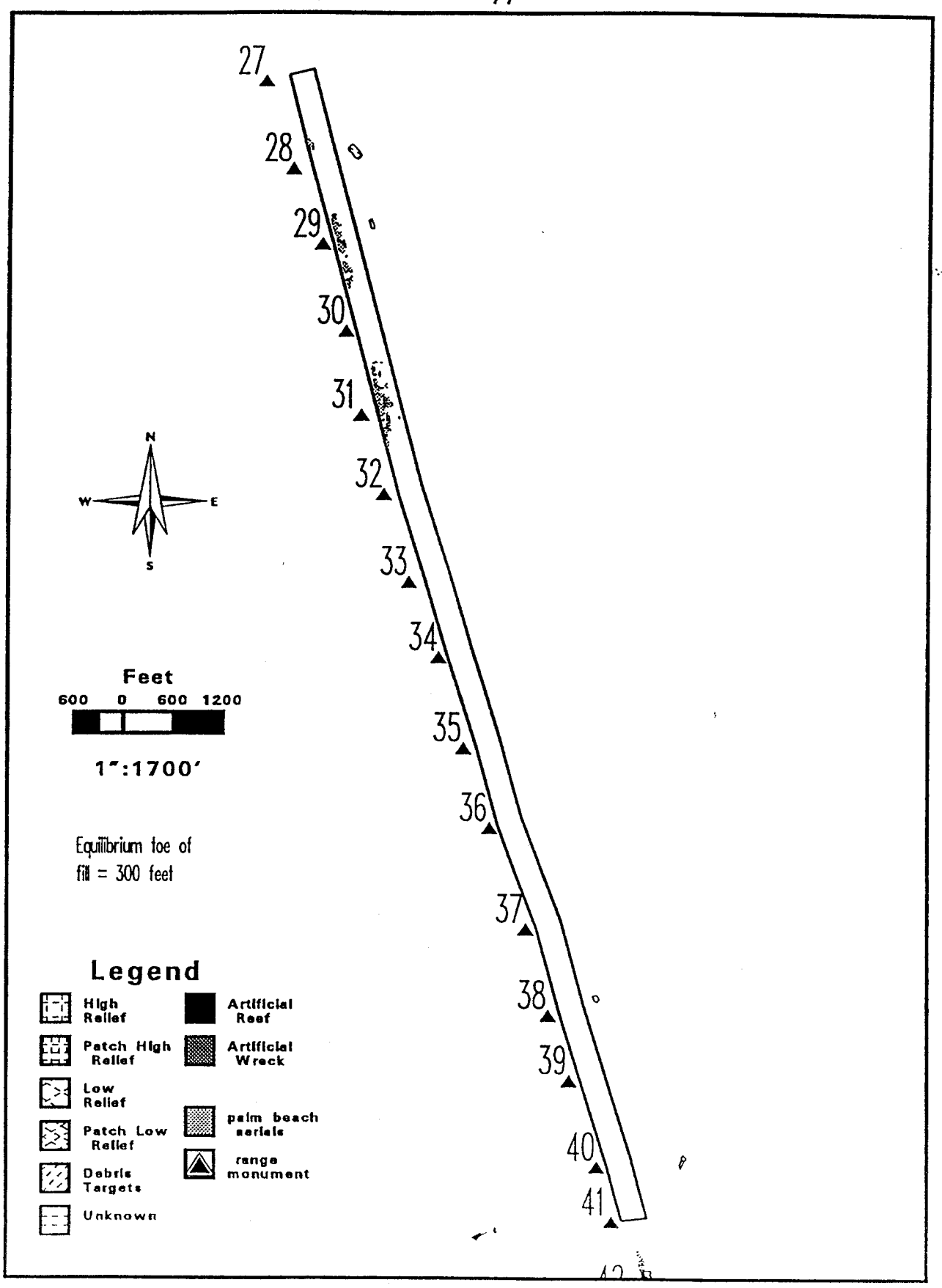

Figure 9 . Ocean Cay/Juno Project Footprint

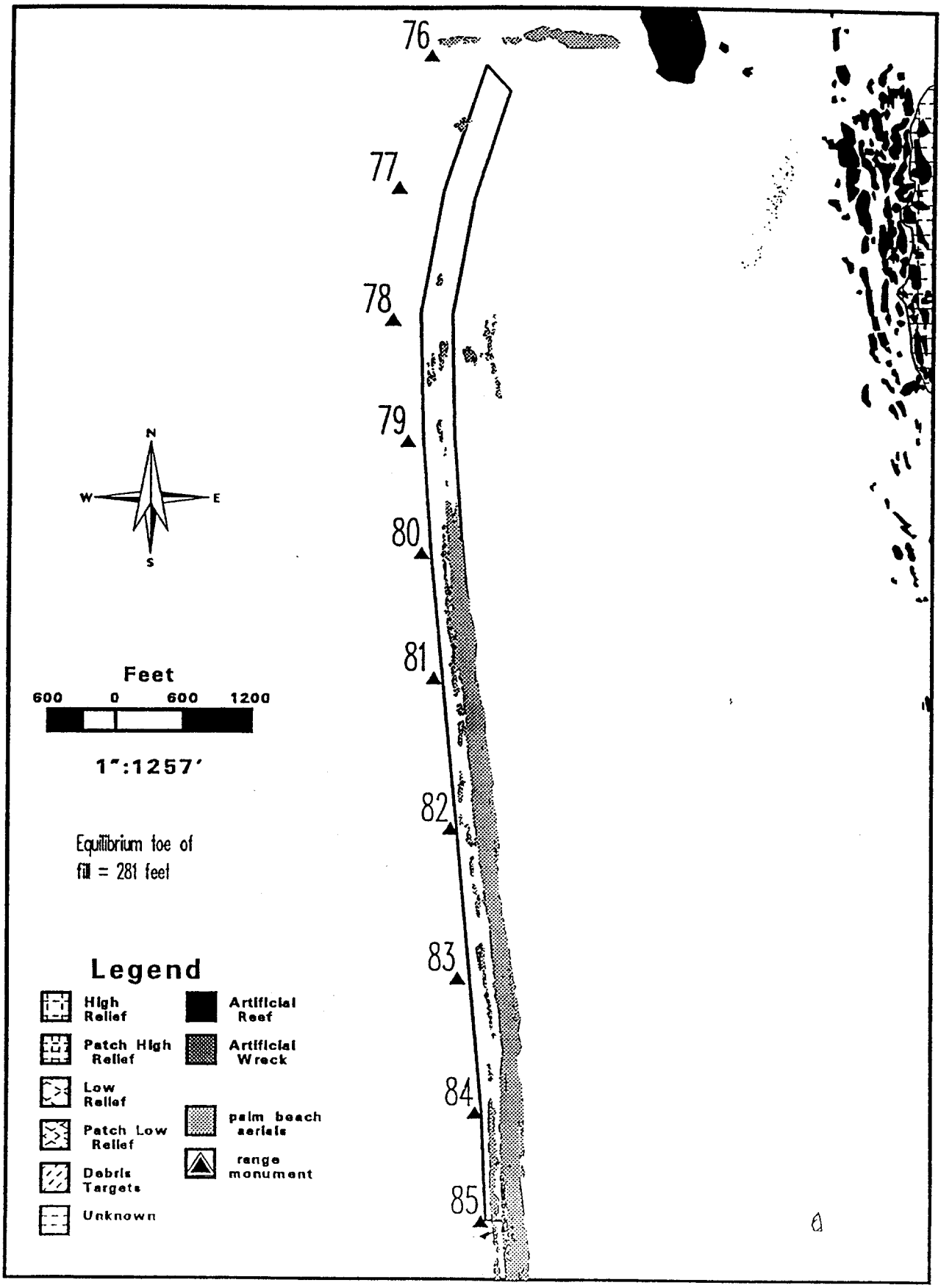

Figure10 Northend Palm Beach Island Project Footprint

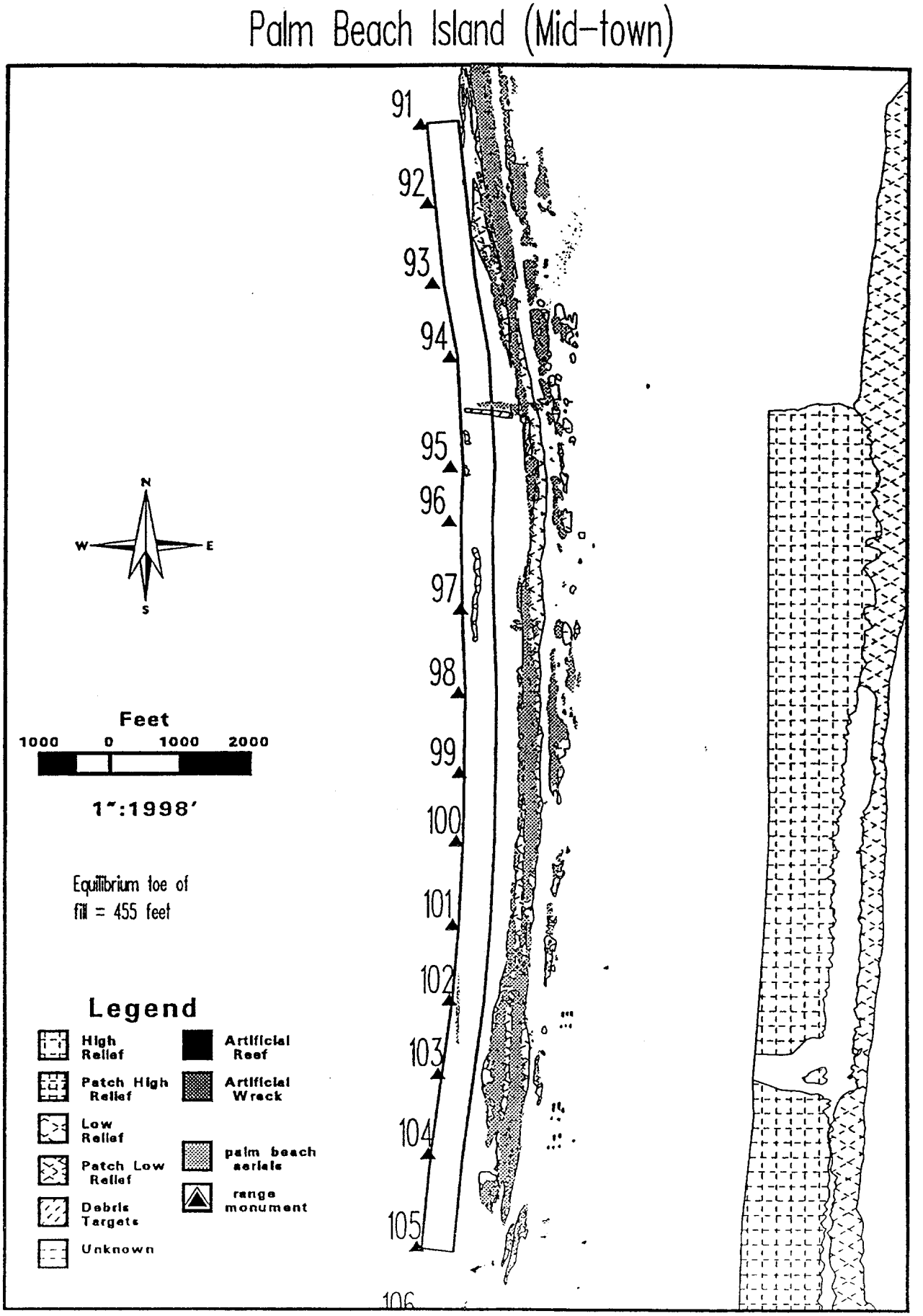

Figure 11 Palm Beach Island (Midtown) Project Footprint

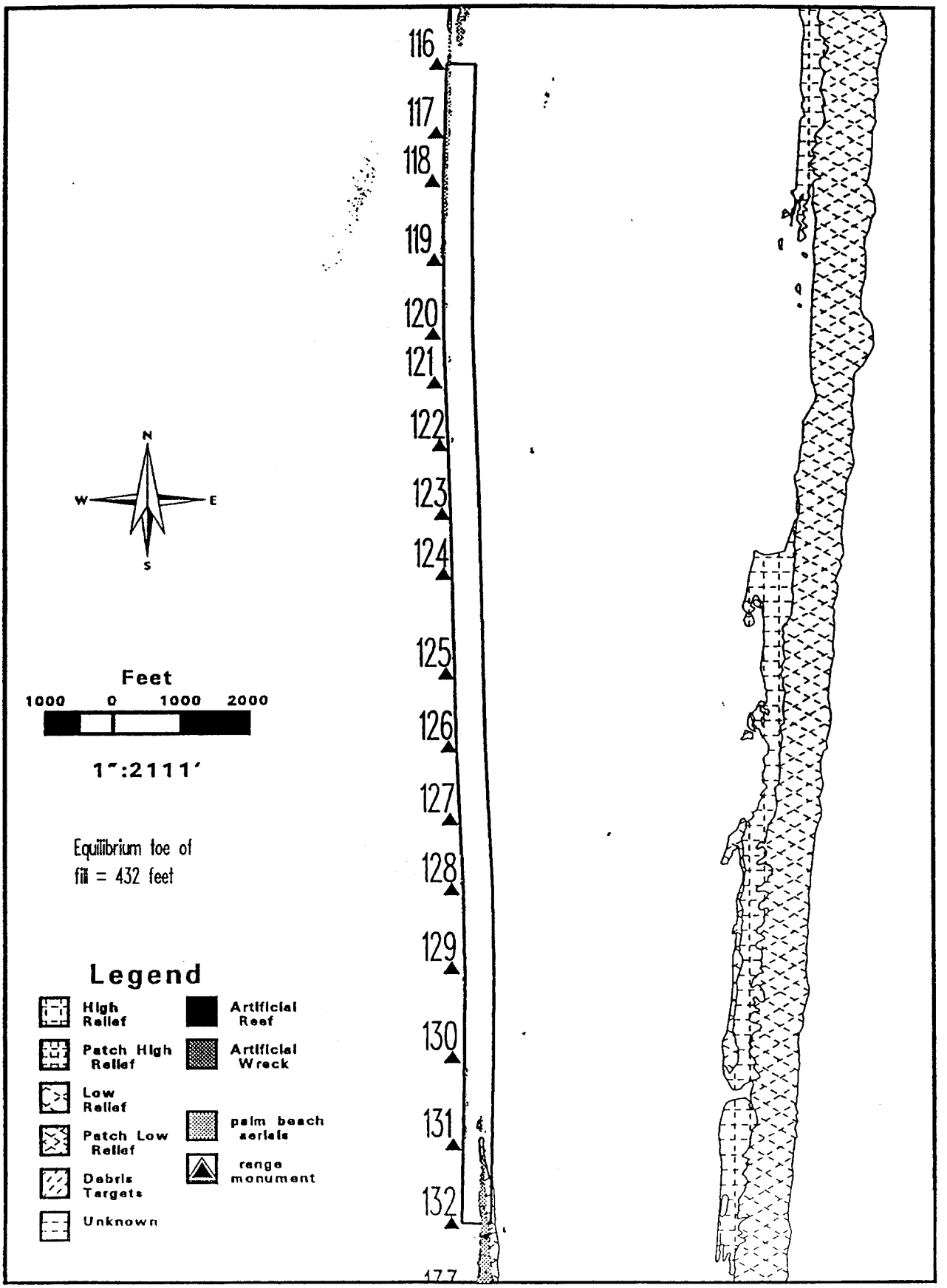

Figure 12 Southend Palm Beach Island Project Footprint

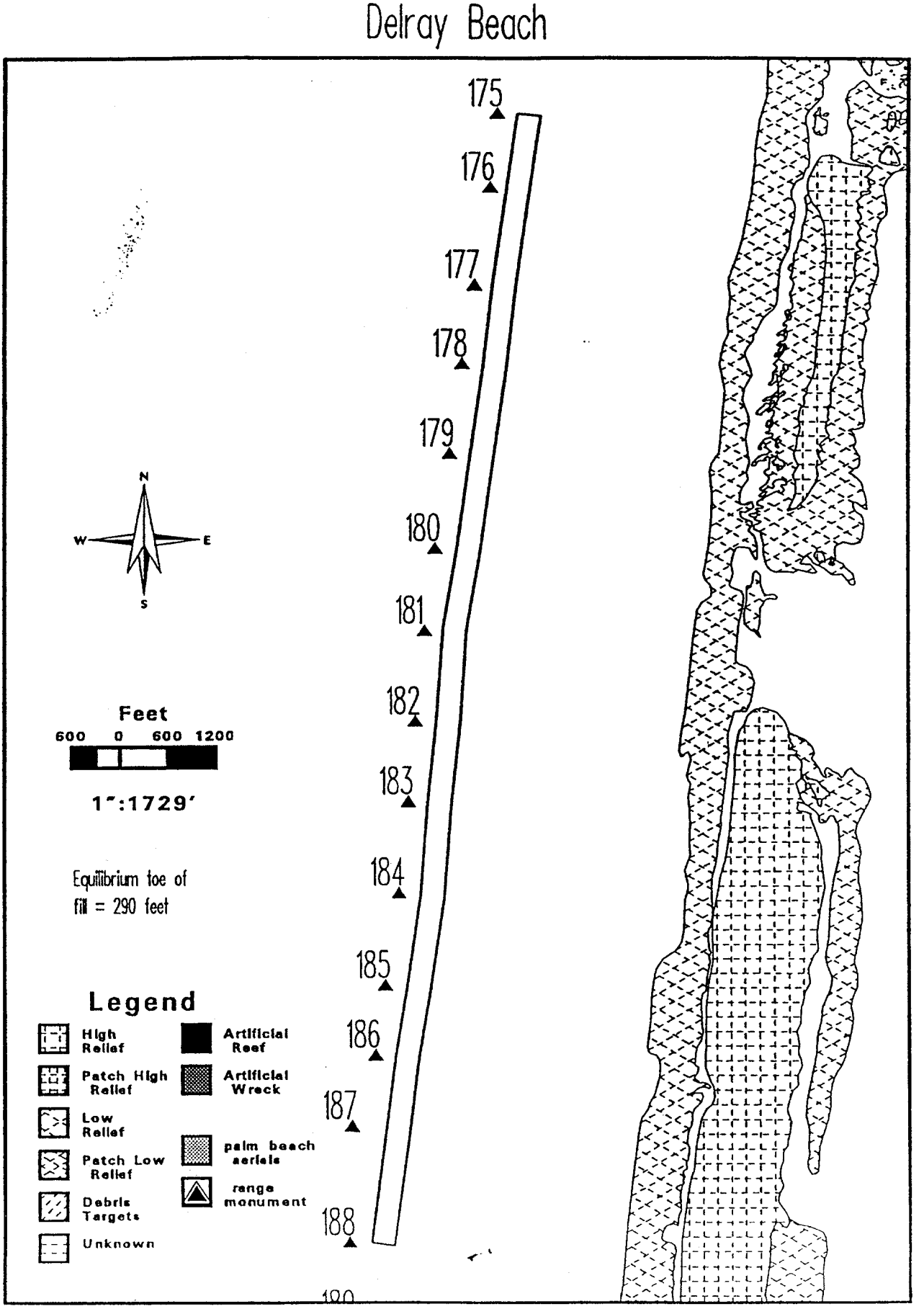

Figure 13 Delray Beach Project Footprint

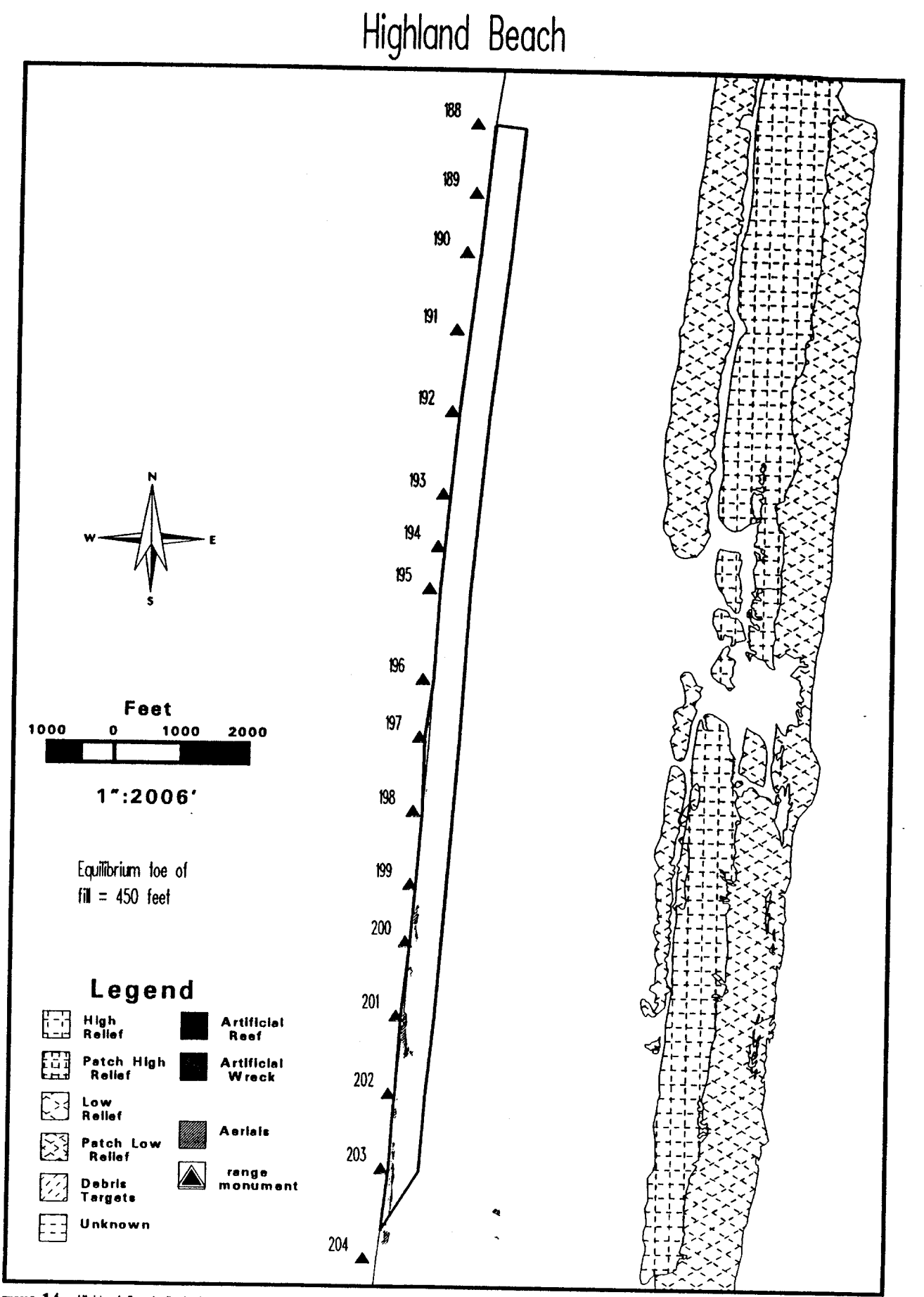

Figure 14 Highland Beach Project Footprint

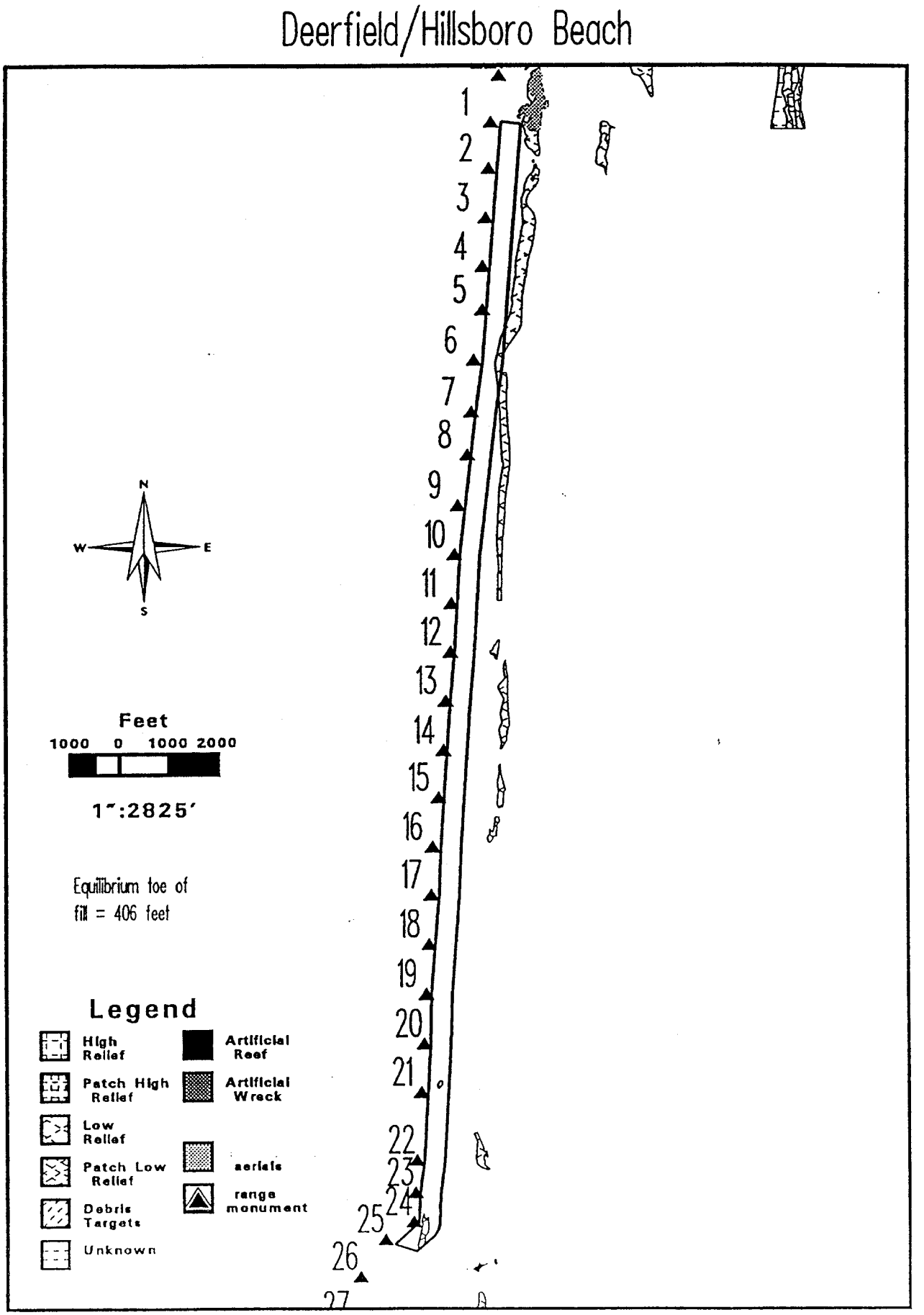

Figure 15 Deerfield/Hillsboro Beach Project Footprint

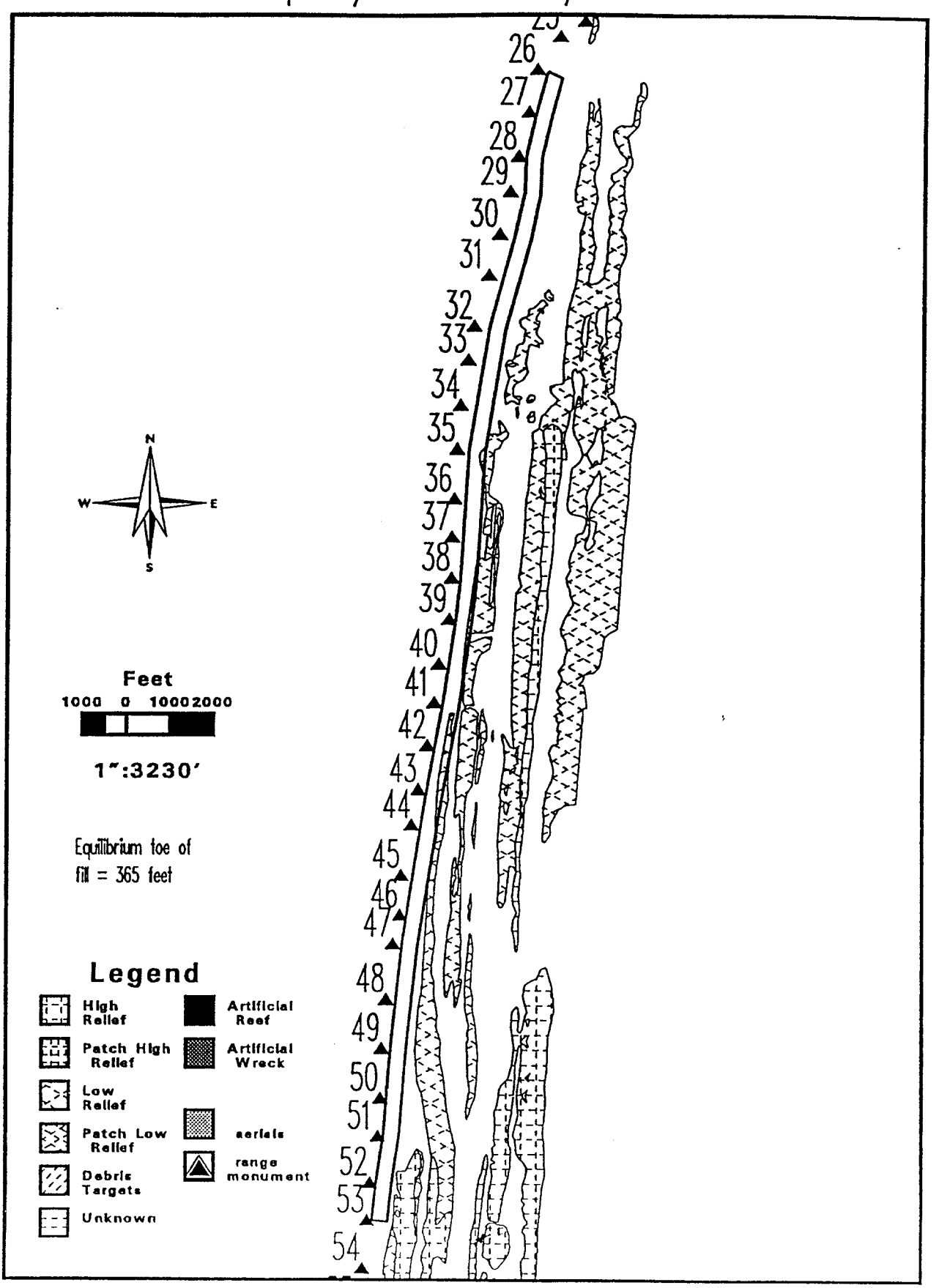

Figure 16 Pompano/Lauderdale-By-The-Sea Project Footprint

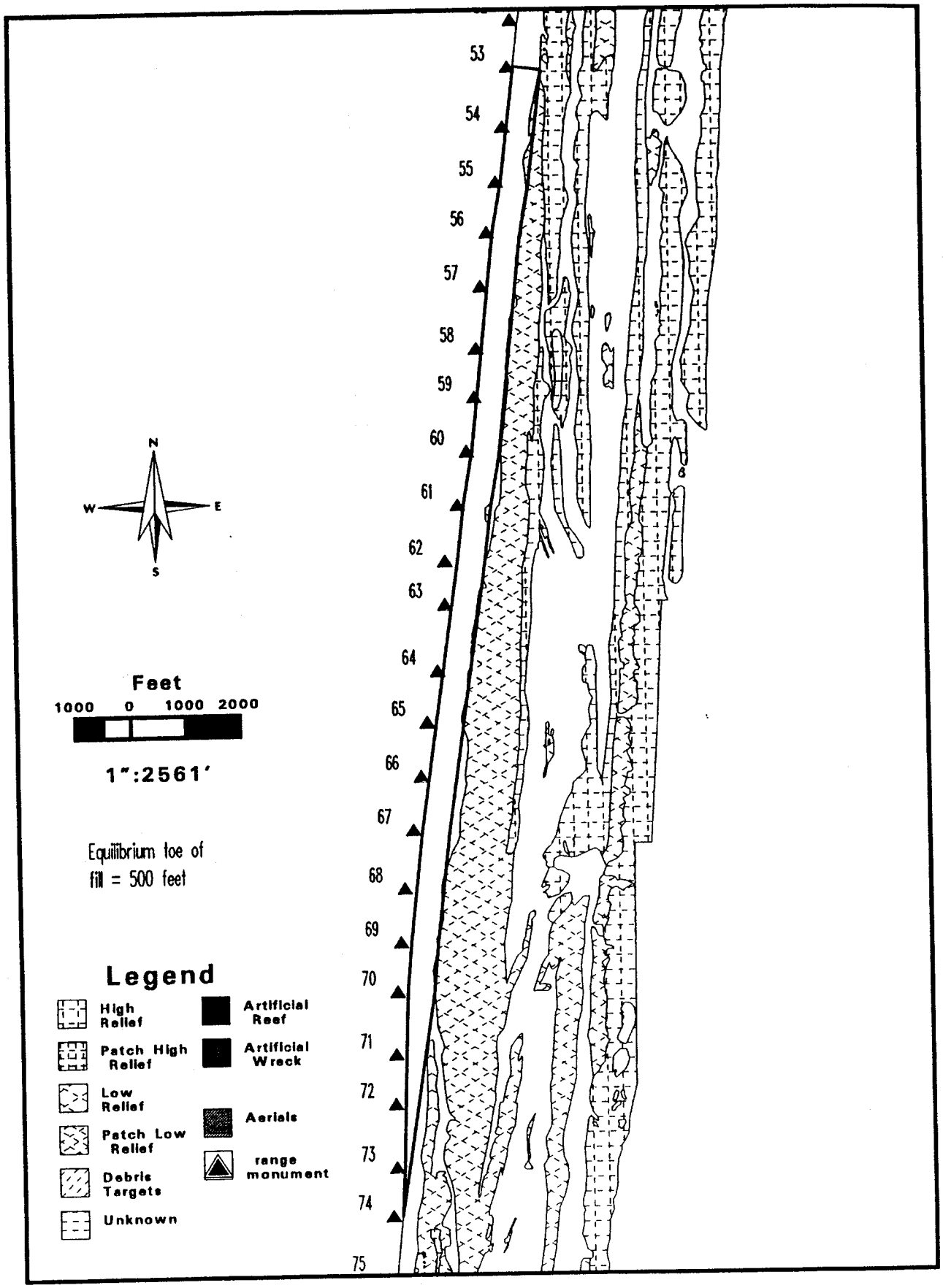

Figure 17 Fort Lauderdale Project Footprint

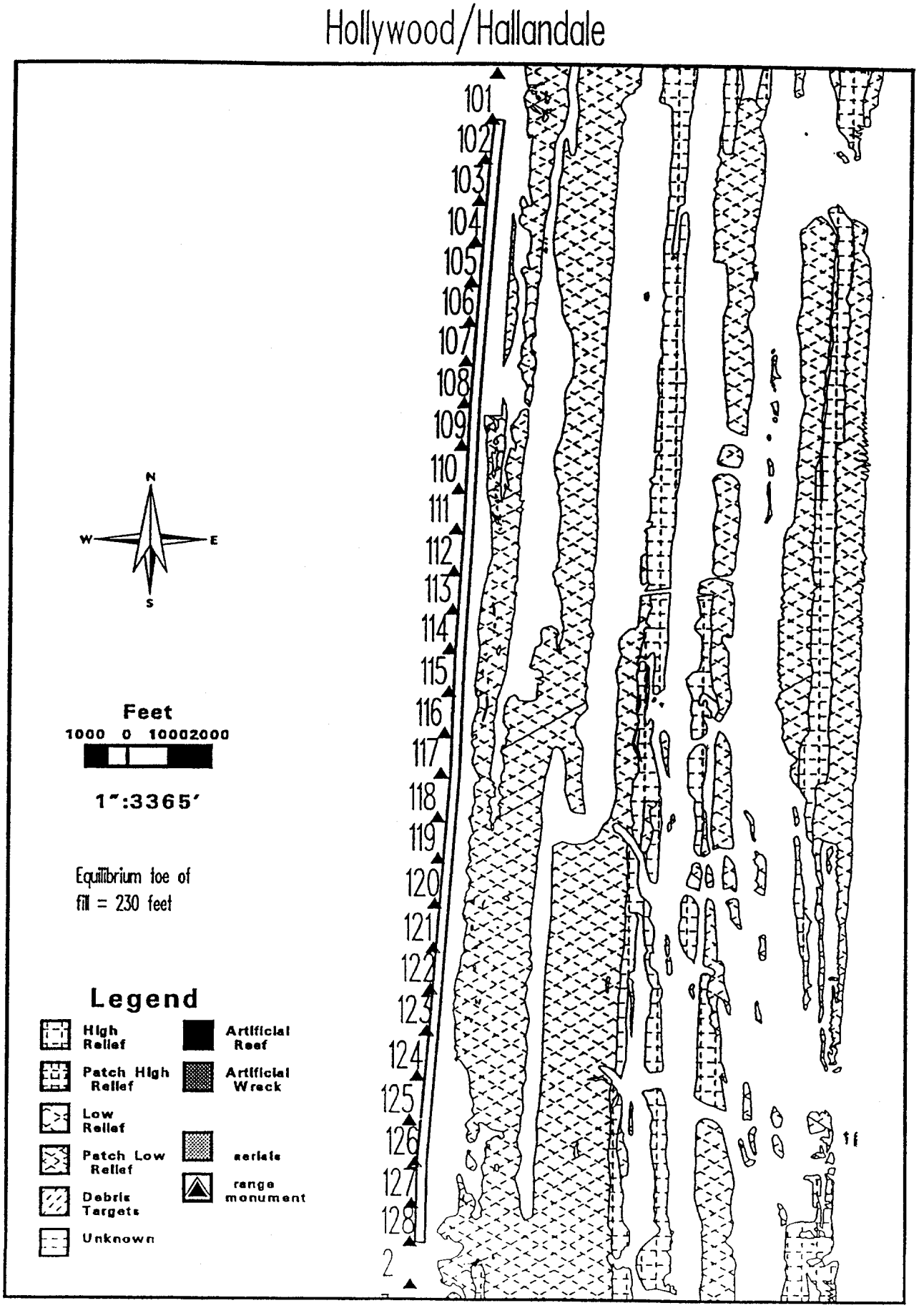

Figure 18 Hollywood/Hallandale Project Footprint

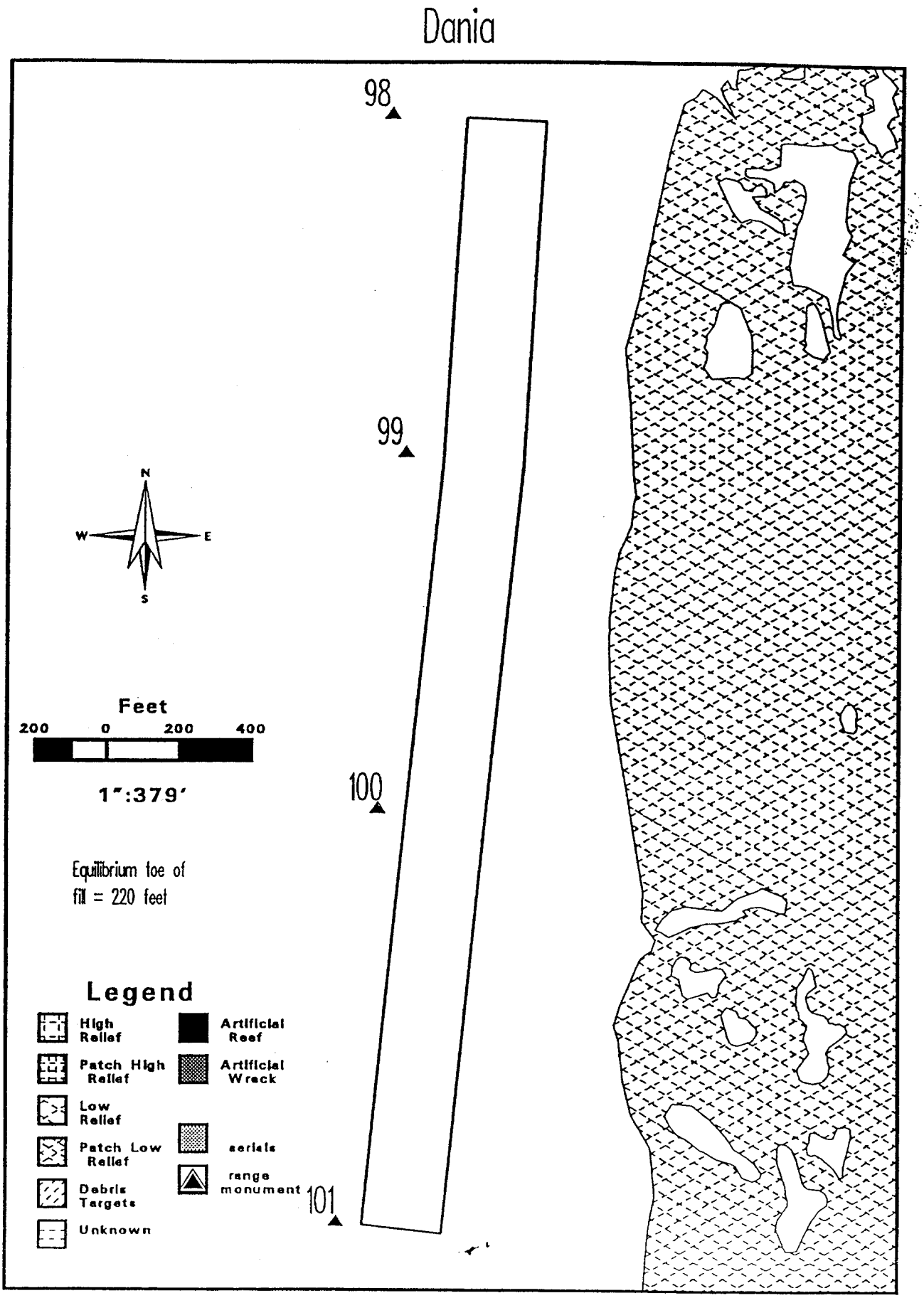

Figure 19 Dania Project Footprint

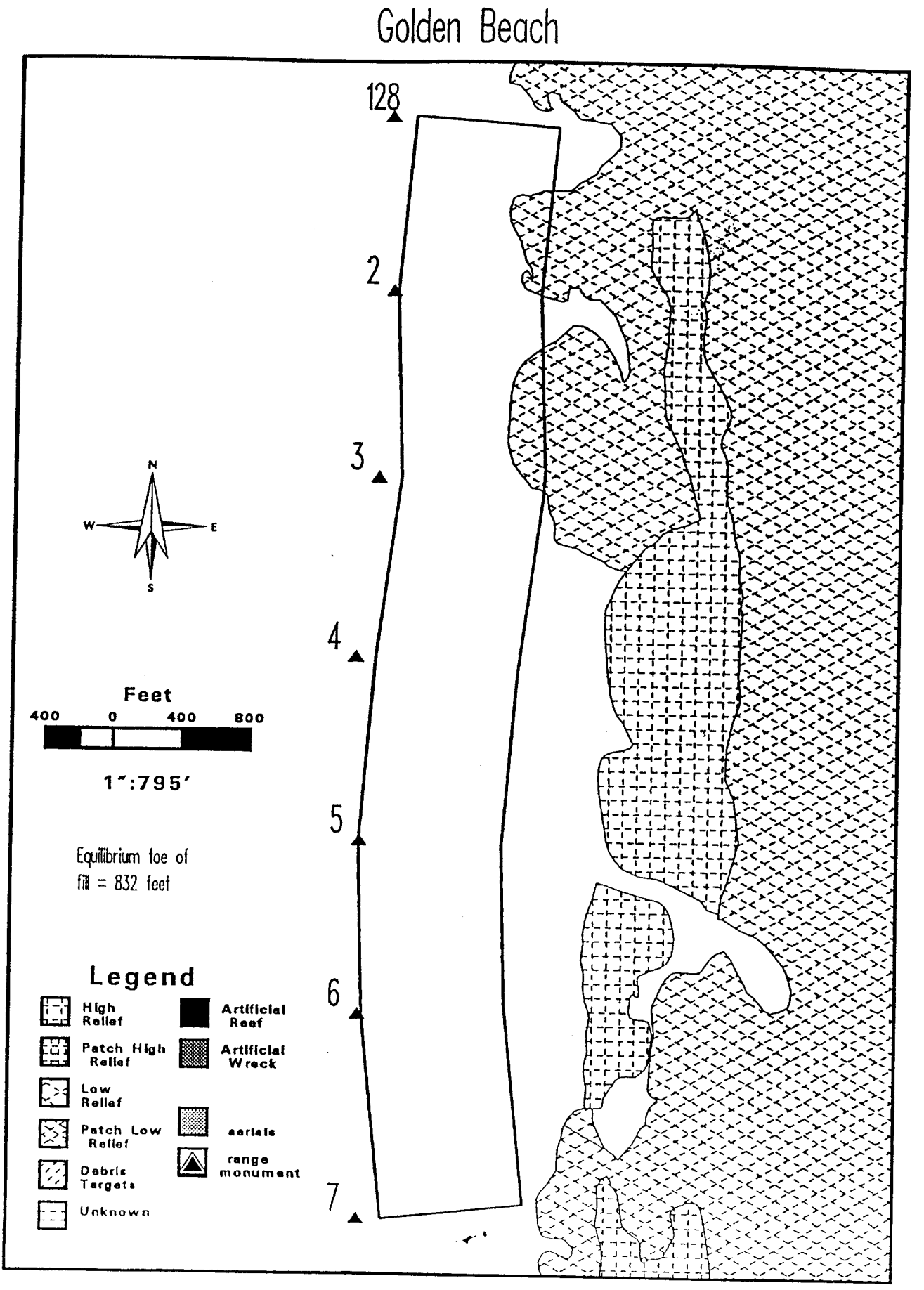

Figure 20 Golden Beach Project Footprint

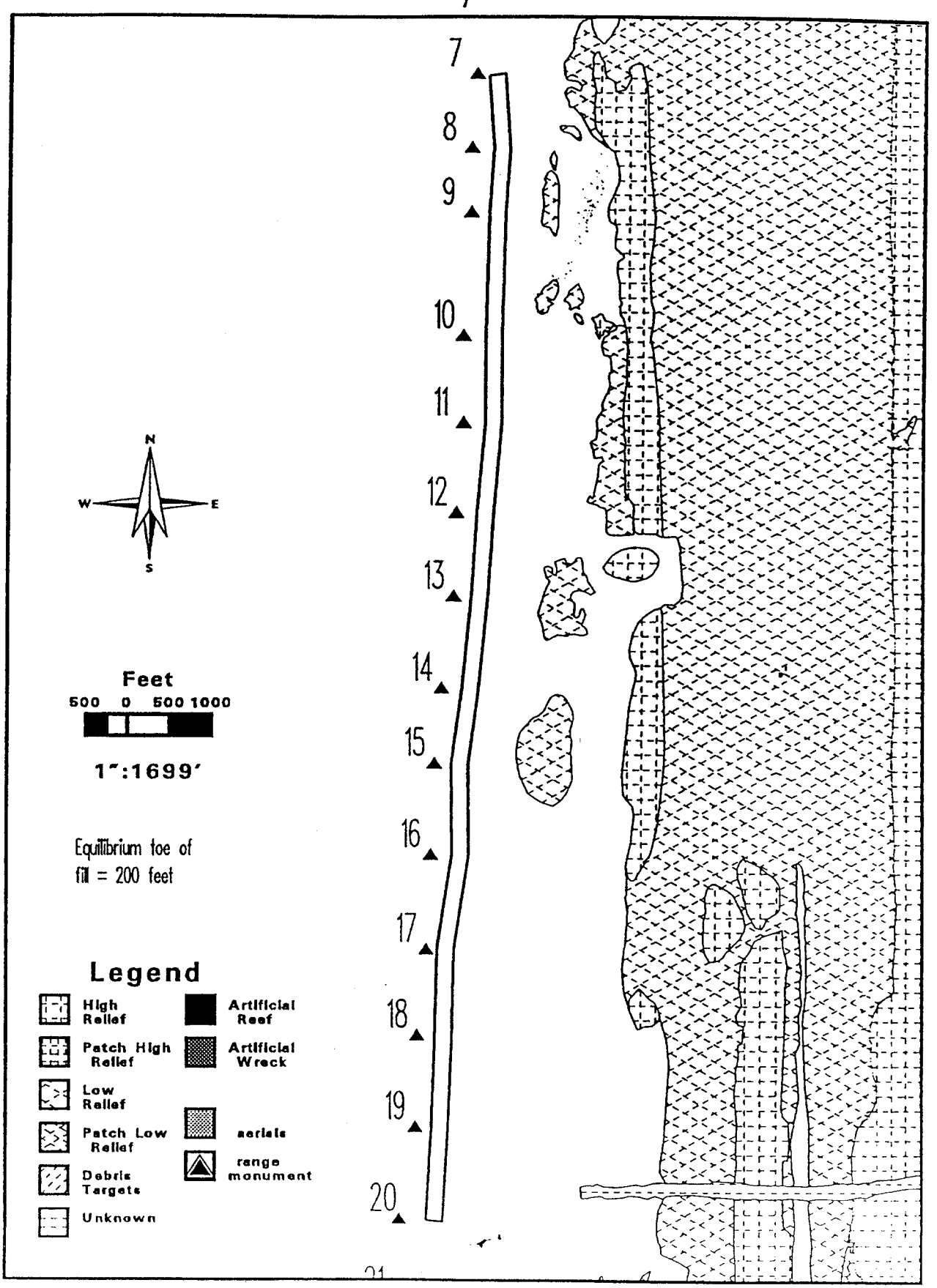

Figure 21 Sunny Isles Project Footprint

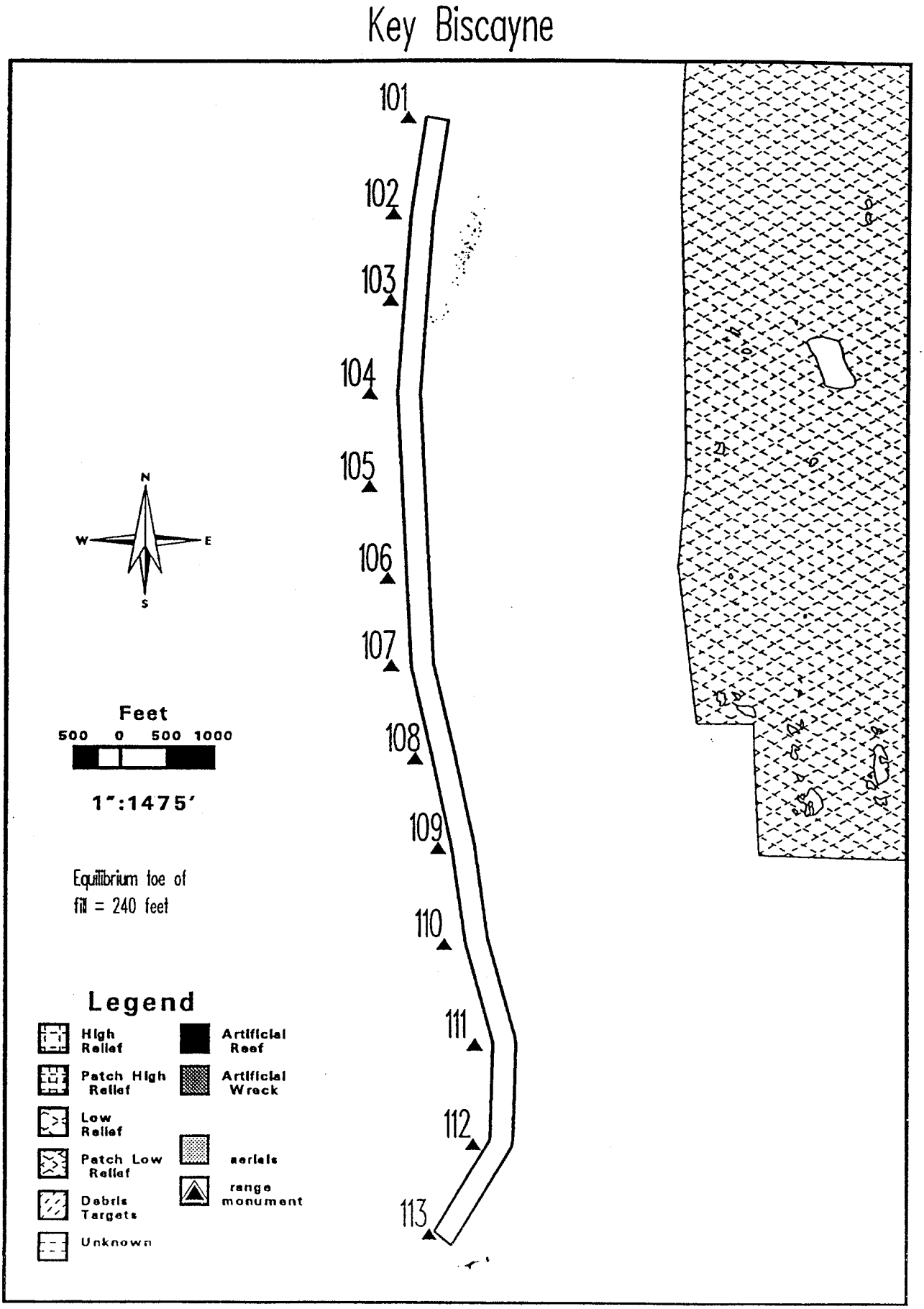

Figure 22 Key Biscayne Project Footprint

hardgrounds. Mitigation for impacts to hardgrounds have been incorporated into the MCACES cost estimates in Appendix D.

PALM BEACH COUNTY

Jupiter Inlet to Lake Worth Inlet Project Segment:

185. Jupiter/Carlin. This existing 1.1 mile beach restoration and periodic nourishment project component is located between DEP monuments R-13 and R-19. The project consists of a beach restoration with a seven year nourishment interval. Initial construction of this project was completed during April 1995. Extension of Federal participation from 10 years from completion of construction to 50 years from the start of construction is recommended. Nearshore berms are not feasible in association with this project area due to the presence of nearshore hardgrounds.

186. Ocean Cay/Juno. This 2.75 mile project component is currently authorized for periodic nourishment as needed and justified. The recommended modification includes adding initial restoration by construction of a design beach with a 55 foot berm, and periodic nourishment between DEP monuments R-27 and R-41. The renourishment interval is seven years. The equilibrium toe of fill, including initial fill plus advance nourishment, is 300 feet. Mitigation for approximately 1.7 acres of hardground impact may be necessary in association with this project component. A nearshore berm site, away from potential hardground impact, has also been identified for use as an alternative maintenance dredged material disposal site. Extension of Federal participation from 10 years from completion of construction to 50 years from the start of construction is also recommended.

Lake Worth Inlet to South Lake Worth Inlet Project Segment:

187. Recommend that the project for Palm Beach County, Florida for Lake Worth Inlet to South Lake Worth Inlet (Palm Beach Island) authorized in 1958 (PL 85-500) be deauthorized. The following project components for Palm Beach Island would be added as project modifications to the Palm Beach County, Florida (1962) project. Extension of Federal participation from 10 years from the completion of construction to 50 years from the start of construction is also recommended for each project component.

188. Lake Worth Inlet. The recommended plan for Lake Worth Inlet requires the construction of a new fixed sand transfer plant to be located north of the inlet with three discharge points located along the dry beach 750, 1,250 and 1,750 feet

south of the south jetty on Palm Beach Island. This system would be designed for a target bypassing rate of about 160,000 cubic yards per year to the south, across the inlet, through a 12-in pipeline.

189. The recommended plan for the sand bypassing plant would include:

a. A deposition area north of the north jetty,

b. An array of jet pumps suspended from a pier oriented perpendicular to the shoreline, or a single jet pump deployed by a crane from the north jetty,

c. A clear water pump and pipeline providing water to the jet pumps,

d. An on shore pumphouse containing the clear water pump and a booster pump for transferring the dredged material past the inlet,

e. A slurry pit to ensure the proper ratio of solids to water,

f. An drilled tunneled pipeline under the inlet from north of the north jetty to the south side of the south jetty, and

g. All associated pipe, valves, instruments, and controls required for operation of the system, including three remote controlled discharge valves located within the first 2,250 feet south of the south jetty.

190. The detailed sand transfer plant design would be determined within a Feature Design Memorandum (FDM) to be prepared during PED.

191. North-end Palm Beach Island. The 1.95 mile beach restoration and periodic nourishment project component located between DEP monuments R-76 and R-85 is authorized (1958), but not constructed. The optimal berm width is 10 feet at elevation +9.0 feet NGVD and slopes of 1:10 berm to MLW and 1:30 from MLW to existing bottom. The initial project design volume is 100,000 cubic yards with a 190 foot toe of fill. The recommended renourishment interval is 4 years. The distance to the equilibrium toe of fill, including initial fill plus advance nourishment, is 281 feet with a total volume of 239,400 cubic yards. Mitigation for approximately 18 acres of hardground impact may be necessary in association with this project segment. Nearshore berms are not feasible in association with this project component due to the presence of nearshore hardgrounds.

192. Palm Beach Island (Mid-town). The 3.1 mile beach restoration and periodic nourishment project component located between DEP monuments R-91 and R-105 is authorized (1958), but not constructed. The optimal berm width is 25 feet at elevation +9.0 feet NGVD and slopes of 1:10 berm to MLW and 1:30 from MLW to existing bottom. The initial project design volume is 568,400 cubic yards with a 390 foot toe of fill. The recommended renourishment interval is 4 years. The distance to the equilibrium toe of fill, including initial fill plus advance nourishment is 455 feet with a total volume of 1,025,7800 cubic yards. Mitigation for approximately 3.65 acres of hardground impact may be necessary in association with this project component. Three potential nearshore berm sites have been identified for use as an alternative maintenance dredged material disposal site for the Federal navigation project at Palm Beach Harbor.

193. South-end Palm Beach Island. This 3.25 mile beach restoration and periodic nourishment project component located between DEP monuments R-116 and R-132 is authorized (1958), but not constructed. The optimal berm width is 35 feet at elevation +9.0 feet NGVD and slopes of 1:10 berm to MLW and 1:30 from MLW to existing bottom. The initial project design volume is 248,900 cubic yards with a 350 foot toe of fill. The recommended renourishment interval is 4 years. The distance to the equilibrium toe of fill, including initial fill plus advance nourishment, is 432 feet with a total volume of 674,500 cubic yards. Mitigation for approximately 5.4 acres of hardground may be necessary in association with this project component.

South Lake Worth Inlet to Boca Raton Inlet Segment:

194. South Lake Worth Inlet. The recommended plan for South Lake Worth Inlet requires the construction, operation and maintenance of a new sand transfer plant to be located north of the inlet with one discharge point located approximately 2,000 feet south of the south jetty. This system would be designed for a target bypassing rate of about 120,000 cubic yards per year. The design would be similar to the Lake Worth Inlet sand transfer plant and would similarly be determined within a Feature Design Memorandum (FDM) during PED studies.

195. Ocean Ridge. The 1.35 mile beach restoration and periodic nourishment project component located between DEP monuments R-152 and R-159 is authorized (1962), but not constructed. This project is scheduled for construction by Palm Beach County during 1996. The optimal berm width is 60 feet at elevation +9.0 feet NGVD and slopes of 1:10 berm to MLW and 1:30 from MLW to existing bottom. The initial

design volume is 770,000 cubic yards and includes 8 years of advance nourishment. The annual advance nourishment is 62,600 cubic yards. Two nearshore berm sites, however, have been recommended as potential dredged material disposal sites. Extension of federal participation from 10 years from completion of construction to 50 years from the start of construction is recommended.

196. Delray Beach. The recommended 2.7 mile beach restoration and periodic nourishment project component located between DEP monuments R-175 and R-188 is authorized and constructed. This project is recommended for modification with an additional 20 feet optimal berm width at elevation +9.0 feet NGVD and slopes of 1:20 berm to MLW and 1:30 from MLW to existing bottom. The recommended additional design volume is 155,300 cubic yards with a 290 foot equilibrium toe of fill. No hardgrounds exist in the vicinity of this project so no mitigation will be required. Although this project component is a considerable distance from either inlet, an extensive nearshore berm site offshore of this project component is recommended as a potential dredged material disposal site. The Delray project has been extended to 50 years of Federal participation by Assistant Secretary of Army (Civil Works) under Section 934.

197. Highland Beach. The 3.4 mile beach restoration and periodic nourishment project component located between DEP monuments R-188 and R-205 is a modification to the authorized (1962) periodic nourishment project. It would fill in a gap between two authorized projects for lessening end losses. The optimal berm width of this project component is 120 feet at elevation +9.0 feet NGVD, and slopes of 1:10 berm to MLW and 1:30 from MLW to existing bottom. The initial project design volume is 1,017,450 cubic yards with a 350 foot toe of fill. The recommended renourishment interval is 7 years. The distance to the equilibrium toe of fill, including initial fill plus advance nourishment, is 450 feet with a total volume of 1,900,430 cubic yards. Mitigation for approximately 1.9 acres of hardground may be necessary for this project component. One nearshore berm site has been identified offshore of this project coastline. Extension of Federal participation from 10 years from completion of construction to 50 years from the start of construction is recommended.

198. Boca Raton. The 1.65 mile beach restoration and periodic nourishment project component located between DEP monuments R-205 and R-213 is authorized and constructed. Extension of Federal participation from 10 years from completion of construction to 50 years from the start of construction is recommended. Another recommended modification to this project component is a nearshore berm

site as an alternative maintenance dredged material disposal site.

Other Palm Beach County Project Segment Alternatives:

199. As previously discussed, specific recommendations for the 1.9 miles of northern the Palm Beach County shoreline, north of Jupiter Inlet, will be addressed in the Region IV COFS study. In addition to the above specific project components, periodic nourishment as necessary and justified is an existing project feature for Palm Beach County, Florida. No modification of this project feature is recommended for the economic life of the project. Dune grassing, as necessary and justified is also recommended for the Palm Beach County shoreline as a cost effective project feature.

BROWARD COUNTY:

Boca Raton Inlet (Palm Beach County) to Hillsboro Inlet (Broward County) Segment:

200. Deerfield Beach/Hillsboro Beach (Segment I). The 4.4 mile beach restoration and periodic nourishment project segment located between DEP monuments R-1 and R-24 is authorized, but not constructed. The optimal berm width is 30 feet at elevation +9.0 feet NGVD and slopes of 1:10 berm to MLW and 1:30 from MLW to existing bottom. The initial project design volume is 746,700 cubic yards with a 300 ft toe of fill. The recommended renourishment interval is 7 years. The distance to the equilibrium toe of fill, including initial fill plus advance nourishment, is 406 feet with a total volume of 1,055,820 cubic yards. Mitigation for approximately 4.65 acres of hardground may be necessary in association with this project segment. A nearshore berm dredged material disposal site has been identified and recommended offshore this project shoreline. It is also recommended that Federal participation in this project segment be extended from 10 years from completion of construction to 50 years from the start of construction.

201. Hillsboro Inlet. Navigation improvements are being considered for the outer channel at this inlet to provide additional advanced maintenance for the entrance channel as part of the Hillsboro Inlet, Florida, Federal navigation project. Two alternatives are being evaluated. One alternative is as designed and contained within a permit request by the sponsor. The other is an alternative designed by Jacksonville District. The recommendations for this navigation project will be addressed in a separate navigation report which will address related potential impacts to the adjacent shorelines.

Hillsboro Inlet to Port Everglades Inlet Segment (Segment II):

202. Pompano/Lauderdale-By-The-Sea. The 5.2 mile beach restoration and periodic nourishment project component located between DEP monuments R-24 and R-53 is authorized and constructed. This project is recommended for modification with an additional 35 feet optimal berm width at elevation +9.0 feet NGVD and slopes of 1:20 berm to MLW and 1:30 from MLW to existing bottom. The recommended additional design volume is 600,000 cubic yards with a resulting equilibrium toe of fill of 365 feet. Mitigation for approximately 12.25 acres of hardground may be necessary in association with this project segment modification. A nearshore berm dredged material disposal site has been identified and recommended off this project shoreline. Extension of Federal participation in this project segment from 10 years from completion of construction to 50 years from the start of construction is also recommended.

203. Fort Lauderdale. This 4.0 mile project segment area located between DEP monuments R-53 to R-74 is authorized for periodic nourishment. A beach restoration and periodic nourishment project component modification is recommended. The recommended optimal berm width is 25 feet at elevation +9.0 feet NGVD and slopes of 1:10 berm to MLW and 1:30 from MLW to existing bottom. The initial project design volume is 466,700 cubic yards. The recommended renourishment interval is 6 years. The distance to the equilibrium toe of fill, including initial fill plus advance nourishment, is 500 ft with a total volume of 858,193 cubic yards. Federal participation to 50 years from the start of construction of this component is recommended. Mitigation for approximately 18 acres of hardground impact may be necessary in association with this project component. Nearshore berms are not feasible in association with this project component due to the presence of nearshore hardgrounds.

Port Everglades Inlet (Broward County) to Bakers Haulover Inlet (Dade County):

Broward County (Segment III):

204. Segment III of the Broward County project includes two authorized beach restoration and periodic nourishment project sections, J. U. Lloyd and Hollywood/Hallandale. Extension of Federal participation to the 50 year economic life of these projects was approved by Assistant Secretary of Army (Civil Works) under Section 934 in September 1992.

205. J.U. Lloyd. The 2.3 mile beach restoration and periodic nourishment project component located between DEP

monuments R-86 and R-98 is authorized and constructed. The optimal berm width in the re-analysis of this project remains at 100 feet at elevation +10 feet NGVD and slopes of 1:15 berm to MLW and 1:30 from MLW to existing bottom. The design volume, including initial fill and advance nourishment is 1,032,000 cubic yards. The renourishment interval is 6 years. The only recommended modification to this project segment is a nearshore berm site as an alternative maintenance dredged material disposal site.

206. Hollywood/Hallandale. The 5.25 mile beach fill project located between DEP monuments R-101 and R-128 is authorized and constructed. This project is recommended for modification with an additional 50 feet optimal berm width at elevation +7.0 feet NGVD and slopes of 1:15 berm to MLW and 1:40 from MLW to existing bottom. The recommended additional design volume is 720,000 cubic yards resulting in a project equilibrium toe of fill of 230 feet. The renourishment interval is 6 years. No hardgrounds exist in the immediate vicinity of this project so no mitigation will be required. A nearshore berm dredged material disposal site has been identified offshore of this project segment.

207. Dania. This 0.6 mile reach of beach is presently authorized for periodic nourishment. A modification to a beach restoration and periodic nourishment project is recommended for this project segment component located between DEP monuments R-98 and R-101. Initial restoration of the beach at Dania would fill in the gap between J.U. Lloyd and Hollywood/Hallandale. Due to the small project length, the fill would be designed as a transition between these two all ready constructed projects and help reduce end losses in Segment III.

208. The optimal berm width transition between J. U. Lloyd and Hollywood/ Hallandale is 125 feet, on the average (i.e., between 100 and 150 feet), with a transition berm height between elevation +10.0 feet and +7.0 NGVD and slopes of 1:15 berm to MLW and 1:40 from MLW to existing bottom. The initial design volume is 208,300 cubic yards. The recommended renourishment interval is 6 years. The distance to the equilibrium toe of fill, including initial fill plus advance nourishment, is 220 feet with a total volume of 460,840 cubic yards. Federal participation in the economic life of this transition project component is recommended.

Other Broward County Project Segment Alternatives:

209. In addition to the above specific project segments, periodic nourishment as necessary and justified is an existing project feature to the Broward County, Florida project. No change in this project feature is recommended

at this time. Dune grassing, as necessary and justified is also recommended for the Broward County shoreline as a cost effective project feature.

DADE COUNTY:

Continuation of Port Everglades Inlet (Broward County) to Bakers Haulover Inlet (Dade County):

210. Golden Beach. It is recommended that the Dade County, Florida, Beach Erosion Control and Hurricane Protection Project be modified to include initial restoration and periodic nourishment for the 1.2 mile shoreline located between DEP monuments R-1 and R-7 in Dade County. This project component would fill in a gap between the Dade County and Broward County authorized projects, decreasing project end losses. The optimal berm width in the analysis of this project is 100 feet at elevation +8.2 feet NGVD and slopes of 1:10 berm to MLW and 1:30 from MLW to existing bottom. The initial project design volume is 311,000 cubic yards with a 260 foot toe of fill. The recommended renourishment interval is 6 years. The distance to the recommended equilibrium toe of fill, including initial fill plus advance nourishment is 832 feet with a total volume of 534,660 cubic yards. Mitigation for approximately 5.25 acres of hardground impact may be necessary in association with this project segment. One nearshore berm site has been identified as an alternative maintenance dredged material disposal site.

211. Sunny Isles. The 2.65 mile beach fill project segment component located between DEP monuments R-7 and R-20 is authorized and constructed. This segment of the Dade County, Florida project is recommended for modification with an additional 20 feet optimal berm width at elevation +8.2 feet NGVD and slopes of 1:10 berm to MLW and 1:30 from MLW to existing bottom. The recommended additional design volume is 146,700 cubic yards with an additional 200 foot toe of fill extension. No hardgrounds exist in the vicinity of this project so no mitigation will be required. One nearshore berm site has been identified as an alternative maintenance dredged material disposal site.

Bakers Haulover Inlet to Government Cut:

212. Bal Harbour, Surfside, Miami Beach. The 9.3 mile beach fill project segment located between DEP monuments R-27 and R-74 is authorized and constructed. The only recommended modifications to this project segment are the addition of four nearshore berm sites that have been identified as an alternative maintenance dredged material disposal sites.

213. Government Cut. As identified in a previous DM, a sand tightening of Government Cut has been recommended. This sand tightening will help reduce end losses to the southern portion of the Miami Beach project segment and further reduce Government Cut maintenance dredging requirements. The sand tightening project will be undertaken as a separate project modification.

Project Segments South of Government Cut:

214. Virginia Key/Northern Key Biscayne. Shore protection of Virginia Key and northern Key Biscayne was authorized by the River and Harbor Act of 1962 (PL 87-874). Construction of the 1.8 mile Virginia Key shoreline and 1.9 mile northern Key Biscayne shoreline was completed in 1969. The Virginia Key shoreline was renourished in 1972 and 13 groins were also constructed. This project was deauthorized in 1990. As documented in the 1992 Rehabilitation Report following Hurricane Andrew, in August 1992, the Virginia Key project was found to be performing well to date. No project segment modification is recommended for Virginia Key at this time.

215. Key Biscayne. The 2.3 mile beach fill project located between DEP monuments R-101 and R-113 was initially constructed in 1985 under the authority of Section 103 of the 1962 River and Harbor Act. Nourishment for 50 years was authorized, however, the Federal limit of $1,000,000 under Section 103 has been met. It is recommended that the Dade County project be modified to incorporate this project segment so that Federal participation in periodic nourishment can be continued through the economic life of this project segment. An additional optimal berm width of 10 feet at elevation +8.2 feet NGVD and slopes of 1:10 berm to MLW and 1:30 from MLW to existing bottom is recommended. The additional project design volume is 106,660 cubic yards. The recommended renourishment interval is 7 years.

Other Dade County Project Segment Alternatives:

216. In addition to the above specific project segment modifications, periodic nourishment as necessary and justified is recommended for all Atlantic Ocean shorelines within Dade County for the economic life of each project segment. Dune grassing, as necessary and justified is also recommended for the Dade County shoreline as a cost effective project feature.

PROJECT COSTS

217. Project costs have been developed for the beach fill alternatives based upon May 1995 unit price levels and the use of borrow areas offshore. Given the dwindling supply of

sand available from inlets and offshore borrow areas in Region III, unit prices have also been developed for aragonite (calcium carbonate) and upland sources and have been used for economic analysis in this report.

218. Unit prices for beach fills are based on the use of hopper and pipeline dredging. Basic mobilization costs of $300,000 to $420,000 and an additional $100,000 for mobilizing to another project segment were used.

219. Costs were generated for each beach fill segment based on a long-term average annual erosion rate and an overfill factor between 6 and 15 percent. Because of the high cost of mobilizing equipment to the various beach fill projects, the option of combining nourishment of some projects were considered. Cost estimates included mobilization and demobilization, unit prices of fill, monitoring, and environmental considerations.

220. The analysis was performed over a 50-year period to determine the annual cost of the authorized beach fill for each project, using a 7.625 percent interest rate. The beach fill alternatives evaluated in the plan formulation included 20, 40, 60, 80, and 100-ft. equivalent extensions (in some cases 120 and 140-ft. extensions). Costs were developed for each extension. An example is shown in Table 14.

221. MCACES cost estimates including mitigation costs are located in Appendix D.

222. Advanced Nourishment Requirements. The majority of beach fill projects include nourishment to maintain the dimensions of the beach fill that were selected for construction. These beach dimensions and the resulting project performance are factored into the economic analysis of the project. In order to ensure that these design dimensions are maintained until the first periodic nourishment event occurs, advanced nourishment of the beach fill is usually incorporated during the initial beach fill operation. Advanced nourishment usually consists of placing an additional amount of beach fill to offset the expected losses from the time of completion of the project to the first scheduled nourishment event. Table 14 is an example of one of the cost optimization analyses which provide the nourishment interval. Enough advanced nourishment will be placed to ensure that the design fill will be maintained for that time interval. Advanced nourishment volumes are included in the initial fill volume. Each project segment's cost optimization is on file at the Jacksonville District.

TABLE 14

SAMPLE
COST OPTIMIZATION
COST OF FLORIDA - REGION III

AVERAGE ANNUAL COST OPTIMIZATION OF BEACH RENOURISHMENT INTERVAL - 100-ft Project
PROJECT NAME : HIGHLAND
APRIL 1994 PRICE LEVELS

ECONOMIC ANALYSIS PERIOD =	50 YEARS	MOBILIZATION COST =	$720,000.00	MONTHLY PRODUCTION RATE :	
INTEREST RATE =	7.750 PERCENT	OTHER FIXED COSTS =	$100,000.00	200,000 CUBIC YARDS	
ANNUAL EROSION RATE =	119,000 CUBIC YARDS	PRICE PER CUBIC YARD =	$2.80		
FILL BEHIND ECL =	0 CUBIC YARDS	BIO/TURB MONITORING =	$23,000 PER MONTH	CAPITAL RECOVERY FACTOR :	
DESIGN FILL QUANTITY =	1,017,450 CUBIC YARDS	CONTINGENCY =	25.00%	0.079400	
RENOURISHMENT FACTOR Rf =	6.00%	E&D, S&A =	15.00%		

TOTAL DESIGN FILL + ECL (C.Y.)	NOURISHMENT INTERVAL (YEARS)	ADVANCE NOURISHMENT W/ Rf OVERFILL (C.Y.)	TOTAL INITIAL FILL (C.Y., WITH Rf OVERFILL)	EST. CONST. TIME (MO'S)	INITIAL COST	INTEREST AND AMMORT-IZATION	RENOURISHMENT QUANTITY, WITH Rf OVERFILL (C.Y.)	RENOUR-ISHMENT COST	ANNUAL COST OF RENOUR-ISHMENT	TOTAL AVERAGE ANNUAL EQIV. COST
1,017,450	1	126,140	1,143,590	5.7	$5,970,749	$474,078	126,140	$1,707,316	$1,707,316	$2,181,394
1,017,450	2	252,280	1,269,730	6.3	$6,499,315	$516,046	252,280	$2,235,882	$1,076,237	$1,592,282
1,017,450	3	378,420	1,395,870	7.0	$7,027,882	$558,014	378,420	$2,764,448	$853,618	$1,411,632
1,017,450	4	504,560	1,522,010	7.6	$7,556,448	$599,982	504,560	$3,293,014	$733,494	$1,333,476
1,017,450	5	630,700	1,648,150	8.2	$8,085,014	$641,950	630,700	$3,821,580	$654,669	$1,296,619
1,017,450	6	756,840	1,774,290	8.9	$8,613,580	$683,918	756,840	$4,350,146	$596,742	$1,280,660
1,017,450	7	882,980	1,900,430	9.5	$9,142,146	$725,886	882,980	$4,878,712	$550,969	$1,276,855
1,017,450	8	1,009,120	2,026,570	10.1	$9,670,712	$767,855	1,009,120	$5,407,278	$512,974	$1,280,829
1,017,450	9	1,135,260	2,152,710	10.8	$10,199,278	$809,823	1,135,260	$5,935,844	$480,325	$1,290,148
1,017,450	10	1,261,400	2,278,850	11.4	$10,727,844	$851,791	1,261,400	$6,464,410	$451,561	$1,303,351
1,017,450	11	1,387,540	2,404,990	12.0	$11,256,410	$893,759	1,387,540	$6,992,976	$425,747	$1,319,506
1,017,450	12	1,513,680	2,531,130	12.7	$11,784,976	$935,727	1,513,680	$7,521,542	$402,262	$1,337,989
1,017,450	13	1,639,820	2,657,270	13.3	$12,313,542	$977,695	1,639,820	$8,050,108	$380,670	$1,358,365
1,017,450	14	1,765,960	2,783,410	13.9	$12,842,108	$1,019,663	1,765,960	$8,578,674	$360,659	$1,380,322
1,017,450	15	1,892,100	2,909,550	14.5	$13,370,674	$1,061,631	1,892,100	$9,107,240	$341,997	$1,403,629
1,017,450	16	2,018,240	3,035,690	15.2	$13,899,240	$1,103,600	2,018,240	$9,635,806	$324,511	$1,428,110
1,017,450	17	2,144,380	3,161,830	15.8	$14,427,806	$1,145,568	2,144,380	$10,164,372	$308,062	$1,453,630
1,017,450	18	2,270,520	3,287,970	16.4	$14,956,372	$1,187,536	2,270,520	$10,692,938	$292,543	$1,480,079
1,017,450	19	2,396,660	3,414,110	17.1	$15,484,938	$1,229,504	2,396,660	$11,221,504	$277,867	$1,507,371
1,017,450	20	2,522,800	3,540,250	17.7	$16,013,504	$1,271,472	2,522,800	$11,750,070	$263,962	$1,535,434

* OPTIMUM NOURISHMENT INTERVAL

Primary Project Benefits

223. Preliminary economic justification for project formulatioin of the beach fill projects in Region III are based solely on the protection of structural improvements located along the front row of development along the project shoreline. Shorefront development is a mix of single family, multi-family, commercial, and park development. The economic evaluation determines the justification of Federal participation based on the benefits generated versus the cost of providing shore protection and storm damage reduction along the project shorefront.

224. Benefits resulting from the project construction are categorized as primary and incidental. Primary benefits, the only benefits used for project formulation, are realized through the prevention and/or reduction of storm damages to coastal development. Tables 16 through 18 summarize the preliminary economic justifications for project formulation.

225. Guidance for the inclusion of incidental project benefits such as recreation are set forth in Engineering Regulation (ER) 1105-2-100 which states "recreation benefits produced as a benefit of the basic project may exceed 50 percent of the total project benefits, but economic justification must be demonstrated on the basis of recreation benefits limited to 50 percent of total project benefits."

226. In the evaluation of the projects, benefits stemming from the elimination of existing erosion control structures and storm damage to development were based on May 1995 price levels and an interest rate of 7.625 percent.

227. In the analysis of the storm damage benefits which the authorized beach fills will provide, the damages projected for the 50-years following completion of construction for each project were determined (assuming with and without project conditions). Damages were simulated from changes due to both long-term average annual shoreline recession and storms. A probabilistic frequency vs. storm recession distance curve was developed for each county and is discussed in greater detail in Appendix D. Annual shoreline position changes were based on historical shoreline recession (or accretion) rates for the study area.

228. The extent of damages are generated as a result of annual shoreline position change and the damage probabilities from the frequency vs. recession distance curve. Damages are claimed as the result of these two mechanisms in the Storm Damage Model (SDM), a computer program developed at USAED Jacksonville. The model computes damages for each foot of storm recession distance. These

computations are performed for each lot and then summarized as backfill damage, structural damage, and armor damage. Structural damage or "Upland" damages include damage to existing structural improvements such as single family homes or condominiums. Upland damages could also include pools, utilities, roads, tennis courts, parking lots, and patios. The extent of damages to existing development is a function of the protection afforded by existing widths of beach and dunes. As a result of future erosion, damages to development in the future will tend to be more severe with a given storm due to the fact that the amount of beach protection between a structure and the shoreline will decrease with time. After the relationships between recession and damage are determined, relationships between probability and damage are then determined by assigning probabilities from the appropriate frequency-recession relationship. This computational process results in without and with project frequency-damage curves for the existing condition and each future year analyzed. The frequency-damage relationships are integrated to produce average annual damages. Basic assumptions of this computer model are that a structure experiences damage when the probabilities landward extent of the erosion envelope reaches the front of the structure. Full value of the bottom two floors of the structure is realized when the erosion reaches the middle of the structure. Inherent in the routine are the capabilities of coastal structures to halt erosion, and ability to construct new coastal structures upon the failure of the existing structures. A more detailed discussion of the SDM and the required input data is provided in Appendix F.

229. The SDM was used to compute damages due to both shoreline recession and storm activity for with and without project conditions. The concept used to determine with project conditions, equilibrium profile theory, is illustrated in Figure 23. If an eroding shoreline is assumed to maintain the same profile above the seaward limit of significant sediment transport (limiting depth) while it erodes, the volume of material eroded per foot of beach is equivalent to the vertical distance from the beach berm crest to the limiting depth, multiplied by the horizontal retreat of the beach profile, $\triangle x$. The volume of material eroded may be represented by a rectangle with a vertical height equivalent to the berm elevation plus the limiting depth and a width equivalent to the assumed uniform horizontal retreat, as shown in Figure 23. Likewise, a volume of material placed on the beach may be represented by a rectangle with a vertical height equivalent to the berm elevation plus the limiting depth and a width equivalent to the assumed uniform horizontal extension, $\triangle x$, provided by the beach fill. The equivalent profile extensions ($\triangle x$)