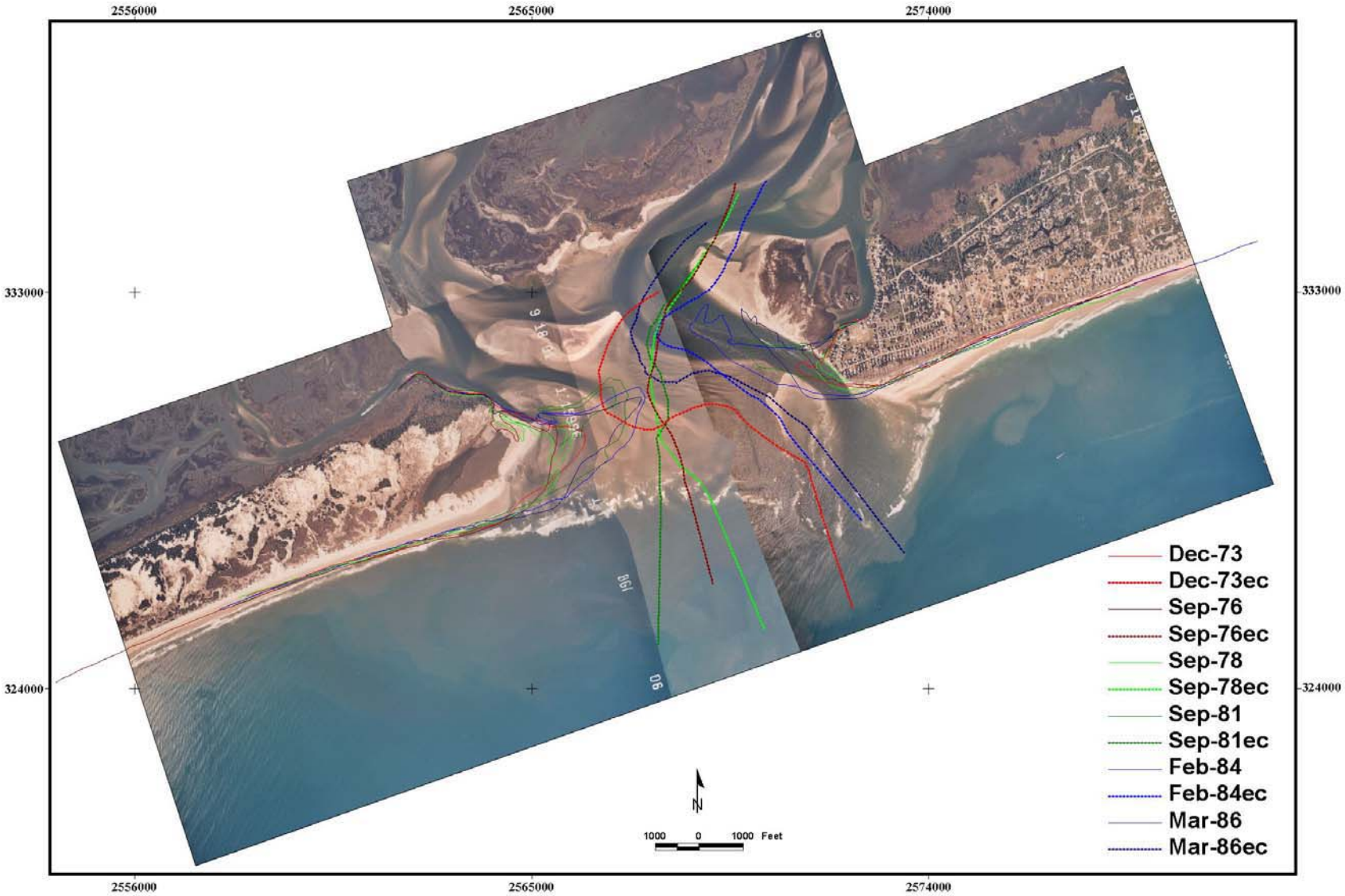

Figure 12. Aerial photograph mosaic (9/18/01) showing ebb channel and shoreline positions between December 1973 and March 1986. Note eastward shift in axis of ebb channel within mid inlet shoal and northwestward shift in the channel toward Dudley Island marsh complex.

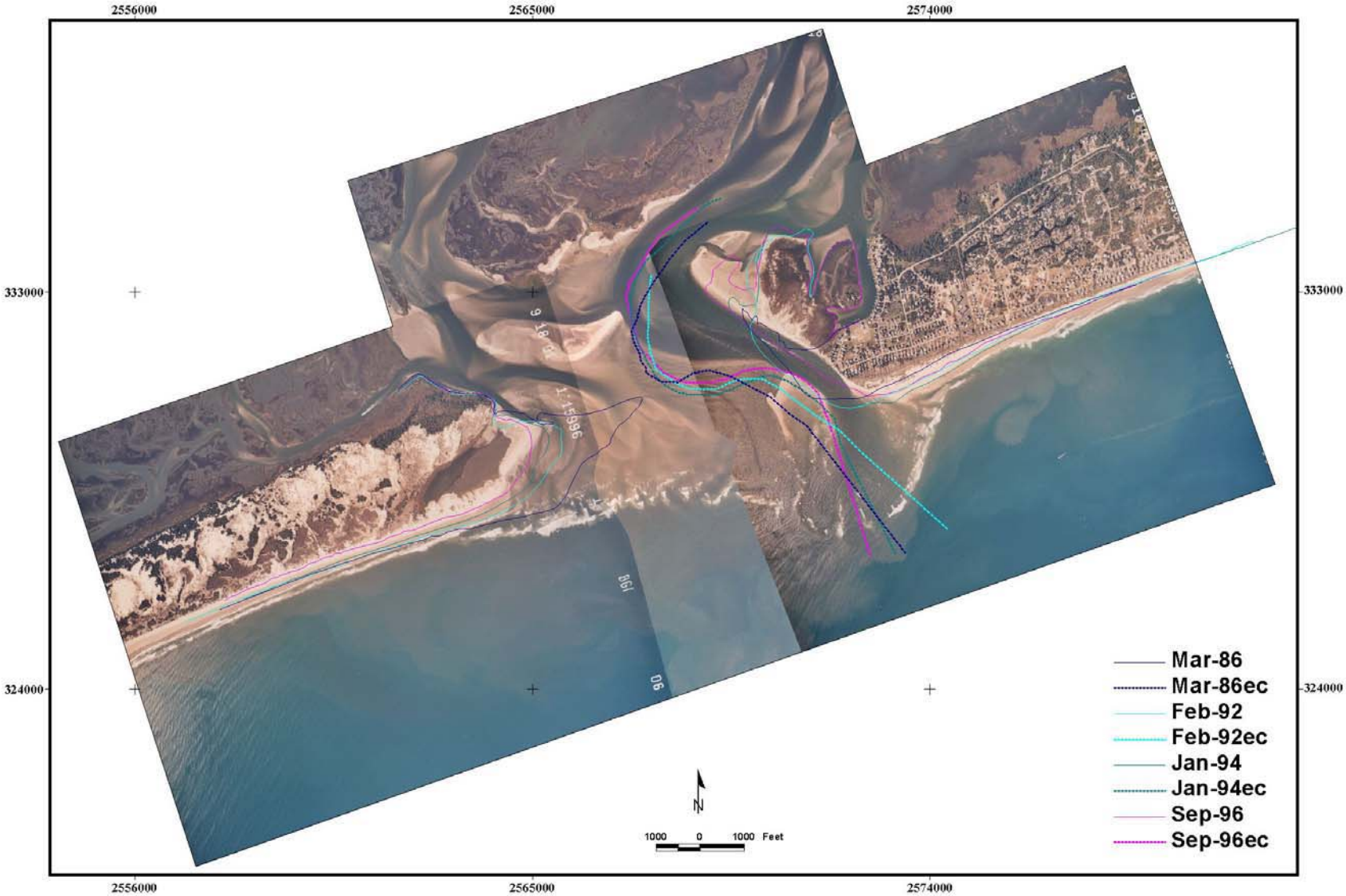

Figure 13. Aerial photograph mosaic (9/18/01) showing ebb channel and shoreline positions between March 1986 and September 1996. Note the general complex eastward shift and reorientation of axis of ebb channel within mid inlet shoal and the northwestward shift in the channel toward Dudley Island marsh complex.

Figures 11, 6 D and 7 A and Figure 4 D, Appendix 1, illustrate the general configuration of the inlet between 1984 and 1986. The aerial photographs depict that during this period, two ebb channels of disproportionate size characterized the inlet. Between February 1984 and March 1986 the primary ebb channel migrated east a distance of 210 ft (Fig. 9) setting the stage for the development of the large contiguous swash platform and the mid inlet shoal that currently characterize the inlet. Over the next 32 months the ebb channels merged, and by November 1988 a single large ebb channel was positioned along the Bogue Banks shoulder.

Between March 1986 and February 1992 the ebb channel moved 364 ft in an easterly direction. Slower migration rates (61 ft/yr) characterized this period of time when the throat shoal complex achieved its present configuration (Figs. 7 A-B, 9 and Fig. 4 E in Appendix 1). Migration rates increased substantially between 1992 and 1996. Between February 1992 and January 1994 eastward migration rates were determined to be approximately 158 ft/yr. During the subsequent 34 months (January 1994 to September 1996) migration rates decreased to 102 ft/yr. Hurricanes Bertha and Fran (July and September 1996) had little substantial impact on the morphology of the inlet aside from the formation of several small spillover channels (Fig 8A).

Subsequent to the landfall of Hurricane Fran in September 1996 the ebb channel moved 226 ft in an easterly direction (Figs. 9,10 and 13 and Figs. 1A and 3 in Appendix 1). The average migration rate of 150 ft/yr during this time interval was slightly higher than the rates during the previous two years (102 ft/yr). Figure 8 illustrates that during the five year interval between September 1996 and September 2001, the basic configuration of the inlet remained unchanged with the exception of the development and extension of a secondary ebb channel on the western margin of the inlet (Fig. 8 B). Between March 1998 and October 2000 the ebb channel migrated toward Bogue Banks a distance of 133 ft at extrapolated annual rates of ~ 50ft/yr (3/98-3/99 = 49ft/yr; 3/99-10/00= 53 ft/yr). The ebb channel remained essentially stable between October 2000 and September 2001 when it moved ~9 feet in a westerly direction (10 ft/yr).

During the past three decades the morphology of the inlet has changed substantially. Several distinct periods of change can be recognized each with unique migration trends and

morphologic characteristics. Information derived from the inspection of Figures 6 - 8 and 11-13 and Figure 4 in the Appendix suggests three basic phases of inlet change can be recognized. The initial phase covers the period between 1973 to 1981 when the ebb channel was moving to the west, subsequent to the shore-normal reorientation and formation of a single ebb channel in 1975. The net westward movement of the ebb channel was ~1895 ft during this initial phase of change. The second stage of inlet evolution occurred between 1981 and ~1988. During this time interval the single well– defined ebb channel migrated to the east a distance exceeding 830 ft and a wide marginal flood channel developed on the Bear Island shoulder. The expansion of the flood channel promoted the development of the swash platform and the mid inlet shoal. Since ~1988 the ebb channel continued to migrate to the east. The data indicate that since 1992 the ebb channel moved a net distance of 825 ft toward Bogue Banks. Little significant change has occurred in the morphology of the platform and mid inlet shoal during this interval with the exception of the emergence of ephemeral "islands" (Islands # 1 and 2) that developed on the linear margin bars and in vicinity of the flood ramp (Fig. 8). The net movement of the ebb channel during the past three decades of morphologic evolution has amounted to 2,117 ft in an easterly direction at an average rate of 76 ft/yr (Fig. 9).

The inlet shoreline changes along Bogue Banks and Bear Island since 1973 are depicted on Figure 10 and Figure 3, Appendix. The movement (erosion or accretion) of the east shoulder (Bogue Banks) and west shoulder (Bear Island) generally follow a pattern of change related to the direction of movement of the channel within the inlet throat. The exception to this is a period in the mid to late 1970's when the inlet morphology was changing rapidly and adjusting to the ebb channel reorientation/repositioning that occurred in 1975. During this interval of time, the ebb channel was migrating in a westward direction at variable rates (1976-81 = 34 to125 ft/yr) following channel repositioning. Concurrent with the initial westward trek of the ebb channel, the Bogue Banks inlet shoreline eroded as much as 509 ft (1978).

Between 1978 and 1984 the Bogue Banks inlet shoreline prograded 957 ft for a net gain of 448 ft. Inspection of the data (Fig. 10 and Fig. 3, Appendix) shows that the ebb channel reversed its movement in 1981 and began its eastward migration that continues to present. The

pattern of shoulder accretion was reversed by 1984 when erosion became the norm. Between February 1984 and September 1996 the Bogue Banks shoulder eroded 912 ft. The majority of these losses occurred between January 1994 and September 1996, a period of time characterized by increased storm activity (Hurricanes Bertha and Fran). By September 1996 the net inlet shoreline change amounted to 446 ft of erosion. An additional 46 ft of shoreline loss occurred between September 1996 and September 2001. Since 1973 the cumulative change along the Bogue Banks inlet shoreline has amounted to ~520ft of erosion (Fig. 10 and Fig. 3, Appendix).

The pattern for the inlet shoreline changes along the Bear Island shoulder is somewhat similar to that for the Bogue Banks, but the scale of change is significantly greater (Fig. 10 and Fig. 3, Appendix). The movement of the west shoulder (Bear Island) generally follows the pattern of initial progradation and subsequent recession recorded for the Bogue Banks shoulder. The Bear Island shoulder (spit growth) generally initially experienced a period of progradation when the ebb channel began its easterly migration in the early 1980s. Following a period of minor erosion (183ft) between 1973 and 1976, the western margin of the inlet prograded 1,609 ft in an easterly direction between 1976 and 1984. With the exception of the brief interval between 1996 and 1998 the Bear Island inlet shoreline has continued to recede in a westerly direction. The recession of the Bear Island shoulder coupled with erosion of the Bogue Banks shoulder has effectively led to a general widening of the inlet throat since 1984. Since the mid 1980's the Bear Island shoulder has eroded ~2,975 ft. The cumulative change along the western shoulder of the inlet has amounted to 1,549 ft of erosion since 1973.

During the past three decades the inlet morphology has changed substantially. Part of this change involved the expansion and contraction of a wide flood channel on the Bear Island margin and the subsequent spit development and progradation until the mid 1980's. In 1984 the western marginal flood channel began to expand concurrent with eastward migration of the ebb channel and the contraction of the eastern marginal flood channel (Fig. 6). Collectively these changes have led to the development of the expansive mid inlet shoal and the concomitant erosion of the Bear Island shoulder (Fig. 8).