Appendix 1

December 1st ROV Footage Analysis

From November 26th to December 1st, 2022, the AWSBS was operated for a debris accumulation test prior to a scheduled ROV inspection. On December 1st, approximately nine hours after shutting down the system, an ROV was placed in the water to record video of trashrack panels.

Upon starting up the system on 11/26, the head differential across the rack was measured at 0.1'. At the time of shutdown on 12/01, the head differential across the rack was measured at 0.6'. Nine hours later when the ROV was placed in the water, operations did not observe a noticeable differential.

Prior visual observations and assumptions when shutting down the system led the team to believe that the rivers natural sweeping flow would remove the majority of the debris. ROV footage showed more debris than expected. The video can be seen in full on ProjectWise ODD AWS ROV Insp 12-1-22.mp4, and stills from this video can be seen in the following pages.

Video Analysis of AWSBS Trashrack

Nine of the eleven trashrack panels were submerged underwater at the time of recording. The following analysis numbers the panels 3 through 11, counting down from the surface.

- The centerline of the AWS opening is at elevation 116.5, 12.5 feet above the bottom concrete slab. Panels 3 (#3 is the upper most submerged panel) through 8 sit above the opening. Panels 9 and 10 sit directly in front of the opening. Panel 11 is fully below the opening.
- Panels 3 through 5 had light debris buildup. They were relatively clear of debris and grass, with some grass stuck between the L-bracket and face of the grating.
- Panels 6 through 8 had heavy debris buildup. They showed significant debris impingement - mostly grass and plant matter which appears to be tangled and wedged into the grating.
- The right half of panels 6 through 8 appear to have significantly more debris coverage than the left half.
- It is not clear from the ROV whether the debris is fully clogging the grating.
- Panels 9 through 11 had medium debris buildup, with the majority of debris present in the corners of the panels.
- At several points in the video, the ROV attempts to scrape against the debris which appears "matted" onto the grating. The debris does not appear to easily be removed by this scraping.

The timing of these results coincided directly with the beginning of the 60% EDR review phase. The PDT delayed sending out the 60% report for review to allow for more discussion and thought pertaining to the video results.

Video of Fish Units (FU) Trashrack

The trashracks for the two Fish Units were ROV surveyed in August 2022 after unusual head differentials were recorded during early summer months. Unlike the AWSBS, the upper trashracks of the FUs were solidly blocked from the surface down to about 60 – 70 feet of depth. The trashracks were relatively open (about 20%) down at about 120 feet of depth. At the time of the survey, the head differentials were much lower than during the freshets, about 0.5 feet.

There are significant differences in the hydraulic conditions between the AWSBS and FU intakes.

- FU intakes are designed to have largely uniform intake velocities as a function of depth along the face of the trashrack.
- AWSBS intake has non-uniform velocities with a peak intake velocity at 40 – 45 feet of depth due to the penstock intake location behind the trashrack.
- FU intakes are located west and downstream of all main powerhouse units drawing larger volumes of flow. Sweeping flow is in the normal downstream direction (west).
- AWSBS is located upstream (east) of the Powerhouse and sweeping flow is typically in the upstream direction (east).
- The Powerhouse has a continuously operating Ice and Trash Sluiceway with selected weirs drawing off surface flow to pass juvenile fish and debris to the tailrace.

Ambient Depth of Debris

Based on the differences in the blockage between AWSBS and FU, it is difficult to determine the ambient level of debris prior to being drawn into the trashracks. However, the greater concentration of debris at or midway above the relatively deep AWSBS penstock intake indicates much of the debris was likely drawn from upper levels towards the intake. The fact that the FUs are downstream of the uniform velocity inflow of the main powerhouse units likely has some influence in spreading the debris more uniformly across a greater depth than might be typical in the river.

Biological Information

Wes Messinger, a biologist from the Willamette Valley, viewed the ROV recording and provided the following biological information:

- There are between five and seven unique aquatic plant species seen on the trashracks.
- Some of the plants appear to be Egeria, Milfoil, Coon-tail, Pondweeds, Najas, and Vallisneria, but accurate identification of the plants is not possible without physical specimens in hand.
- All the observed plants grow rooted in muddy substrate, so it is highly unlikely that the plants are growing on the racks.
- All the observed plants are soft, fragile, and mostly water, and should break/tear easily.

Impact to 60% Plan

The PDTs 60% recommended alternative prior to this ROV footage proposed leaving the trashrack panels as is, and had the following three-pronged approach:

1. Passive: Floating boom to deflect surface debris
2. Passive/Active: Sensors to monitor head differential and cycle valves when a 2' differential is reached. The trashracks are designed to withstand a 5’ head differential, but a 2’ differential has been chosen as the actuation trigger for safety reasons.
3. Active: Mobile crane operated brushing device if valve cycling does not restore head differential

With this approach, the main two methods would not be physical removal systems. All prior assumptions led the PDT to believe that approach 3 would be seldomly utilized, as valve cycling has been effective at lowering the head differential. After seeing the video, the PDT became concerned that due to the higher-than-expected debris impingement after nine hours of shutdown, approach 3 would need to be utilized more than expected.

The PDT considered both reverting back to using a dedicated hoist over the mobile crane and switching the recommended and second-best alternatives to prioritize a complete trashrack replacement for easier and more effective brushing. Simultaneously, The Dalles Operations staff met internally on 12/20/2022 to discuss the ROV results.

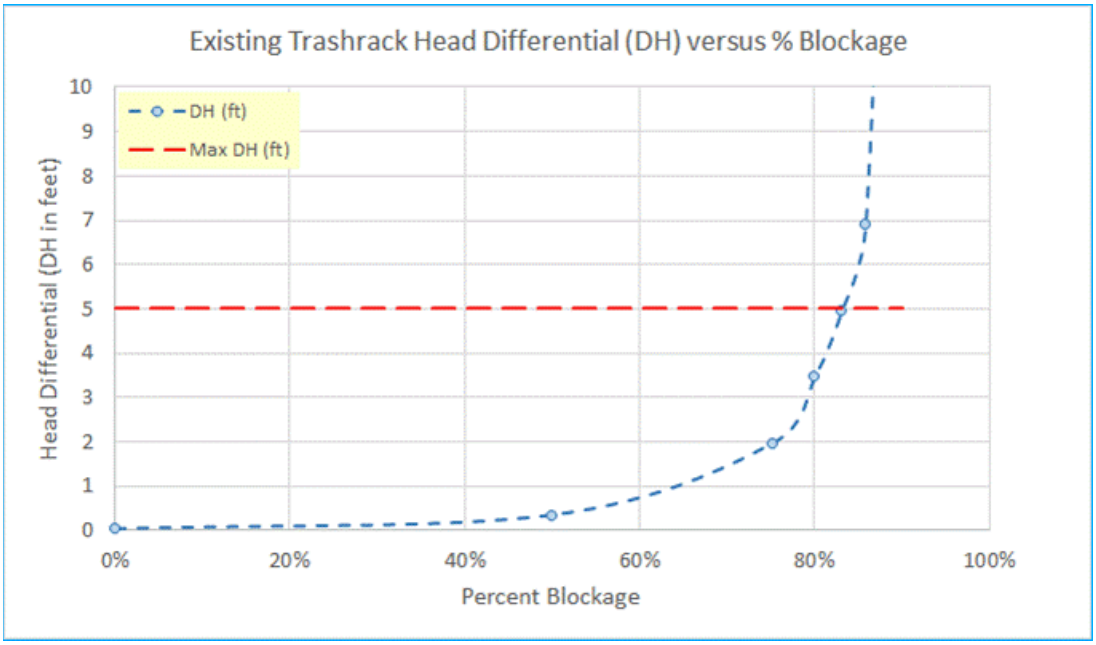
As a result of these discussions, the PDT is changing the 60% EDR to recommend a dedicated hoist. Leaving the trashracks as is will still be the preferred alternative. The reasoning for this decision follows:

- The Dalles Dam operators have previously stated that valve cycling has always been successful at restoring a safe head differential. It had previously been

inferred that this meant shutting down the system fully removed debris from the rack.

- The Dalles Dam operators have said that debris can visibly be seen floating off the panels in the upper column of water when the system is shut down. This further supported the assumption that shutting down the system fully removed debris from the rack.
- Per the graph below and seen in Section 2.4.3, the percent blockage at the time of shutdown corresponding to a 0.6' differential is approximately 55%.
- A rough visual approximation from the ROV video estimates the percent blockage at no more than 40% (Panels 3-5: 10%, Panels 6-8: 70%, panels 9-11: 50%). This would correspond to a head differential of less than 0.25'.
- The change in head differential from 0% blockage (perfectly clean) to 40% blockage (seen in the video) is essentially negligible, per the graph below.
- A 2' head differential, which has been chosen as a trigger for valve cycling, corresponds to an approximate blockage of 75%.
- Even though the head differential may be deemed safe, if debris accumulation rates stay constant and the baseline is 40% instead of 0% blockage, the time between valve cycling will decrease.
- Due to the unknowns of debris accumulation rates and system performance over long-term continuous operations, The Dalles Operators no longer feel comfortable using the projects mobile crane.

Figure 2-2 from section 2.4 Hydraulic Constraints



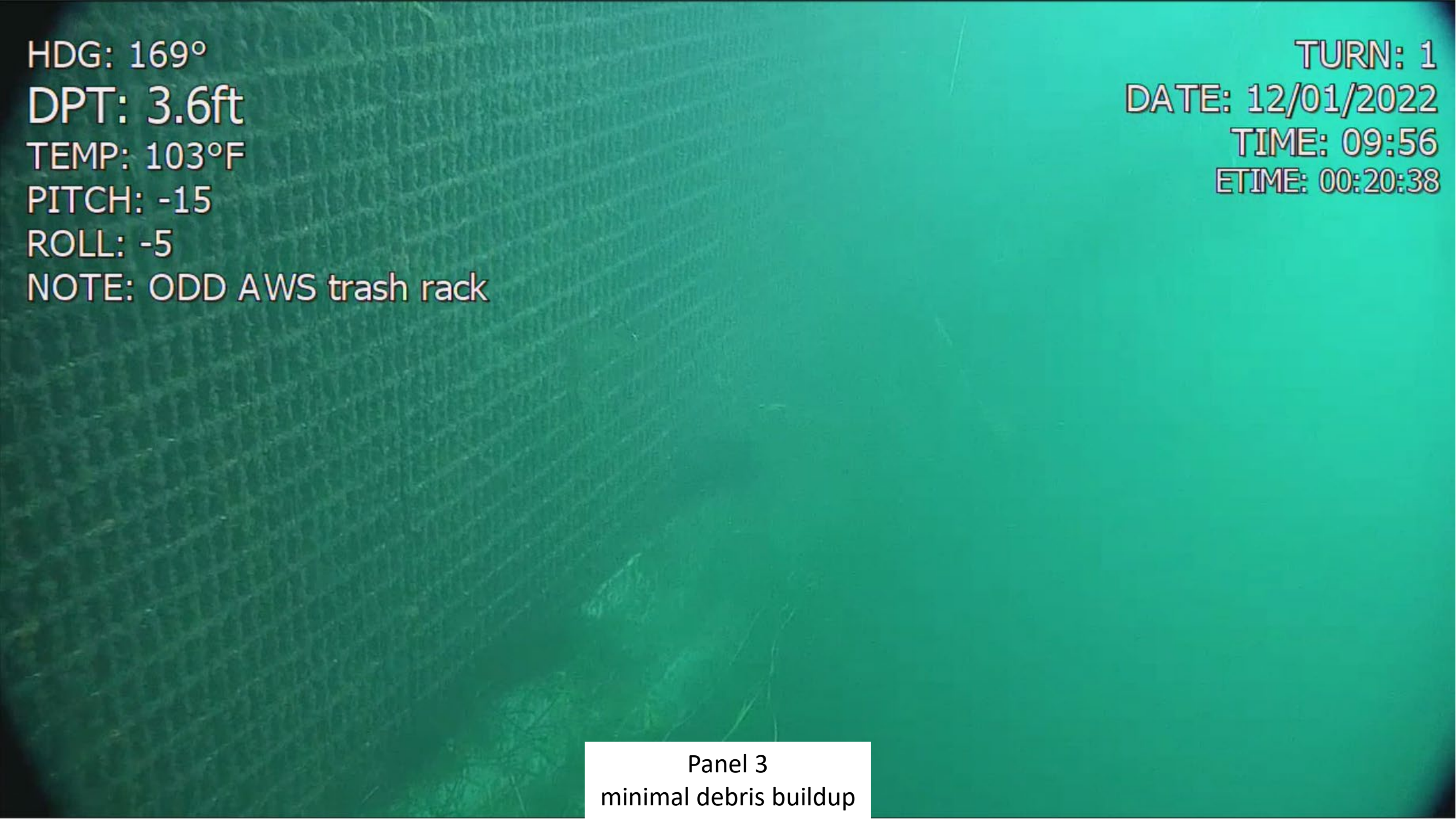
Conclusion

The team's previous assumption that shutting down the system fully removes debris may not hold true, but it does not change the fact that enough debris is removed to

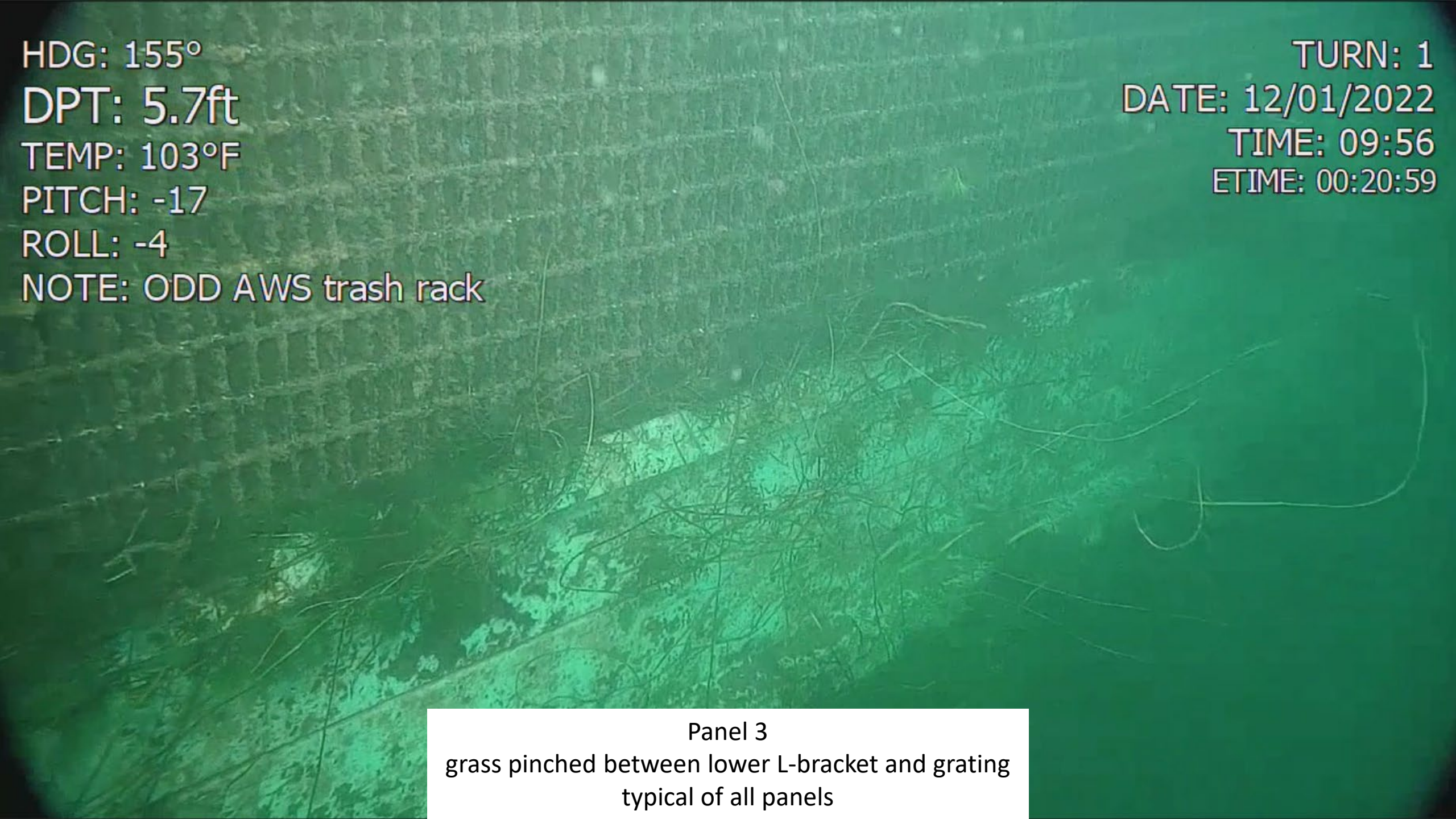
restore a safe head differential. Due to the exponential relationship between debris blockage amount and head differential, it is still beneficial to remove as much debris as possible. If the baseline debris blockage is 40% however, the time between cleaning operations over a continuous usage period will be shorter. Due to the unknowns of long term use and debris accumulation, the project has requested a dedicated hoist which can be utilized faster and more consistently than the mobile crane.

ROV FOOTAGE SCREENSHOTS

- Full Video: ODD AWS ROV Insp 12-1-22.mp4
- AWSB Operated November 26 – December 1, 2022
- System shut down ~nine hours prior to ROV footage
- Nine of eleven panels submerged at time of recording
- Panel numbering from shallowest to deepest (3 just below surface, 11 at bottom)
- Typical – more debris impingement on right half of panels
- Typical – grass pinched between protruding L-brackets and grating



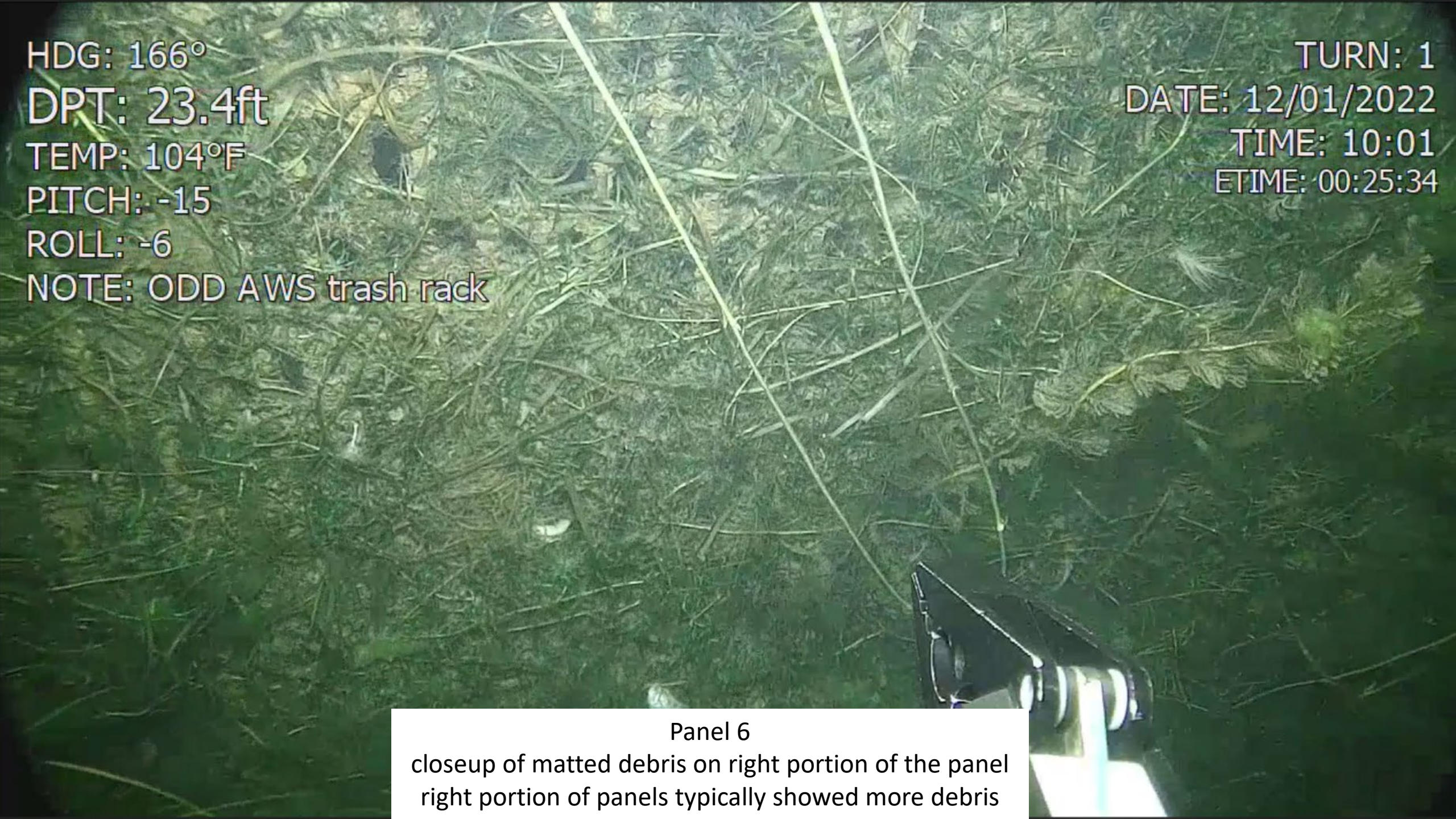
Panel 3
minimal debris buildup



Panel 3
grass pinched between lower L-bracket and grating
typical of all panels

Panel 4
minimal debris buildup
some grass stuck on upper L-bracket

Panel 6
portions of panel with significant grass/debris matting, but no buildup in front of rear wide flange beam structural portion of panel (typical)

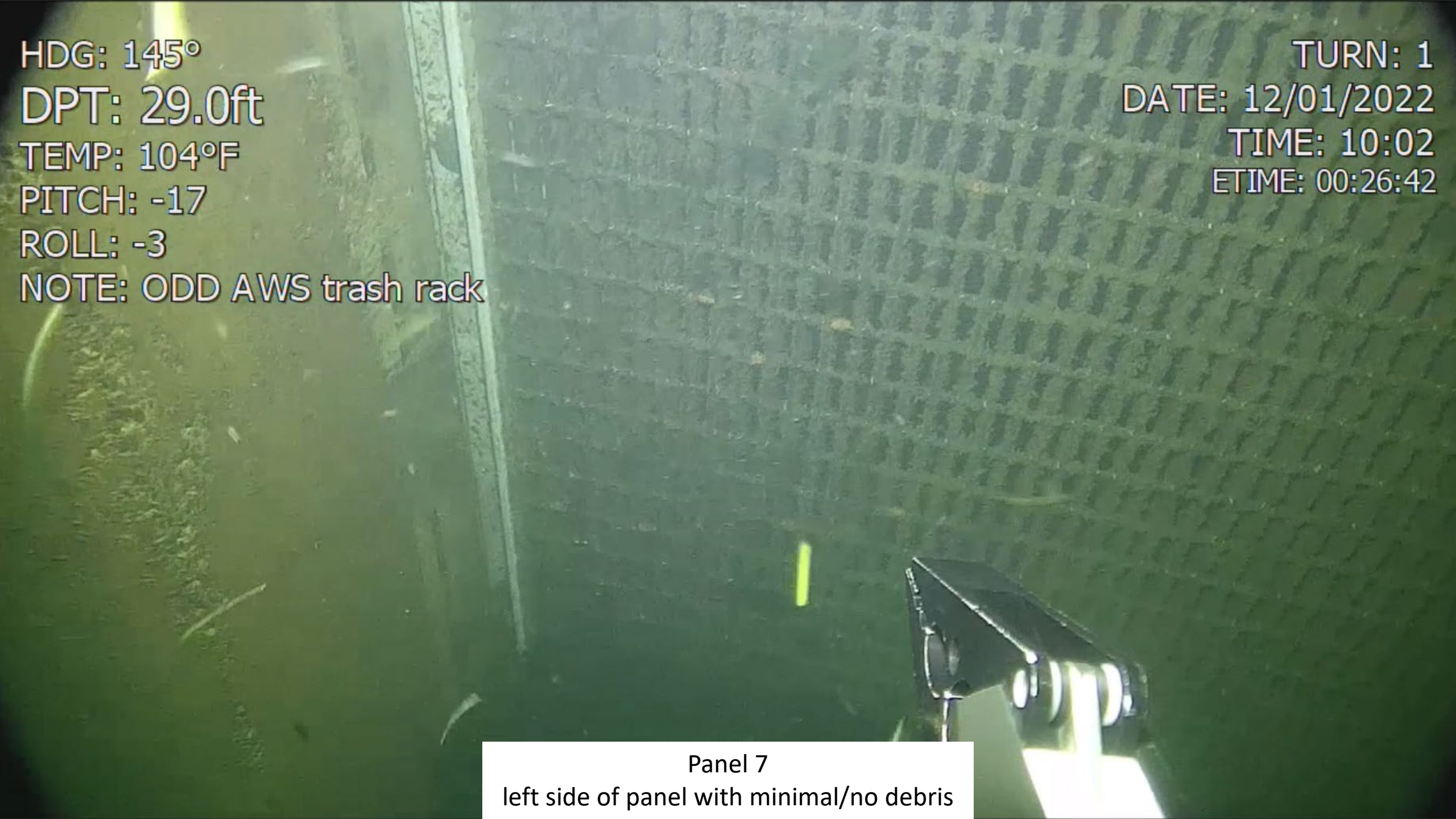


Panel 6

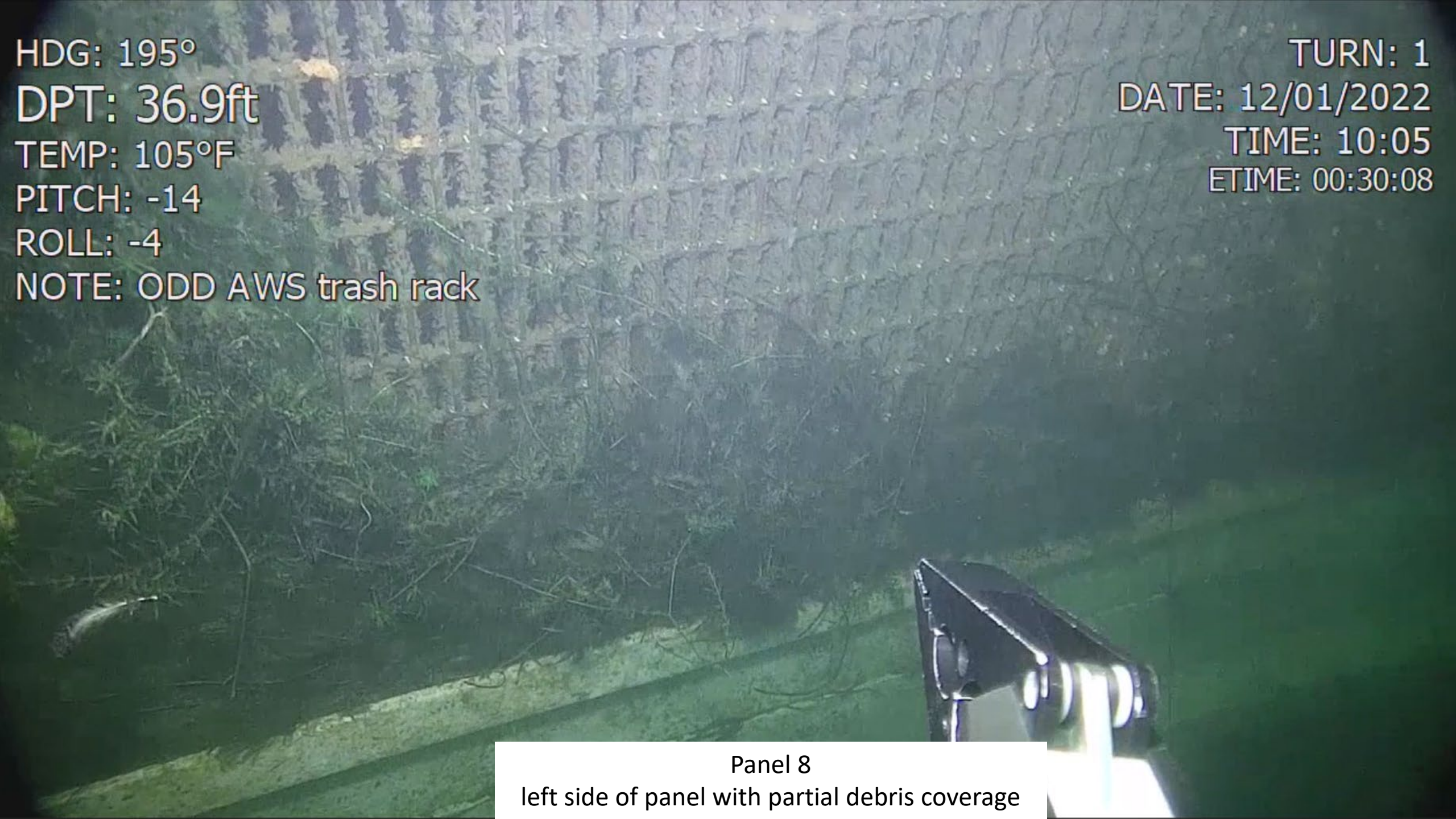
closeup of matted debris on right portion of the panel

right portion of panels typically showed more debris

Panel 7
closeup of debris on bottom right portion of the panel



Panel 7
left side of panel with minimal/no debris



Panel 8
left side of panel with partial debris coverage

Panel 8

middle portion of panel with defined transition from no debris to full debris matting

Panel 8

upper right portion of panel showing defined transition to near full debris matting

Panel 9
similar debris matting on lower right portion of panel

Panel 10

panel appeared to have minimal to no debris matting, with visibility through panel

Panel 11
deepest panel, bottom right portion with significant debris matting

Panel 11
lower left end of panel showing fairly significant debris matting

Panel 11
middle portion of panel with partial matting
area in-front of wide flange structural section clear