.</p>
<b>Maintenance:</b>	<p>The concrete drain trough/gutters for the KM 58 and Makeout pile walls were cleaned in 2018. No other maintenance reported.</p>

Observations:	Description	Worsened?
<input checked="" type="checkbox"/> Pavement Distress	Several cracks were observed in the ACP in 2013 (See Photos 1 and 9) prior to the construction of the km 58 and Makeout pile walls and have not changed since the previous inspection. A minor dip was observed in the SBL shoulder above the middle of the Makeout pile wall (km 58.15).	<input type="checkbox"/>
<input checked="" type="checkbox"/> Slope Movement	<p>The old landslide scarps below the pile wall that were regraded in 2015 have ongoing movement and most of the piles from the old wall are now exposed with the highest drop at 2.0 m from the top of the exposed piles (Photo 4). No major changes were observed immediately below either pile wall (Photos 2, 3, 4 and 10).</p> <p>Lower slide area below the 2015 Makeout slide bowl repair is active and has ongoing movement and retrogression of the scarps within the lower portion of the slope (Photo 6).</p>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> Erosion	<p>Both ends of the km 58 pile wall have become eroded by runoff water and water overtopping the outlet of the pile wall due to blockage of the drain trough with sediment buildup (Photos 7 and 8). Scour at the north end of the wall has increased in size and was 2 m deep and 0.7 m wide.</p> <p>The solid HDPE outlet drain pipe for the clay backfilled area became disconnected from the perforated CSP drain pipe at the base in 2018 and erosion damage is ongoing (Photo 5).</p>	<input checked="" type="checkbox"/>
<input type="checkbox"/> Seepage		<input type="checkbox"/>
<input type="checkbox"/> Bridge/Culvert Distress		<input type="checkbox"/>
<input checked="" type="checkbox"/> Other	No change observed in the ACP shoulder protective cover at either pile walls (Photos 2 and 11).	<input type="checkbox"/>
<b>Instrumentation:</b>		
<b>Makeout Pile Wall</b>		
SI-PM12 and SI-PM24	<p>Two slope inclinometers were installed in retaining wall piles during construction. SI-PM12 has shown no incremental movement since Fall 2019. Since construction total cumulative deflection is 1 mm in the upslope direction over the length of the pile and 3 mm in the upslope direction over the combined length of the pile and waler.</p> <p>SI-PM24 has shown no incremental movement since Fall 2019. Since construction total cumulative deflection is 3 mm in the upslope direction over the length of the pile and 4 mm in the upslope direction over the combined length of the pile and waler.</p>	

VC1848, VC1849, VC1851, VC1852 and VC 1854	Since their final lock off in May of 2015, the soil anchors have lost about 15 kN to 35 kN of carrying load. The load cells showed increases in measured load ranging from 2.86 kN in VC1848 (anchor M12L) to 6.20 kN in VC1854 (anchor M12U). The load cells at the Makeout wall have generally shown an overall trend of relatively stable to slightly increasing loads since the end of construction, with seasonably higher loads during the winter months.								
<b>Km 58 Pile Wall</b>									
SI-PK15, SI-PK36, SI-PK54 and SI-PK80	Four slope inclinometers were installed in retaining wall piles during construction. Since construction completion the total cumulative movements measured as of Spring 2020 are summarized below. SI-PK15: 0.9 mm downslope over length of pile, 0.5 mm downslope over combined length of pile and water. SI-PK36: 2.2 mm downslope over length of pile, 3.2 mm downslope over combined length of pile and water. SI-PK54: 2.8 mm downslope over length of pile, 1.6 mm downslope over combined length of pile and water. SI-PK80: 4.6 mm downslope over length of pile, 2.8 mm downslope over combined length of pile and water. Overall rates of movement over the length of pile at all instruments has been small and has ranged between 0 mm/yr to 0.6 mm/yr.								
VC1853 and VC1855 to VC1862	Since Fall 2019, the load cells at KM 58 showed increases in measured load ranging from 0.78 kN in VC1859 (anchor K79U) to 6.89 kN in VC1862 (anchor K15M) the measured loads have shown a trend of gradually increasing loads since the end of construction, with seasonably higher loads during the winter months.								
PN13-32-1S and PN13-32-1D	The pneumatic piezometers PN13-32-1S and PN13-32-1D showed decreases in groundwater level of 0.08 m and 0.07 m, respectively, since Fall 2019.								
<p><b>Assessment:</b></p> <p>The newly reconstructed slide bowl repair and pile walls appear to be performing well. Recent movement observed in the passive soil bench below the km 58 wall was anticipated and accounted for in the design.</p> <p>The progressing of the scour below the disconnected drain pipe at base of the clay backfilled slide bowl will need to be monitored. This slide could grow rapidly in size and retrogress toward the highway if the water leakage is not remediated.</p> <p>The drain troughs for both the km 58 and Makeout pile walls will require annual cleaning and the protective soil cover that was lost at the north end of the km 58 pile wall because of the drain trough overtopping should be re-instated in order to prevent further scour enlargement and soil loss.</p>									
<table border="0" style="width: 100%;"> <thead> <tr> <th data-bbox="240 1398 1234 1430" style="text-align: left;"><b>Recommendations:</b></th> <th data-bbox="1250 1398 1433 1430" style="text-align: left;"><b>Cost</b></th> </tr> </thead> <tbody> <tr> <td data-bbox="240 1440 1234 1535">The slope inclinometers will continue to be read manually twice per year and the datalogger installed at the site will continue to take readings of the load cells twice daily as part of the Geohazard Assessment Program.</td> <td data-bbox="1250 1440 1433 1535">Monitoring</td> </tr> <tr> <td data-bbox="240 1566 1234 1661">The pile wall surface drainage gutters will require to be regularly cleaned in order to continue to provide erosion protection for the partially buried pile wall and avoid clogging of its solid down drain pipes.</td> <td data-bbox="1250 1566 1433 1661">Maintenance</td> </tr> <tr> <td data-bbox="240 1692 1234 1829">Some further drainage efforts might be required at the wet area as a future maintenance item as history has shown that persistent seepage can lead to significant slide movements. The disconnected drain pipe below the north end of the km 58 pile wall should be reconnected to help prevent further retrogression of the landslide scarp that has formed below it.</td> <td data-bbox="1250 1692 1433 1829">Maintenance</td> </tr> </tbody> </table>		<b>Recommendations:</b>	<b>Cost</b>	The slope inclinometers will continue to be read manually twice per year and the datalogger installed at the site will continue to take readings of the load cells twice daily as part of the Geohazard Assessment Program.	Monitoring	The pile wall surface drainage gutters will require to be regularly cleaned in order to continue to provide erosion protection for the partially buried pile wall and avoid clogging of its solid down drain pipes.	Maintenance	Some further drainage efforts might be required at the wet area as a future maintenance item as history has shown that persistent seepage can lead to significant slide movements. The disconnected drain pipe below the north end of the km 58 pile wall should be reconnected to help prevent further retrogression of the landslide scarp that has formed below it.	Maintenance
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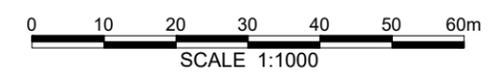


**LEGEND**

- 2014 SLOPE INCLINOMETER LOCATION
- 2014 TEST PIT LOCATION
- PREVIOUS SLOPE INCLINOMETER (PRESENT)
- PREVIOUS SLOPE INCLINOMETER APPROXIMATE LOCATION (MISSING)
- 2014 PNEUMATIC PIEZOMETER (PRESENT)
- PREVIOUS TEST HOLE LOCATION
- 2014 PILE WALLS
- 1997 H-PILE REINFORCED CONCRETE PILE WALL
- GASLINE ABANDONED IN 2018
- GASLINE ABANDONED IN 2005
- GUARD RAIL
- DRAINAGE PIPE OUTLET
- TREE LINE (SURVEYED)
- TREE LINE (ESTIMATED)
- SOLID DRAIN PIPE
- BURIED DRAIN PIPE
- CONTROL POINT
- DIRECTION AND PHOTO NUMBER

**NOTES:**

- 1 LOCATION DATA RECORDED USING HAND HELD GPS RECEIVER. ALL LOCATIONS ARE APPROXIMATE AND ARE FOR ILLUSTRATIVE PURPOSES ONLY.
- 2 JUNE 10, 2020 OBSERVATIONS SHOWN IN RED.



**PEACE REGION (PEACE RIVER/HIGH LEVEL)  
PH032-1 JUDAH HILL - MAKEOUT SLIDE**

**2020 PH032 INSPECTION PLAN**

**DWG No. 13351-PH032-1**

DRAWN BY	ML
DESIGNED BY	TTC
APPROVED BY	DWP
SCALE	1:1000
DATE	JULY 2020
FILE No.	13351





**Photo 1.**  
Looking northwest from the SBL shoulder of Hwy 744:04 at km 57.96 along the guardrail above the km 58 pile wall. There has been no major changes in the cracks in the ACP since 2019.



**Photo 2.**  
Looking northwest from the south end of the km 58 pile wall. The ACP shoulder protective cover was in good condition. No significant changes were noted downslope of the wall at this side relative to the 2019 condition.



**Photo 3.**  
Looking northwest at a scarp in the bench below the south end of the wall with approximately 1.5 m maximum drop. Area is well vegetated has had only minor movement with no significant expansion since 2019.



**Photo 4.**  
Looking north from below the north end of the km 58 pile wall. The old landslide scarps below the pile wall that were regraded in 2015 have ongoing movement and most of the piles from the old wall are now exposed with the highest drop at 2.0 m from the top of the exposed piles. No change from 2019.



**Photo 5.**  
View upslope towards an active seepage and erosion area approximately 40 m downslope from the north end of the pile wall and disconnected drain pipe further upslope.



**Photo 6.**  
Looking west at the lower slide area between the pile walls. Area has ongoing movement and retrogression of the scarps especially within the lower portion of the slope. Expanded cracking and backscarps have further dropdown relative to the 2019 condition.



**Photo 7.**  
Looking south from the north end of the km 58 pile wall. Note the silt and sand buildup, plugging the drainage trough along the top of the wall which requires regular maintenance to keep cleaned out.



**Photo 8.**  
Increase soil loss around the north end of the km 58 pile wall due to drain trough overflow from being plugged with sediment. Scour hole has expanded and was approximately 2 m deep and 0.7 m wide.



**Photo 9.**  
Looking northwest at the highway above the “Makeout” pile wall. A dip was noted around the SBL shoulder near the middle of the wall but otherwise ACP condition was unchanged from the 2019 condition.



**Photo 10.**  
Looking north at the bench and graded area below the “Makeout” pile wall. Area appeared in good condition and had no observable changes from 2019.



**Photo 11.**  
Looking south along the top of the “Makeout” pile wall. ACP shoulder protective cover was in good condition. Previous ridge of sediment building beneath the guardrail was removed/washed away. Drainage trough was relatively clear and functioning.