JOHN DAY DAM
TRIP REPORT
SOUTH FISH LADDER SUBSIDENCE
May 6, 2015

1. GENERAL. Subsidence at the south fish ladder (SFL)/Juvenile Bypass System outfall chute (JBS outfall chute)/JBS elevate chute was observed on May 6, 2015 during the 2015 Annual Inspection. A potential void area of at least 4' x 6' x 3' deep below the existing sidewalk between the SFL Section 10 and the JBS outfall chute is likely caused by internal erosion from leaking contraction joints in the JBS outfall chute. Further erosion could possibly affect the stability of the SFL, JBS outfall chute, and/or JBS elevated chute, and should be further evaluated. Recommendations are included in Section 4 of this trip report.

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2. BACKGROUND.

In February 2015 the Project discovered a void area below the sidewalk at the north side of the SFL at Section 10, adjacent to a JBS column pile cap (Figure 1). Project staff used a camera to probe the void area below the sidewalk. The probe has a 3 ft reach and never reached the bottom of the void (Photo 1). Approx 3½ subsidence was measured at the curb (Photo 2). The Project notified the District. The District concluded that erosion in the area is likely caused by leaking waterstops in the outfall chute which could be eroding fine materials in the area and causing the sink. The District did not feel that the SFL was threatened since it is founded much deeper than the JBS outfall chute and is excavated into hard basalt. The District also did not feel that the JBS column was threatened since it is pile supported. However, the District could not be completely sure since there were no calculations available to verify the assumption that the piles do not require lateral earth pressure for design.

John Day Project crews made repairs to the JBS outfall chute joints in March 2015. Joints at Sta's 7+15, 7+45, 7+75, 8+05, 8+35, 8+65, 8+95, 14+15 as well as a few other various spot joints were repaired using oakum and Sikaflex 1A. Repairs were made along both sides of the wall at each joint.

A similar depression was observed and studied at Section 12 in January 2015 and was documented in a trip report dated January 28, 2015 (Figure 1). It is likely that the failing concrete from the abandoned temporary fish ladder plug is allowing backfill to erode thus creating a void.

3. OBSERVATIONS.

During the 2015 Annual Inspection the subsidence area at the SFL Section 10 was observed. As documented, the subsidence area is occurring beneath the sidewalk between the SFL and the JBS outfall chute in Section 10 (Photo 3). Subsidence is indicated by differential vertical settlement between the sidewalk and surrounding areas, separation between the sidewalk and the adjacent JBS elevated chute pile cap, and hollow "drummy" sound of the sidewalk (Photo 4).

The Project has cordoned off the area to keep vehicle and foot traffic away. Concrete sidewalk settlement near the curb and separation from the adjacent pile cap was also evident as previously documented. Settlement did not appear to be progressing.

The subsidence at Section 12 was also observed. There did not appear to be any change since January 2015 (Photo 5). The settlement between top of fish ladder wall and top of sidewalk curb was measured at 2-3/8" for future reference (Photo 6). Concerns for the Section 12 include JBS pile cap stability, stability of the South Fish Ladder Wall, and stability for the Section 13 fish ladder column footing.

During the Annual Inspection visit, John Day Project Operations Project Manager Kevin Moynahan expressed concern over these two areas and requested advice as to how to proceed.

4. CONCERNS.

Specific concerns in Section 10 of the SFL/JBS include stability of the SFL; JBS elevated chute pile cap and JBS outfall chute.

Construction drawings indicate that the SFL is excavated into hard basalt so global stability of the fish ladder is probably not a concern. However, if the fish ladder was not designed for asymmetrical soil loading, a large enough void on the north side could create an internal stability problem as indicated by the exaggerated deflected shape shown in Figure 3. It is not known at this time if the SFL design considered this condition. The structural calculations should be reviewed and the SFL should be evaluated for internal stability with asymmetrical soil loading on one side if the original design did not consider asymmetrical soil loading.

Construction drawings indicate that the JBS elevated chute column is supported on piles founded in competent rock (Figure 4). It is not likely that the piles rely on lateral support of the surrounding soil for stability. However, the design calculations should be reviewed to verify this assumption and also to verify that the piles do not rely on surrounding soil to resist lateral earthquake and wind loads.

Construction drawings indicate that the JBS outfall chute is not supported on rock, but is instead supported in the fill (Figure 4). Stability of the JBS outfall chute could be affected if erosion has created a large enough void beneath the chute. At this time the extents of erosion not known. Removal of the concrete sidewalk and investigation of the void is recommended.

5. RECOMMENDATIONS.

a) Carefully demolish sidewalks over subsidence areas in Sections 10 and 12 to quantify the extent of subsidence/internal erosion.

b) Photograph and measure extents of subsidence/internal erosion and backfill with crushed rock. District Structural and/or Geotechnical engineer should be onsite to characterize the erosion areas. Leave areas exposed and cordoned off until subsidence ceases.

c) Establish a means to measure settlement and continue to monitor.

d) Erosion is likely caused by water through the JBS outfall chute. Some of these joints have been sealed, but more repairs may be likely based on what is discovered and based on observations.

e) Structural calculations for the JBS and SFL are not available at the District. EC-DS requests that John Day Project try to locate any structural calculations for the South Fish Ladder and JBS so that EC-DS staff can review and evaluate.

6. FIGURES.

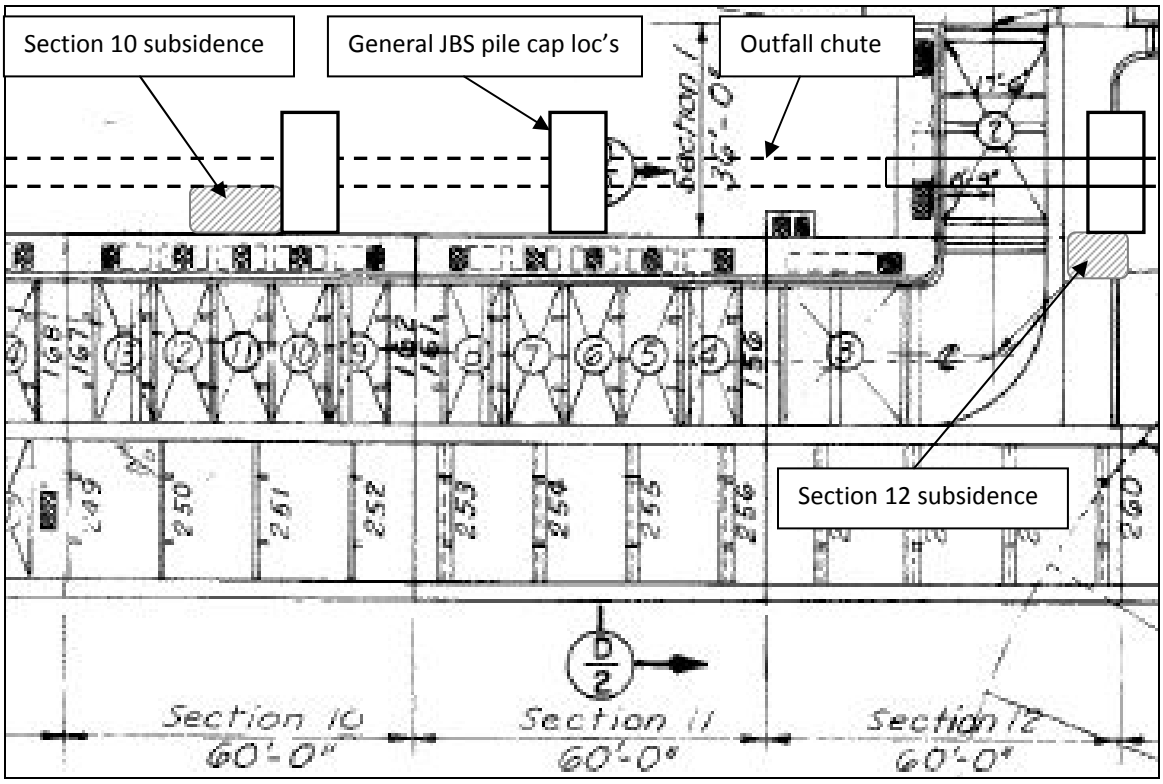

Figure 1. South Fish Ladder general plan showing subsidence and critical JBS features

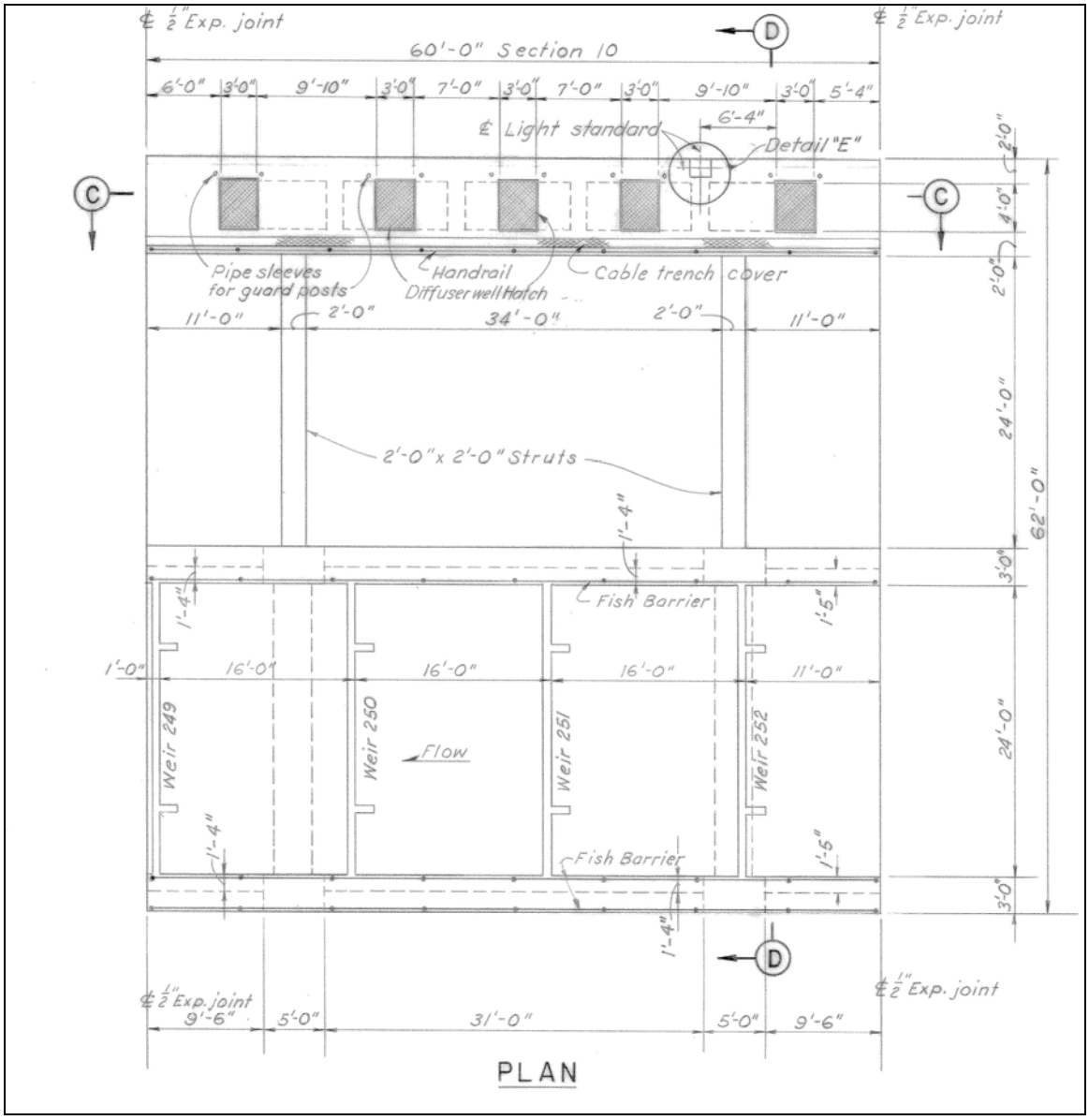

Figure 2. SFL Section 10 Plan

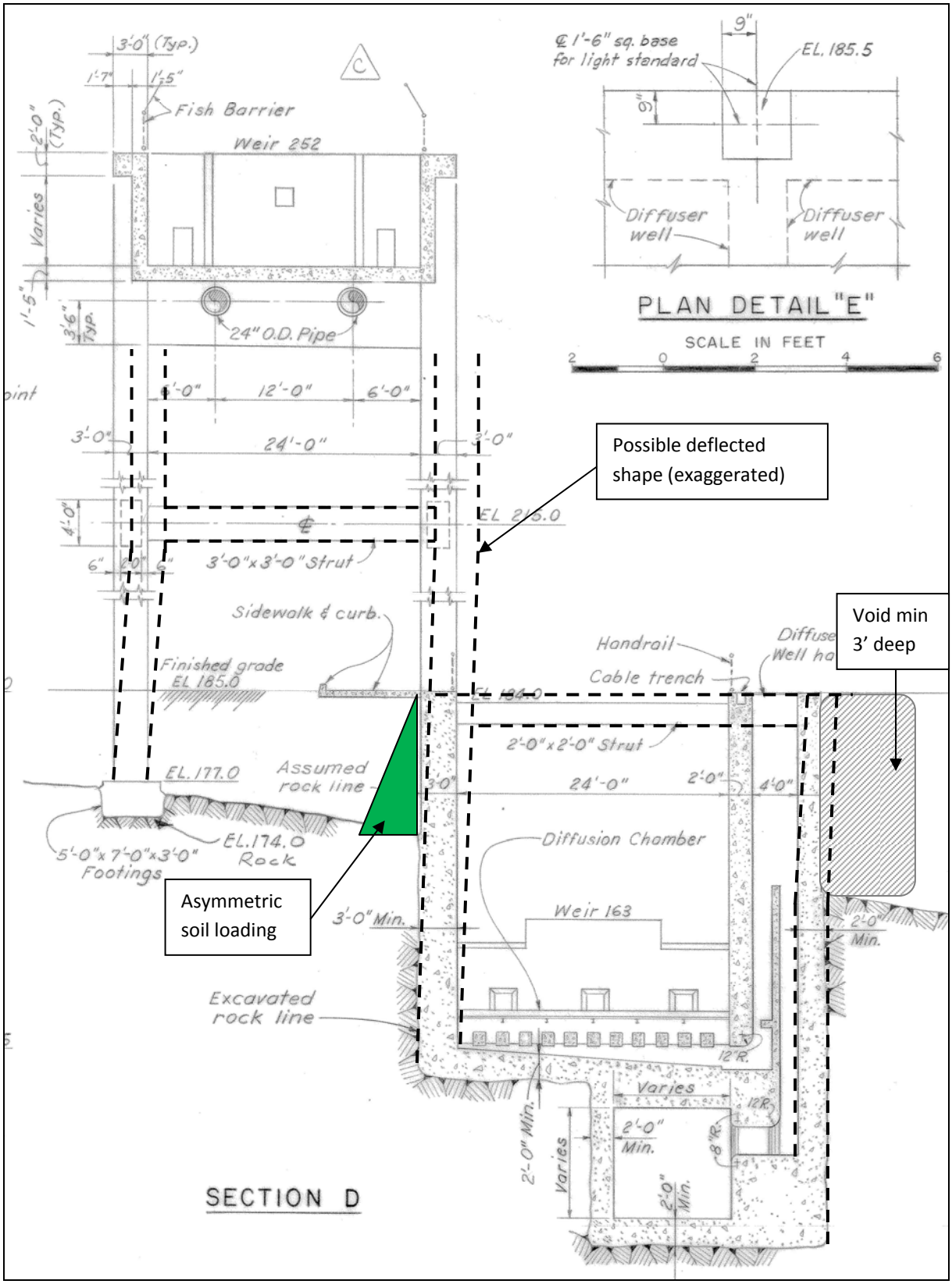

Figure 3. SFL Section 10 showing possible effect of void and exaggerated deflected shape due to asymmetrical soil loading

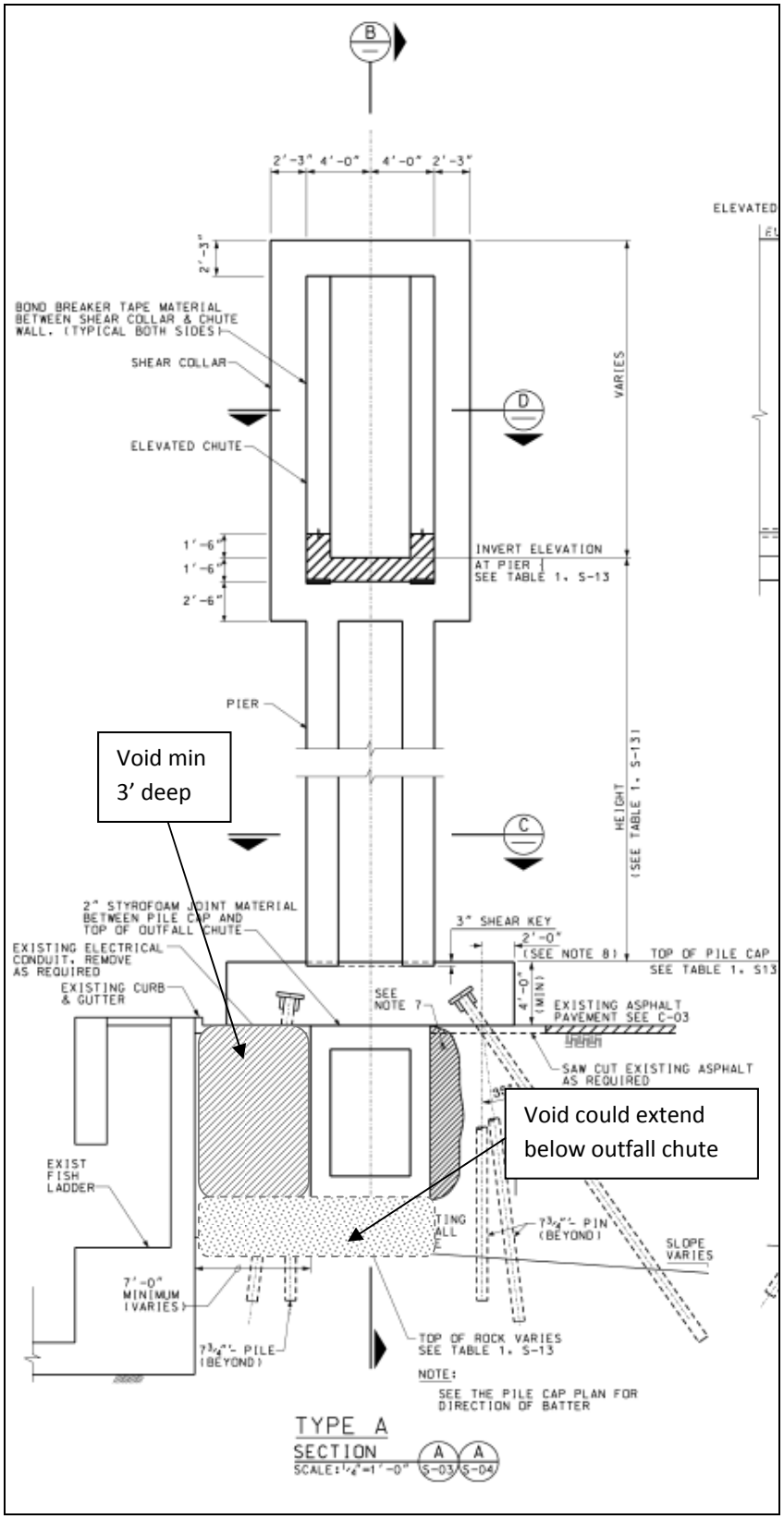

Figure 4. Sections through SFL and JBS outfall and elevated chute with possible extents of void

7. <u>PHOTOS</u>.

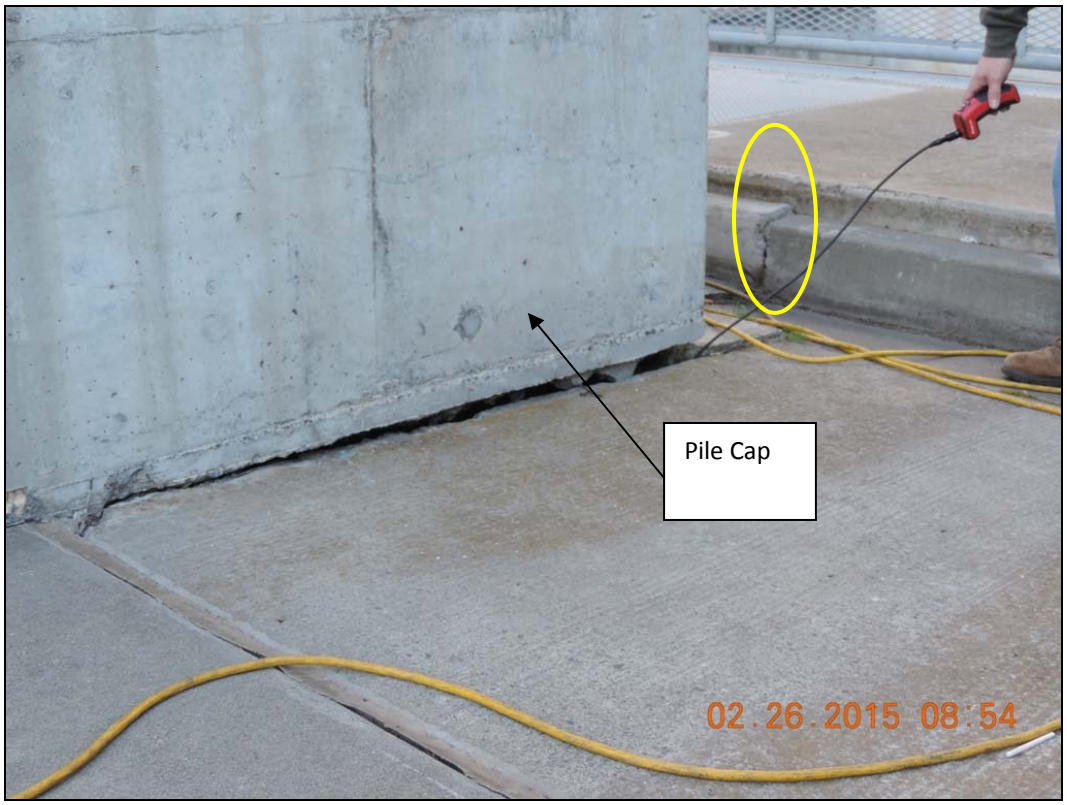

Photo 1. South Fish Ladder Section 10 subsidence with Project camera probe

Photo 2. South Fish Ladder Section 10 showing approx 3½ inch subsidence

Photo 3. South Fish Ladder Section 10 showing subsidence area

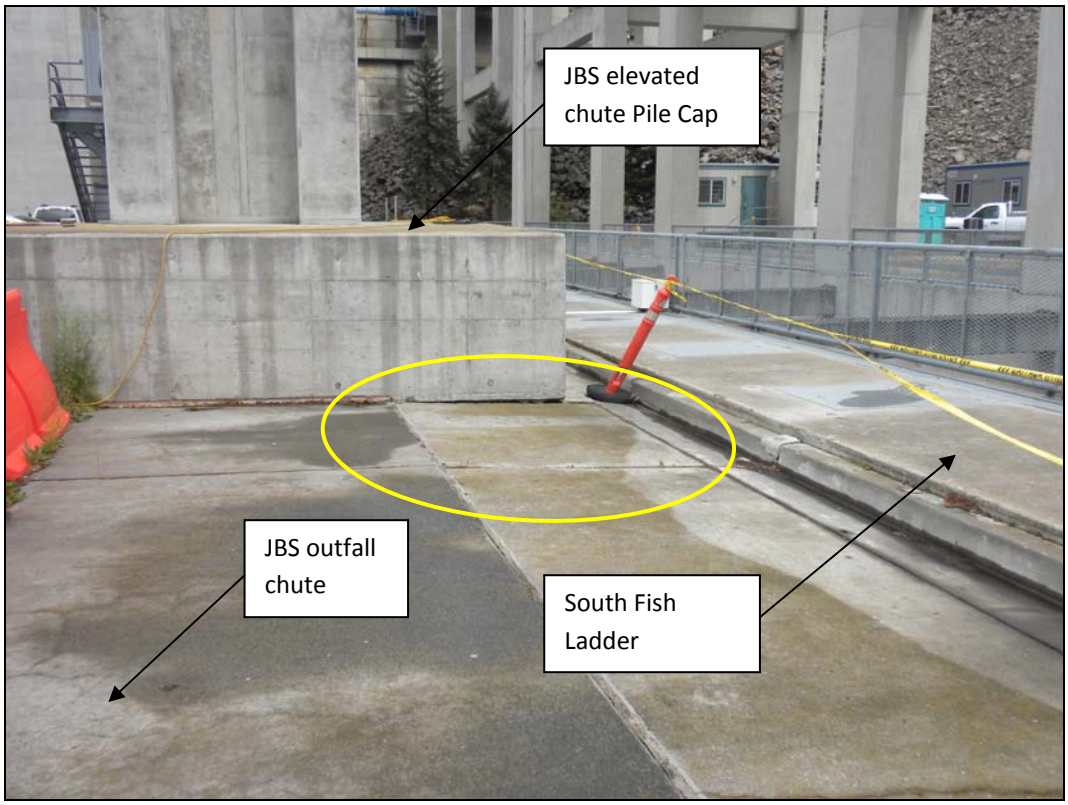

Photo 4. South Fish Ladder Section 10 showing subsidence area and drummy concrete

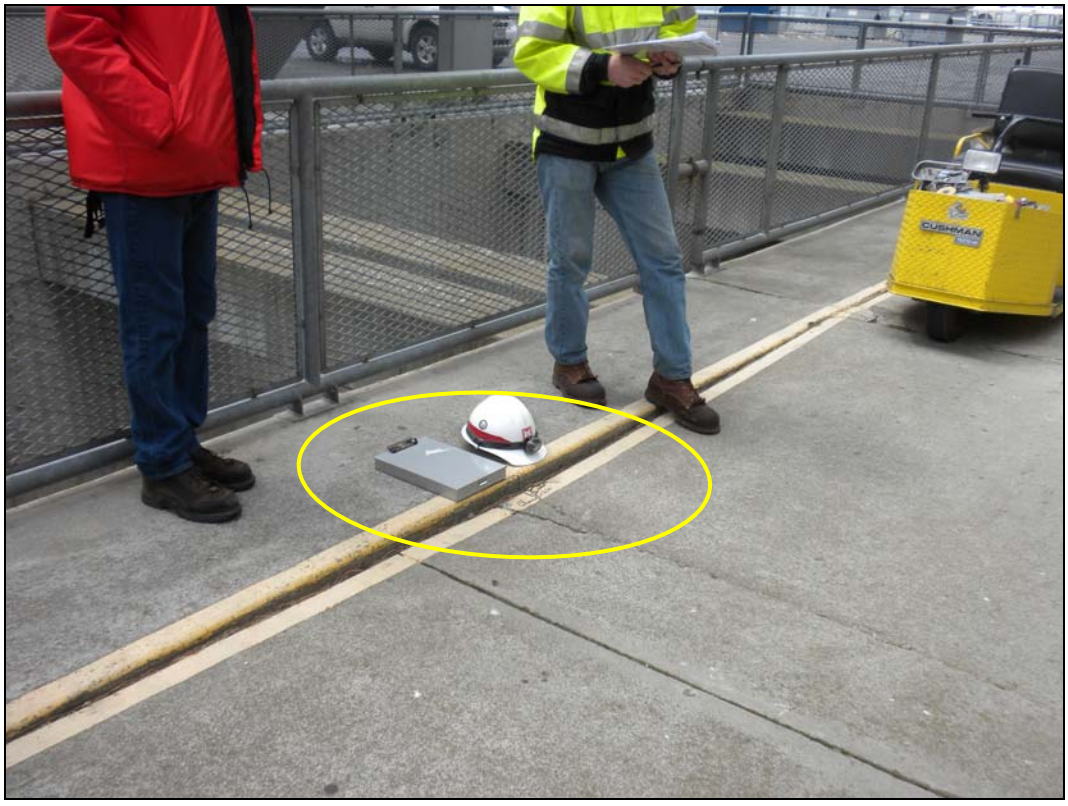

Photo 5. South Fish Ladder Section 12 showing subsidence area

Photo 6. South Fish Ladder Section 12 measured subsidence