APPENDIX A

REMOTS® Figures

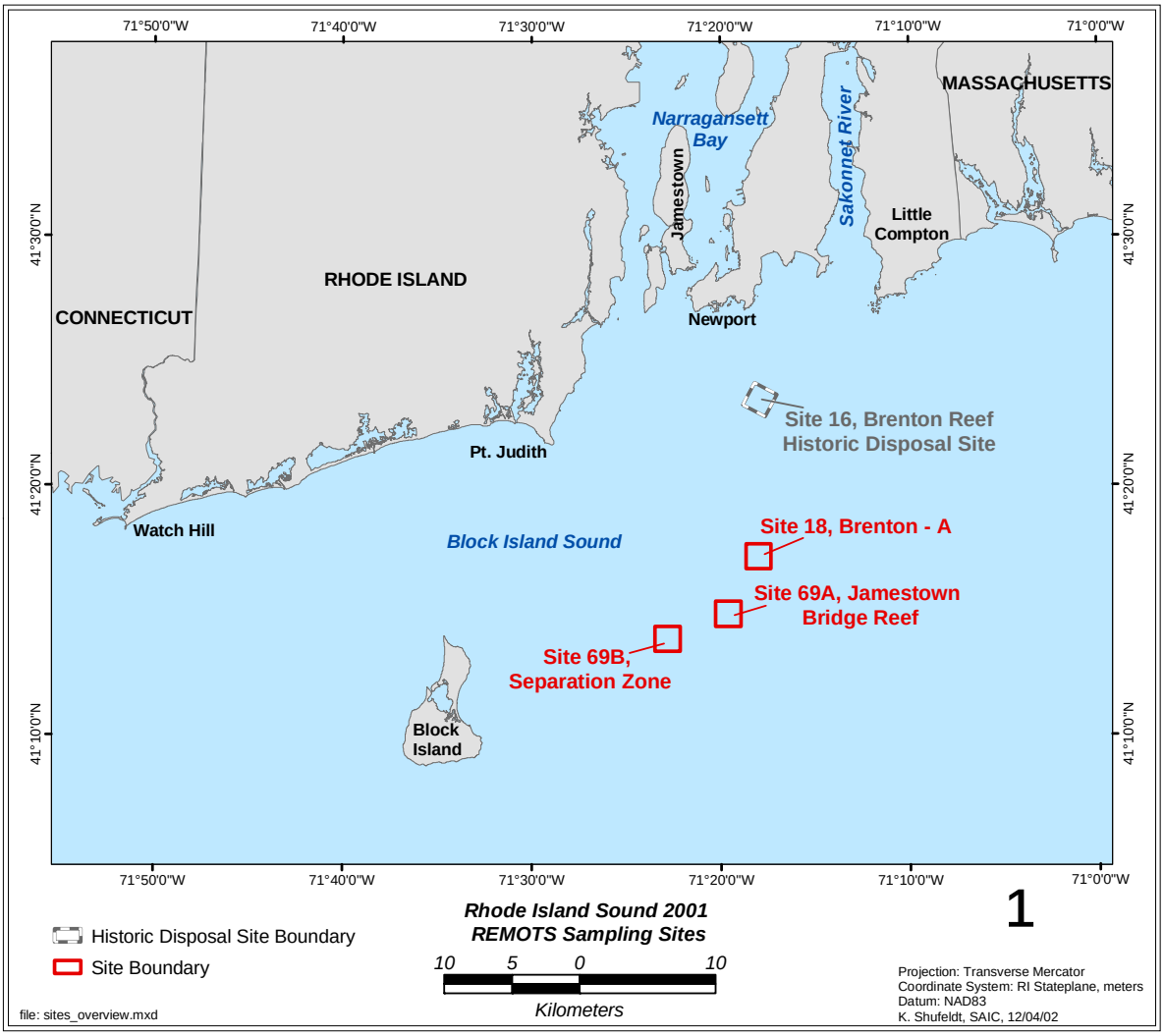

Figure 1. Locations of the Four Candidate Dredged Material Disposal Sites in Rhode Island Sound.

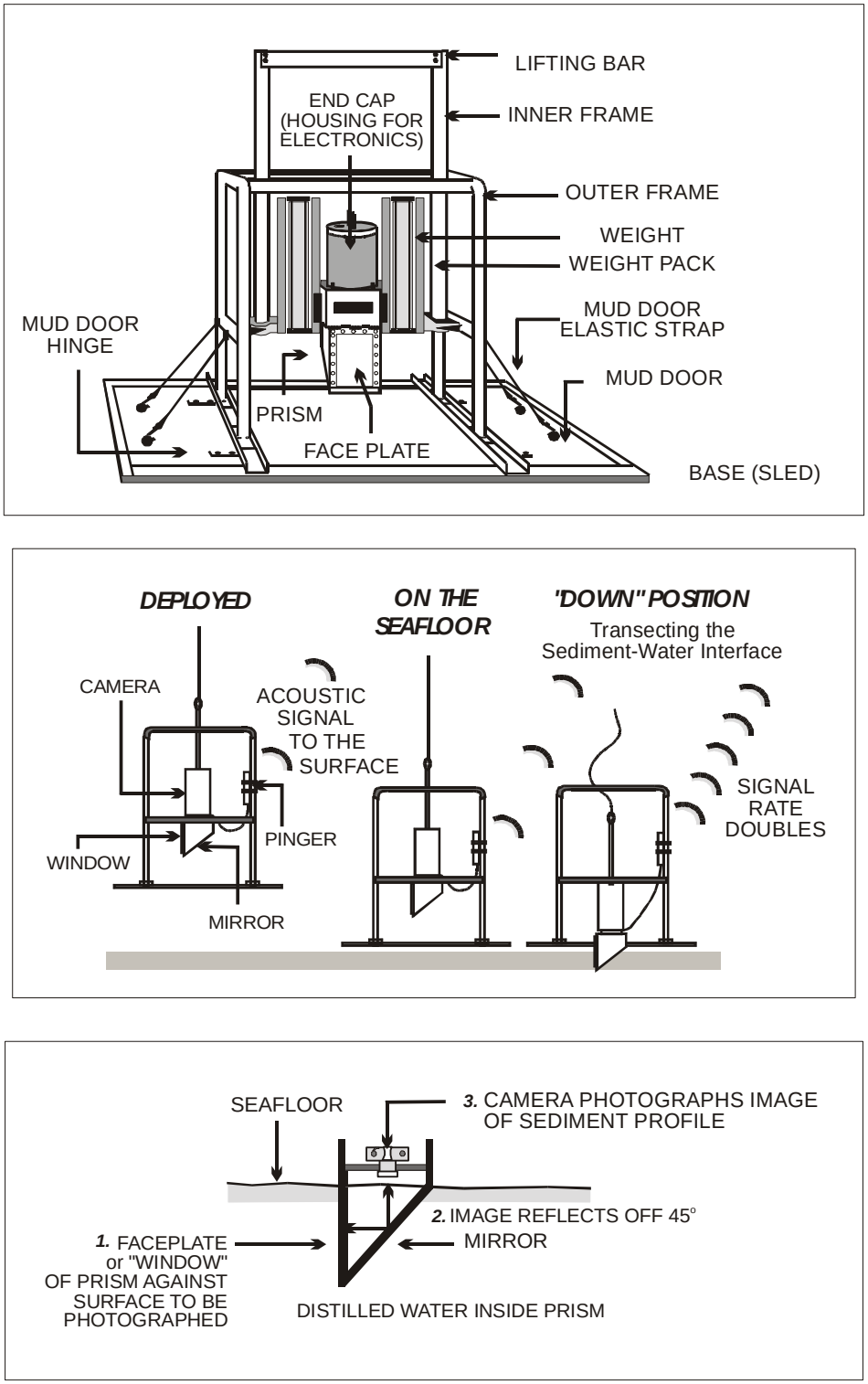

Figure 2. Schematic Diagram of the Benthos, Inc. Model 3731 REMOTS® Sediment-profile Camera and Sequence of Operation on Deployment.

September 2001
REMOTS® Stations
at the Four Study Sites

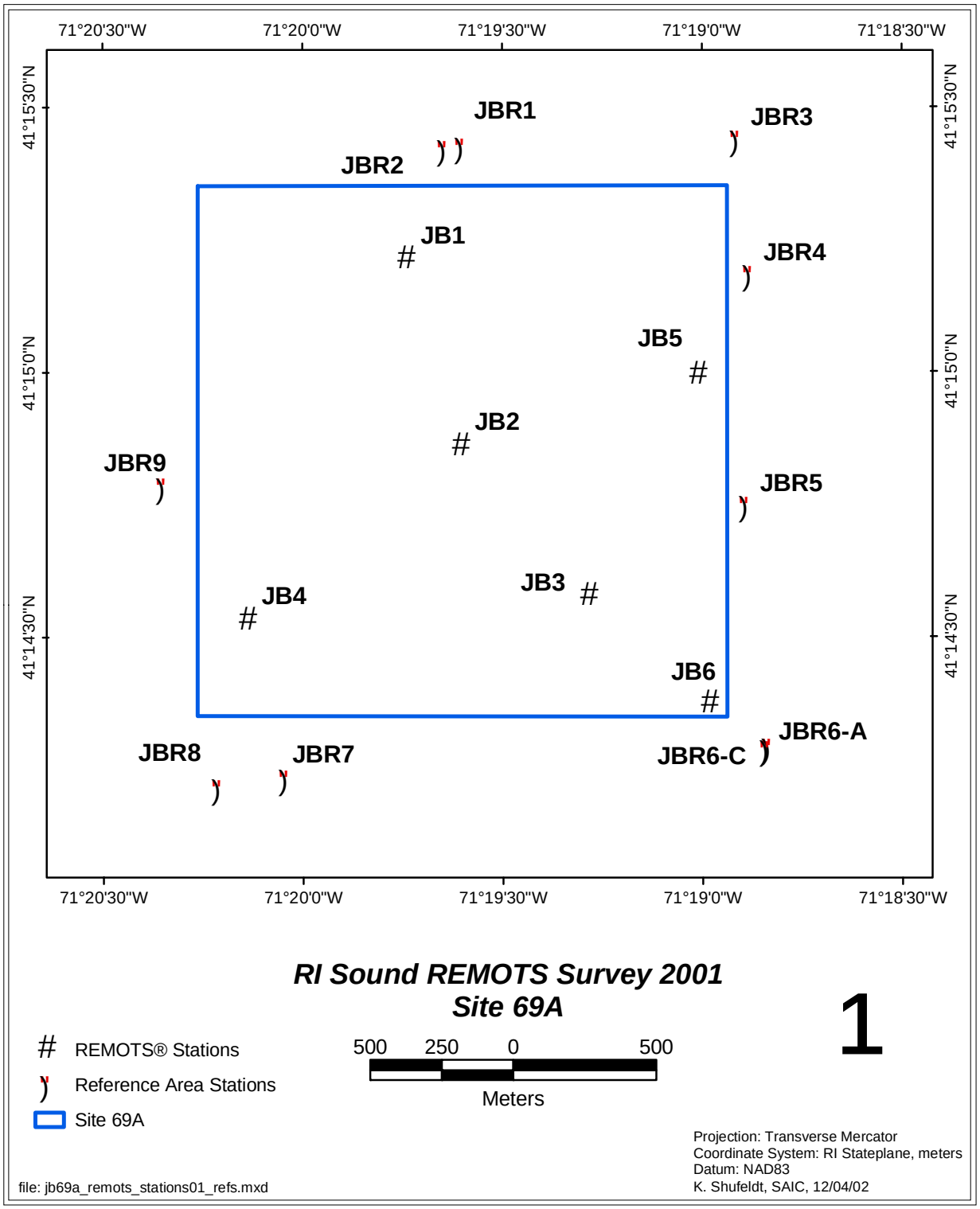

Figure 3. September 2001 REMOTS® Stations, Site 69A (Jamestown Bridge Reef).

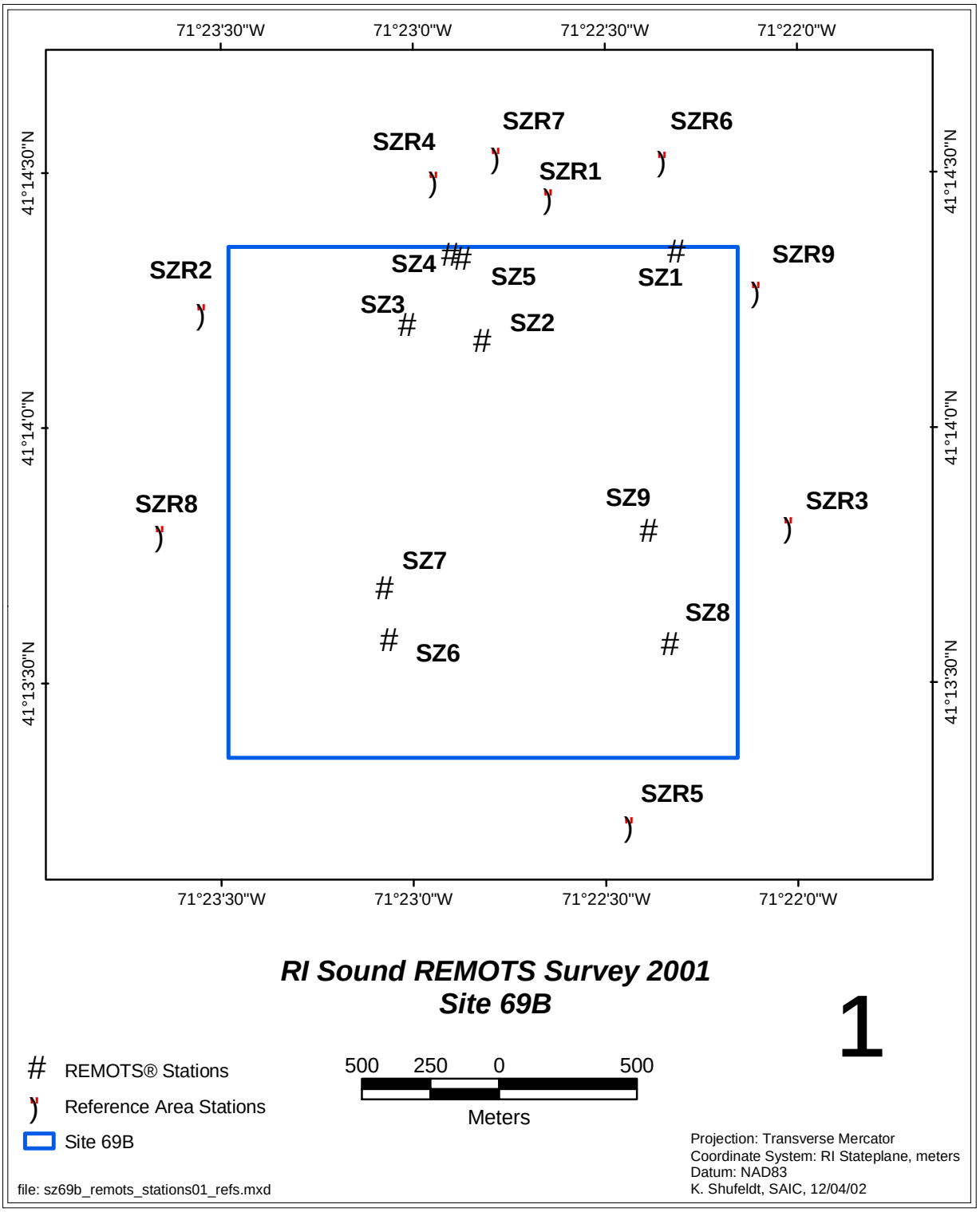

Figure 4. September 2001 REMOTS Stations, Site 69B (Separation Zone).

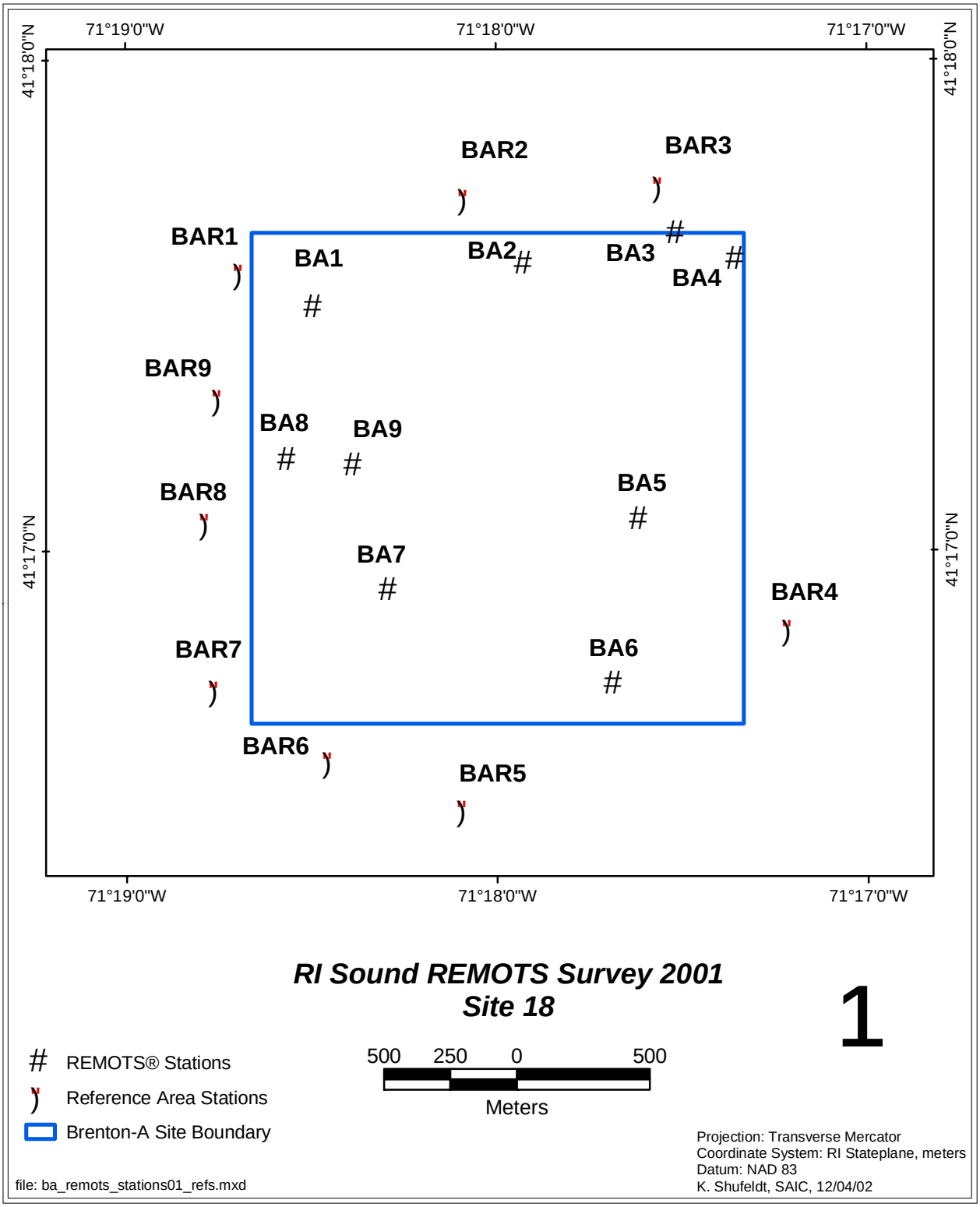

Figure 5. September 2001 REMOTS® Stations, Site 18 (Brenton-A).

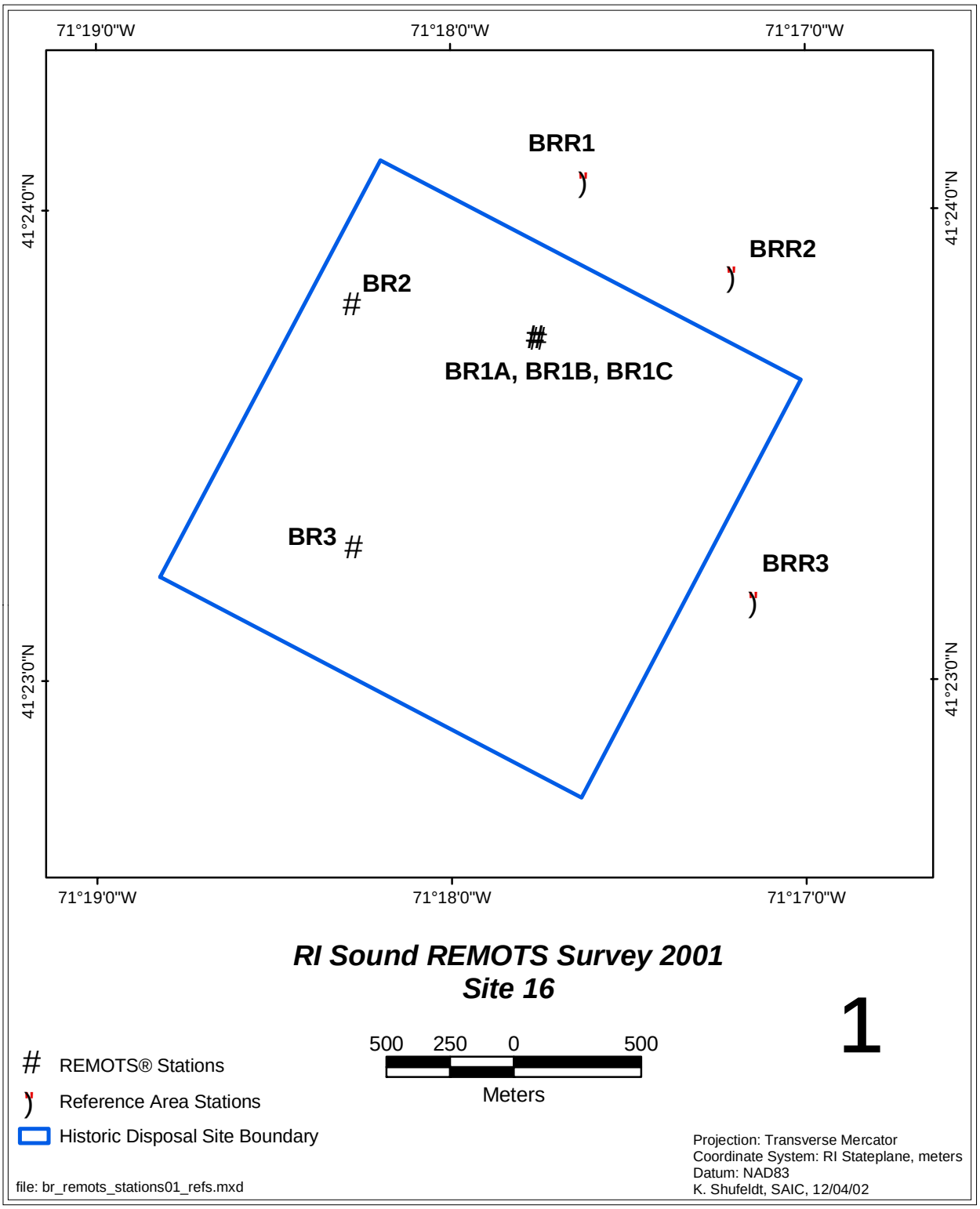

Figure 6. September 2001 REMOTS® Stations, Site 16 (Brenton Reef).

Site 69A

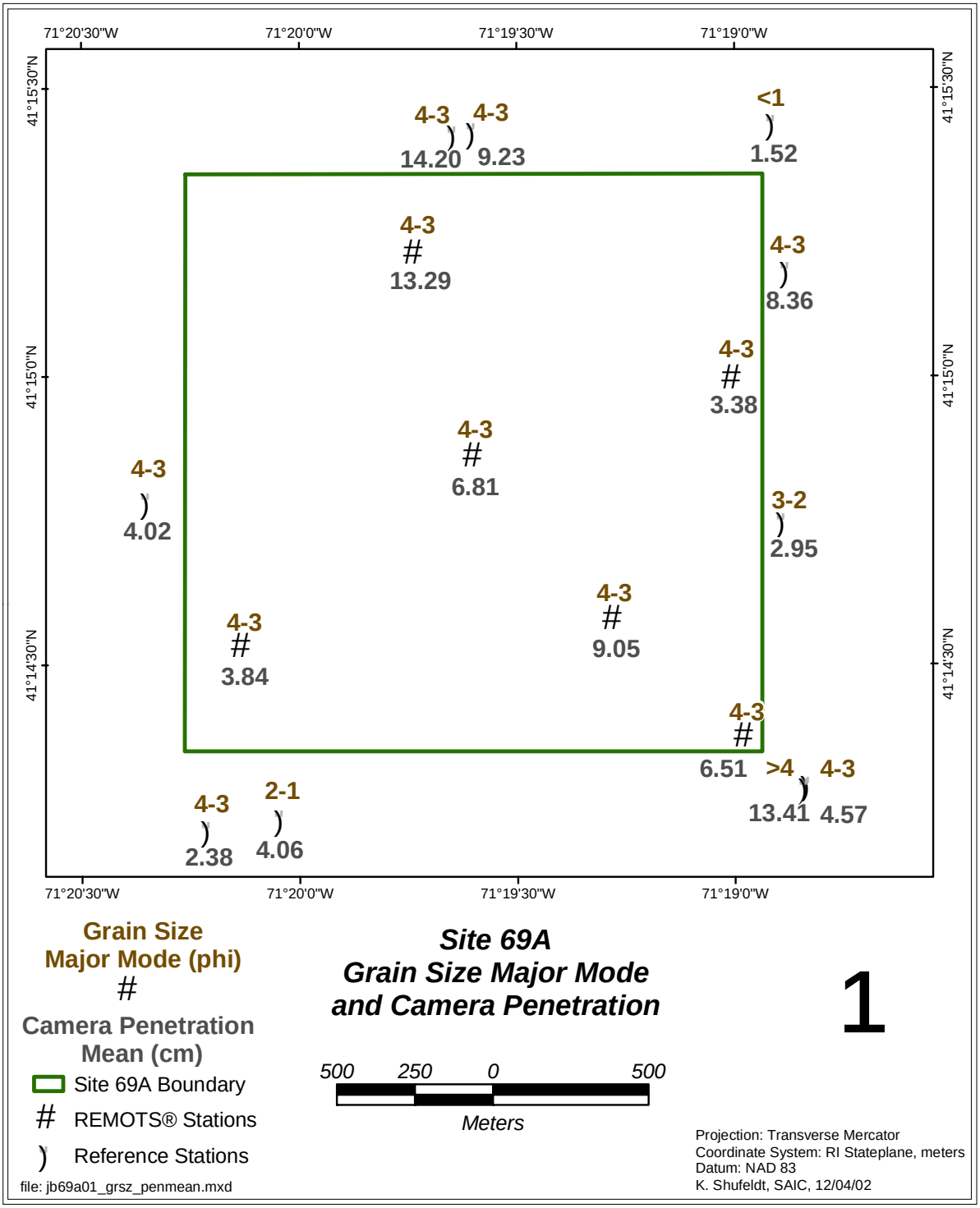

Figure 7. Grain Size Major Mode Values and Camera Penetration Depths, Site 69A (Jamestown Bridge Reef).

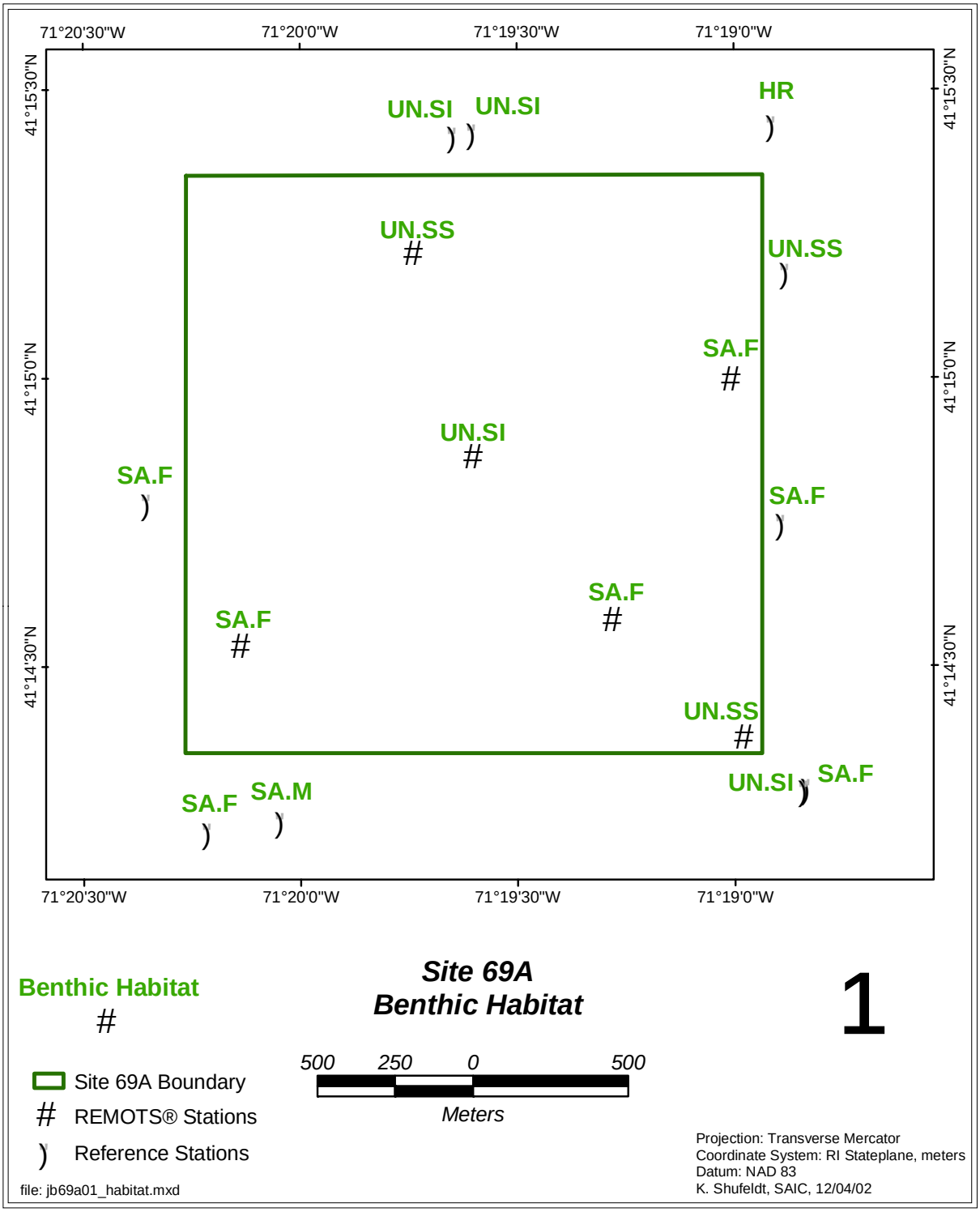

Figure 8. Benthic Habitat Classification, Site 69A (Jamestown Bridge Reef).

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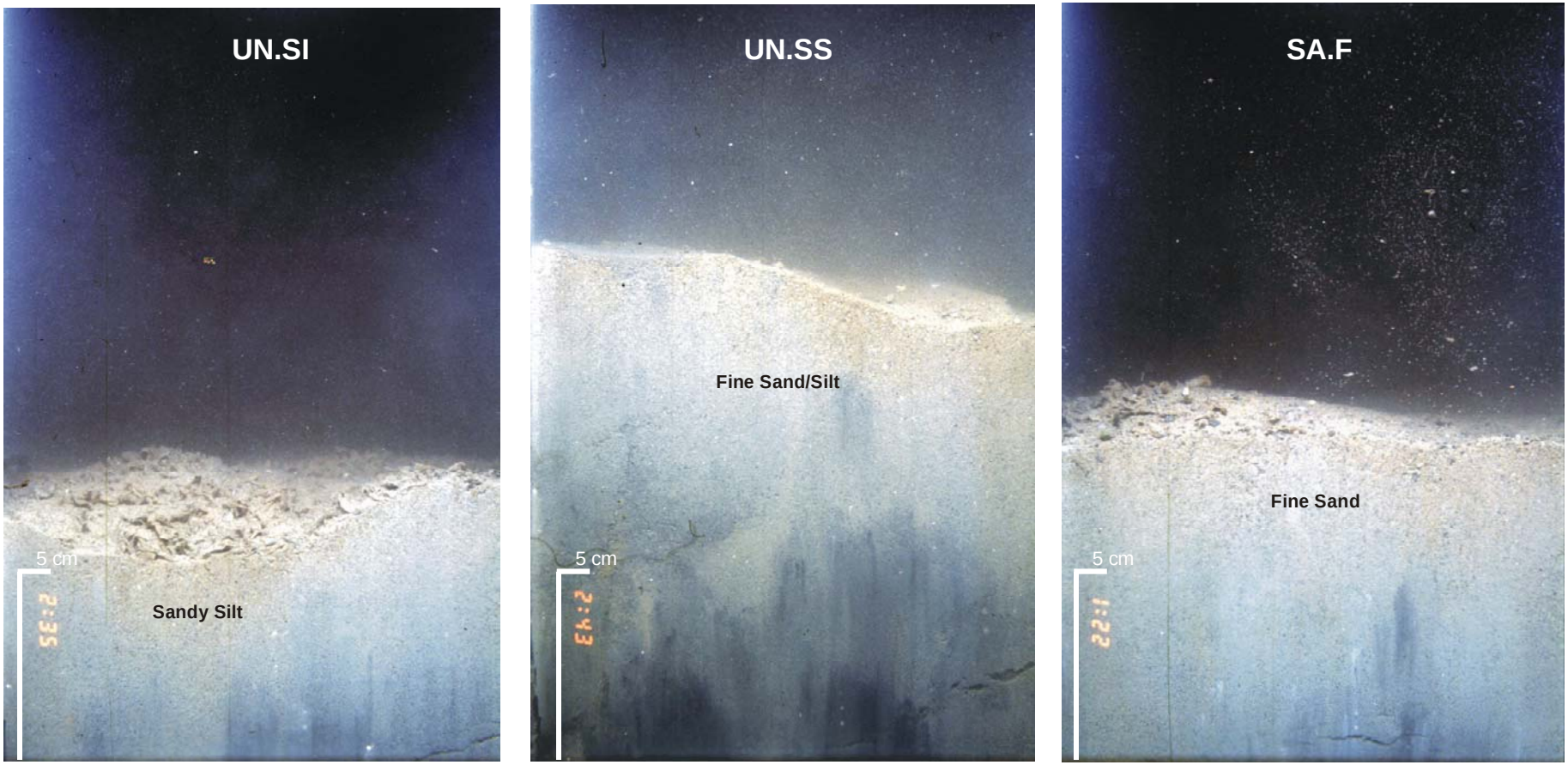

A **B** **C**

Figure 9. Three REMOTS® images from Stations JB2 (A), JB1 (B), and JB3 (C) within Site 69A (Jamestown Bridge Reef) illustrating the similarity in appearance of habitat types UN.SI, UN.SS, and SA.F. These habitat types are distinguished based on subtle visual differences in sediment texture that in turn reflect varying proportions of fines (silt-clay) and very fine sand.

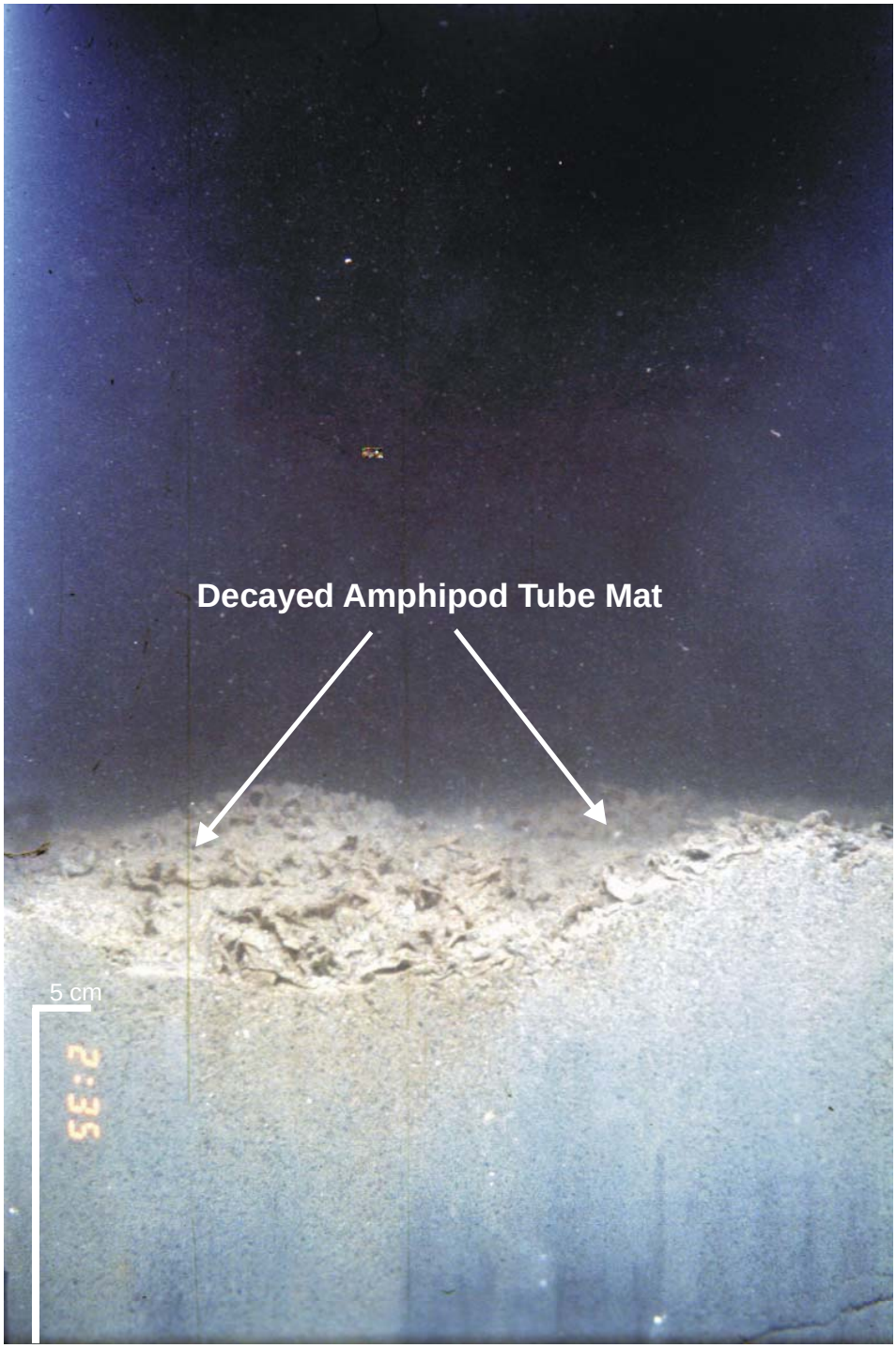

Figure 10. REMOTS® image obtained from Site 69A (Jamestown Bridge Reef) Station JB2 showing biogenic surface roughness in a silty benthic habitat (habitat type UN.SI) as a result of a decayed amphipod tube mat (*Ampelisca* sp.). This image was assigned a Stage II successional designation due to the presence of some living amphipod tubes at the sediment-water interface.

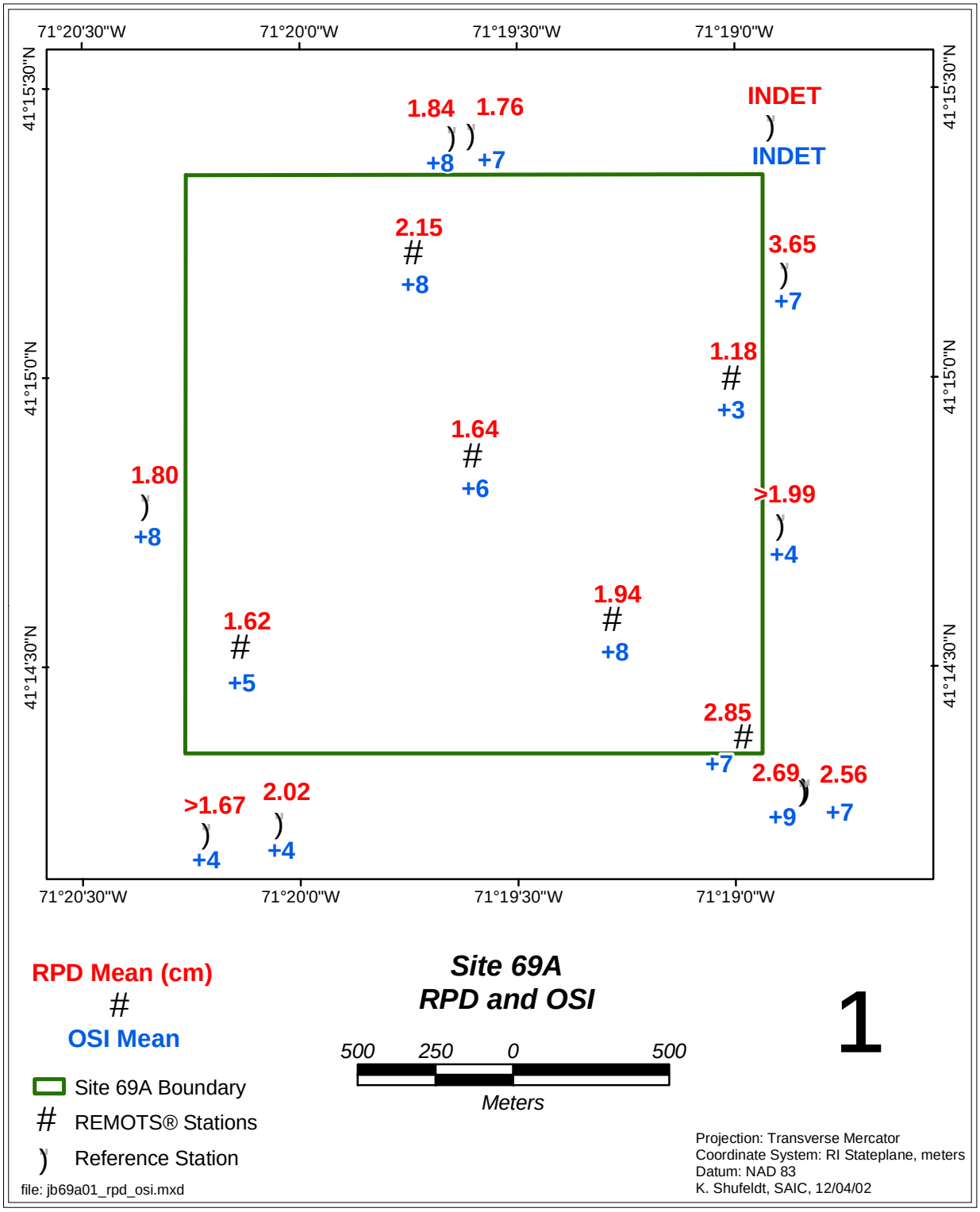

Figure 11. RPD Depths and OSI Values, Site 69A (Jamestown Bridge Reef).

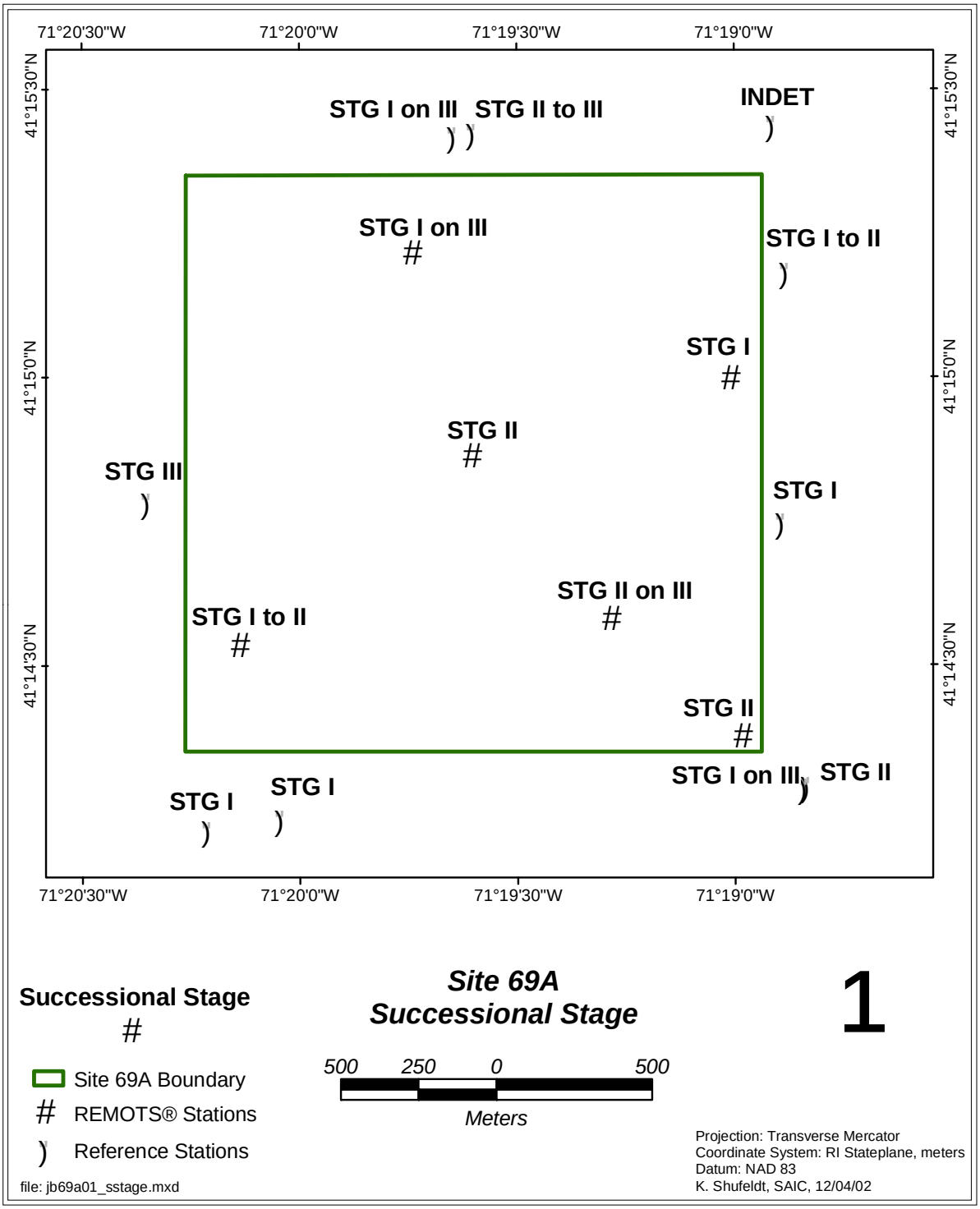

Figure 12. Infaunal Successional Stages, Site 69A (Jamestown Bridge Reef).

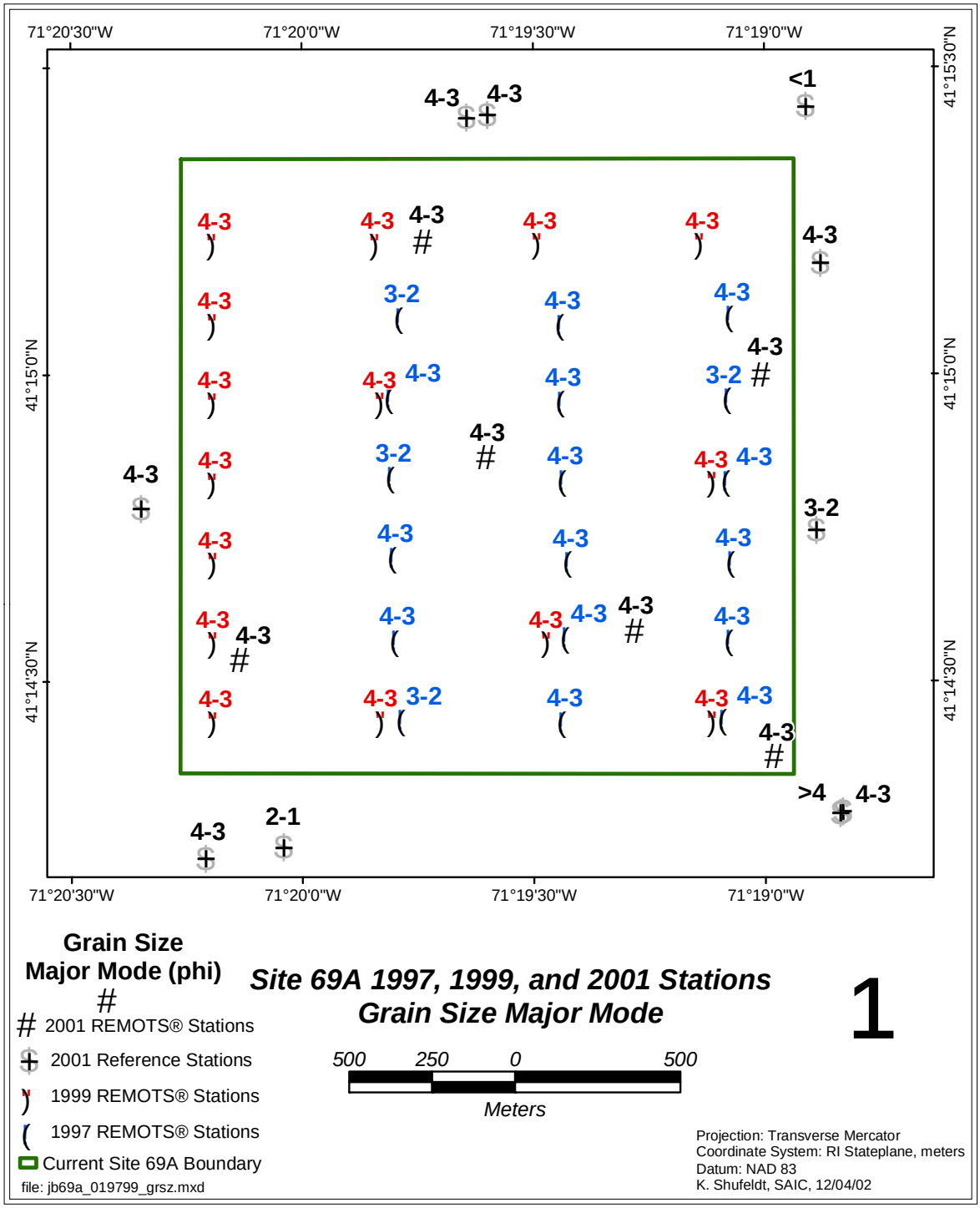

Figure 13. Grain Size Major Mode Values, 1997, 1999, and 2001 REMOTS® Stations, Site 69A (Jamestown Bridge Reef).

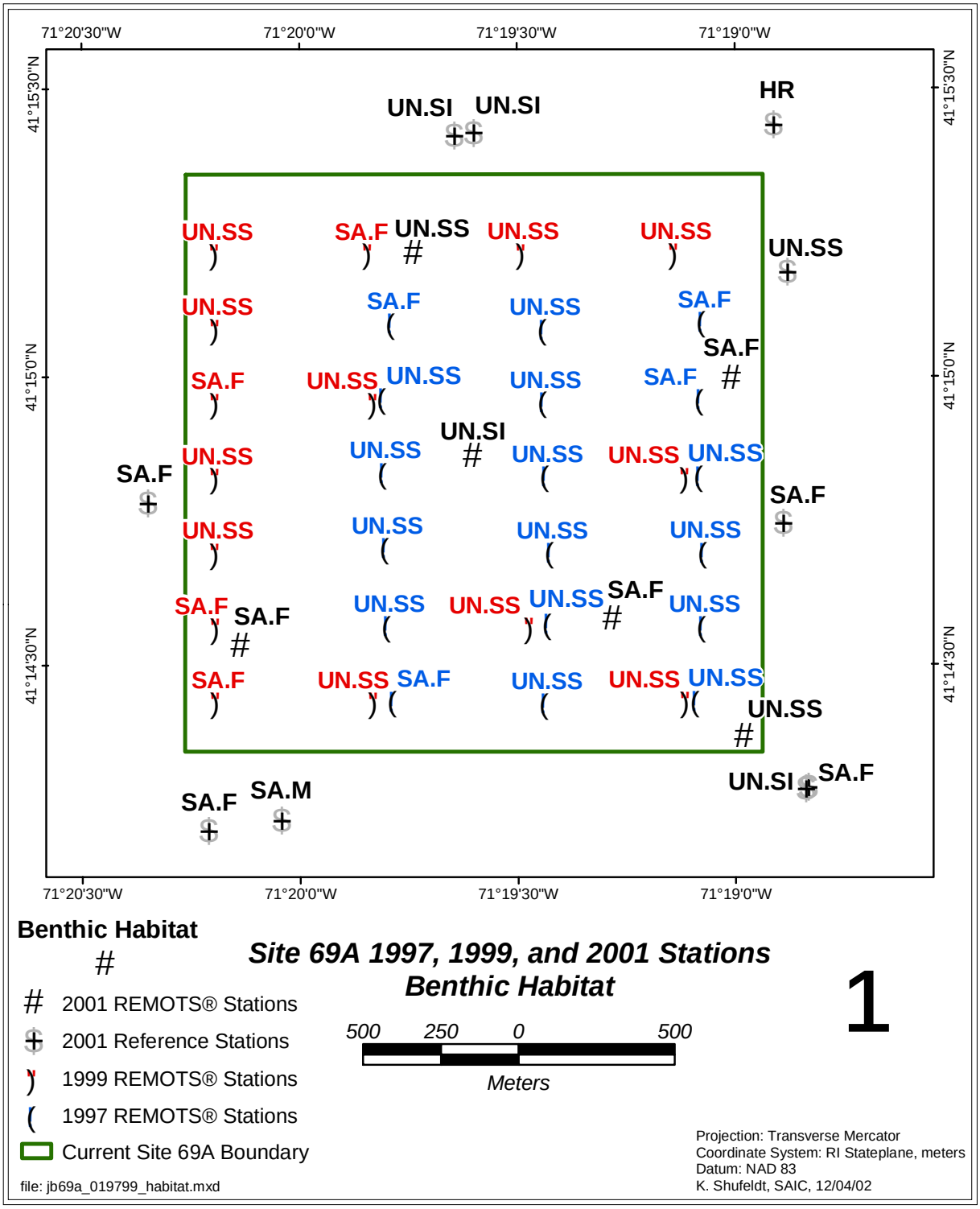

Figure 14. Benthic Habitat, 1997, 1999, and 2001 REMOTS® Stations, Site 69A (Jamestown Bridge Reef).

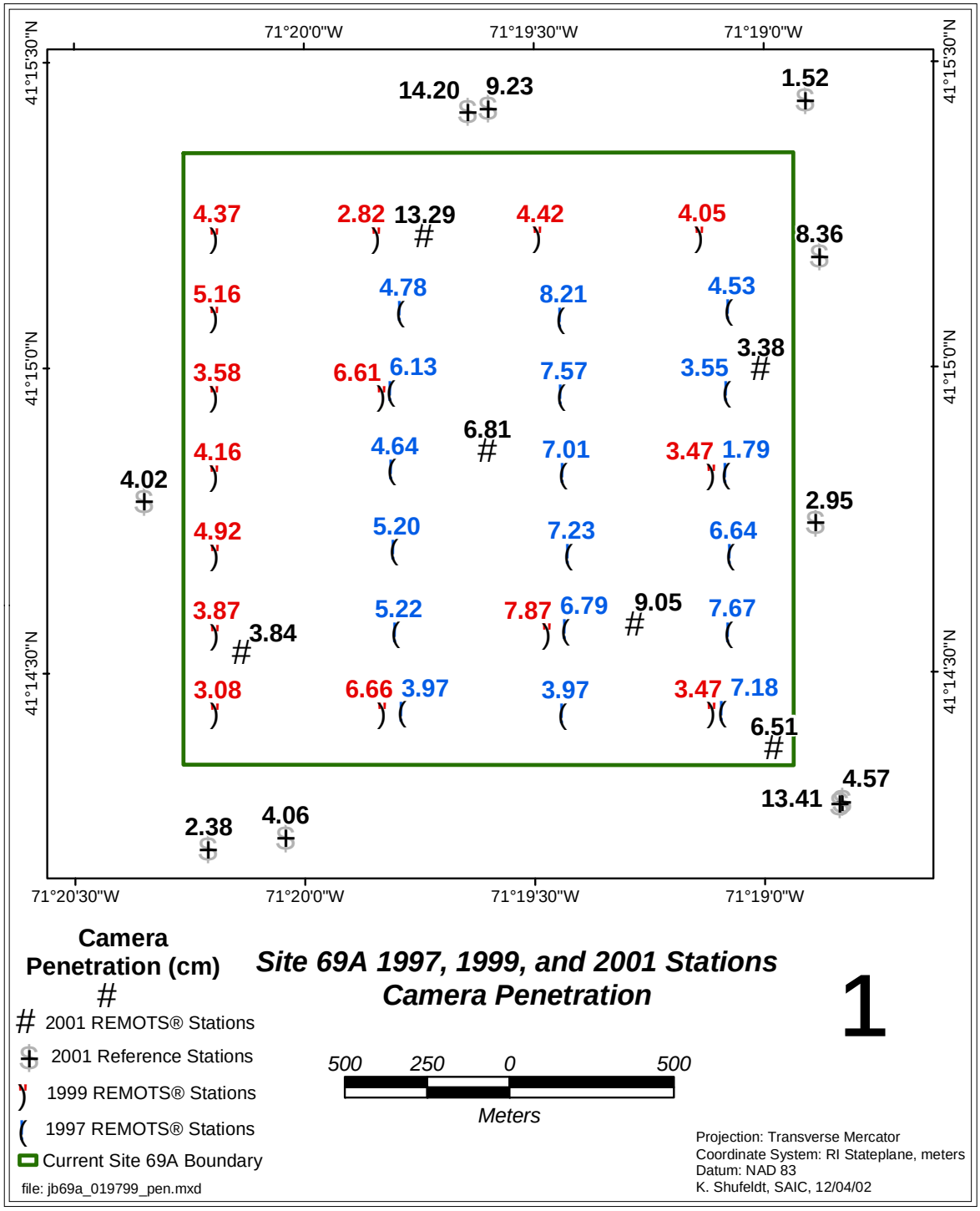

Figure 15. Camera Penetration Depths, 1997, 1999, and 2001 REMOTS® Stations, Site 69A (Jamestown Bridge Reef).

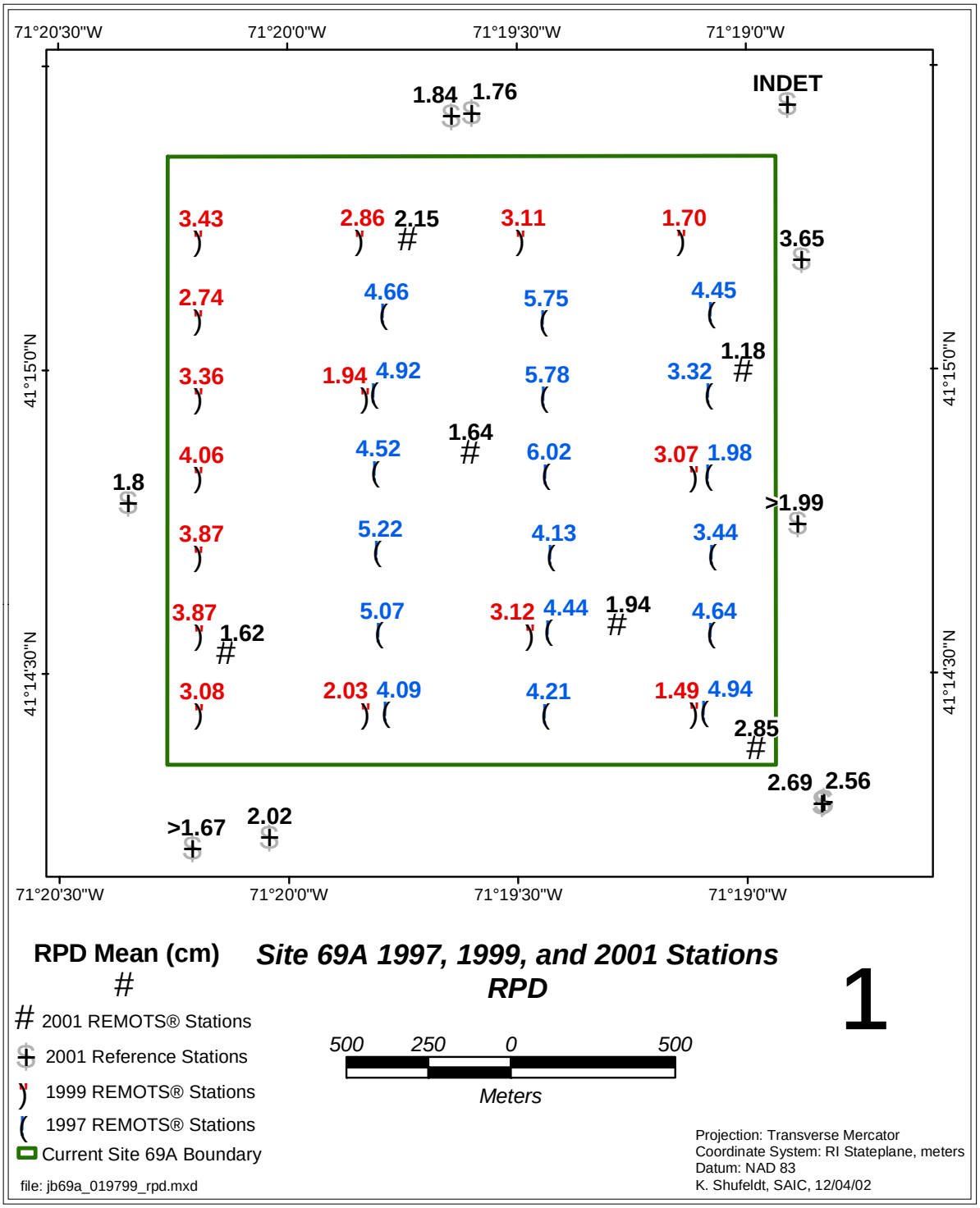

Figure 16. RPD Depths, 1997, 1999, and 2001 REMOTS® Stations, Site 69A (Jamestown Bridge Reef).

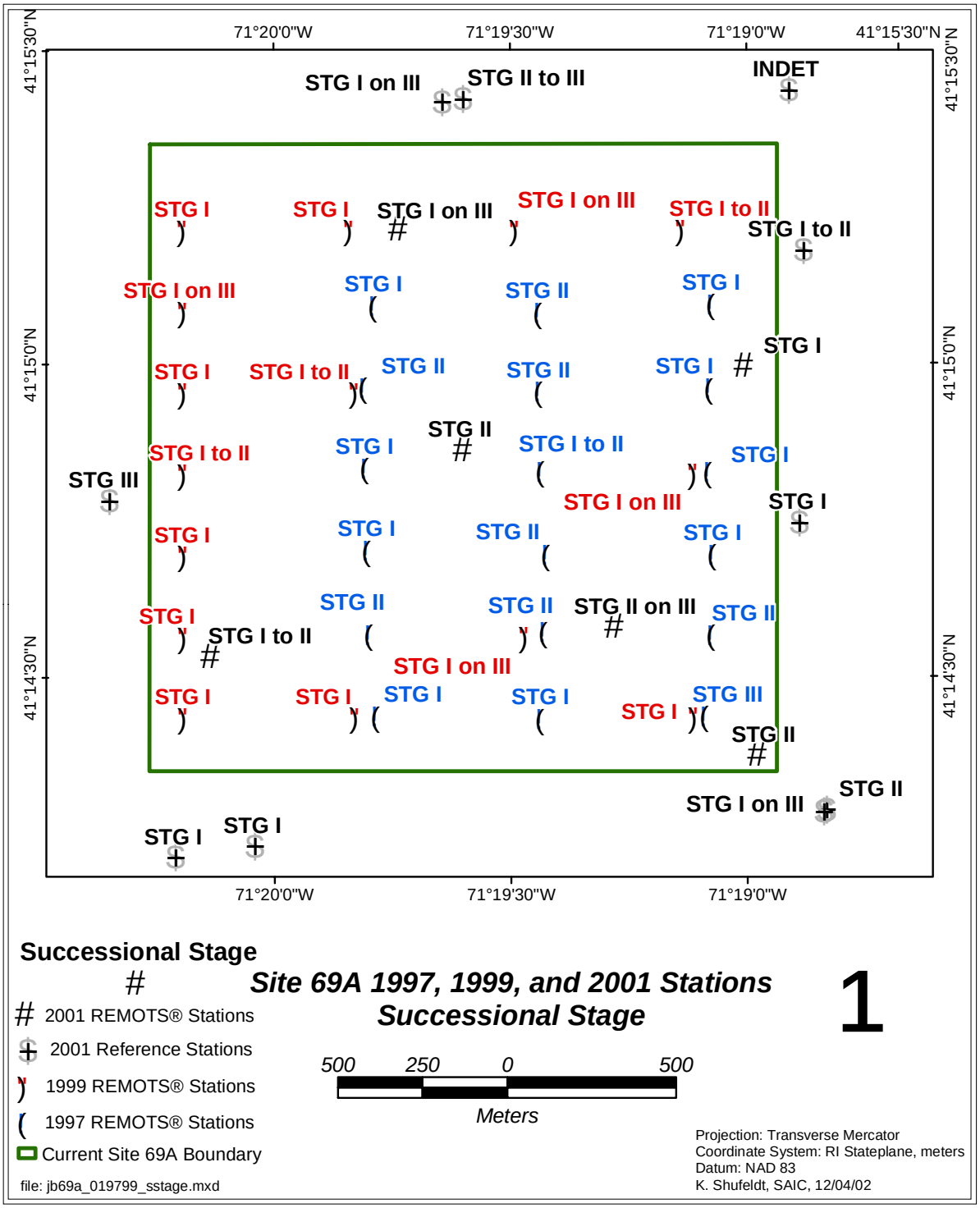

Figure 17. Infaunal Successional Stages, 1997, 1999, and 2001 REMOTS® Stations, Site 69A (Jamestown Bridge Reef).

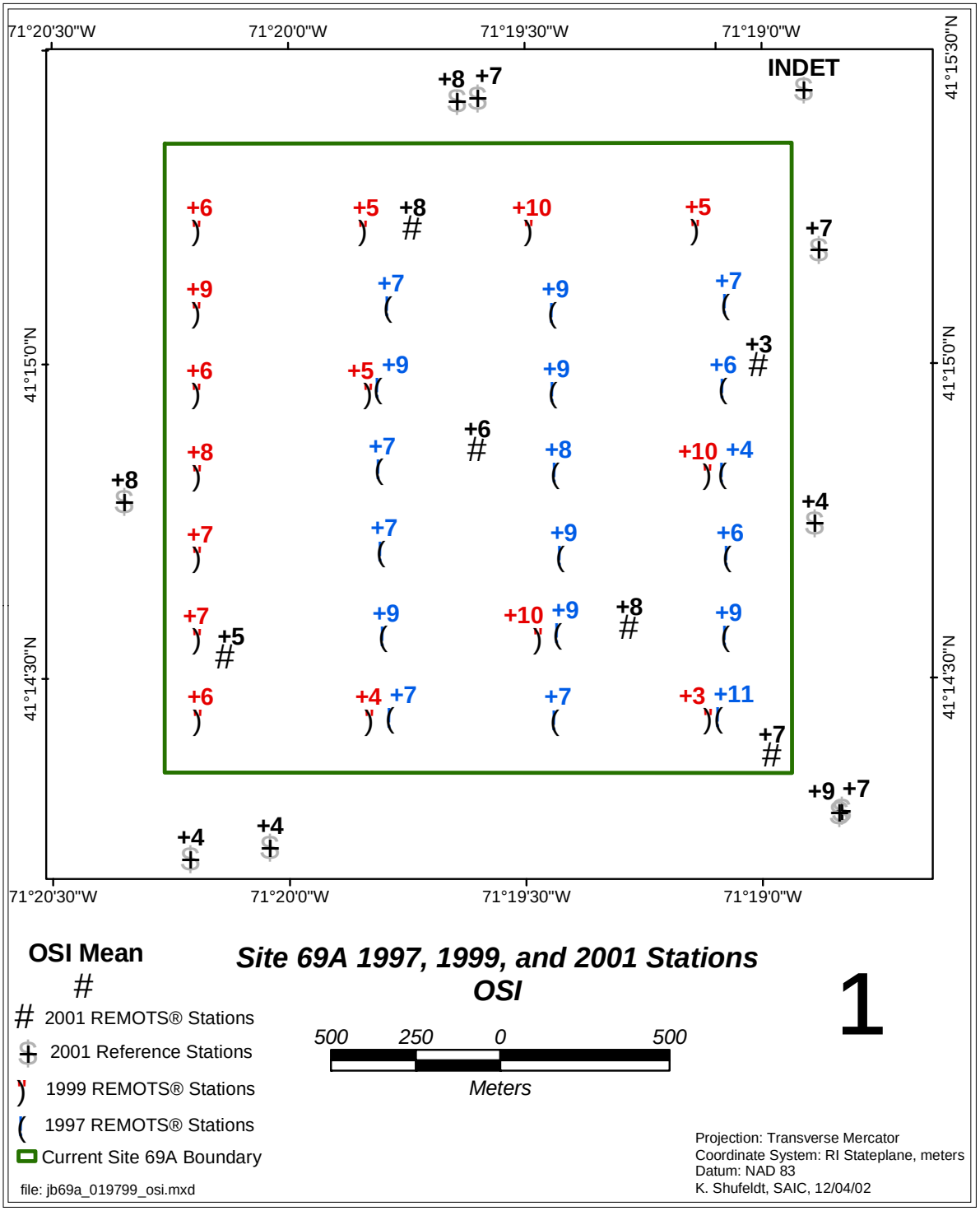

Figure 18. OSI Values, 1997, 1999, and 2001 REMOTS® Stations, Site 69A (Jamestown Bridge Reef).

Site 69B

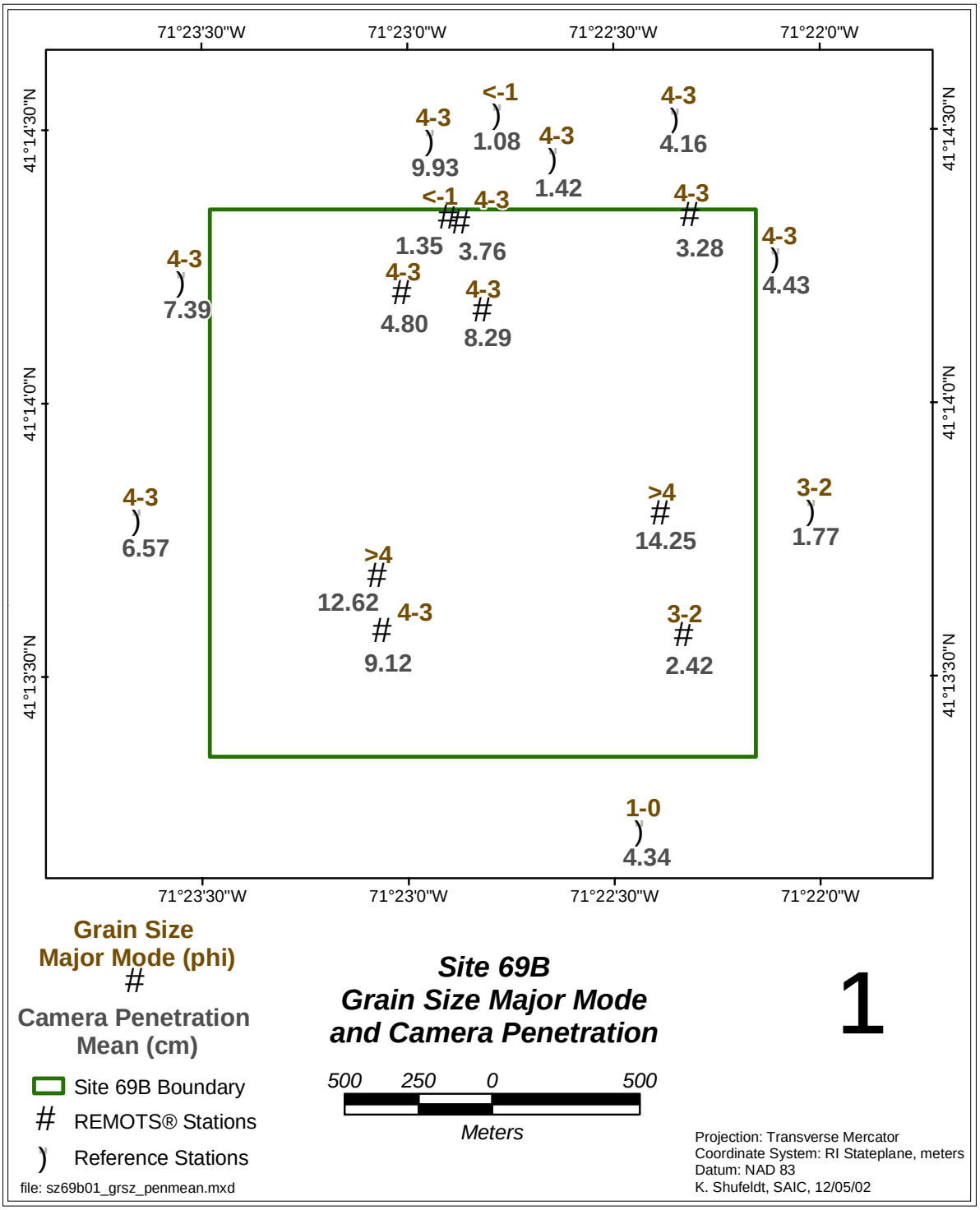

Figure 19. Grain Size Major Mode Values and Camera Penetration Depths, Site 69B (Separation Zone).

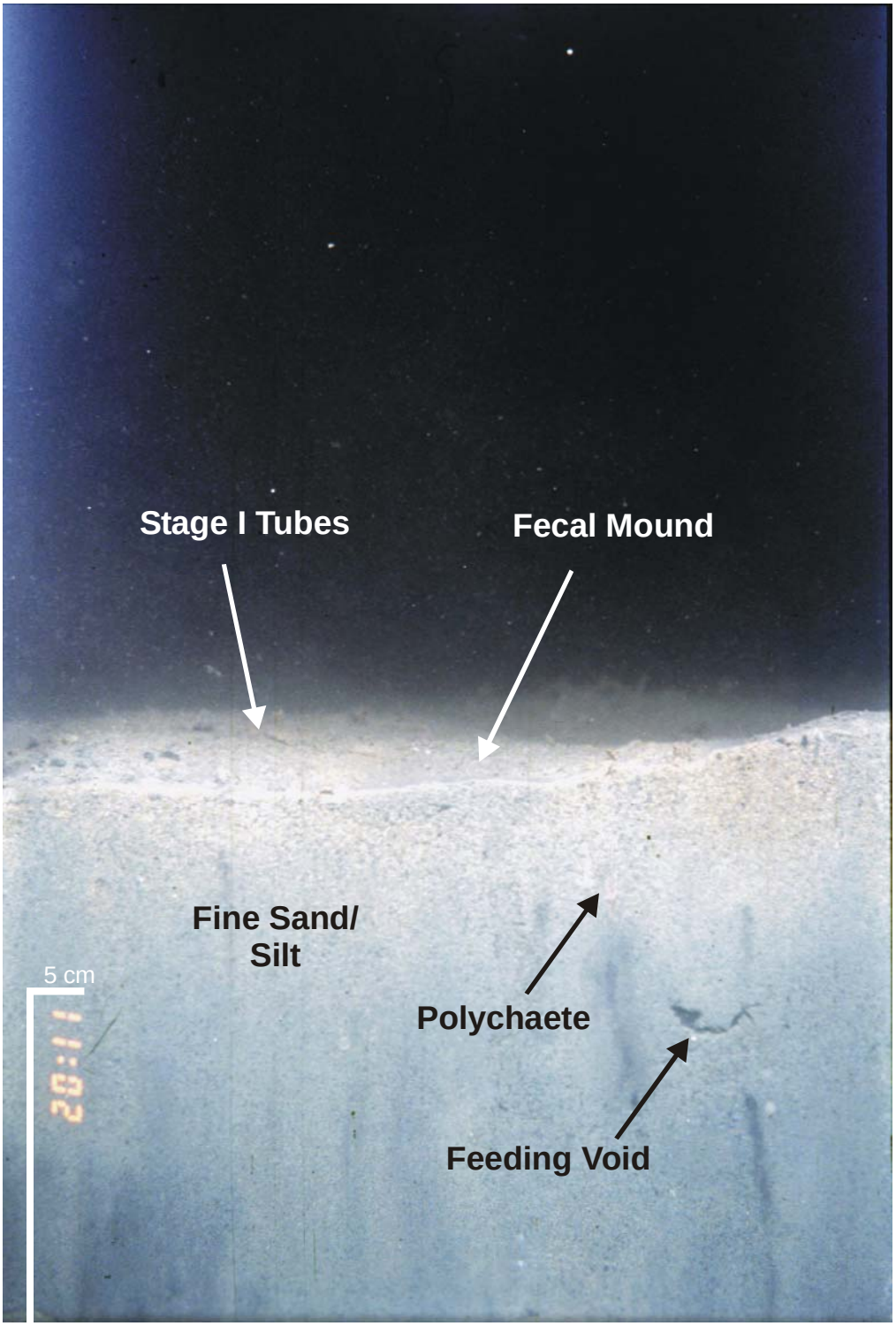

Figure 20. REMOTS® image collected at Station SZ6 from Site 69B (Separation Zone) displaying silty, very fine sand (grain size major mode of 4 to 3 phi). This is an example of benthic habitat type UN.SI that characterized the majority of Site 69B stations. A fecal mound is visible at the sediment-water interface. Stage I tubes at the sediment-water interface and a feeding void in the subsurface sediments resulted in a Stage I on III successional status.

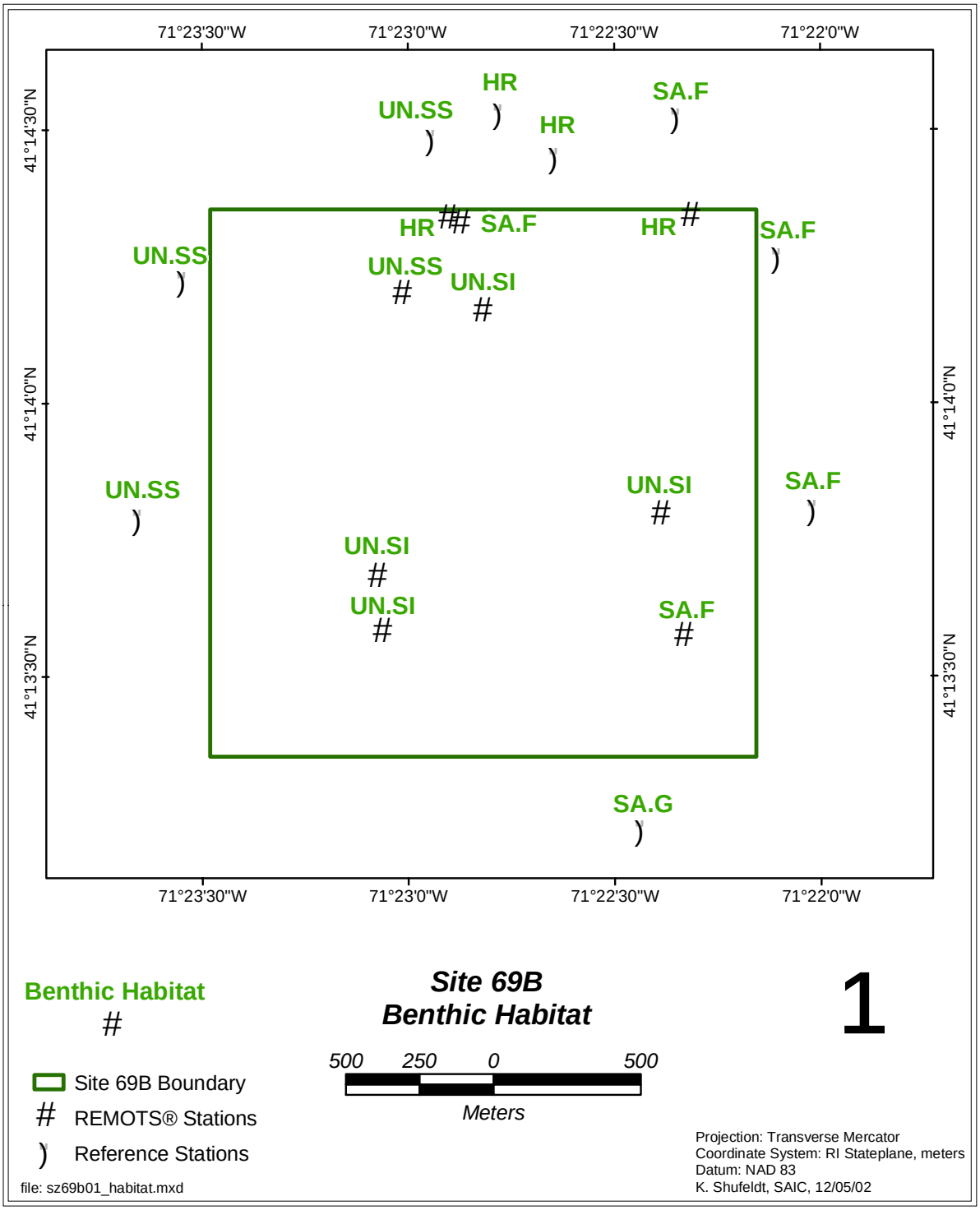

Figure 21. Benthic Habitat, Site 69B (Separation Zone).

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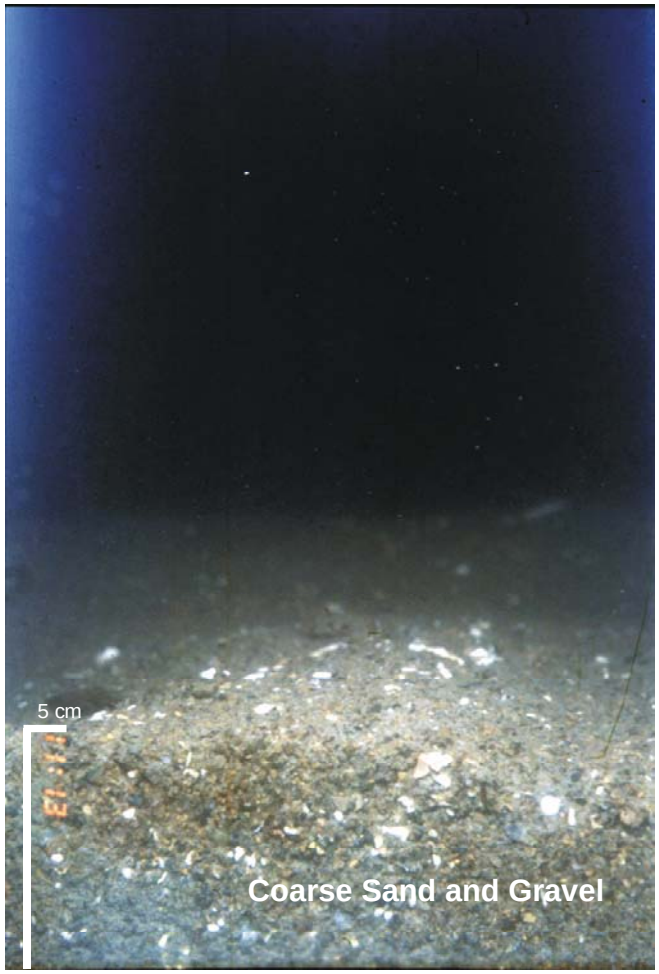
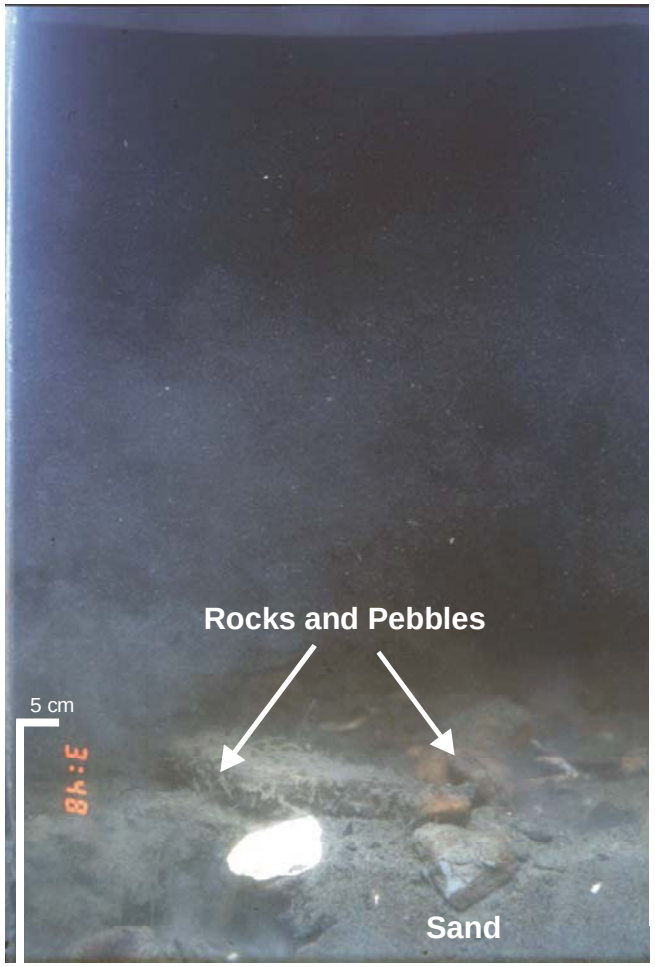


A



B

Figure 22. Two REMOTS® images illustrating the various types of benthic habitats observed within the reference stations surrounding Site 69B (Separation Zone). The sediment in image A (Station SZR5) is comprised of coarse sand and gravel and is classified by benthic habitat type SA.G (Medium sand and gravel). Image B (Station SZR1) displays hard bottom conditions composed of rocks and pebbles over sand and is classified by benthic habitat type HR (Hard Rock/Gravel Bottom).

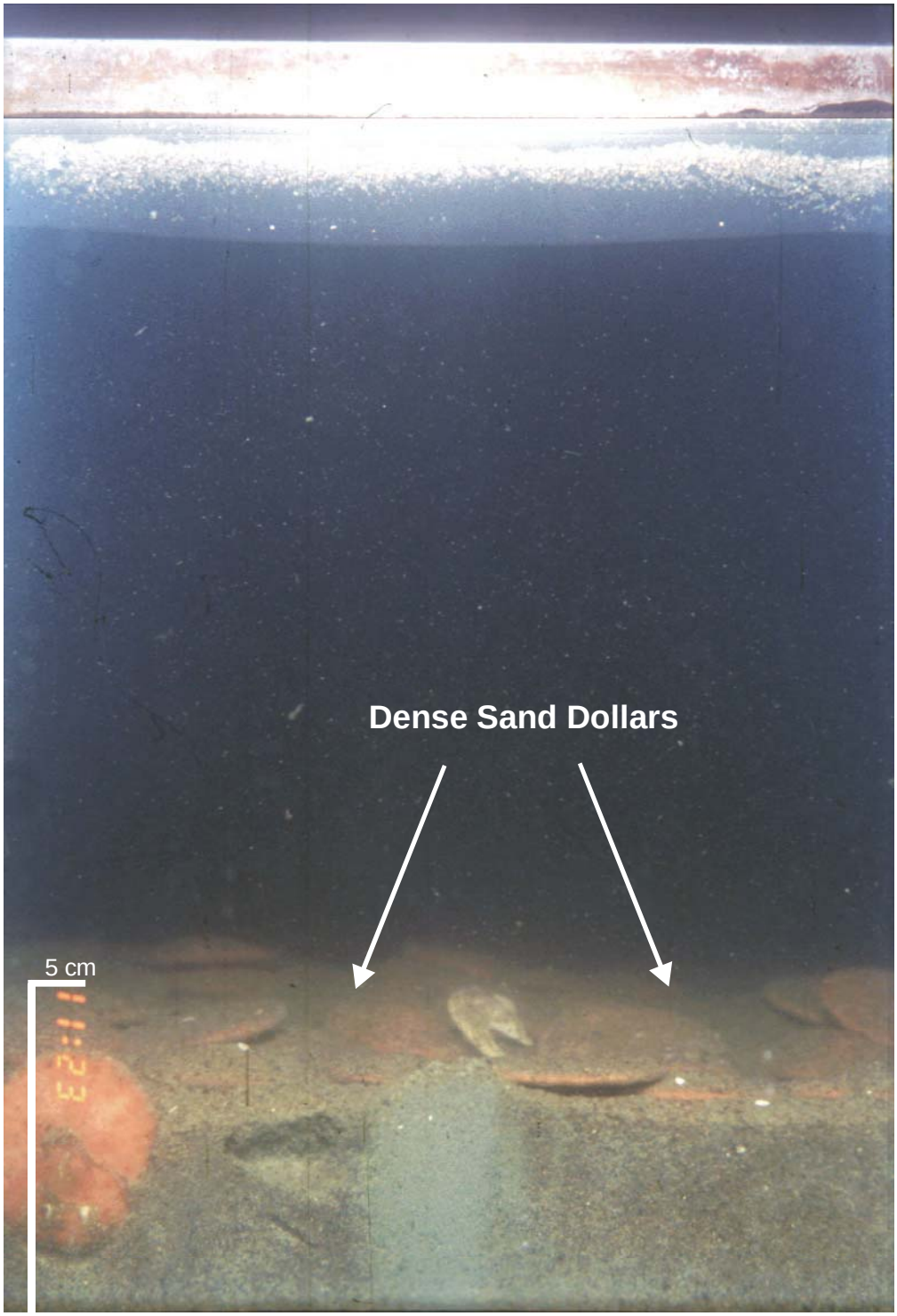


Figure 23. REMOTS® image obtained from Station SZ8 within Site 69B (Separation Zone) showing a biologically active environment with a dense aggregation of sand dollars within the sandy substrate (habitat type SA.F).

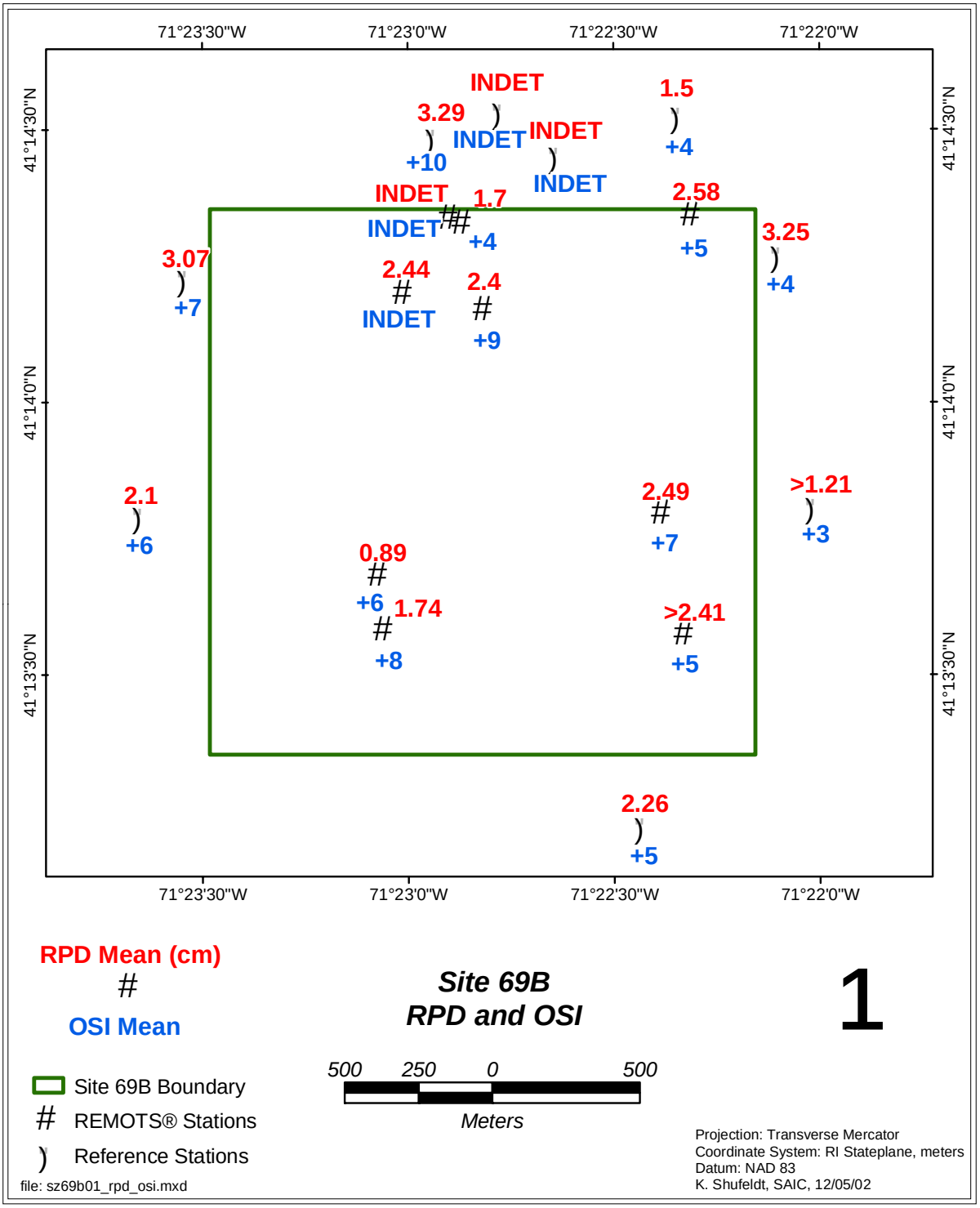


Figure 24. RPD Depths and OSI Values, Site 69B (Separation Zone).

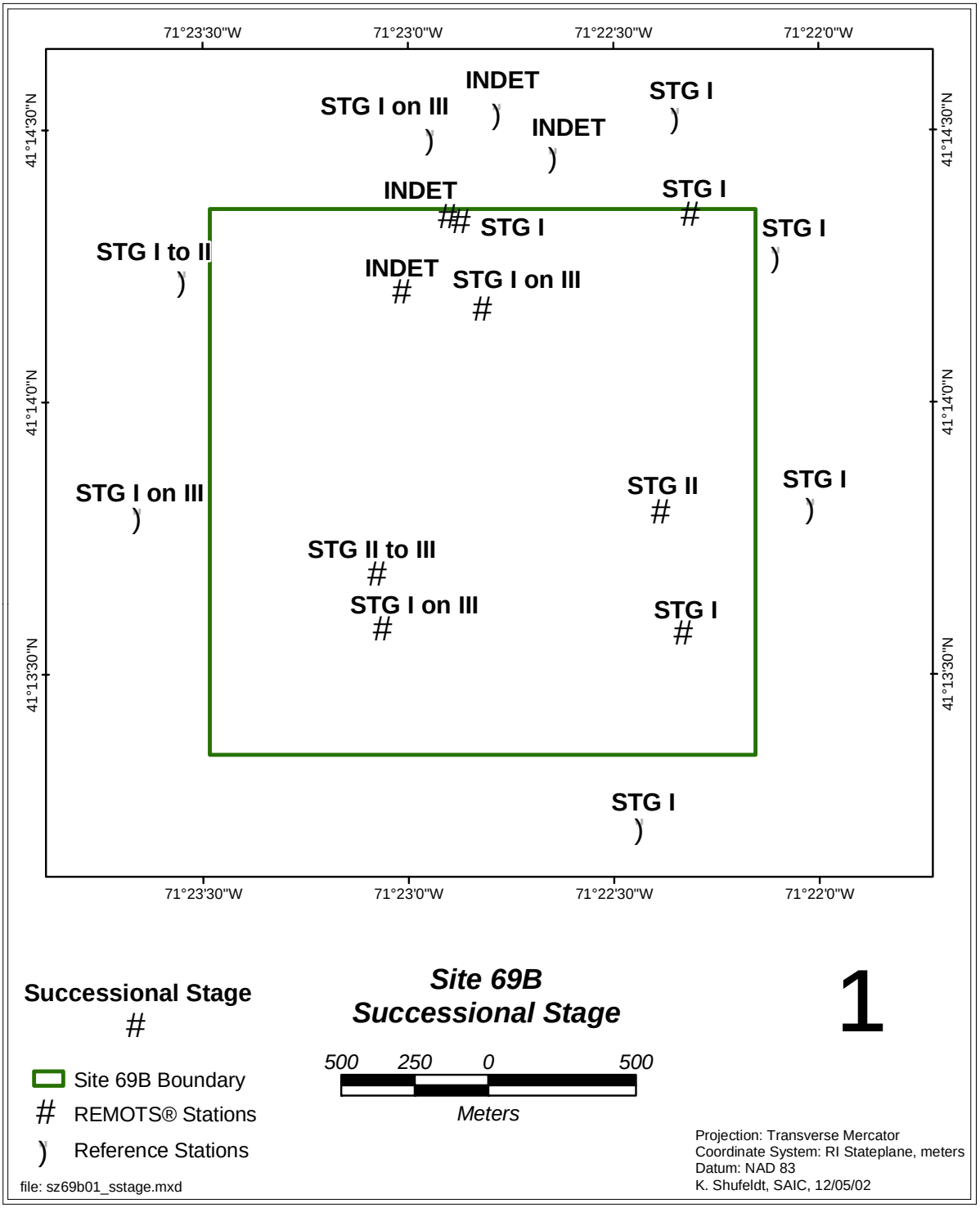


Figure 25. Infaunal Successional Stages, Site 69B (Separation Zone).

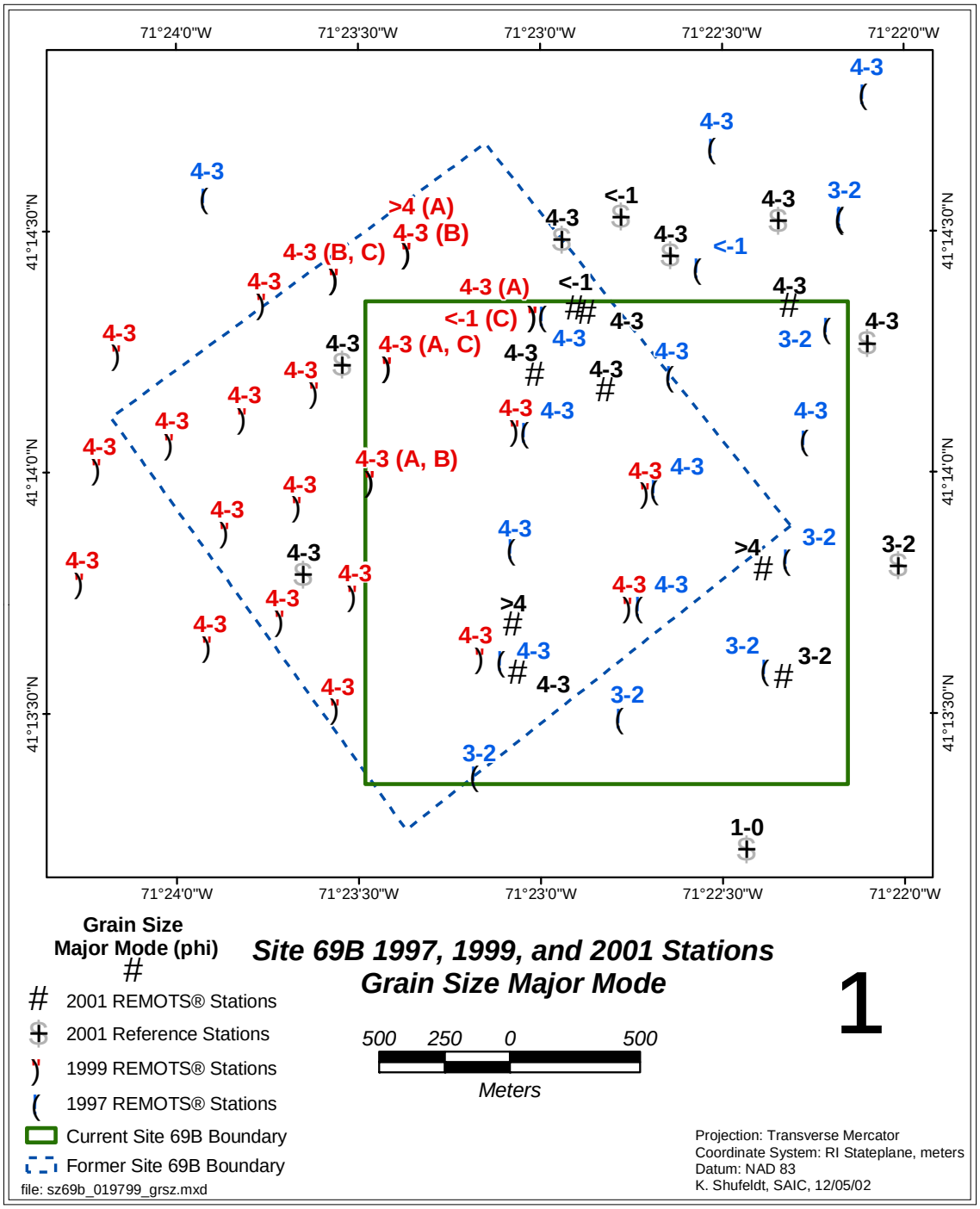


Figure 26. Grain Size Major Mode Values, 1997, 1999, and 2001 REMOTS® Stations, Site 69B (Separation Zone).

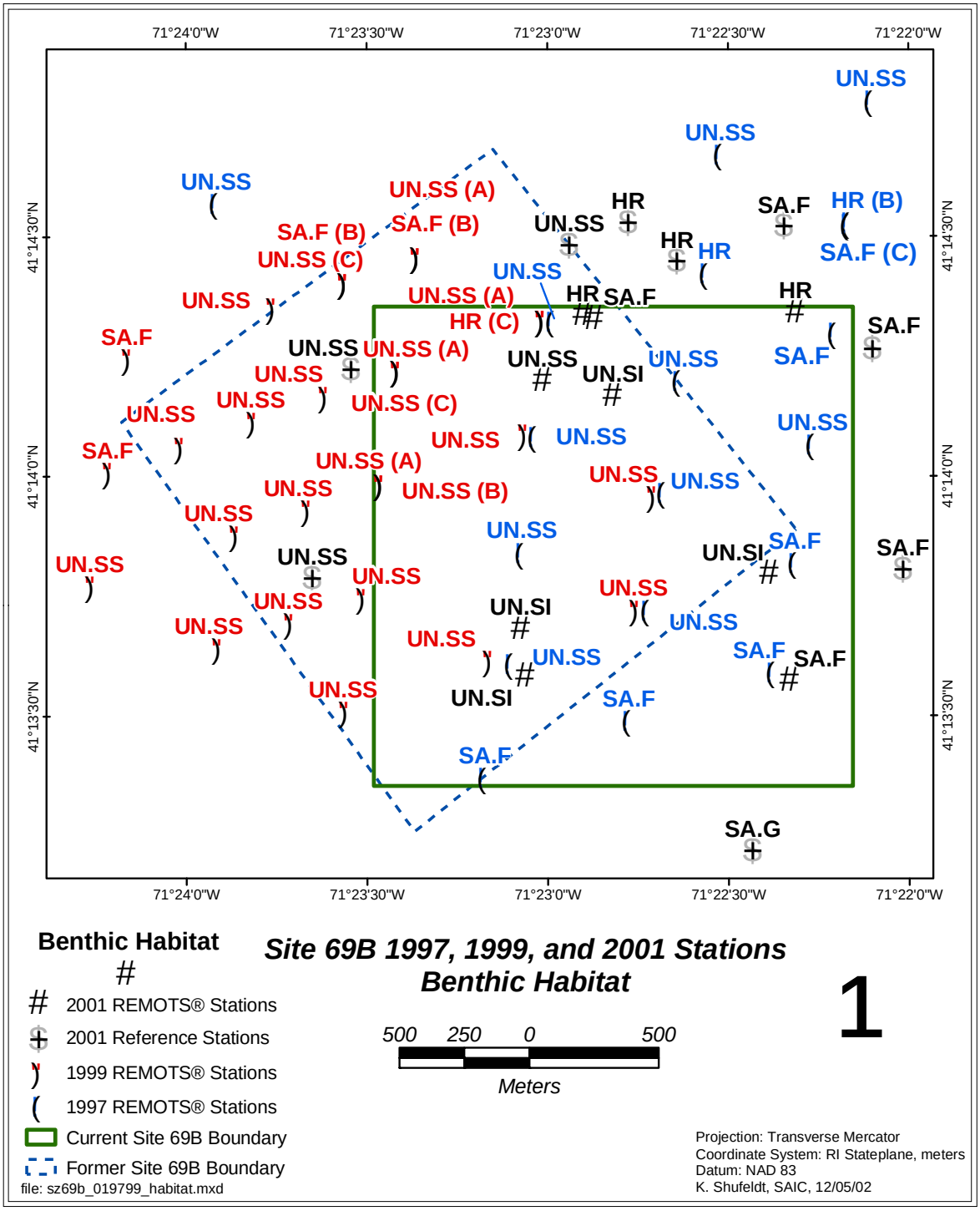


Figure 27. Benthic Habitat, 1997, 1999, and 2001 REMOTS® Stations, Site 69B (Separation Zone).

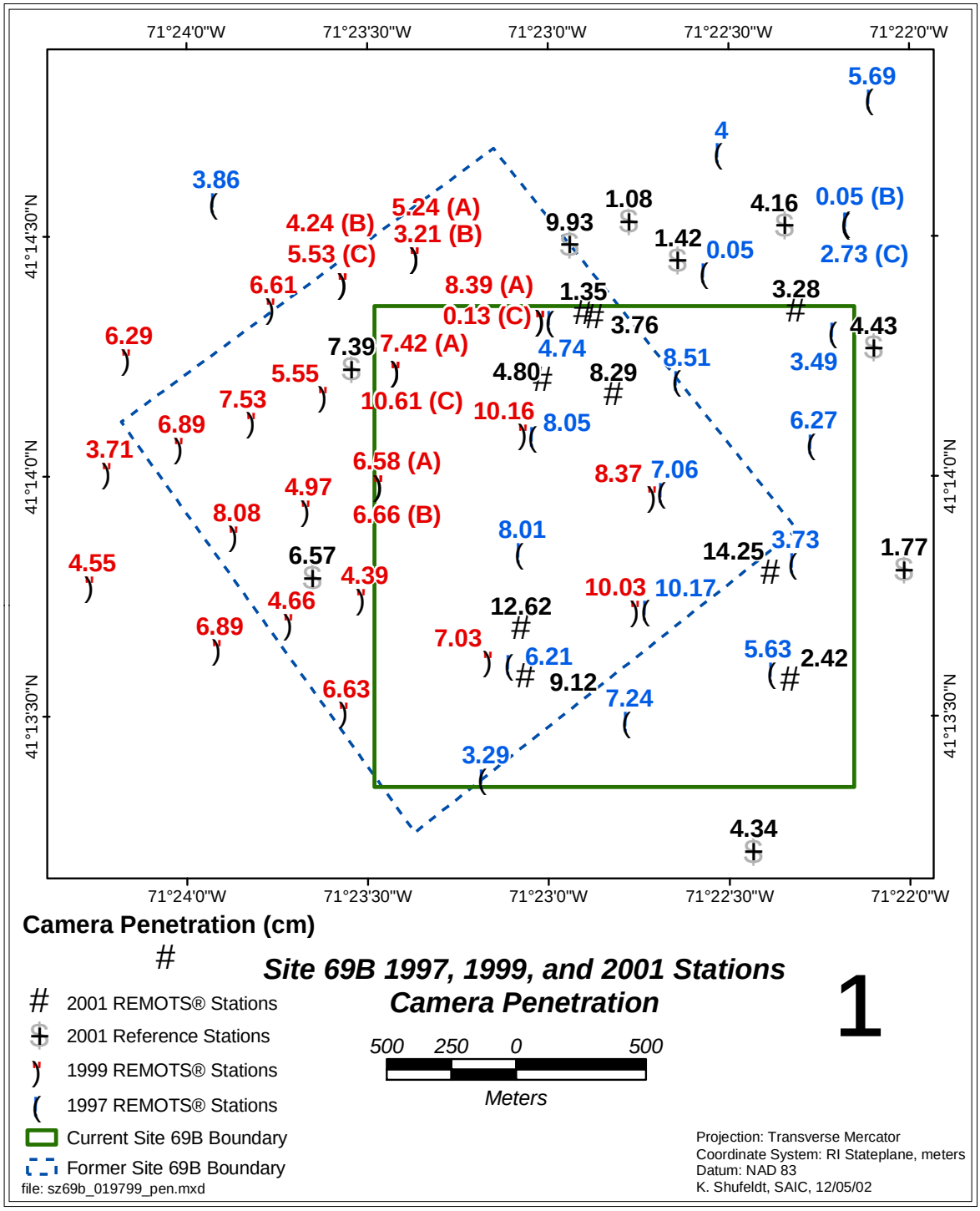


Figure 28. Camera Penetration Depths, 1997, 1999, and 2001 REMOTS® Stations, Site 69B (Separation Zone).

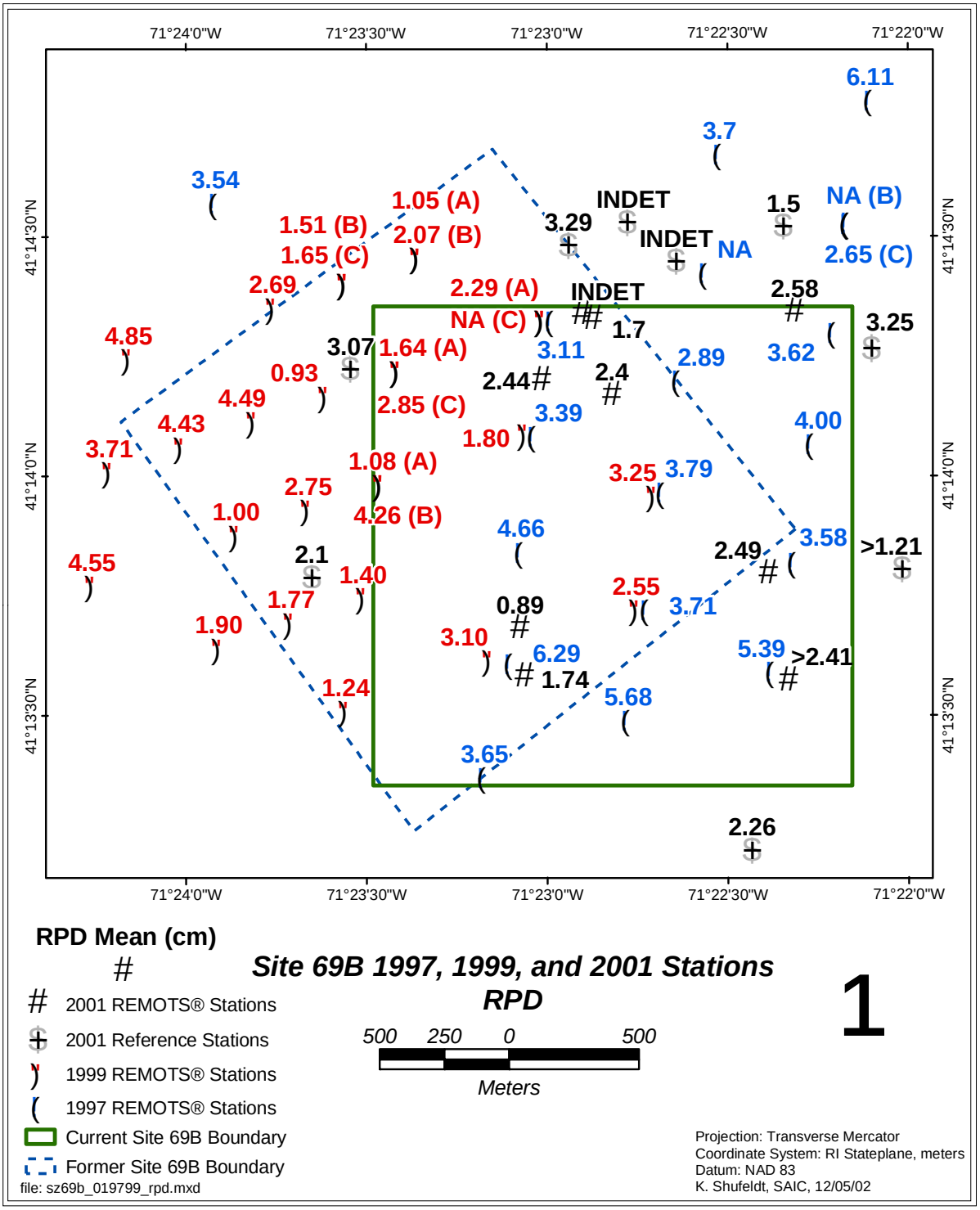


Figure 29. RPD Depths, 1997, 1999, and 2001 REMOTS® Stations, Site 69B (Separation Zone).

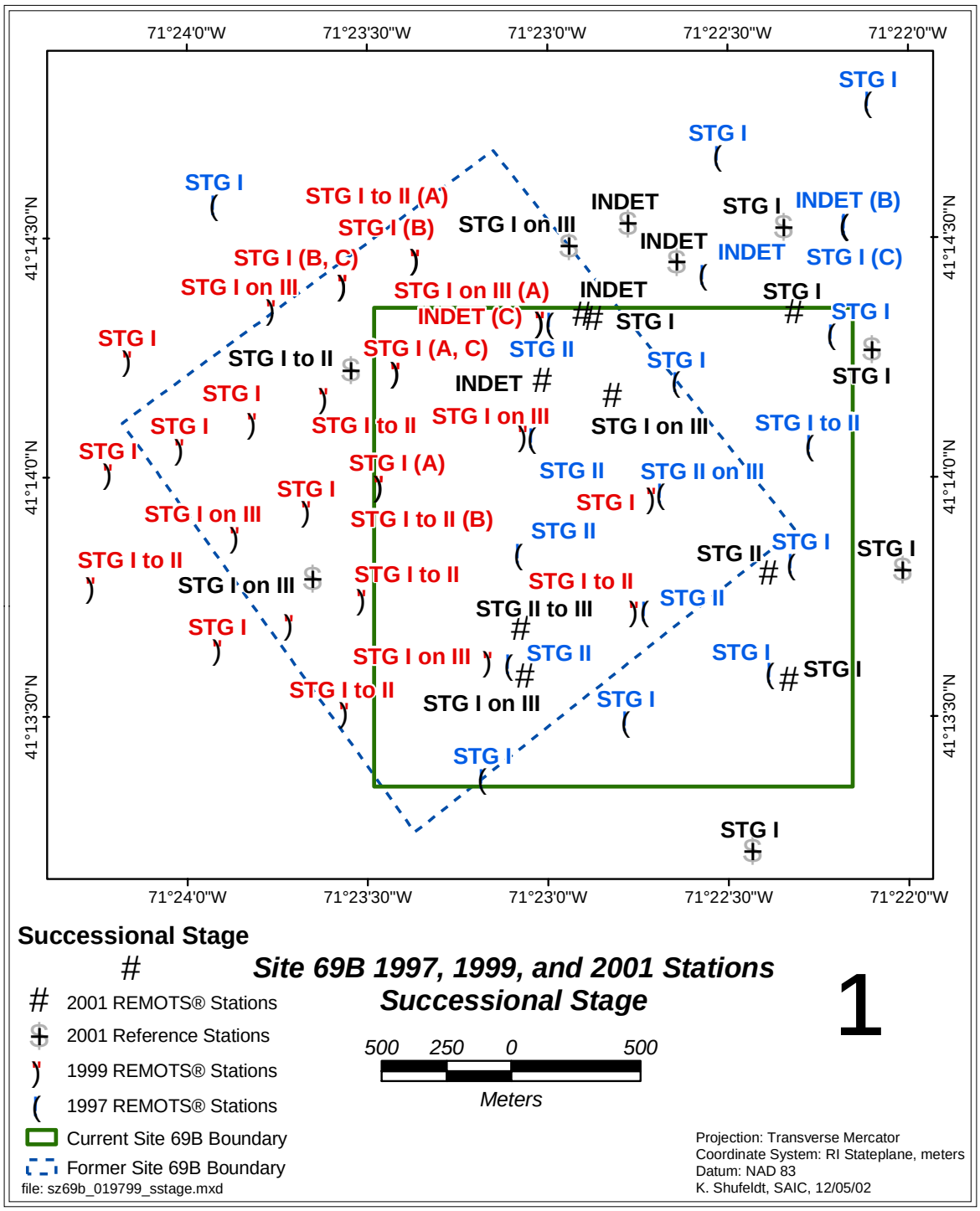


Figure 30. Infaunal Successional Stages, 1997, 1999, and 2001 REMOTS® Stations, Site 69B (Separation Zone).

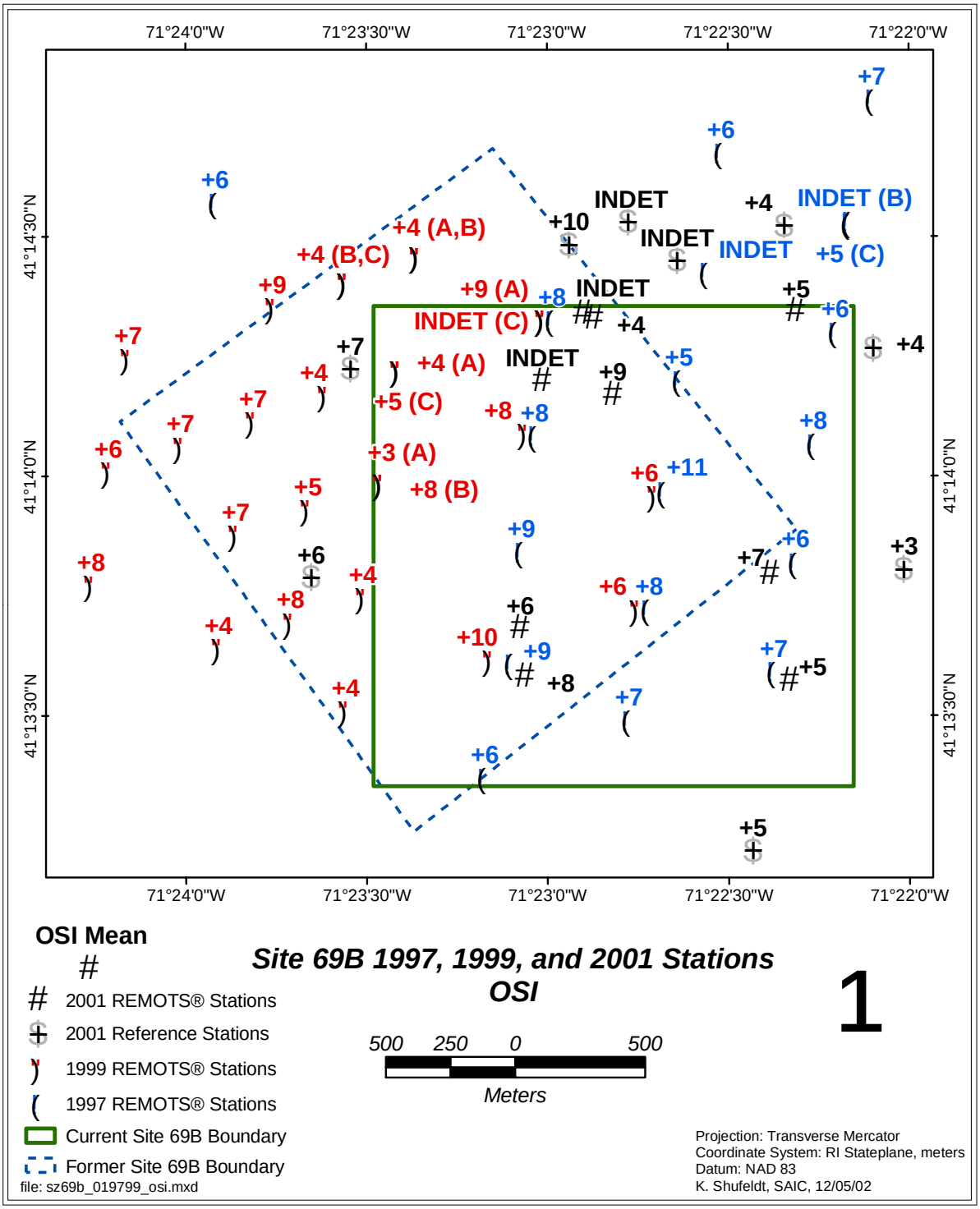


Figure 31. OSI Values, 1997, 1999, and 2001 REMOTS® Stations, Site 69B (Separation Zone).

Site 18

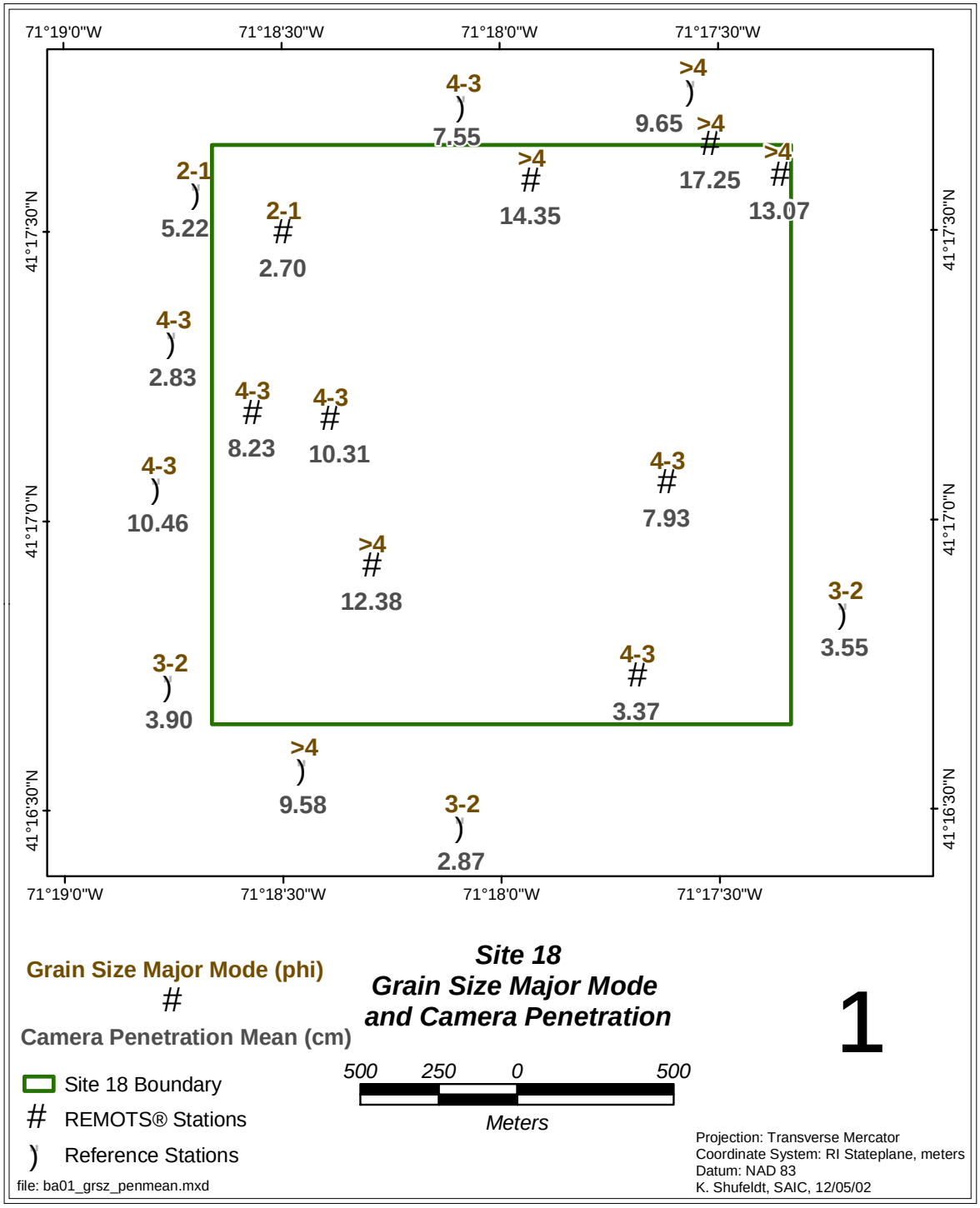


Figure 32. Grain Size Major Mode Values and Camera Penetration Depths, Site 18 (Brenton-A).

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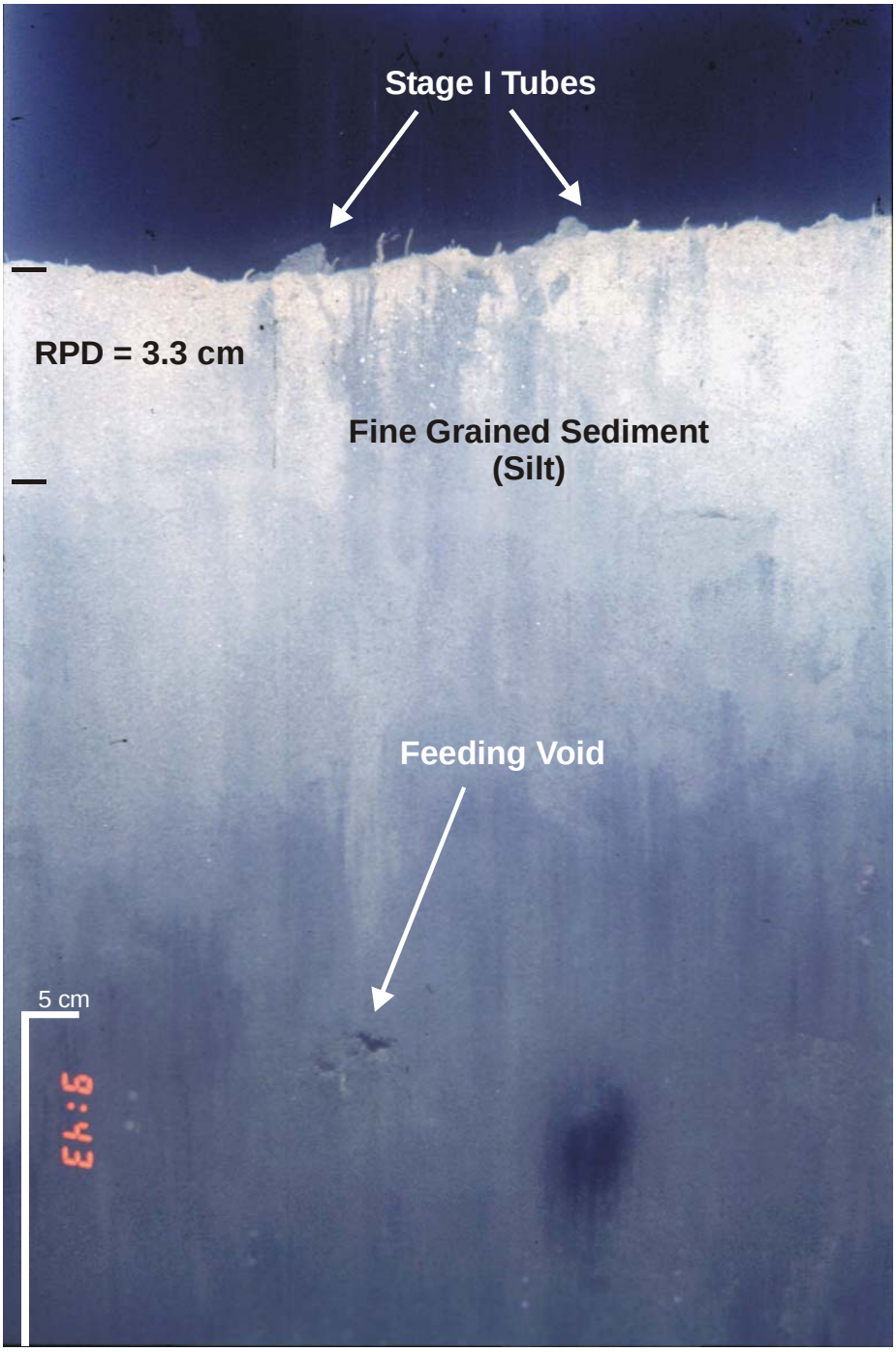


Figure 33. REMOTS® image from Site 18 (Brenton-A) Station BA3 illustrating soft, fine-grained, muddy sediment having a major modal grain size of >4 phi. This is an example of benthic habitat type UN.SF (very soft mud) observed throughout the majority of Site BA images. A Stage I on III successional status was assigned to this image due to the presence of Stage I polychaete tubes at the sediment surface and an active Stage III feeding void at depth. A well-developed RPD (3.3 cm) coupled with the advanced, Stage I on III successional status resulted in an OSI of +10. This OSI value indicates undisturbed or non-degraded benthic habitat quality.

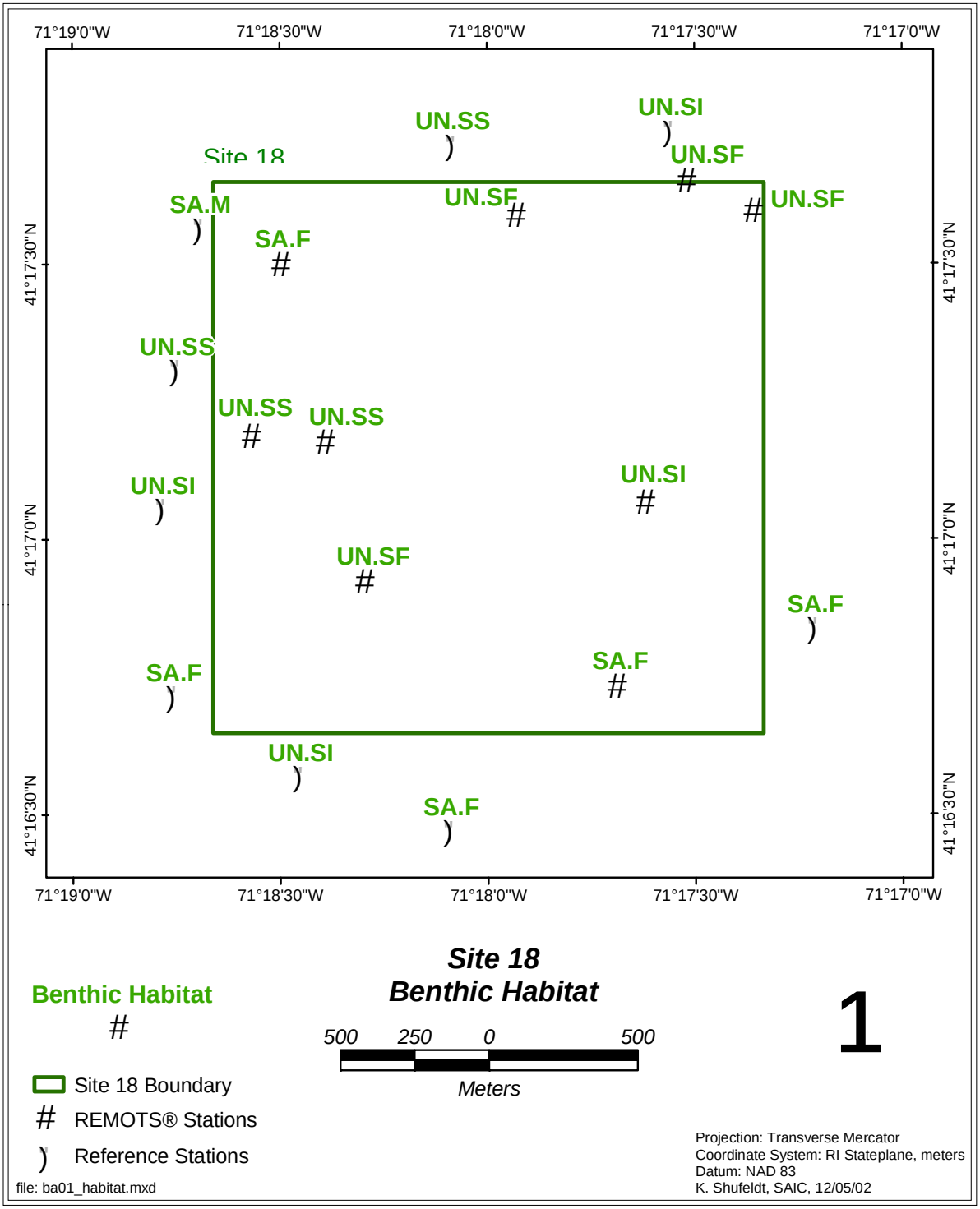


Figure 34. Benthic Habitat, Site 18 (Brenton-A).

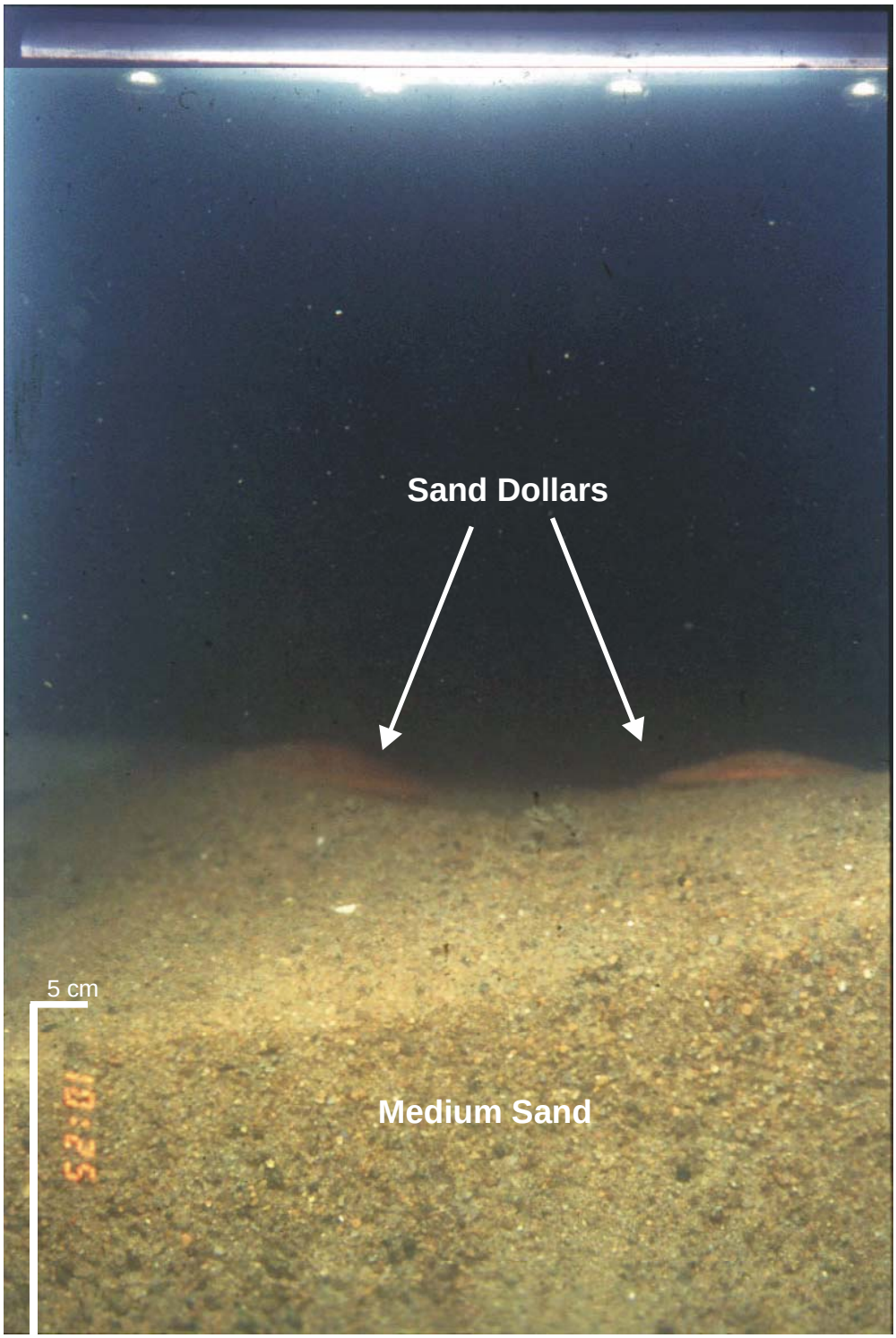
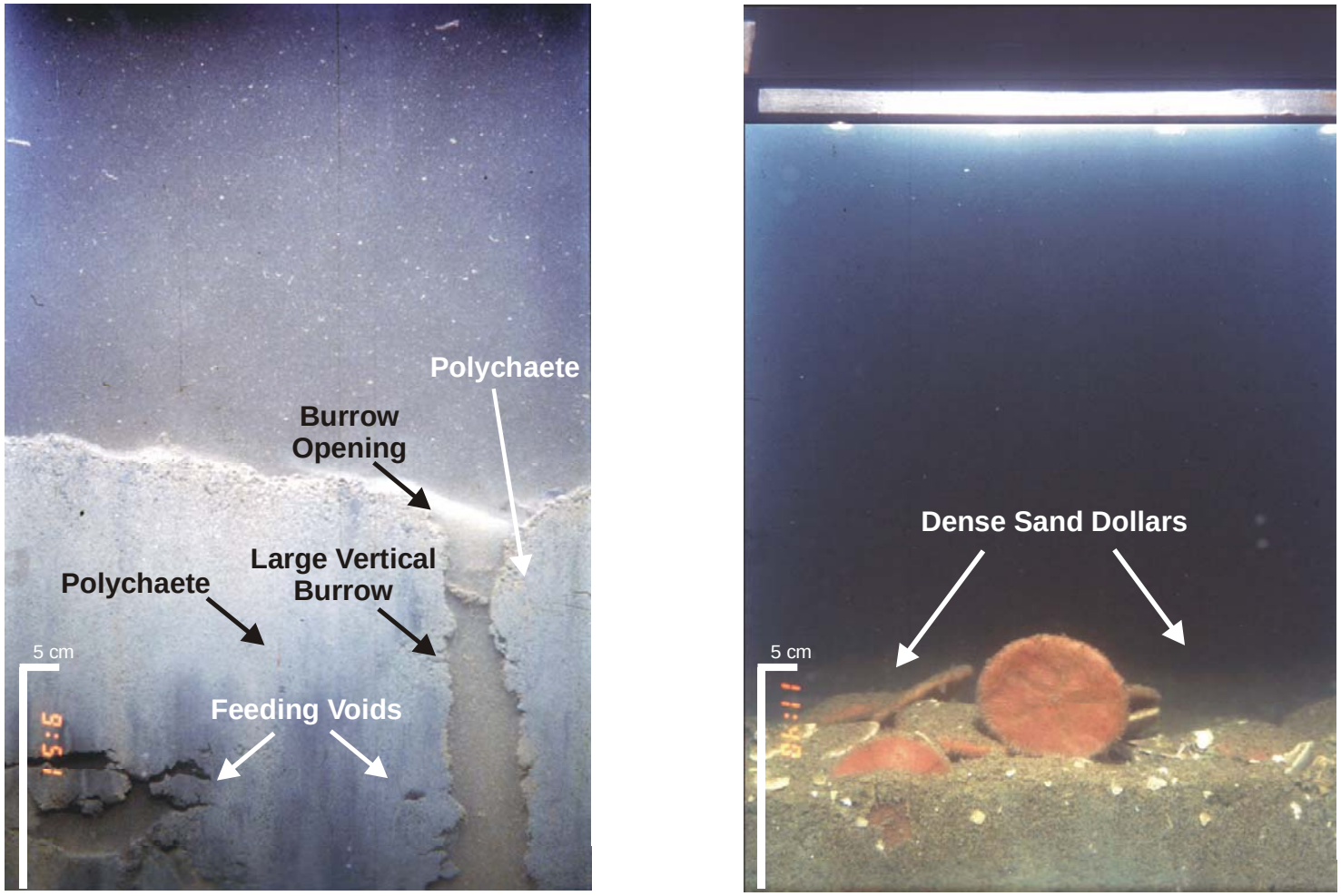


Figure 35. REMOTS® image collected at reference station BAR1 surrounding Site 18 (Brenton-A) displaying benthic habitat SA.M (medium sand) having a grain size major mode of 2 to 1 phi. Sand dollars are visible at the sediment-water interface.



A B

Figure 36. REMOTS® images from Site 18 reference stations BAR3 (A) and Station BAR5 (B) showing biogenic surface reworking by burrowing infauna (A) and a dense assemblage of sand dollars at the sediment-water interface (B).

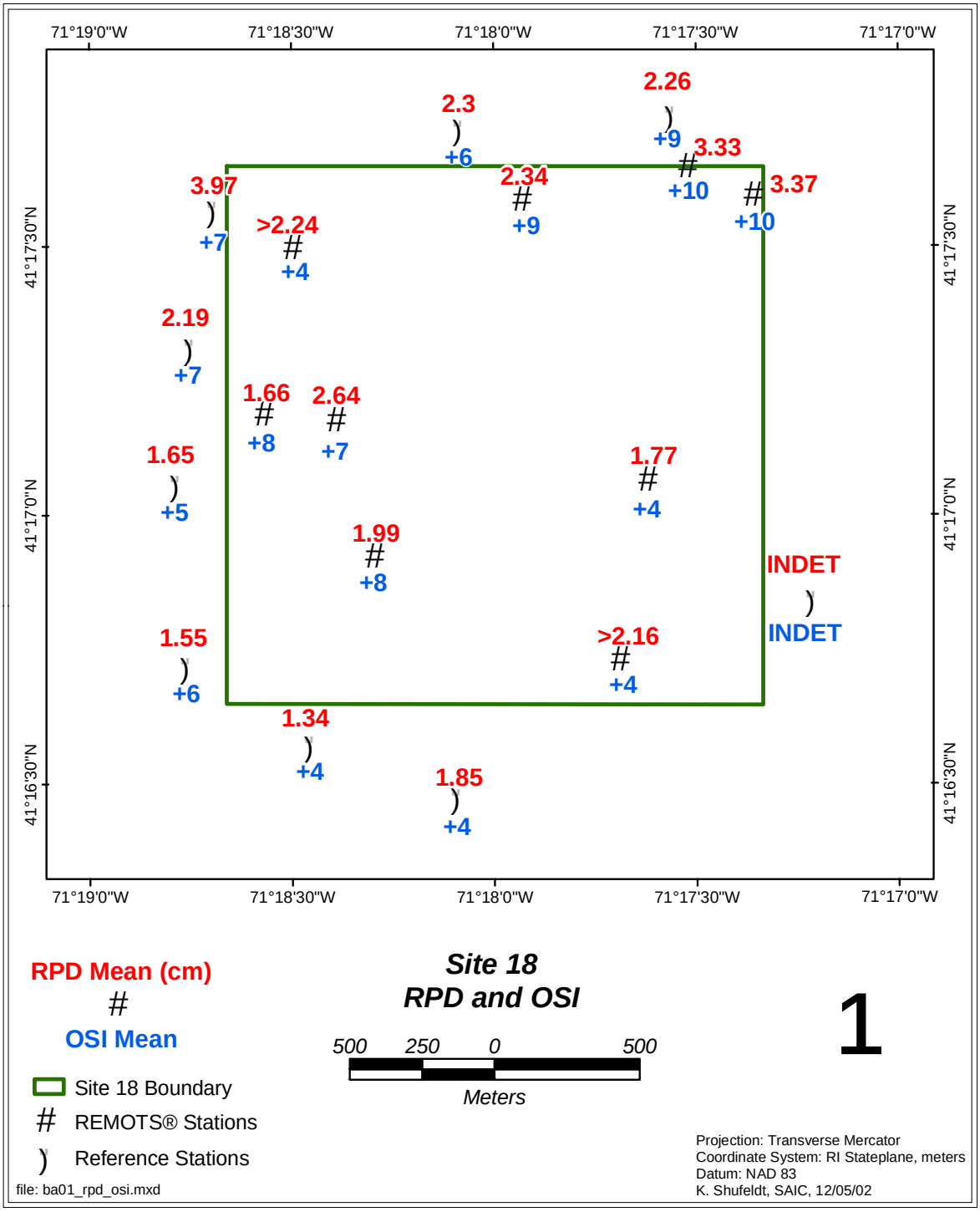


Figure 37. RPD Depths and OSI Values, Site 18 (Brenton-A).

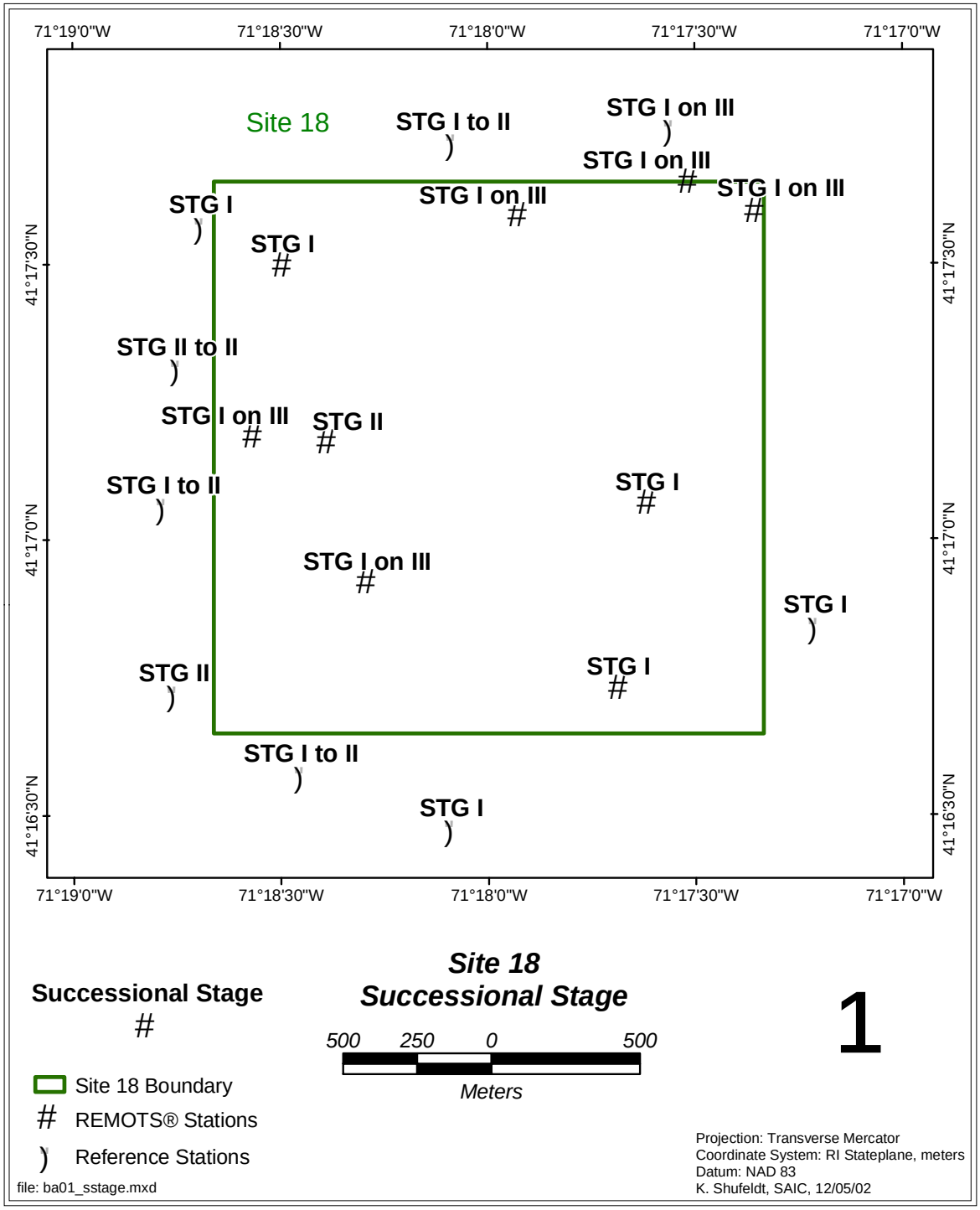
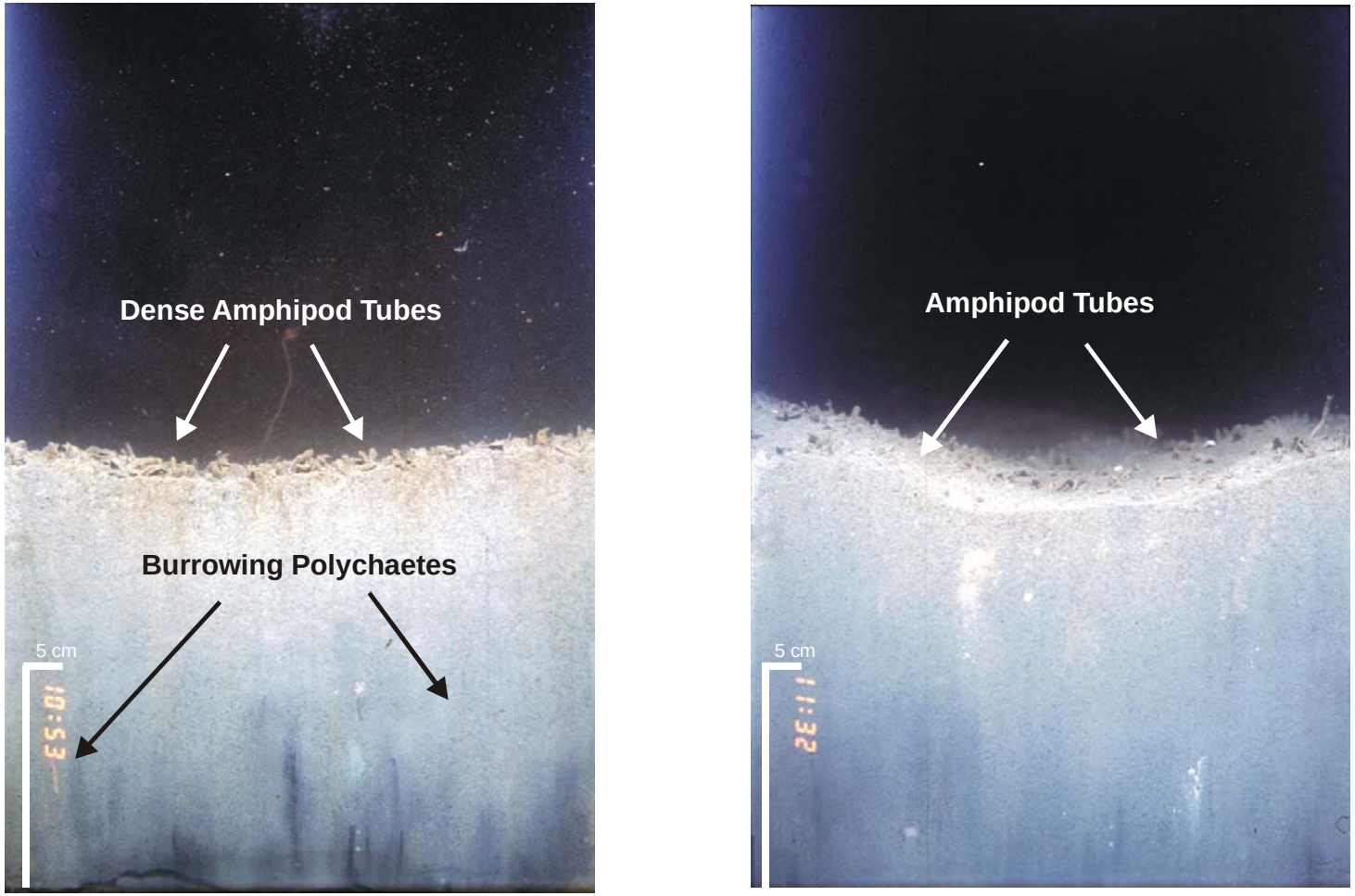


Figure 38. Infaunal Successional Stages, Site 18 (Brenton-A).



A B

Figure 39. REMOTS® images collected from Site 18 (Brenton-A) Station BA9 (A) and reference station BAR6 (B) surrounding Site BA showing dense amphipod (*Ampelisca* sp.) tube mats at the sediment-water interface. Image A (benthic habitat type UN.SS) illustrates a Stage II successional status, while image B (benthic habitat type UN.SI) indicates a Stage I to II successional status due to the presence of both Stage I, opportunistic polychaete tubes and Stage II amphipod tubes at the sediment-water interface.

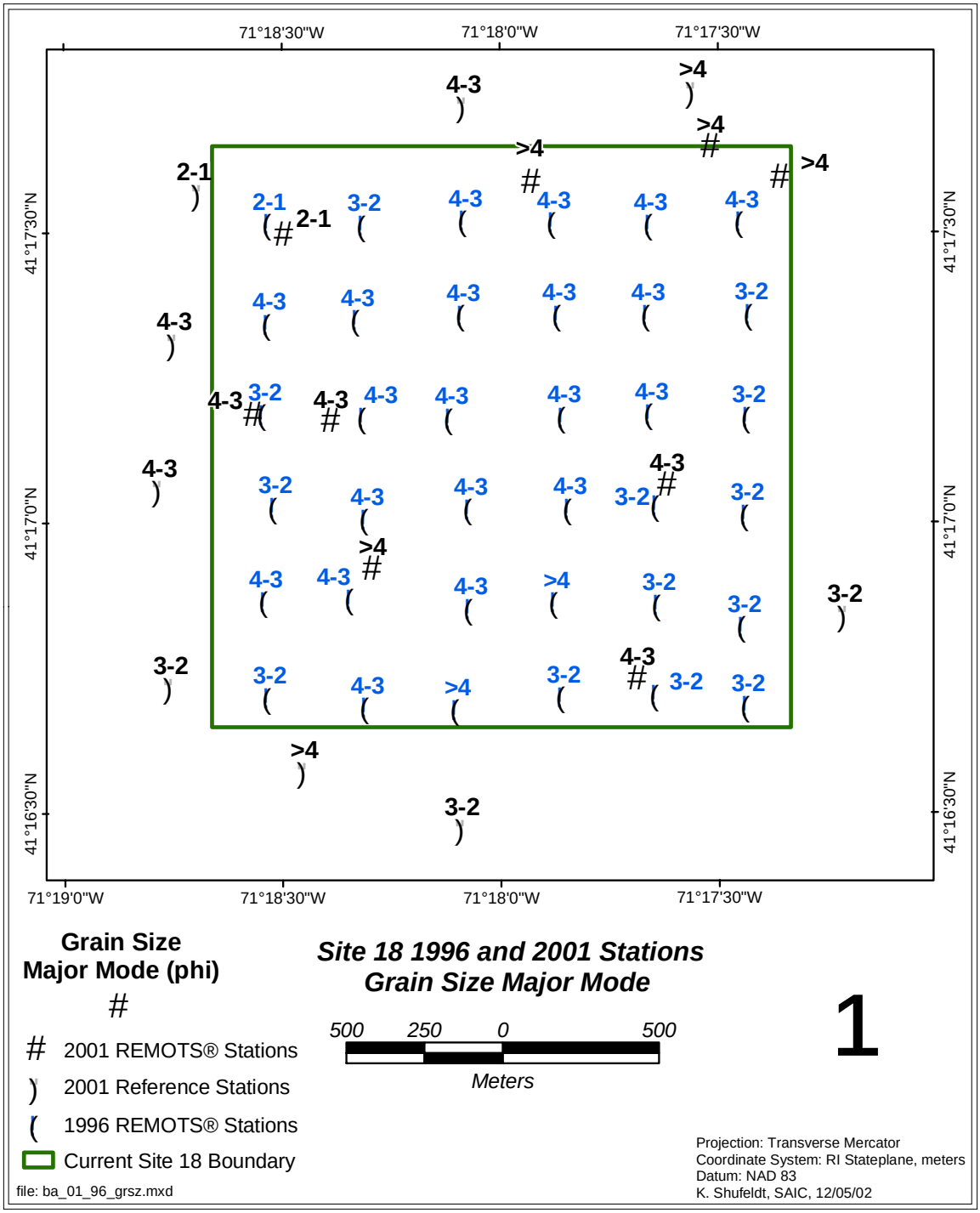


Figure 40. Grain Size Major Mode Values, 1996 and 2001 REMOTS® Stations, Site 18 (Brenton-A).

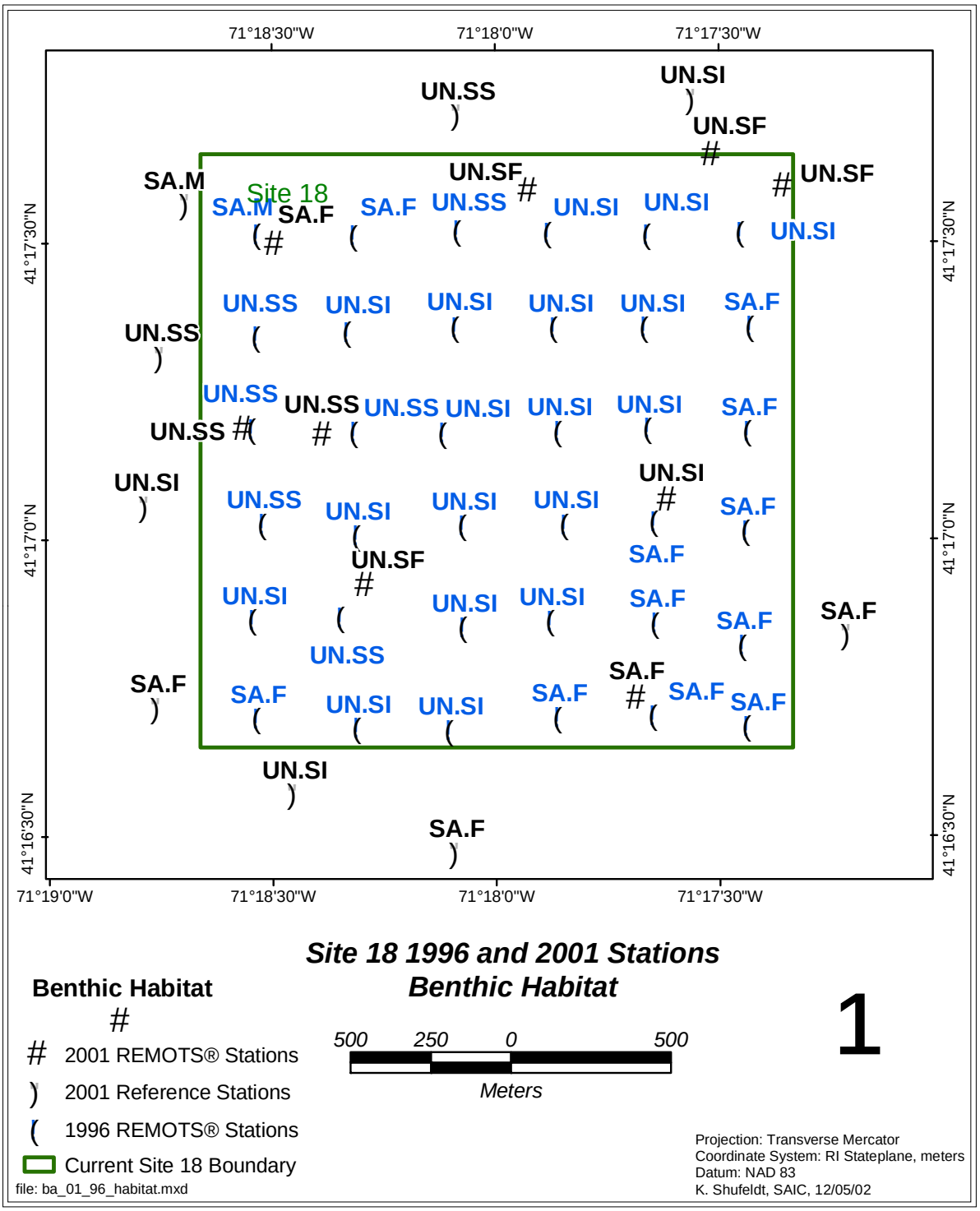


Figure 41. Benthic Habitat, 1996 and 2001 REMOTS® Stations, Site 18 (Brenton-A).

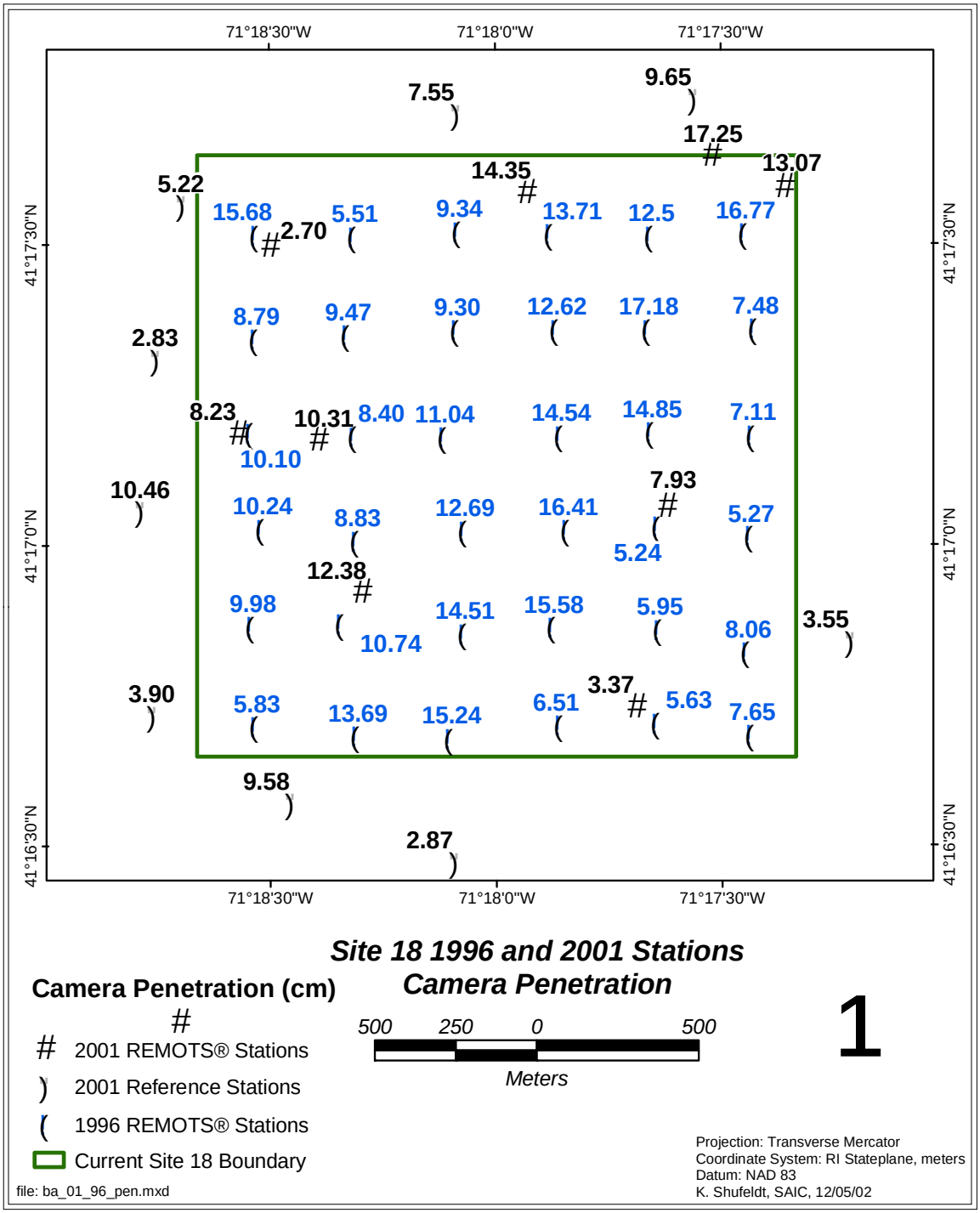


Figure 42. Camera Penetration Depths, 1996 and 2001 REMOTS® Stations, Site 18 (Brenton-A).

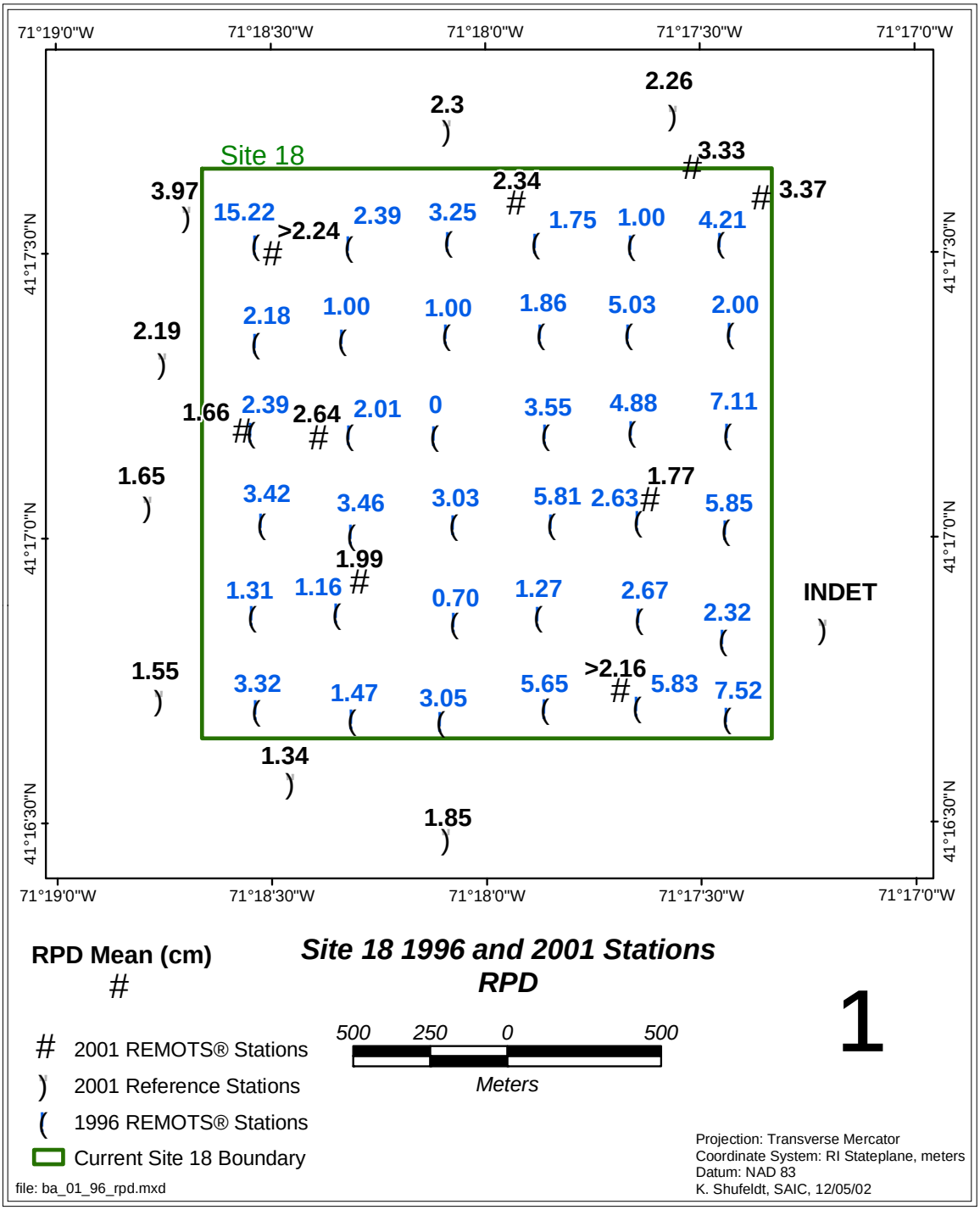


Figure 43. RPD Depths, 1996 and 2001 REMOTS® Stations, Site 18 (Brenton-A).

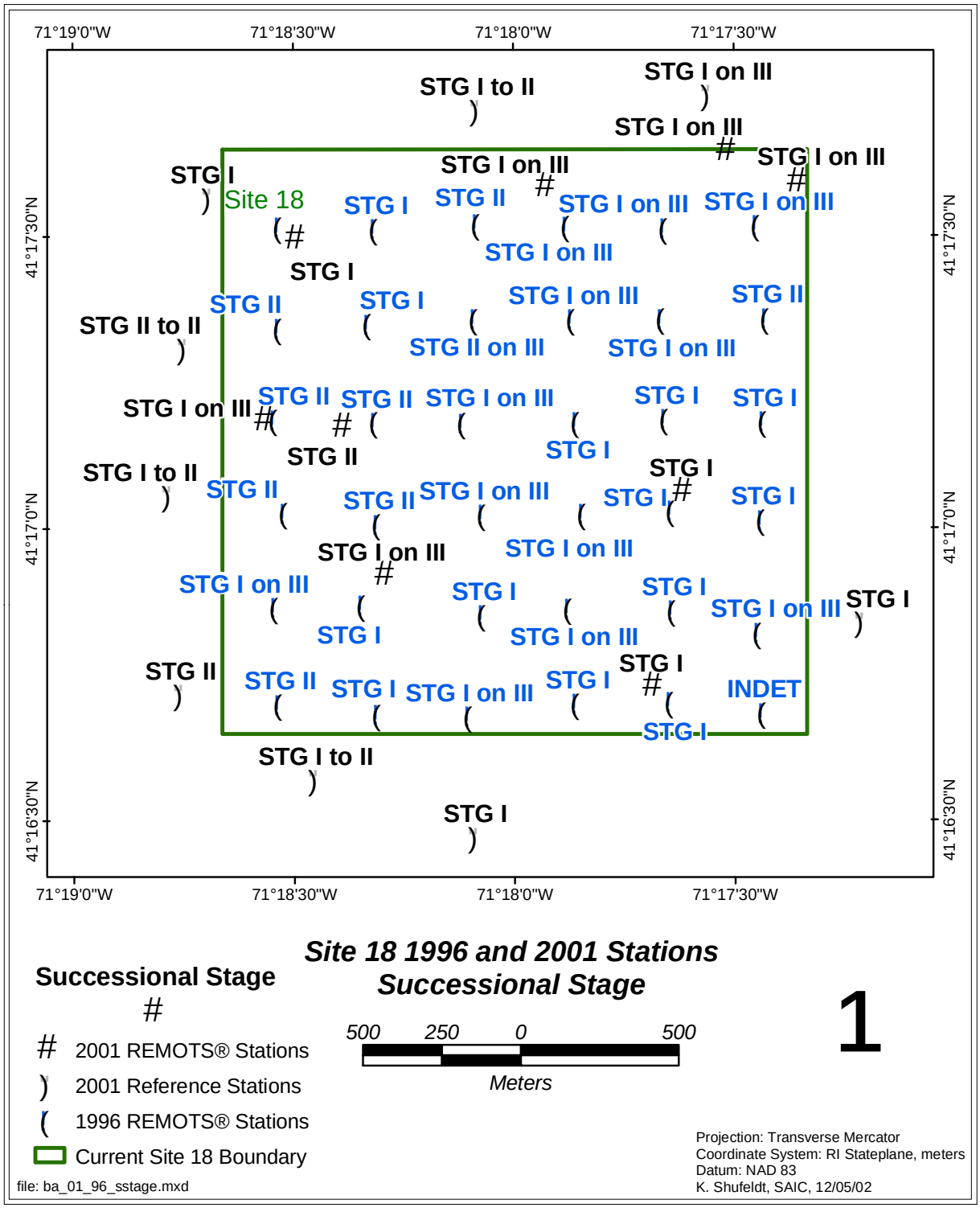


Figure 44. Infaunal Successional Stages, 1996 and 2001 REMOTS® Stations, Site 18 (Brenton-A).

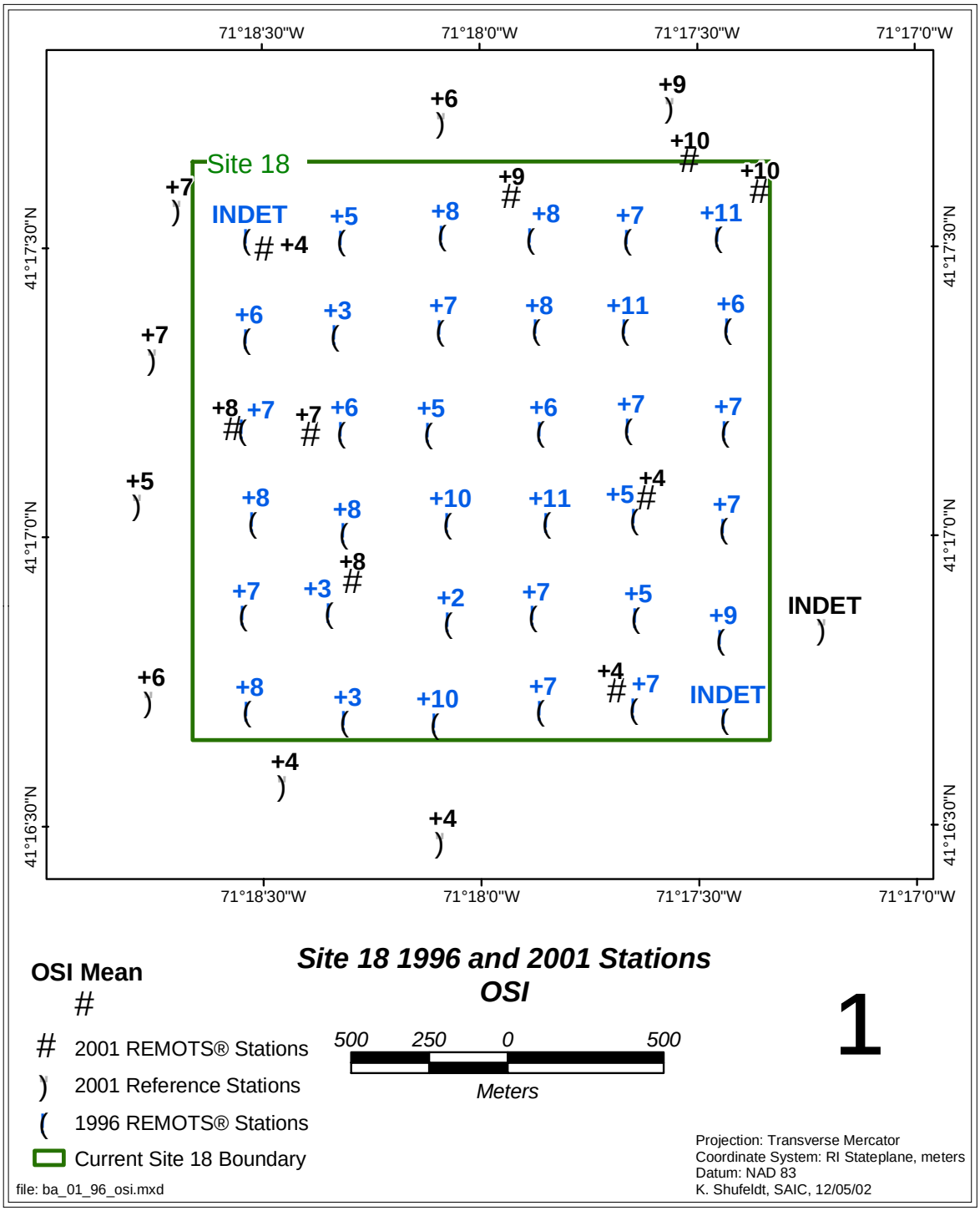


Figure 45. OSI Values, 1996 and 2001 REMOTS® Stations, Site 18 (Brenton-A).

Site 16

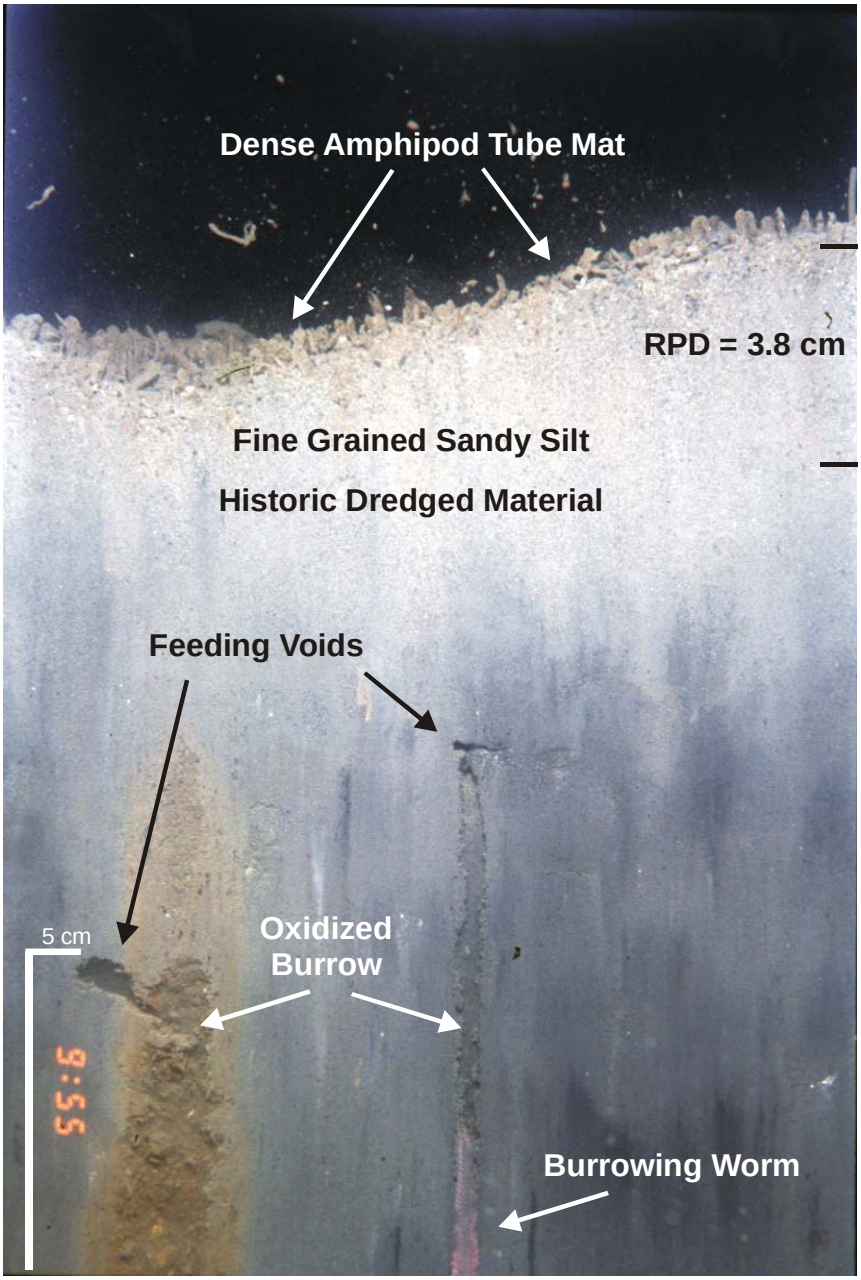


Figure 46. REMOTS® image from Station BR1B within Site 16 (Brenton Reef) showing the characteristics of historic dredged material (oxidized silt over gray sandy silt) observed within the Brenton Reef Disposal Site stations. Benthic habitat type UN.SI (Silty) observed in this image characterized most of the Site 16 sampling stations. Stage II amphipod tubes at the sediment-water interface and active feeding voids (Stage III taxa) in the subsurface sediments resulted in a Stage II on III successional status designation for this station. A well-developed RPD depth (3.8 cm) indicative of well-oxygenated surface sediments and an advanced benthic community resulted in an OSI of +11, indicative of undisturbed or non-degraded benthic habitat quality. Oxidized burrows and a burrowing polychaete are visible in the subsurface sediments.

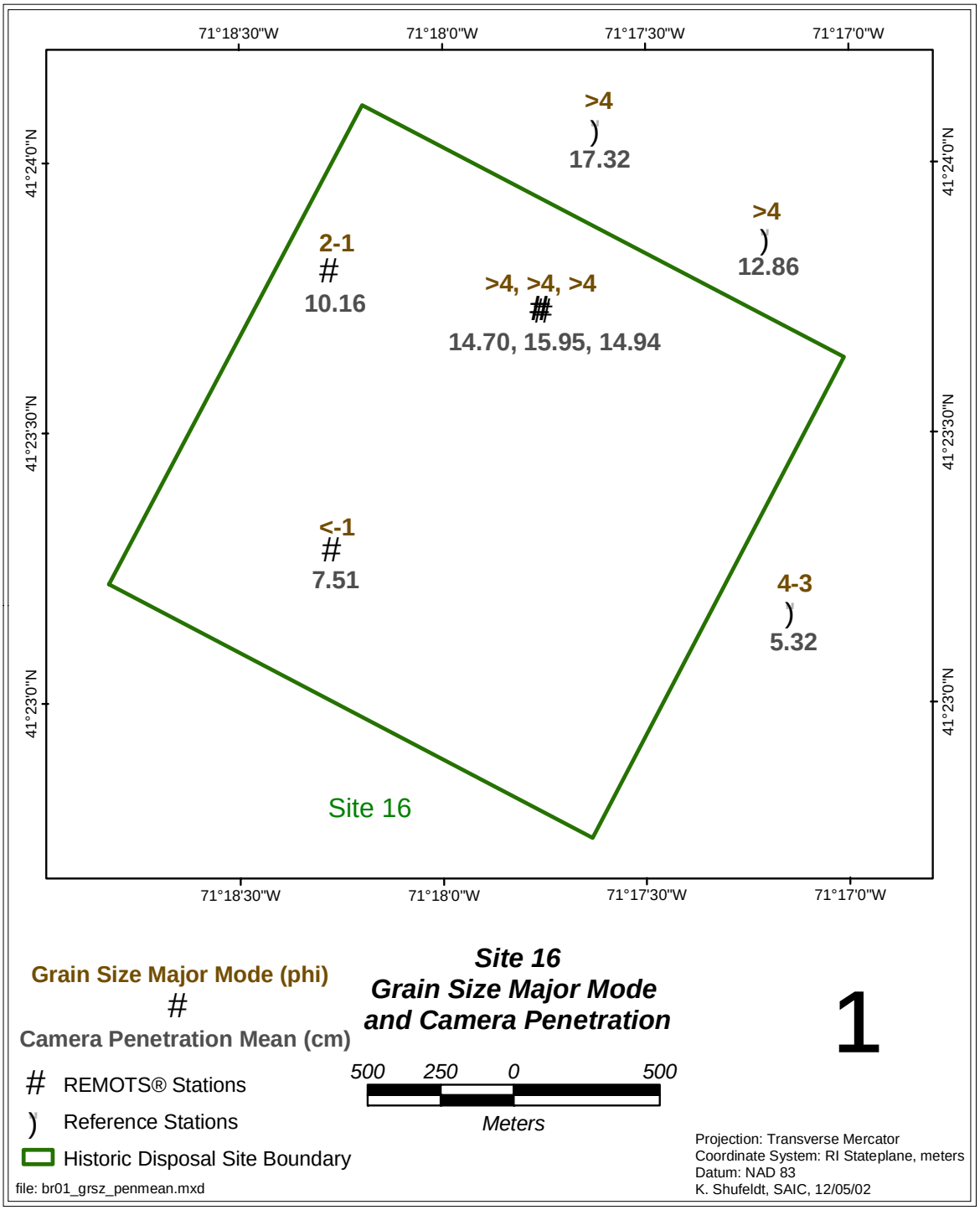


Figure 47. Grain Size Major Mode Values and Camera Penetration Depths, Site 16 (Brenton Reef).

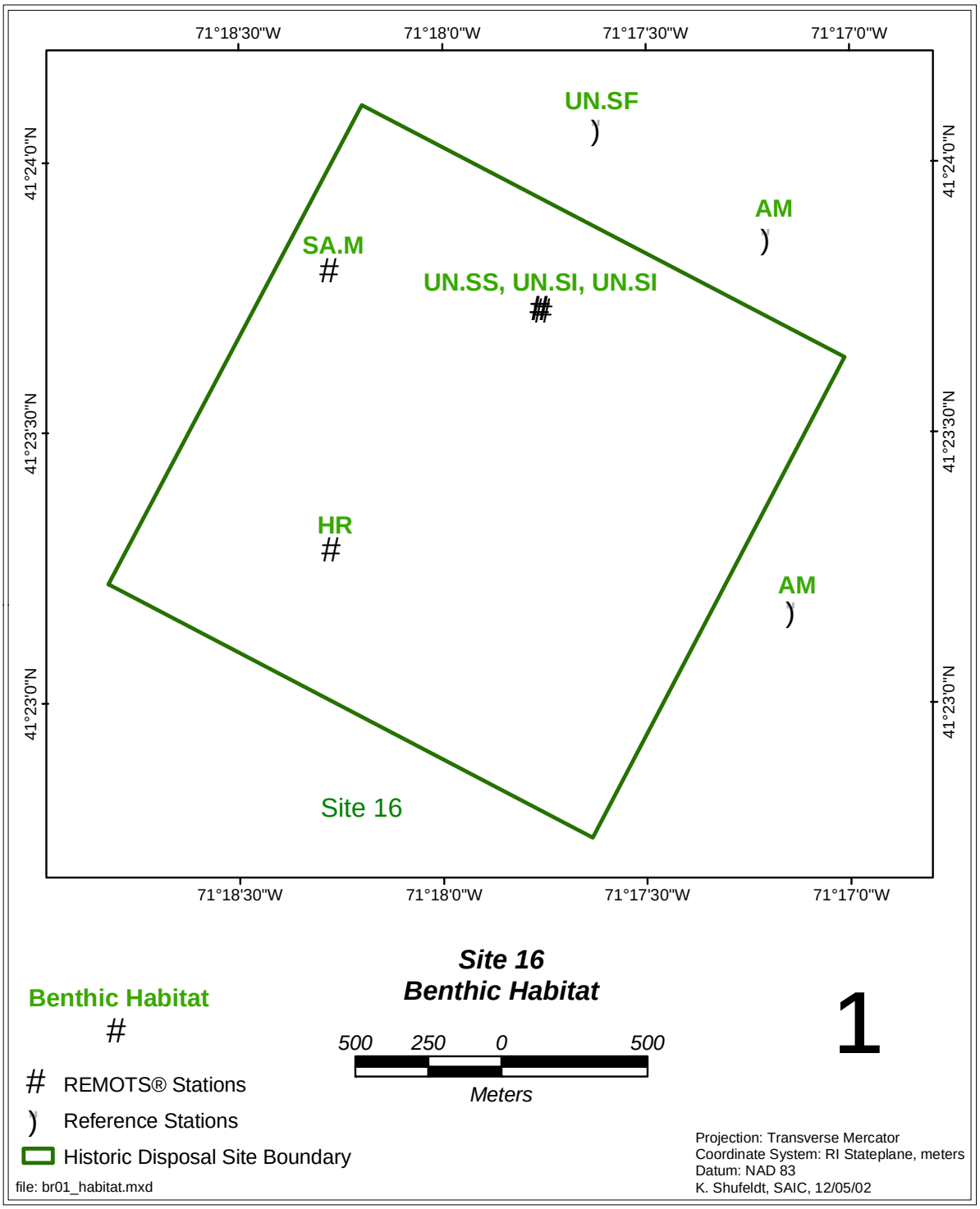


Figure 48. Benthic Habitat, Site 16 (Brenton Reef).

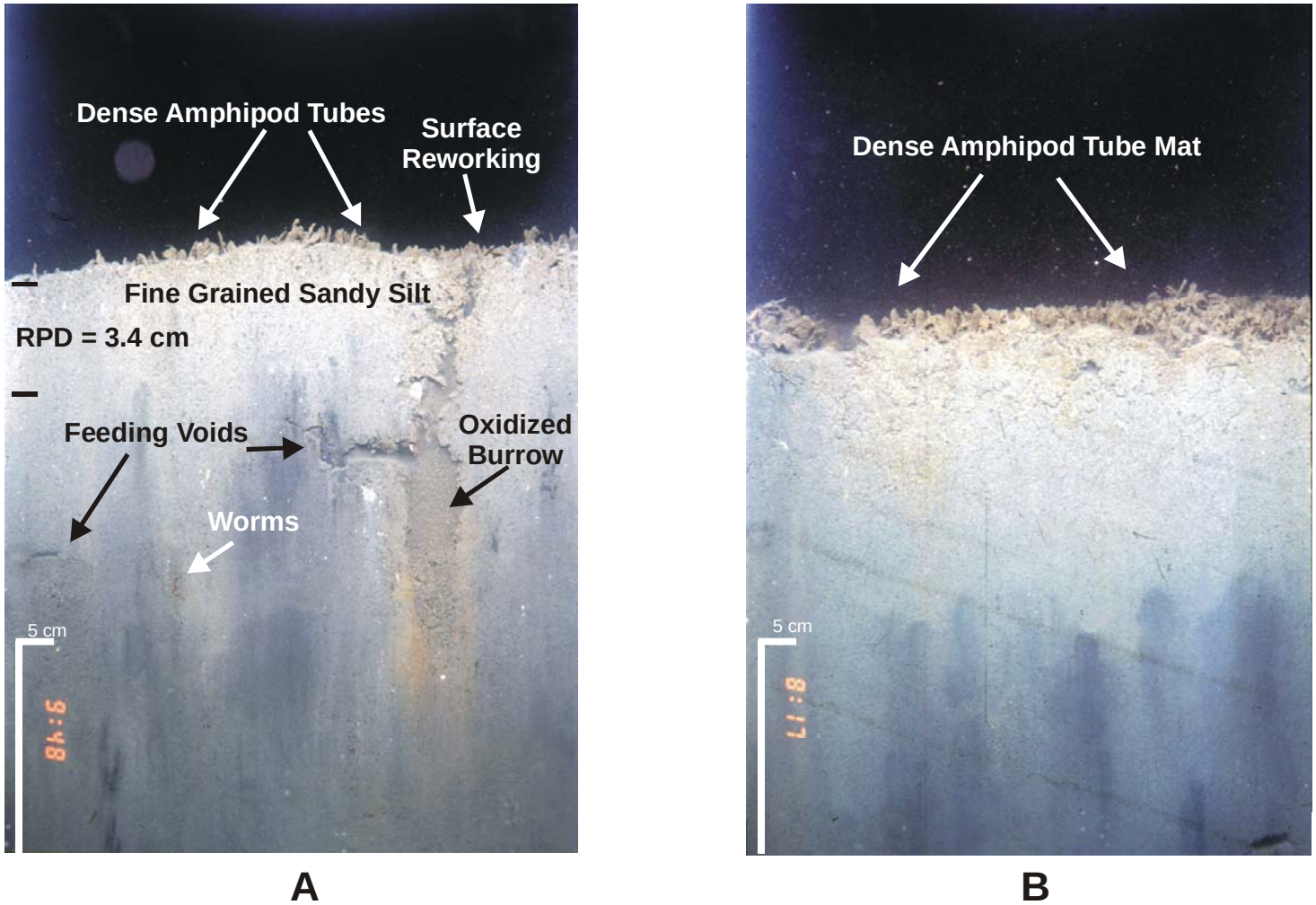


Figure 49. REMOTS® images obtained from Site 16 (Brenton Reef) Station BRIA (A) and reference Station BRR2 (B) surrounding Site 16 illustrating well-formed amphipod tube mats at the sediment-water interface. Image A was classified as benthic habitat type UN.SS (fine sand/silty) while Image B was classified as benthic habitat type AM (*Ampelisca* Mat) due to the dense assemblage of amphipod tubes at the sediment-water interface. Biogenic surface roughness as a result of surface reworking by burrowing infauna and a Stage II on III successional status due to Stage II amphipod tubes and active feeding voids (Stage III taxa) characterized both images.

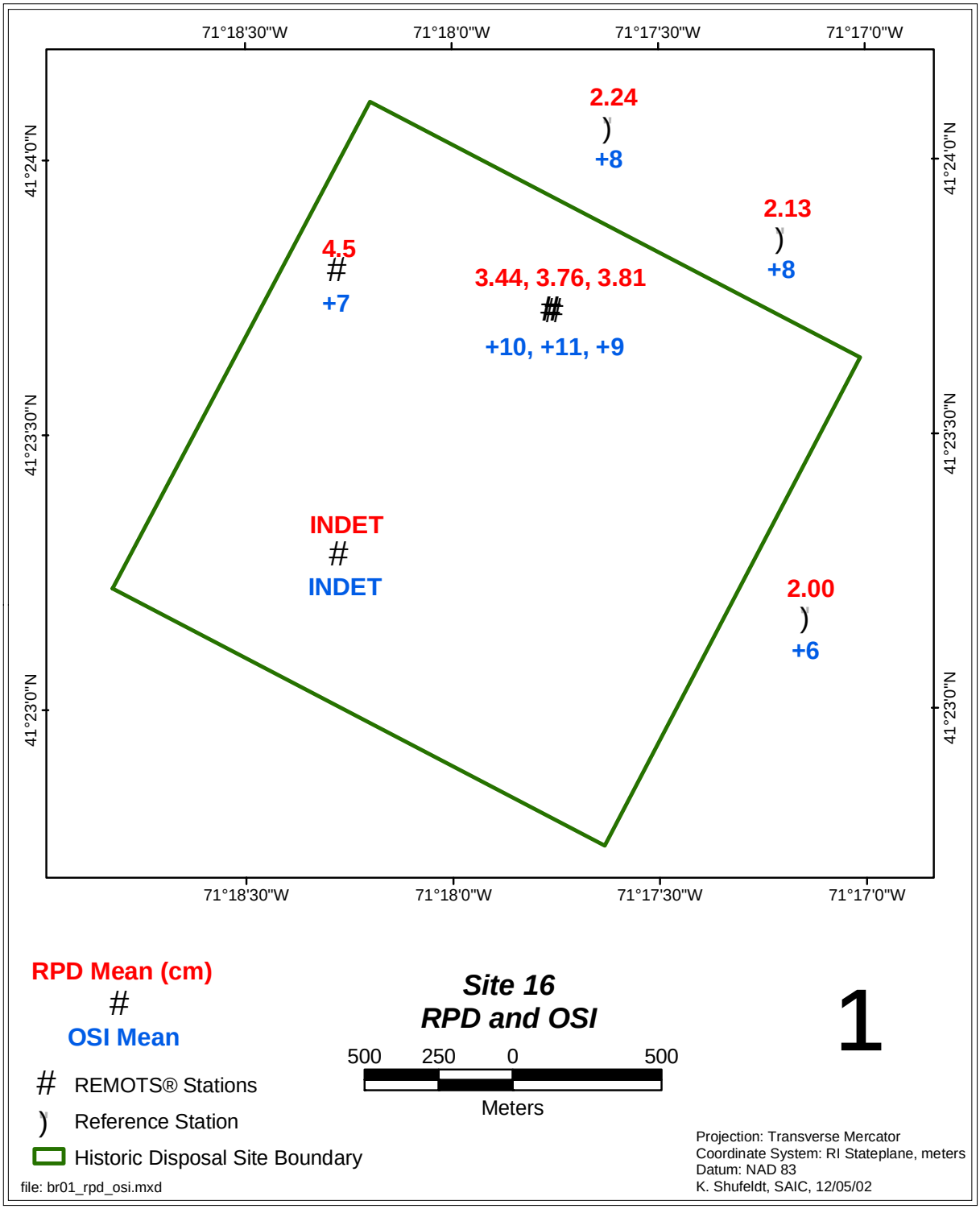


Figure 50. RPD Depths and OSI Values, Site 16 (Brenton Reef).

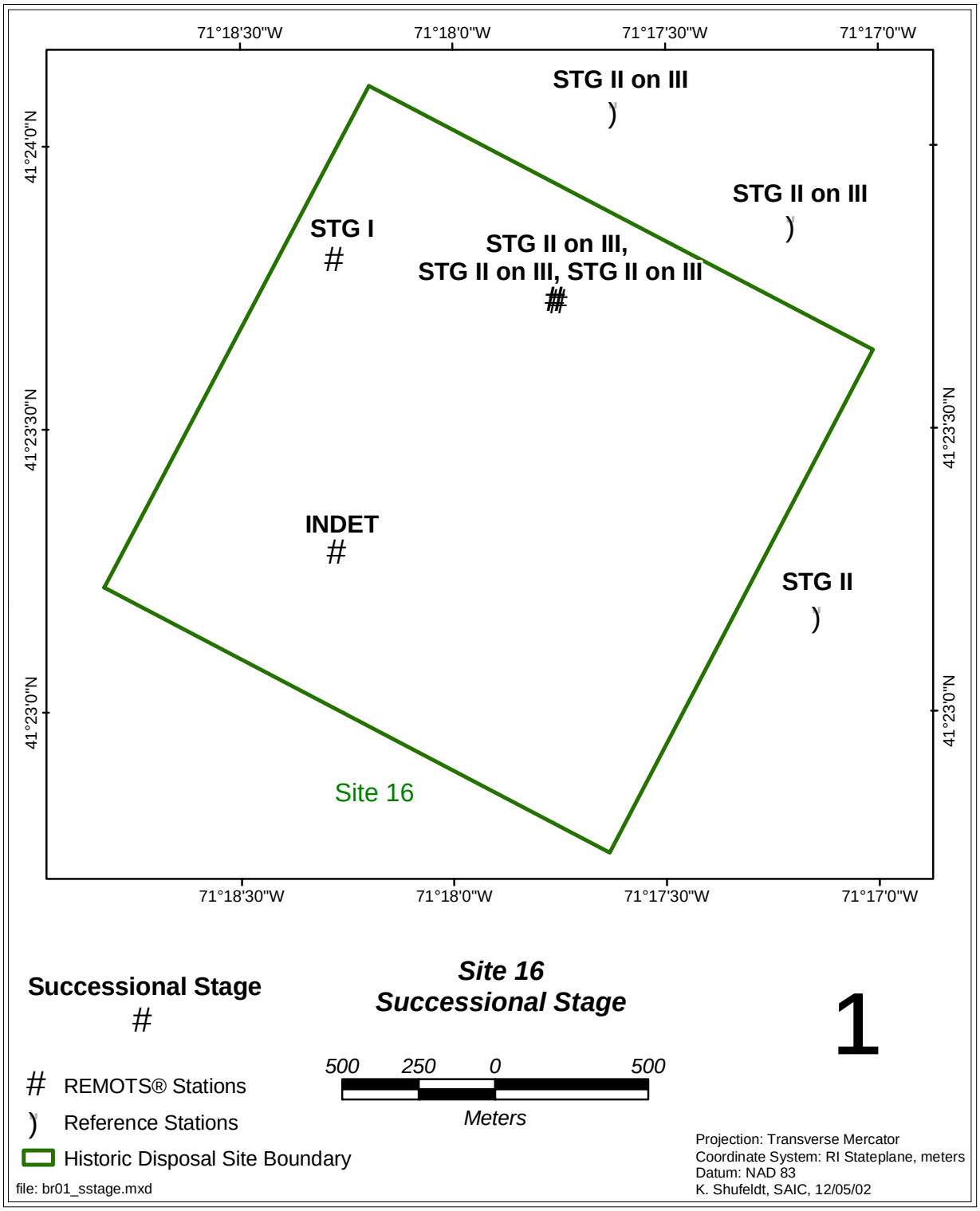


Figure 51. Infaunal Successional Stages, Site 16 (Brenton Reef).

Benthic Habitat Maps with Historical Data

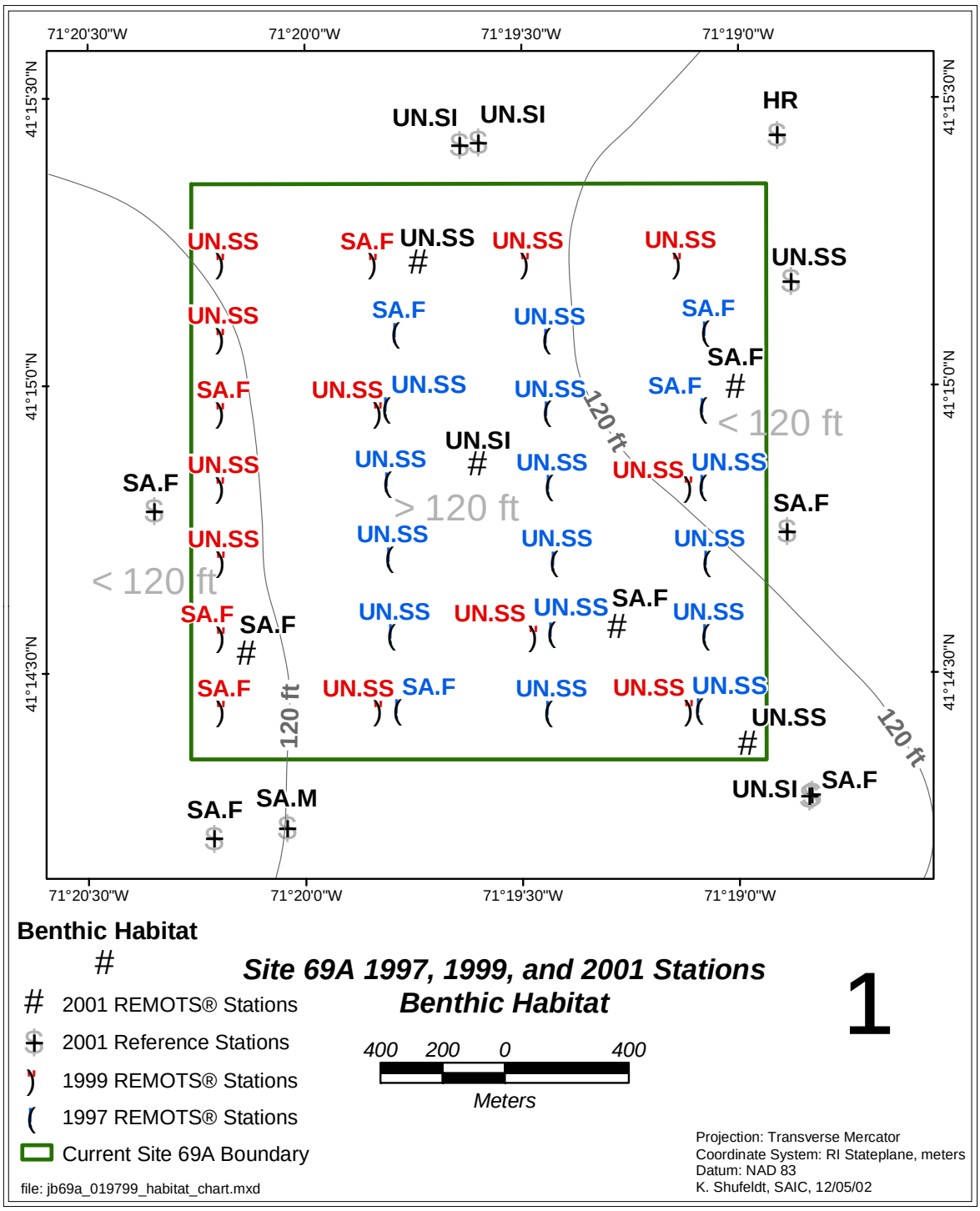


Figure 52. Benthic Habitat, 1997, 1999, and 2001 REMOTS® Stations, Site 69A (Jamestown Bridge Reef) overlayed on bathymetric contours from NOAA Chart 13218.

Note the 120 ft (37 m) contour is highlighted.

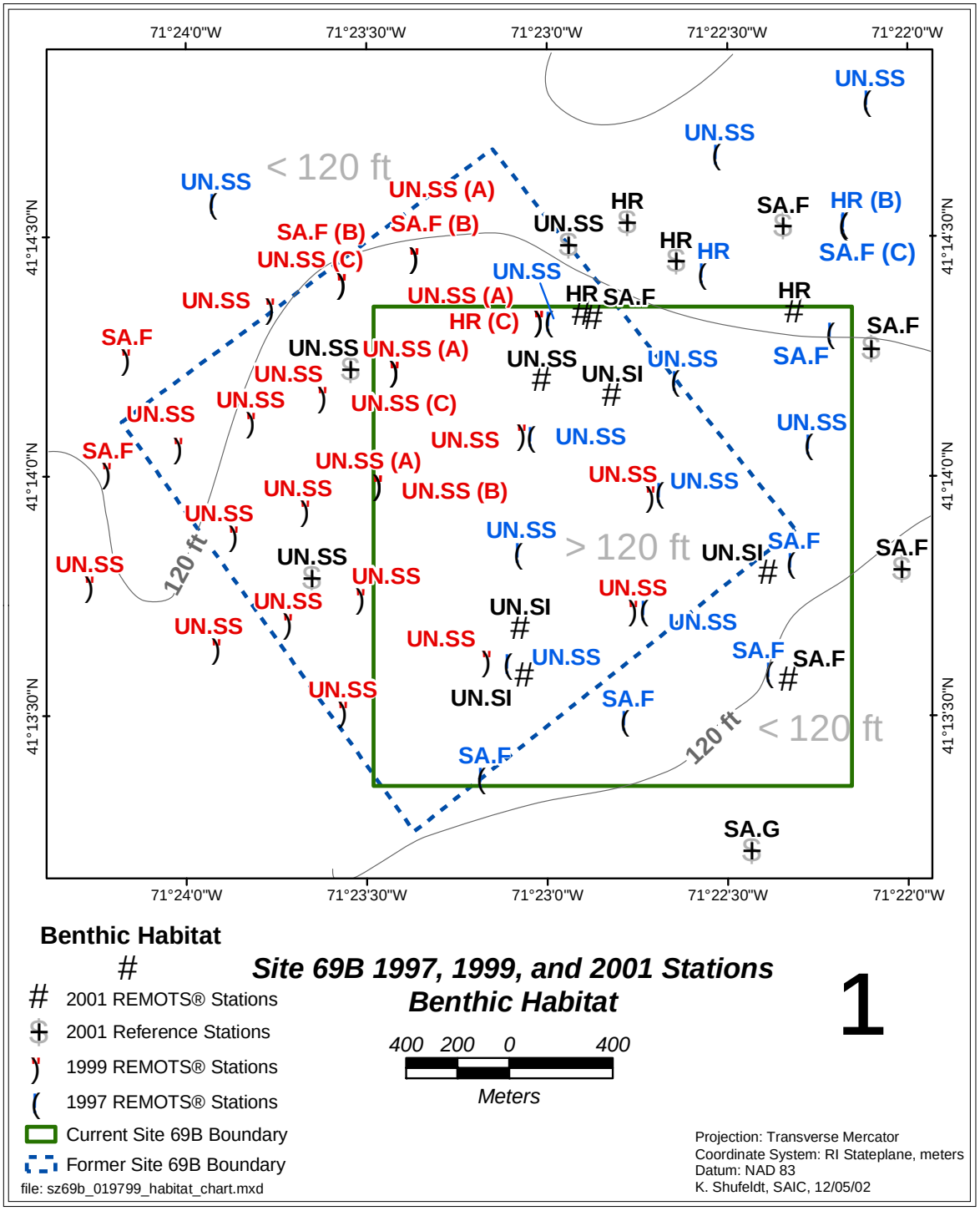


Figure 53. Benthic Habitat, 1997, 1999, and 2001 REMOTS® Stations, Site 69B (Separation Zone) overlayed on bathymetric contours from NOAA Chart 13218.

Note: the 120 ft (37 m) contour is highlighted.

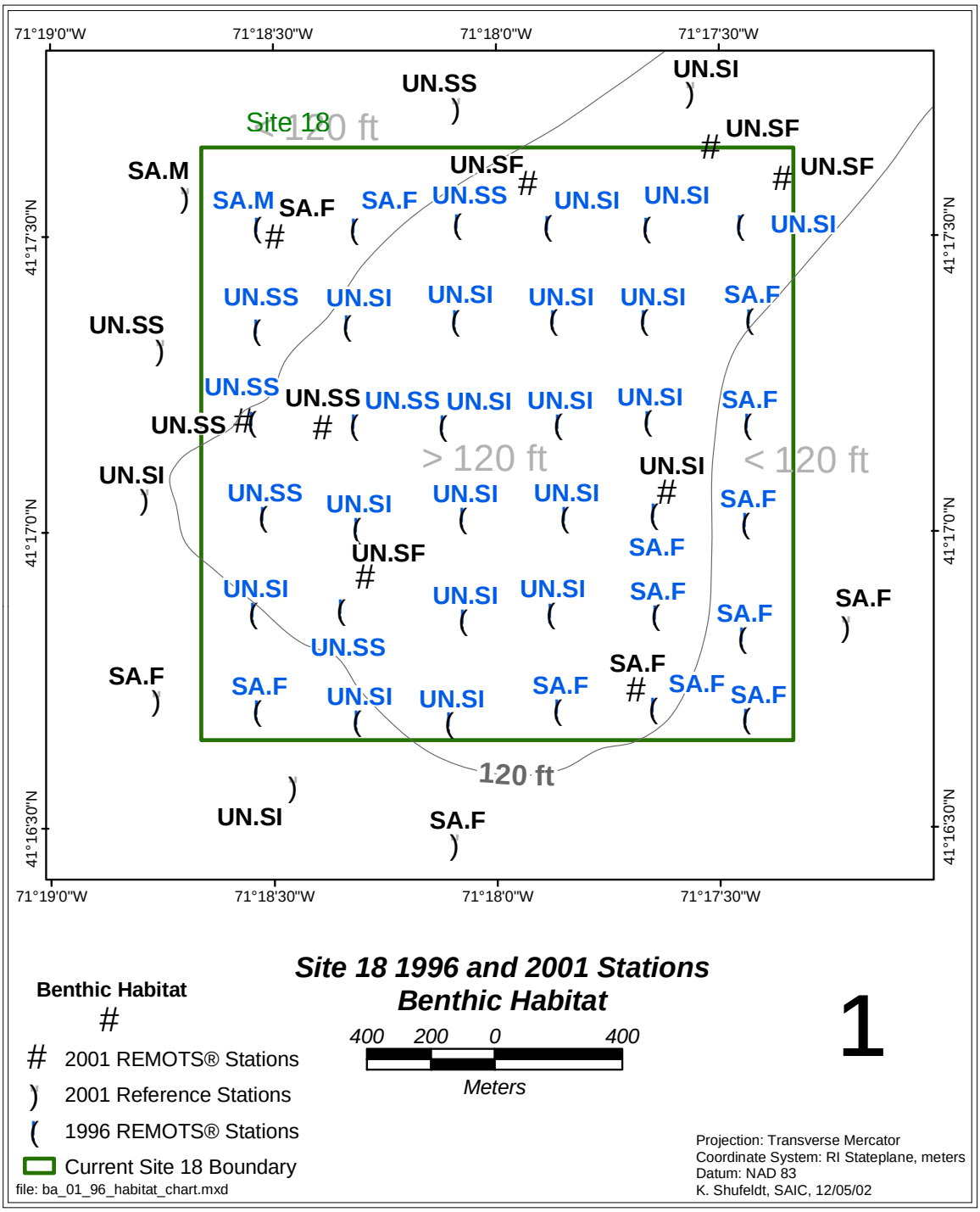


Figure 54. Benthic Habitat, 1996 and 2001 REMOTS® Stations, Site 18 (Brenton-A) overlayed on bathymetric contours from NOAA Chart 13218.

Note: the 120 ft (37 m) contour is highlighted.

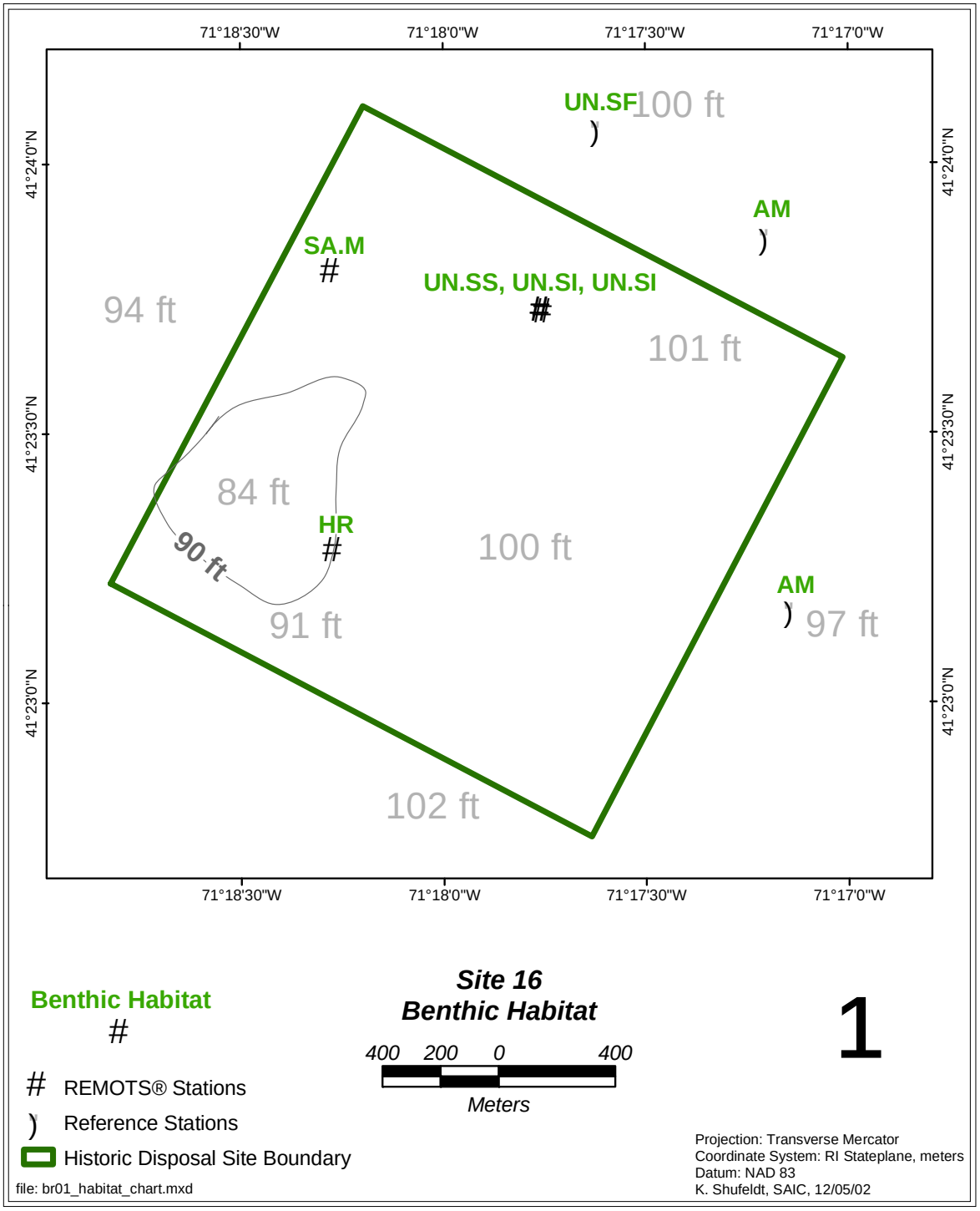


Figure 55. Benthic Habitat, 1996 and 2001 REMOTS® Stations, Site 16 (Brenton Reef) overlayed on bathymetric contours from NOAA Chart 13218.

Note: the 90 ft (27 m) contour that defines the apex of the historic disposal mound on the western side of the disposal site.