ISLAND RESOURCES FOUNDATION

SEARCHING FOR HISTORIC SHIPWRECKS:
REPORT ON A MARINE ARCHAEOLOGICAL SURVEY OF CROWN BAY, ST. THOMAS, U.S. VIRGIN ISLANDS

FINAL REPORT
NOVEMBER, 1984

Prepared for The
Virgin Islands Port Authority

BY

Dr. Edward L. Towle, Project Director
Mr. J. Barto Arnold, III, Marine Archaeological Consultant

With the Assistance of Project Staff:

Mr. William Jones, Master Diver
Mr. Andrew Fredebaugh, Support Diver
Mr. Edward Trupp, Technician (Logistics)
Ms. Sandra Tate, Technician (Administration)
Ms. Judith Towle, Technician (Fiscal)
Mr. Werner Wernicke, Engineer

RED HOOK CENTER BOX 33, CHARLOTTE AMALIE, ST. THOMAS, U.S. VIRGIN ISLANDS 00802, (809) 775-6225

TABLE OF CONTENTS

PAGE NO.

LIST OF FIGURES

LIST OF TABLES

1.0 INTRODUCTION AND ABSTRACT

Pursuant to its development plans for Crown Bay, which involved certain dredge and fill activities for Phases IIA and IIB of the original project scheme, the Virgin Islands Port Authroity arranged for a preliminary magnetometer/ side scan sonar survey of Crown Bay, St. Thomas, to identify any submerged shipwreck sites which might have historic value. This task was carried out in February, 1981, by Tetra Tech, Inc. of Jacksonville, Florida, under contract to the Port Authority and under the direction of Mr. Erik Olsen, who was assisted by a professional marine archaeologist, Mr. J. Barto Arnold from Austin, Texas.

Twenty-nine magnetic anomalies were identified in the study (Olsen, 1981), but nineteen were determined to be either modern debris or eliminated for other technical reasons, leaving ten possible high priority marine archaeological sites that needed to be assessed as to their historical significance.

The Island Resources Foundation was contracted in late July, 1984, to perform this task of relocating and evaluating each of the ten high priority magnetic anomalies reported previously by Tetra Tech. For those proving, upon inspection, to have significance, a salvage archaeological excavation effort was to be carried forward expeditiously prior to any dredging activity.

Project mobilization commenced on 8 August; field work at Crown Bay started on 6 October, using a Geometrics Model

806A Proton Magnetometer to relocate each anomaly site and pinpoint the anomaly epicenter on the seabed. At the request of the Port Authority three additional low priority sites in an area to be dredged were examined. Additionally, three new anomalies were found and investigated during the course of the survey work.

Subsequent to relocation and inspection, ten promising sites were subjected to a pattern of sequential high pressure water jet probes penetrating up to sixteen feet of unconsolidated bottom sediments seeking evidence of the presence of a buried shipwreck. Test excavations using an air lift were also carried out.

All findings were negative, as no historical shipwreck sites were confirmed. Two anomaly areas proved to be geological in origin, and all others were caused by modern ferrous objects -- mostly debris on the seabed or buried in the sandy harbor sediments.

From a marine archaeological perspective, there appears to be no valid reason why the Port Authority cannot proceed to dredge the specified Crown Bay areas as scheduled. A dredge spoil area monitoring strategy for artifacts is recommended.

2.0 BACKGROUND INFORMATION

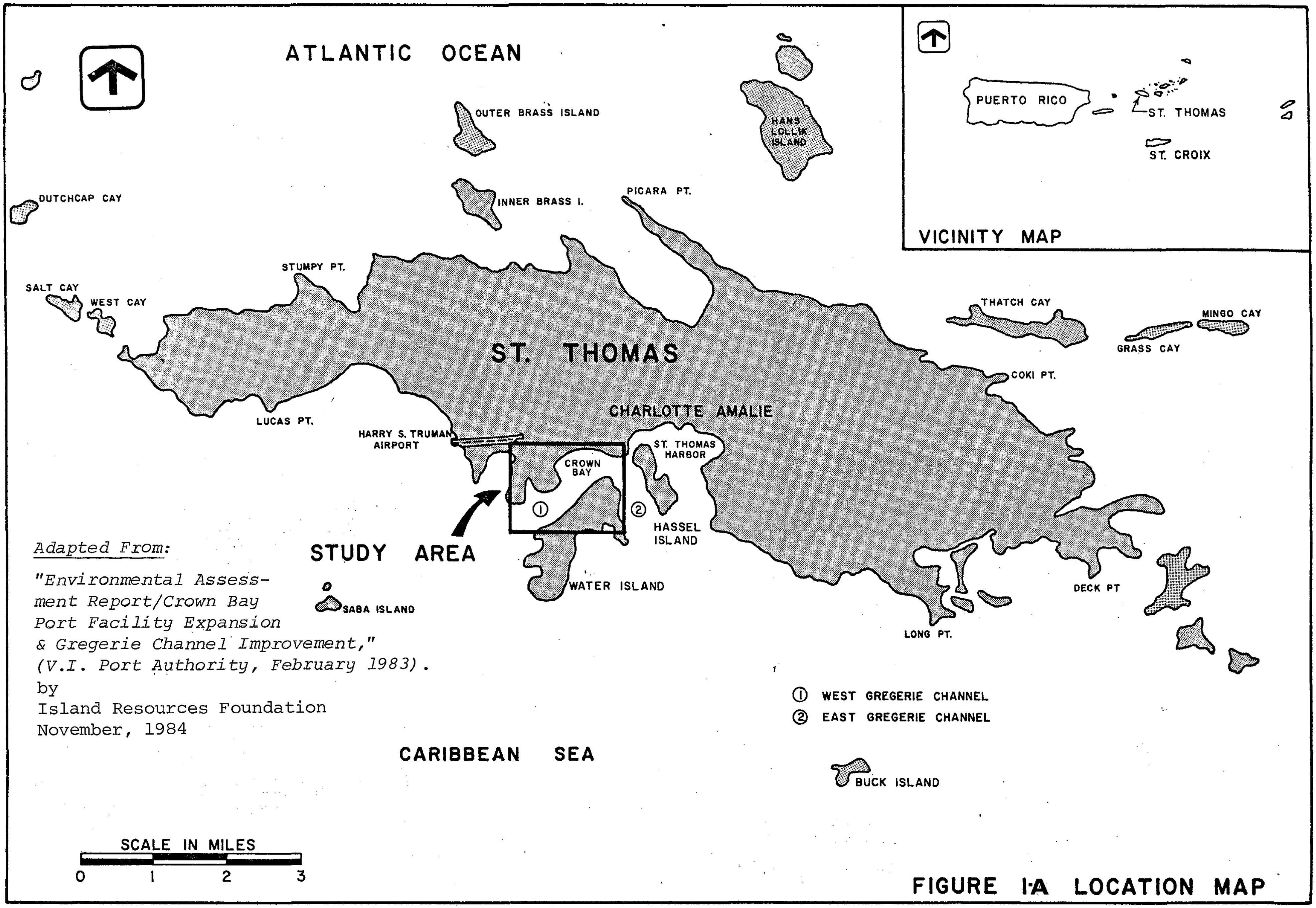
2.1 The Location

The project area is located adjacent to the Crown Bay Marine Freight Terminal along the southwestern portion of urbanized Charlotte Amalie, St. Thomas, Virgin Islands. The site is within the Crown Bay Harbor directly north of Water Island and east of Haypiece Hill and the former Submarine Base docking facilities at Little Krum Bay (Figures 1A and 1B).

2.2 The Virgin Islands Port Authority Crown Bay Project

The Virgin Islands Port Authority has proposed and received the necessary permits to expand the existing Crown Bay freight terminal facilities and provide deep water access to the cruise ship docking facilities presently under construction in the Crown Bay area. The project is a modification of the jointly sponsored proposal by the Virgin Islands Port Authority and the U.S. Army Corps of Engineers in 1980. The U.S. Army Corps recommended in its feasibility report that a terminal area for freight and cruise vessels be created in Crown Bay from fill material which would be dredged from Crown Bay Harbor to provide access to the terminal and increasing the depth of Gregerie Channel to 38 feet. It further recommended the development of new docking space and additional filled land to accommodate freight and passenger ship service facilities.

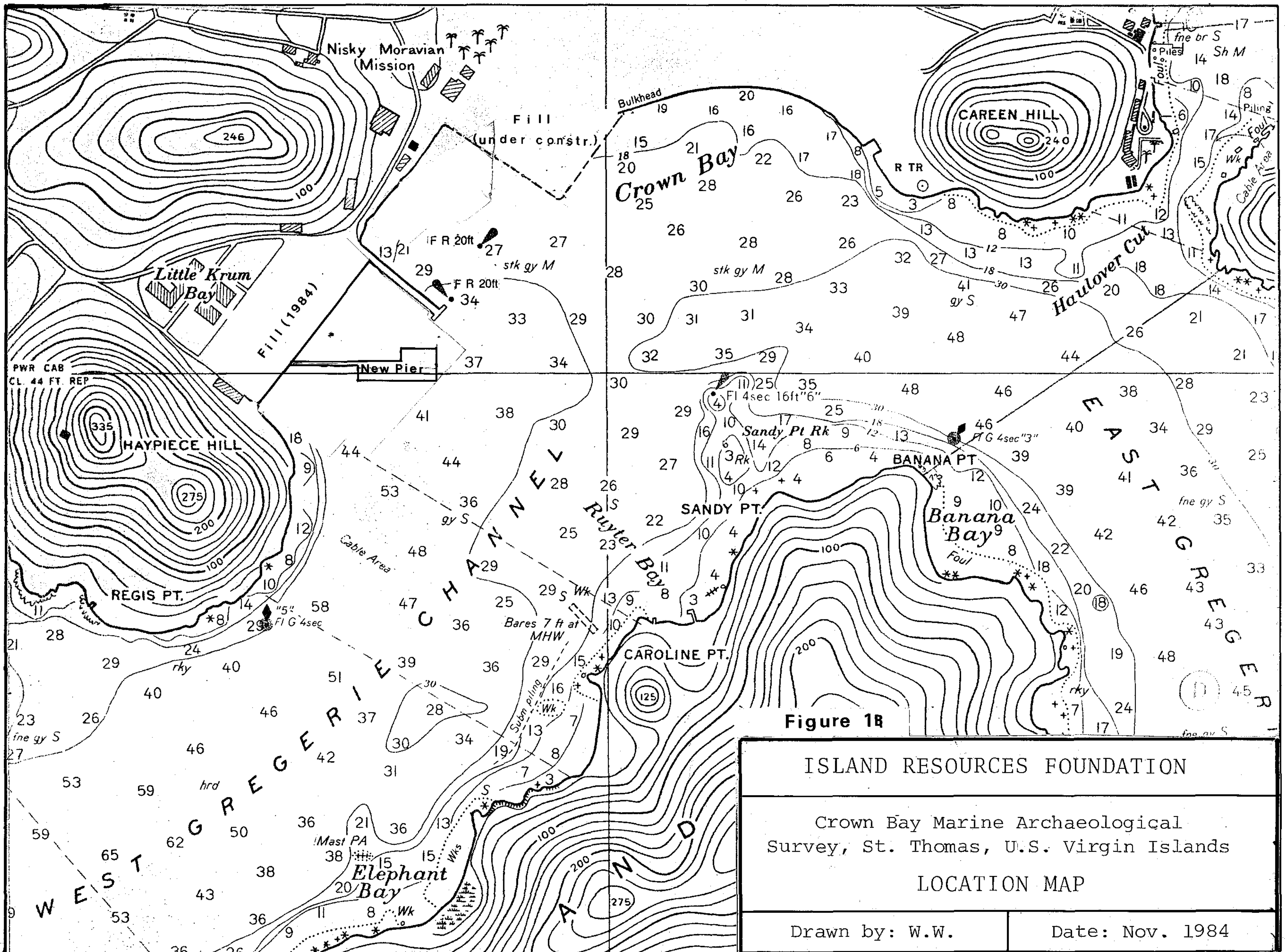
The expansion of Crown Bay port facilities was endorsed by the Virgin Islands Coastal Zone Management Program as



Adapted From:

"Environmental Assessment Report/Crown Bay Port Facility Expansion & Gregerie Channel Improvement," (V.I. Port Authority, February 1983).
by
Island Resources Foundation
November, 1984

FIGURE I-A LOCATION MAP



ISLAND RESOURCES FOUNDATION

Crown Bay Marine Archaeological Survey, St. Thomas, U.S. Virgin Islands

LOCATION MAP

Drawn by: W.W.	Date: Nov. 1984

approved by the Governor of the Virgin Islands and Secretary of the U.S. Department of Commerce in 1979. The present phase of the project is supported by a local Coastal Zone Permit Application CZT-47-83W submitted by the Virgin Islands Port Authority and a subsequent letter of conditional approval from E.E. Hatchette, Chairman, St. Thomas Coastal Zone Management Committee, addressed to Mr. J. Harding, Executive Director, Virgin Islands Port Authority, dated August 8, 1983.

All parties acknowledged that dredging a 38 foot channel and turning basin in Crown Bay posed the risk of possible destruction of potential cultural resources in the form of historic shipwreck sites which might exist within and beneath the seabed sediments scheduled for removal to deepen the channel and provide fill material on shore.

Therefore, the Virgin Islands Port Authority prepared and submitted to the Virgin Islands Coastal Zone Management and Virgin Islands Planning Office (Division of Archaeology and Historic Preservation), a marine archaeological plan outlining a protocol for a proper survey and assessment of the magnetic anomaly site documentation in the 1981 Tetra Tech study.

The plan became the basis for the operational strategy employed by the Island Resources Foundation in carrying out the site surveys.

2.3 The Historical Setting

Crown Bay, a small cove on the south shore of St. Thomas between Careen Hill (Frenchtown) and Little Krum Bay (the old U.S. Navy Sub-Base dock area), was originally known as Gregerie Bay (see Rohde map of 1822), after a prominent Grigri tree on its shore. This name, after spreading to embrace the adjacent entrances from the Caribbean Sea (East and West Gregerie channels), disappeared at its place of origin and was, in the mid-19th Century, replaced by the name Crown Bay (Maguire, 1925). In turn, this name is often now expanded to include the entire harbor, anchorage and dock area west of Banana Point on Water Island and east of Haypiece Hill. (See Figure 1B.)

Maguire (1925) notes that Crown Bay was at that time a cable landing area, a feature reported forty-odd years later in the Virgin Islands chapter in "Sailing Directions for the West Indies," published by the U.S. Navy Hydrographic Office:

> Submarine cables are laid across West Gregerie Channel just southward of Little Krum Bay and just southward of Krum Bay. Cables are also laid between the northwestern extremity of Hassel Island and the mainland west-northwestward. [Crown Bay]

As the Tetra Tech consultants did previously (Olsen, 1981), we have examined the available historical cartographic, bathymetric, meteorological and narrative records in some detail seeking to establish a profile of maritime usages and physical modifications within the Crown Bay study area. Some of the findings were instructive. For example, the old Keulen chart of 1719 shows "Gringri Bay" and "Water Eyeland Haven" as having four principal anchorages near what we now call Grambokola Hill, Krum Bay and Haypiece Hill and in Crown Bay itself. The Montargue chart of 1772 notes that "Gringri Bay" is "fur grose Schiffe," suggesting a major ship anchorage; and the Rohde chart of 1822 displays the preferred track for larger deep draft vessels sailing through East and West Gregerie Channels. The successive editions of the U.S. Coast and Geodetic Survey Chart #933 (1917, 1920, 1928, 1936, 1941, 1944, 1948, and 1965) are also instructive as is the U.S. Navy Hydrographic Office's Chart #977 of 1873, showing the channel and harbor bathymetry and shoreline configurations prior to subsequent major dredge and fill operations.

Much of the waterfront within the limits of the study area has been affected by major development activities within the last 50 or so years. As indicated in Figures 1B and 4, major segments of the shoreline between Little Krum Bay and Careen Hill have been extended bayward by either bulkheading and backfilling or by filling alone. Correspondingly, various portions of the Crown Bay study area have been dredged as a source of fill, in order to eliminate hazards to navigation or to increase navigable depths. The 1941 and 1944 versions of U.S.C.& G.S. Chart #922 indicate that major wartime improvements to Little Krum Bay had been completed within that time span. The facility was subsequently used as a submarine base and, to date, is still referred to locally as the "Sub-base." These charts likewise indicate that between 1941 and 1944, a large rock or reef outcropping known as Gregerie Bank was removed from the northern end of West Gregerie Channel as a hazard to navigation to ships traversing between East and West Gregerie Channels. The former location of this geological feature is shown on Figure 4.

Within the past decade, physical modifications to the Crown Bay/Little Krum Bay/West Gregerie Channel area shoreline and seabed have proliferated and usage levels by both large and small vessels seeking mooring sites, anchorages, dockage and support services has expanded rapidly. For example:

- Whereas in 1974, there were only seven vessels (yachts and barges) moored or anchored in Elephant and Ruyter Bay on the north shore of Water Island (to the south of the main West Gregerie ship channel opposite Little Krum Bay), by 1981 it was 31 vessels, by 1983 it was 54 and in October of 1984, during the field work for this project, it exceeded 80 vessels.

- Little Krum Bay (where the old U.S. Navy Docks were situated) has been filled, and a new Port Authority angled dock for cruise ship use is under construction.

- Whereas in 1974, there was one marina (Shoreline), there are now three in the area.

- Dredging has taken place adjacent to the new Port Authority dock and elsewhere.
- A major container-ship facility has been developed at the Crown Bay bulkhead.

With all this recent expanded marine activity, and associated dock and bulkhead dredging and construction, it is inevitable that one will find a motley collection of ferrous (iron or steel) debris on the harbor bed -- vessel parts, abandoned vehicles, wire rope, old engine-block moorings, lost anchors, chain, etc. All this on top of, or intermixed with, U.S. Navy debris from the World War II period, and at least three runs of abandoned, heavy steel armored underwater telegraph, telephone or power cable, linking St. Thomas with Water and Hassel Islands, are known to be buried in the Crown Bay and West Gregerie Channel sediments. In places, this old cable is cut, broken, twisted and the ends are looped back in convoluted coils.

Historic shipwrecks in the area were listed by Towle (1976), and in the Tetra Tech report (Olsen, 1981), but the three documented coastal wreck sites now lie buried under the dredge spoil/fill areas at Crown Bay, Little Krum Bay and Krum Bay. A recently completed, even more comprehensive list of known historical shipwrecks completed by Mr. George Tyson for the Virgin Islands Planning Office's Division of Archaeology and Historic Preservation, adds no <u>new</u> documented historical shipwreck sites in the Crown Bay area (Mr. George Tyson, personal communication).

2.4 Environmental Parameters

Crown Bay, along with St. Thomas Harbor and the entire south coast of the island has a tidal regime that is principally diurnal.

The mean range is about 1/2 foot and the diurnal range is less than 1 foot. The mean level of the sea is 1 foot lower in April and May than at other periods of the year.

The tidal currents in West Gregerie Channel and East Gregerie Channel set eastward on the flood and westward on the ebb at the junction of these two channels. The U.S. Navy Hydrographic Office reported that in 1958, a current of 2 or 3 knots was encountered in the vicinity of Little Krum Bay. This current was setting north-northwestward through East Gregerie Channel and southwestward through West Gregerie Channel. The wind was east-southeasterly at a velocity of 15 knots during the time of observation. It was also reported in 1961 that a 4-knot, westerly current was experienced in these channels.

During the current marine archaeological survey, bottom and surface currents at anomaly sites E8, E9, 126 and E127 exceeded 3 knots in a southwesterly direction on five occasions when there were strong southeasterly winds combined with an ebb tide. Marker buoys with ten-pound anchors in 40 feet of water would not stay in place under the force of this current, which also prevented divers (wearing 30 lbs. of lead weights) from maintaining position on the bottom for the jet probe and air lift work during periods of maximum flow.

The steep magnetic gradients within the area, caused by local geological formations and conditions, rendered all magnetometer survey measurements less than optimal and subject to a masking effect, making interpretation of data more difficult and less indicative.

Sedimentation rates in Crown Bay itself have been increasing as a consequence of adjacent shoreline and watershed development. Present seabed depths (except where modified by dredging) are shallower, and overlying silt and sand sediment layers are thicker than in decades past.

West Gregerie Channel, however, is characterized by deeper water, courser sandy sediments, and little evidence of cumulative sediment depositation, probably due to the scouring effect of the periodically fast flowing bottom currents moving southwestward towards the channel's seaward entrance west of Water Island. Visibility at the bottom rarely exceeded two meters during the project at all anomaly sites except those near the Sandy Point navigational beacon. Within the study area, living corals are present in quantity only near the Sandy Point beacon, along the northerly shoreline of Water Island, facing West and East Gregerie Channels, and, to a lesser degree, along the foot of Haypiece Hill, adjacent to anomaly 127.

2.5 Archaeological Antecedants

Prior to 1981, only one underwater archaeological project had been conducted in the immediate Crown Bay area.

Albright (1975) reports the results of a shipwreck survey. He encountered difficult magnetometer survey conditions due to the geological conditions and the type of magnetometer available at the time.

Some years later, as a segment of its environmental impact assessment strategy regarding its proposed Crown Bay Development Project, the Virgin Islands Port Authority contracted with Tetra Tech in 1981 for a preliminary survey of Crown Bay to identify possible cultural resources in the area which might be affected by the project and associated engineering and construction work.

The Tetra Tech study was to include map studies, historic research, interviews with local divers and historians, marine geophysical remote sensing (i.e., magnetometer and side scan sonar surveys), and a limited amount of verification diving. It was assumed that historic shipwrecks or other kinds of underwater cultural resources, if identified, would need to be assessed for their significance during a later site test excavation phase.

The on-site field research was carried out in February of 1981, using a Geometrics Model G-806M Marine Proton Precission Magnetometer, in company with a Soltec Model VP-6723S dual channel strip chart recorder, and operating with a 200 foot streamer tow in sequential cross channel arcs with 50 meter spacing. A back-up side scan sonar survey, using a Klein Model 401 (100kHz), was also carried out with transects running normal to the channel axis (NE-SW), covering approximately 150 meters per pass.

The Tetra Tech report, dated April 1981 by Erik J. Olsen (with Mr. J. Barto Arnold of Texas as an archaeological consultant), identified, on the basis of the systematic magnetometer and side scan sonar survey, some ten priority sites out of twenty-nine magnetic anomalies (see Figure 1C and Table 1). Bounce dives by Arnold and others to inspect these and other less promising "sites" resulted in little or no additional evidence as to the reason for the magnetic anomaly or the likelihood that the anomaly represented shipwreck sites, let alone those with historical value, potential, or significance. The magnetic anomalies could simply represent modern metalic relics (i.e., discarded junk), reflecting the U.S.Navy's heavy and extensive use of the area as a submarine base during World War II, or any number of other kinds of modern, non-historic, metal objects discarded in the Crown Bay harbor bed over time and now covered by even more recent marine and terrestrial sediments.

Obviously, it would be prohibitively costly to investigate every isolated ferrous object on the Crown Bay seabed; and, therefore, a practical compromise, leading to those sites with the highest probability of historical significance and based on the best available professional judgement and technology, was required.

But since the real evidence lay buried beneath the surficial harbor bed sands and sediments deposited in years past, a second stage investigation was needed to relocate

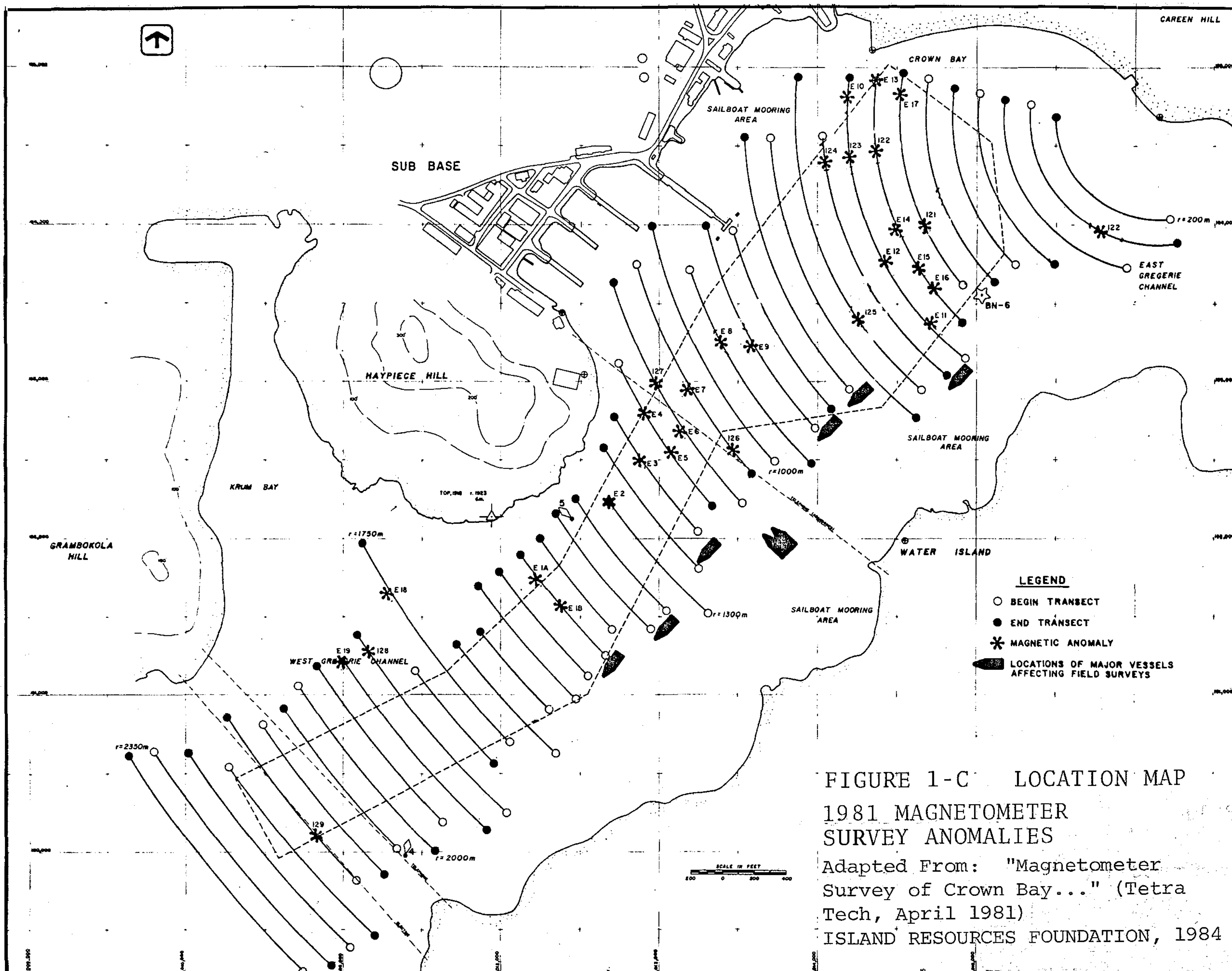


FIGURE 1-C LOCATION MAP
1981 MAGNETOMETER SURVEY ANOMALIES
Adapted From: "Magnetometer Survey of Crown Bay..." (Tetra Tech, April 1981)
ISLAND RESOURCES FOUNDATION, 1984

TABLE 1

CROWN BAY MAGNETOMETER SURVEY, U. S. VIRGIN ISLANDS

RANKING OF MAGNETIC ANOMALIES AS TO POTENTIAL SIGNIFICANCE[1]

HIGH PRIORITY

Cluster - E122, E123, E124
Cluster - E14, E121
E125
Cluster - E8, E9
E126
E127

LOW PRIORITY

E120
E17
E15
E11
E12
E10
E4

DISREGARD

E13 - modern bulkhead
E16 - probably geological
E7 - probably geological
E6 - probably geological
E5 - probably geological
E3 - probably geological
E2 - modern navigation buoy
E1 - probably geological
E18 - probably geological
Cluster - E128 and E19 - significant cluster but lies outside dredging area
E129 - probable cause identified as modern iron objects

---

1 A subjective analysis on the part of the project archeologist

Extracted From: "Magnetometer Survey of Crown Bay ..." (Tetra Tech, April 1981).

and evaluate each of the ten alleged high priority sites by means of a sub-bottom probe test excavation activity. The procedures used in carrying out this task are reveiwed in the following sections.

3.0 RESEARCH DESIGN

3.1 Relocation and Georeferencing

The scope of work to be done in the anomaly testing phase was defined by the Virgin Islands Port Authority. The anomalies listed in the high priority section of the 1981 Tetra Tech report were selected for further investigation. We are referring to the magnetic anomalies here, as the side scan sonar anomalies from 1981 were not promising in this regard.

The approach to the problem, that is a magnetometer re-survey and a follow-up anomaly investigation, utilizes a standard method. The magnetometer is an electronic instrument which measures the strength of the earth's magnetic field. Ferrous (iron) artifacts present on a historic shipwreck site, such as anchors, cannons, chains, spikes, and nails, and other forged or cast-iron hardware, cause a change of the gradients in the earth's field. The disturbance is known as an anomaly and is recorded by the magnetometer. Of course, similar anomalies are caused by modern ferrous debris. The magnetometer survey has, in recent years, proved to be a very useful tool in both underwater and land archaeology. References include Breiner 1965; Arnold 1975, 1976, 1977, 1981, and 1982; Arnold and Clausen 1975; Arnold and Weddle 1978; and Murphy 1980 and 1983.

The techniques selected for the present project included preliminary or rough relocation using shore-based surveyor's transits sited at known locations and with known baseline distances between them. Angular arcs from known baselines and intersecting lines of bearing were established in pairs for each position at which a given anomaly had been located on a survey track during the initial 1981 survey. Employing a radio-telephone link between the magnetometer tow boat and the two shore survey stations, a position buoy would be placed at the point of intersection. Then, towing the magentometer sensor a measured distance behind a survey vessel, both north-south and east-west, crossing transects would be run on the mark and buoys dropped to bracket the anomaly area. The center of the anomaly or area of highest readings which is located closest to the anomaly cause would then be defined by as many passes with the magnetometer sensor or "fish" as needed. The next step would be to send down a diver for an initial inspection to see if there were any readily visible or obvious seabed surface indications for the anomaly cause, i.e., debris. If not, the survey vessel would then be anchored slightly downwind of the anomaly marker buoy and the magnetometer sensor supported by a float then moved slowly in arcs over the anomaly by a dinghy or surface swimmer to precisely pinpoint the center of the anomaly, which would be buoyed. All five previously installed, temporary buoys would be removed at this time, and the seabed beneath the new anomaly epicenter buoy-marked with a five foot piece of one-half inch steel or aluminum rod flagged with several feet of flat, brightly colored vinyl surveyor's tape to make the marker rod more visible and easier to relocate. This was a necessary back-up site marker in case the buoy on the surface (a) drifted; (b) was stolen; or (c) was cut off by the propellors of passing boats at night.

In the case of a cluster of anomalies, preliminary position bouys were placed on each anomaly and transects run to establish the relationship and to determine whether the initial readings were two recordings of the same large anomaly or separate anomalies or dispersed clusters of numerous smaller anomalies.

3.2 Sub-Bottom Search Methods

Once all target anomaly sites are relocated, marked, visually inspected by divers and the magnetometer data analyzed, one then commences a laborious process of jet probing and a test airlift excavation at each site for which there is no visible or demonstrable cause of the anomaly, such as a major piece of ferrous debris, a nearby steel dock or bulkhead, or a dominant geological feature.

This phase of the assessment requires a rather large work barge positioned sequentially over each site with a four point moor and carrying two low pressure, high volume air compressors (150 psi @ 11 to 15 cubic feet per minute each), one surge tank, one high pressure water pump (500 gallons per minute), one fifteen foot long galvanized steel, two inch jet probe pipe, plus all necessary pressure guages, hoses, valves, manifolds, dive gear (both SCUBA and a Desco, or equivalent, full face mask) and a surface-to-diver, two-way communication system.

Each site is then submitted to a series of twenty or more high pressure water jet probing efforts using the 15 foot pipe which is repeatedly jetted into the seabed at two meter intervals along a north, south, east, and west axis from the seabed site marker to determine both point of refusal and texture and location of any subsurface artifact. The diver reports the probe depth at each probe hole via the diver-to-surface intercom, and they are plotted. Once a buried target object is located, a diving team excavates a test hole through the overlying sediments with an air lift to find out what it is -- more modern debris or possibly the remains of an old wooden vessel or shipwreck.

Any historic wreck site located in this manner would be briefly investigated by additional test air lift excavations to determine its age, condition and significance. Any further work necessary would be carried out in a subsequent phase of the investigation requiring different equipment and support systems.

Since no shipwrecks were located during the course of examining the various anomaly sites, there is no point in summarizing here the research design for a salvage archaeology effort prior to dredging that would have been used in the event of a "find" and positive determination of its historical significance.

4.0 PROJECT OPERATIONS SUMMARY

4.1 Chronology

This project was carried out by the Island Resources Foundation (IRF) under a contract with the Virgin Islands Port Authority (VIPA), dated 31 July, 1984. The Notice to Proceed was received 8 August, 1984, and, following a scheduled sixty-day logistic planning and mobilization phase to assemble and test equipment, the IRF research team moved to the staging site at the new, partially completed, cruise ship dock at the Sub-base on the 5th of October, with two tons of equipment, one leased work barge, the IRF research vessel (Odyssey), four dinghies and outboard engines, six radio communication systems, and one support vehicle. The leased magnetometer arrived from Texas on the 5th of October, and the consulting marine archaeologist the following day. Field work commenced on Sunday, October 7th and continued for 23 consecutive days. Demobilization, data analysis and report preparation required another 30 days. The Port Authority vessel, Lady Pleasant (skippered by Chip Gerard), was made available for the initial phase of the magnetometer work from 7 October to 13 October.

4.2 Staffing

The survey team consisted of the following:

Project Director: Dr. Edward L. Towle - maritime historian, marine resource planner, skipper of Odyssey, marine archaeologist, certified diver.

Consulting archaeologist: Mr. J. Barto Arnold, M.A. - State

Marine Archaeologist (Texas), certified by the Society of Professional Archaeologists in Marine Archaeology and Marine Archaeological Surveying, staff director for the Texas Antiquities Committee, certified diver (on site: 10/6 to 10/14/84).

Master Diver: Mr. William Jones - PADI Instructor, commercial diver, Coast Guard Ocean Operator Captain's License, 20 years experience as diver, dive shop operator, welder, mechanic.

Support Diver: Mr. Andrew Fredebaugh - commercial diver, certified PADI.

Project Engineer: Mr. Werner Wernicke, P.E., M.A. - surveyor, cartographer.

Project Technician: Mr. Edward Trupp - IRF Facilities Manager, diver/surface support specialist, mechanic.

The administrative and technical support team consisted of the following:

Project Secretary:	Ms. Sandra R. Tate
Fiscal Manager:	Ms. Judith A. Towle
Electronics:	Mr. Stuart Setterfield.

Total person days expended was 220. Total diver bottom time was 105 hours. Two persons were stationed on site, one at the staging area and one on the work barge 24 hours a day for the duration of the field work. All SCUBA tank filling, refueling, preventative maintenance and data logging was done in the evening during the field operations.

4.3 Mobilization and Equipment

All mechanical and electronic systems to be employed on the project were not only assembled but tested during this phase. This included three communication systems (to link diver to surface and the work barge and two vessels to base and the two surveyors moving from station to station), plus two low pressure and one high pressure air systems, the high pressure water pump jet probe system, the air lift system, navigation and georeferencing systems, and the vessel support system (two survey boats, one barge and four dinghies). A hurricane contingency plan was developed, as was an injured diver evacuation plan. Fortunately, neither was needed. A critical compressor and engine spare-parts inventory was developed, and seven separate portable dock lockers built to keep equipment both organized, orderly and secure. Critical items like the sextant, hand-bearing compass, headphones, dive-tank guage, wire cutters, and other key tools were acquired in pairs in order to have a redundant spare on site and to avoid delays in the event of a breakdown or loss of an item. Marker buoys were made up during the mobilization phase of the project.

Five site visits were conducted by project staff to plan the deployment of vessels and equipment under varying conditions of weather and for the various sequential or routine tasks -- magnetometer search, anomaly site marking, diver surveys, jet probing air lift excavation, buoy retrieval, barge relocation, refueling, etc.

All of this advance planning enabled us to carry out 23 straight days of field work without a major breakdown or delay. With five persons and a leased barge, boat and magnetometer on site, each lost day would have cost in excess of $1,000.00 and unnecessarily delayed the project--a situation which we sought to avoid as the Port Authority's contracted dredge was arriving in early November.

4.4 Anomaly Relocation and Positioning

Under the direction of the consulting archaeologist, Mr. J. Barto Arnold, the Geometrics Magnetometer was, after calibration and adjustment (7 October, 1984) to local geomagnetic conditions, deployed in a towed search mode for the entire first week of field work (7-13 October), seeking to relocate, reconfirm and buoy each target anomaly.

More or less simultaneously, the shore-based "positioning" crew, under the direction of Mr. Werner Wernicke, was re-establishing six "base" stations (not one of the base station marks used during the Tetra Tech survey survived the passage of time). Once the base reference stations were shot in and baselines established (see Table 2), angles were calculated and swung for each anomaly site, and the vessel towing the magnetometer directed by radio along a reverse line of bearing to an intersect point with the second surveyor's line of site when a marker buoy was dropped on signal via VHF or CB radio from the second shore-based transit operator. Sequential towed magnetometer transects at right angles, generally east-west and north-south, over the newly marked site were then run and the anomaly bracketed with four more marker buoys. The center of the anomaly was then established by making sufficient additional passes through the bracketed area with the magnetometer sensor to pinpoint and mark the corrected epicenter of the anomaly. A temporary bottom (seabed) marker made from steel re-bar flagged with surveyor's tape was driven into the sediment with a sledge hammer directly beneath the new epicenter buoy.

At this point in time, the bracket buoys were removed, a cursory bottom inspection sweep made by SCUBA divers, noting visible ferrous debris (large items were buoyed), and the entire team would then shift its attention and strategy to the next 1981 anomaly location and repeat the entire operation.

All ten high priority anomaly sites (plus three others requested by the Port Authority) were relocated and inspected in this manner during the first seven days of field work. Two sites, however, E14 and E12, which were determined to be geological, and site E13, which was caused by an adjacent bulkhead with sheet steel piling, were not marked the same way, as epicenters could not be established. The locational results of this first relocation phase of the work are summarized in Table 2 and Table 3 and displayed in Figures 2 and 3.

Water depths involved and prior major modifications to the study area by dredge and fill activities are

TABLE 2.
Shore Survey Station Georeference Locational Coordinates (see Figures 2 and 3 for sites).

STATION	N	E
A	185,117	1,014,350
B	184,916	1,015,958
C	183,571	1,013,415
C-1	183,571	1,012,906
C-2	183,757	1,013,415
D	183,153	1,012,418

****

TABLE 3.
Crown Bay Magnetic Anomaly Georeference Locational Coordinates (see Figure 2 and 1981 Tetra Tech Report).

ANOMALY NUMBER	N	E
E122	184,518	1,014,362
E123	184,382	1,014,209
E124	184,545	1,014,040
E14	184,018	1,014,464
E121	183,948	1,014,695
E125	183,255	1,014,282
E8	183,300	1,013,364
E9	183,185	1,013,610
E126	182,600	1,013,439
E127	182,948	1,013,000
E17	184,785	1,014,520
E10	184,760	1,014,189
E13	184,970	1,014,363

N.B. Anomaly Numbers E8, E9, 124, 125 and 127 were plotted incorrectly in the Figures used in the 1981 Tetra Tech Report to the Virgin Islands Port Authority. Figures 2 and 3 of this Report shows them at their corrected location. The coordinates in both instances are the same.

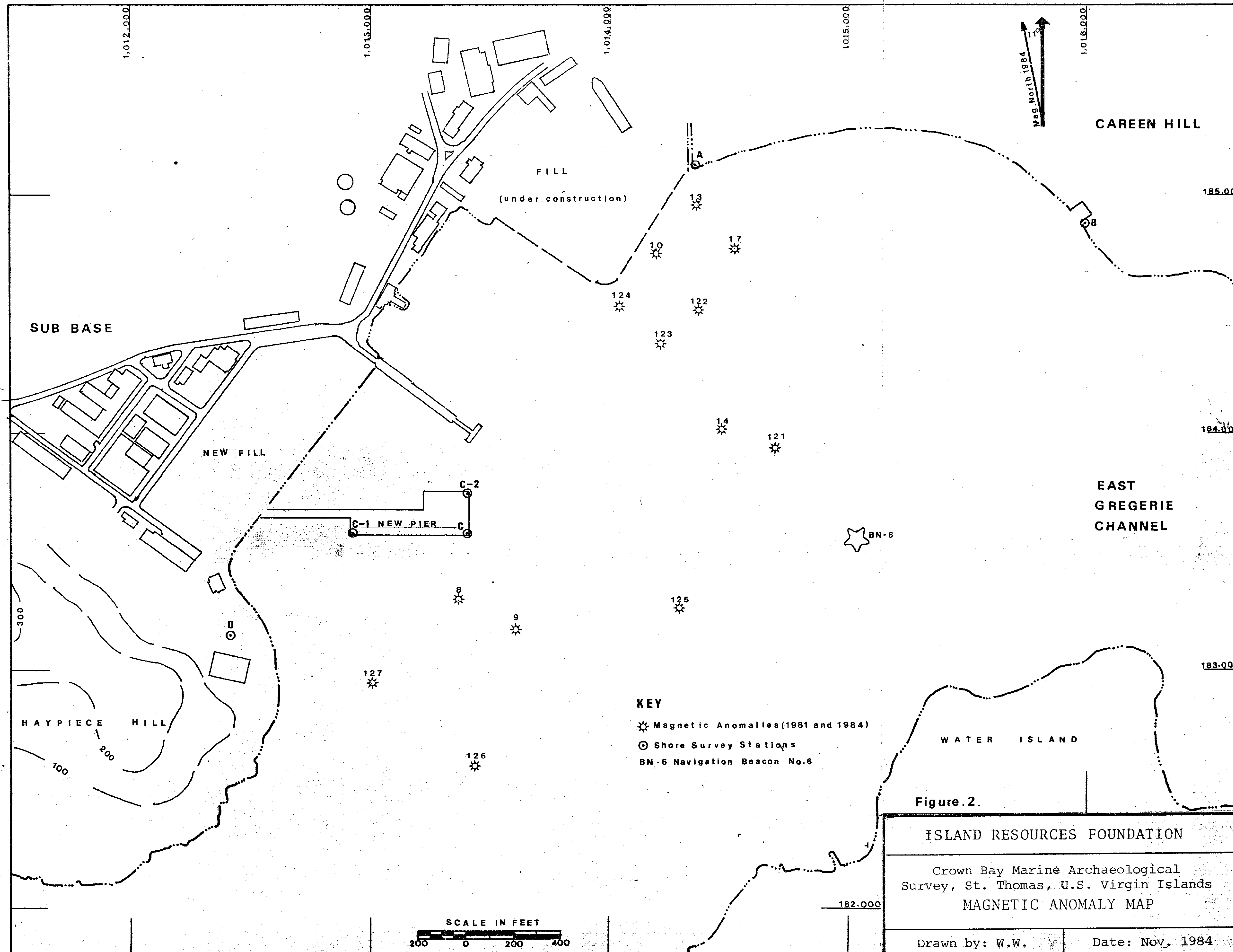

1,012,000
1,013,000
1,014,000
1,015,000
1,016,000
Mag North 1984
CAREEN HILL
FILL
(under construction)
SUB BASE
NEW FILL
C-2
C-1 NEW PIER
C
BN-6
EAST
GREGERIE
CHANNEL
185,000
184,000
183,000
182,000
HAYPIECE HILL
300
200
100
D
WATER ISLAND
KEY
Magnetic Anomalies(1981 and 1984)
Shore Survey Stations
BN-6 Navigation Beacon No.6
SCALE IN FEET
200 0 200 400
ISLAND RESOURCES FOUNDATION
Crown Bay Marine Archaeological Survey, St. Thomas, U.S. Virgin Islands
MAGNETIC ANOMALY MAP
Drawn by: W.W.
Date: Nov. 1984

Figure.2.

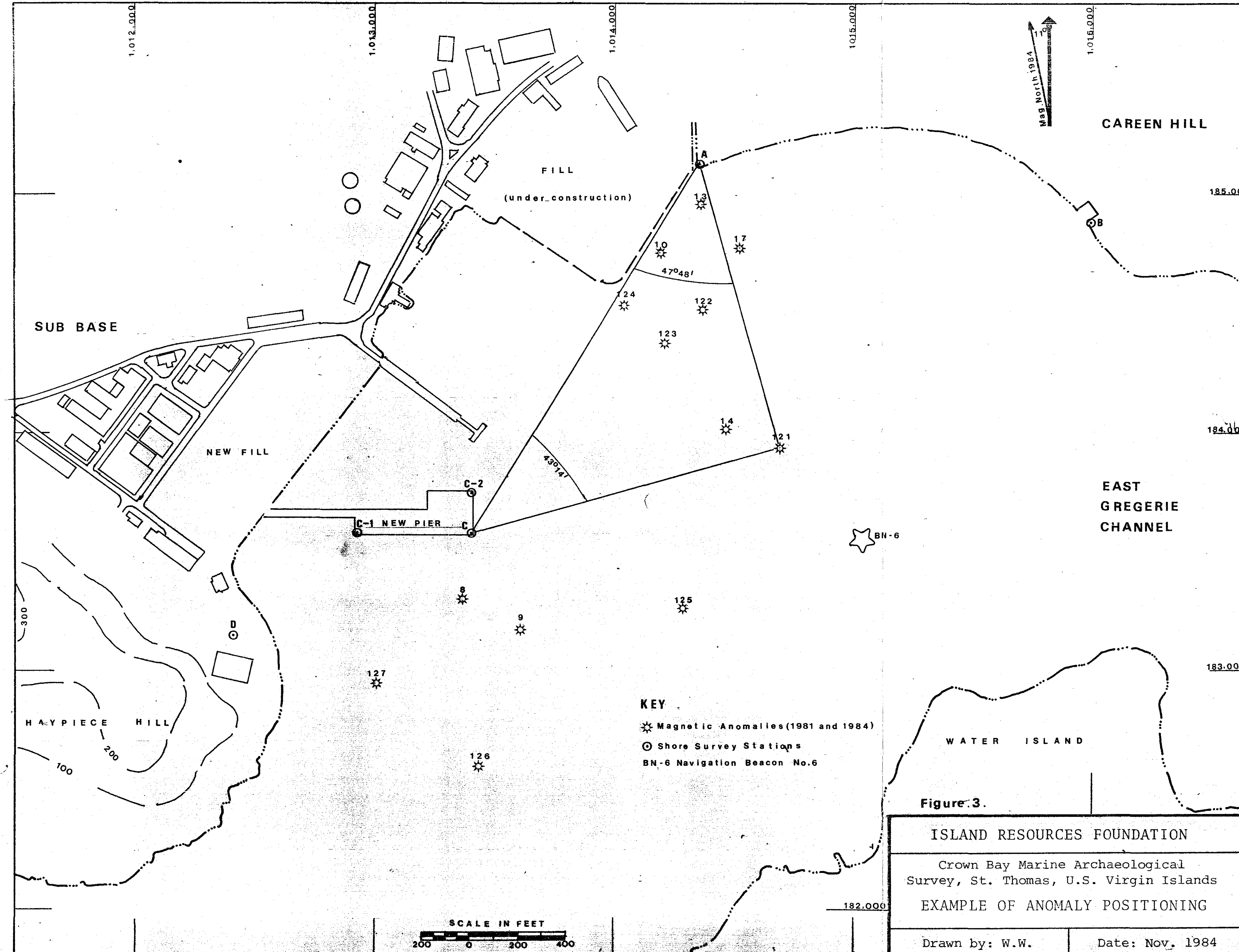

1,012,000
1,013,000
1,014,000
1,015,000
1,016,000
Mag. North 1984
11°
CAREEN HILL
185,000
184,000
183,000
182,000
FILL
(under construction)
A
B
C
C-1 NEW PIER
C-2
D
47°48'
43°14'
13
17
10
124
122
123
14
121
8
9
125
127
126
BN-6
SUB BASE
NEW FILL
EAST
GREGERIE
CHANNEL
HAYPIECE HILL
300
200
100
WATER ISLAND
KEY
Magnetic Anomalies (1981 and 1984)
Shore Survey Stations
BN-6 Navigation Beacon No.6
SCALE IN FEET
200
0
200
400
ISLAND RESOURCES FOUNDATION
Crown Bay Marine Archaeological
Survey, St. Thomas, U.S. Virgin Islands
EXAMPLE OF ANOMALY POSITIONING
Drawn by: W.W.
Date: Nov. 1984

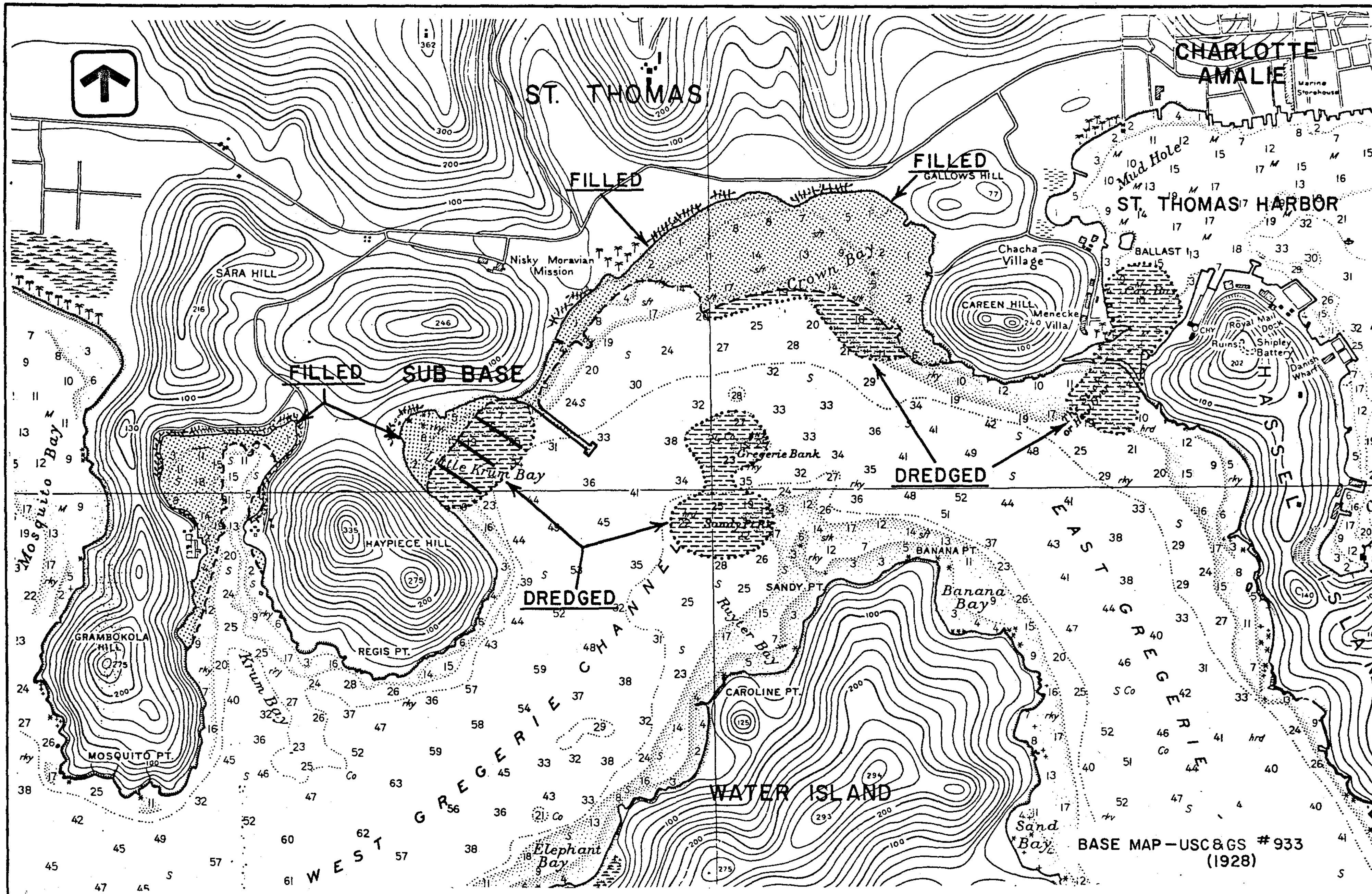
Figure 3.

portrayed in Figure 4.

4.5 Anomaly Site Assessment

For this phase of the project, the magnetometer was shifted from the highly maneuverable towing vessel (Lady Pleasant) to a more stable, self-propelled work barge, approximately 12 feet by 30 feet, with an enclosed deck house and flat working-deck area capable of serving as a tethered diver support platform while also carrying a rather heavy load of air compressors, water pumps, hoses, dive tanks, air lifts, marker buoys, mooring anchors and anchor rodes, chain, radios, fuel containers, and the magnetometer plus 200 feet of armored cable attached to the sensing head. The work barge was positioned directly over a given anomaly site and secured in place by four, 45 pound anchors, each with a 16 foot heavy chain (3/8 inch) leader and 200 feet of anchor rode in order to keep the steel anchors and chain as far from the barge and study area (a 24 meter diameter circle) as possible so as to not influence the magnetometer sensor. Each anchor was provided with buoyed retrieval line to facilitate barge repositioning to the next anomaly site.

Once the work barge was in position on a site, the next step involved deployment of the magnetometer sensing head suspended 10 to 15 feet above the bottom on a line to a large surface float and with a tether line (15 feet), which enabled a diver using an aluminum SCUBA tank to tow the sensing head in sequential sweeps or arcs over the bottom at varying distances from the barge. The radius of the



Adapted From: "Magnetometer Survey of Crown Bay..." (Tetra Tech, April 1981).

FIGURE 4 HISTORICAL DREDGE AND FILL ACTIVITIES WITHIN STUDY AREA arc was determined by adjusting the length of the sensing head cable. This process enabled the team to select the best spot to use as the focal point for the jet probing and test air lift excavation to follow. Two difficulties with the tactic should be noted.

First, it had to be done in four separate stages (i.e., for each 90 degrees of arc) because with a four-point barge mooring system, the magnetometer cable would foul on the anchor lines if a full circle sweep was attempted. Second, with the sensing head closer to the seabed, it was more sensitive to smaller ferrous bottom surface debris, and in sites with an irregular bottom contour, there was a risk of damaging the head if it were to touch bottom. During this operation, the towing diver could not see the head as his 15 foot tether line put him beyond the range of visibility because of turbidity levels in the area. This 15 foot distance was necessary, however, because of the steel in the diver's air tank valve and regulator. (This could be overcome by building a tank valve and regulator system entirely out of bronze and non-magnetic stainless steel similar to the old U.S. Navy two hose regulators.)

The next stage followed the high pressure water jet probe procedure described in Section 3.2 of this report. A diver, wearing 30 pounds of lead weights and a Desco Full Face Mask with free flow air supply from the low pressure (150 psi) air compressor (11 CFM) on the barge, drilled (jetted) a sequence of holes in the seabed with a heavy-walled, one-and-one-half inch, 15 foot piece of galvanized steel pipe that was linked by hose to a high pressure, high volume, 7 horsepower, 3" Peabody and Barnes water pump (500 gallons/minute) stationed on the work barge. Starting at the "center point" and using a wrist compass for direction, the diver would jet the pipe into the seabed six times with two meter spacing between holes, following a line of bearing first to the east and then repeating the process to the north, south and west of the center point. The jet probe was driven to point of refusal and the probe depth and hole bottom texture reported to the surface via the intercom for each probe hole. When necessary, after an immediate surface team analysis of the "pattern," the diver would be instructed from the surface to drive additional probe holes. The average number of probe points per site was 25 and the average depth approximately eight feet (minimum was two feet and maximum was 16 feet).

The third stage of anomaly site assessment involved (a) selecting a test location, and (b) deploying a standard three inch air lift with a 15 CFM air supply, and (c) deploying a SCUBA equipped diver and observer, and (d) excavating a test pit seeking any indication of a shipwreck, isolated artifacts or the nature of the sub-bottom "point of refusal" (i.e., bedrock, coral encrusted rock, coral or consolidated calcareous sediments).

Upon completion of these three activities, all surviving buoys were retrieved, bottom markers removed, and the work barge repositioned on the next site.

During this site assessment activity, we had a work barge mooring line severed twice by passing vessels, lost 36 buoys to either currents, theft, or vessel traffic, and had numerous verbal complaints from passing vessels about "blocking" the channel, despite the fact we were displaying the day marker for electronic survey work. Also, on numerous occasions passing small craft ignored our large, prominently displayed, "diver in the water" flag.

5.0 RESULTS AND CONCLUSIONS

5.1 Summary

Magnetometer readings, sub-bottom jet probe data, diver observations and test air lift excavation findings for each anomaly site are summarized in Table 4 and reported on in detail in the following segment of this report.

In sum, there was no indication of any historical or modern shipwreck remains, whether intact or dispersed, at any of the 13 sites investigated by the anomaly site assessment strategies employed.

These findings do not, however, imply, nor should the reader infer, that there are no culturally and historically significant shipwrecks in the larger Crown Bay area. Some may lie outside the study area as defined by the previously established list of priority anomalies identified by the Tetra Tech sweep survey strategy. A truly old wreck -- say from the eighteenth century -- might well by now be irrevocably entombed in the hard consolidated coral substrate beneath the sediment layer and, therefore, essentially be unsalvageable. We found no evidence of such a possibility, however.

The most logical explanation for the absence of shipwreck sites lies in the nature of Crown Bay and its relative shallowness, its short reaches, its semi-closed, elongated and therefore protected configuration, and its proximity to populated areas. Virtually any ship wrecked by storm action but not totally destroyed by the grounding process

TABLE 4. Magnetic Anomaly Survey Data Summary

Anomaly Number	Anomaly Strength 1981 Survey	Maximum Strength on Initial Relocation 1984	Maximum Strength on Pinpointing Center prior to Probing and Test Excavation	Average Water Depth (feet)	COMMENTS
Cluster - E122 E123 E124	-520γ -128γ -69γ	-60γ -65γ -80γ	-90γ -75γ -80γ	28 25 21	E122, E123 and E124 were caused by buried abandoned broken cables, see Figure 5.
Cluster - E14 E121	-30γ, $+20\gamma$ -17γ			32 30	Disturbed area of over 100 geological gradients. Probably not caused by man-made objects. See Figure 5.
E125	$+100\gamma$, -90γ	$+75\gamma$	$+80\gamma$	29	Steel pipe, modern vessel wreckage, plus apparent buried rock ledge with sharp geological gradient.
Cluster - E8 E9	$+40\gamma$ $+160\gamma$	$+14\gamma$, -11γ $+100\gamma$	-15γ, $+10\gamma$ $+120\gamma$	42	Possible distant readings on pipe and H-beam just to north. E9 was caused by a tangle of discarded steel reinforcing rod partially buried in the seabed.
E126	$+90\gamma$	-45γ	-60γ	38	Modern ferrous debris including a large pipe and a large triangular piece of steel plate were found.
E127	-210	-165γ	--	40	Two crossing submarine cables were found.
E17	-26	-35γ, -50γ	-50γ	12	Closely spaced associated anomalies - mooring debris.
E10	+50	$+12\gamma$	-30γ	12	Modern ferrous debris--big coil of wire rope and heavy steel wire box.
E13	-520γ	$+500\gamma$	--	--	Part of very large anomaly from modern bulkhead.

was accessible for either scavenging or salvage. In centuries past, ships driven ashore and considered unsalvagable were, after stripping, customarily burned in order to salvage the iron or bronze fittings and fastenings, which could be recycled. Vessels that sank or foundered at anchor or when moored "in the stream" in areas like Crown Bay and East or West Gregerie Channels were sometimes raised, if only for their salvage value. If they could not be raised, grappling hooks and/or black powder (and later dynamite) were often used to break or blow them apart to make salvaging cannon, stores and cargo easier or to eliminate them as hazards to other vessels transiting or using the area as an anchorage.

This Project has established that for the 13 magnetic anomaly target sites and their individual environs to a radius of 12 meters (approximately 80 feet), no identifiable evidence of an historic shipwreck exists on or in the unconsolidated seabed sediments, nor is there any assemblage of singular isolated historical artifacts suggesting the possible presence of such a shipwreck in the immediate area.

It is concluded, therefore, that based on these findings the dredging activity at Crown Bay, as proposed by the Virgin Islands Port Authority, offers no threat or risk to any marine archaeological site that might have cultural or historical significance.

Crown Bay has a history of maritime usage, but it is most unlikely that we will ever be able to learn much about those sailors and ships of yesteryear from historical evidence derived from a well preserved shipwreck site in the Bay. What we do know now, however, as a result of this project is that no potentially valuable historic wreck site is likely to be destroyed in the process of dredging the area.

5.2 Detailed Anomaly Survey Data

Cluster E122, E123, and E124

These anomalies were recorded in the 1981 survey as -520γ, -128γ, and -69γ, respectively, in strength and looked like the best possibility for a historic wreck site. Upon relocation and inspection, all three anomalies appear to have been caused by convoluted lengths of heavy steel-armored underwater (telegraph?) cable mostly buried in the bottom sediments. Maguire (1925) reports this area of Crown Bay as a telegraph cable landing site. The difference in the initial survey strength of the anomaly at -520γ, and the -60γ strength recorded in the relocation survey is accounted for by the fact that it is generally difficult if not impossible to completely replicate the position and direction of the original vessel and sensor. The magnetometer signatures achieved during the relocation process were quite sufficient to define the anomaly area and guide the divers to the correct locale for the jet probing and test air lift excavation at each site. Probe depths at all three sites averaged just under four feet to hard consolidated coral. Twenty-five probe holes were jetted at each site on a north/south and east/west axis with two meter spacing between probe locations. These and test air lift excavations produced no evidence of any buried shipwreck, and no artifacts were recovered.

Cluster E14 and E121

E14 was originally recorded as a dipolar anomaly of -30γ, and $+20\gamma$, and E121 was -17γ. After numerous transects, it was determined that these anomalies were distant readings on a disturbed area of geological anomalies (E12, E13, and E16). This is the area (Gregerie Bank) from which a pinnacle of rock had been removed by blasting and dredging as a hazard to navigation in the 1940's. (See Figure 5.) Jet probing attempts were unsuccessful at both sites as the sediment overburden was less than three feet in depth at the locations tested. Moderate levels of miscellaneous ferrous surface debris were also observed, but no large objects were noted.

E125

This was a dipolar anomaly of $+100\gamma$ and -908γ which proved both elusive and difficult to relocate due to the presence of numerous moored or anchored sailboats in the area and the hidden presence of an apparently massive sediment covered rock ledge or ridge of hard coral, which bisected the site and which may account for part of the anomaly signature. To the west and south of the anomaly center, our jet probe regularly penetrated the sandy overburden from 10 to 15 feet, but to the north and east the point of refusal rarely exceeded two feet of penetration before hard bottom was reached. Modern vessel debris and a semi-buried length of steel pipe were observed on the seabed and may also account for or contribute to the anomaly signature recorded.

Twenty-five jet probe holes were driven on a standard x-y axis with two meter spacing, and one test air lift excavation was undertaken with no positive indications of the presence of a shipwreck buried in the deeper sediments.

Cluster E8 and E9

In the original survey, E8 was a -40γ anomaly and E9 a +160γ anomaly. At the positions indicated, we found associated broad, weak -13γ, +14γ, and -11γ anomalies. Found nearby to the north of E8 was a very large piece of heavy-walled steel pipe about 12 inches in diameter and 20 feet in length which produced a large -200γ anomaly on one run and a large dipolar -100γ and +145γ anomaly on another. Near E9 and again to the north was found a large steel H-beam about 2 feet x 1-1/2 feet x 20 feet in length which produced a +380γ anomaly. E8 and E9 could be distant readings on the large steel pipe and H-beam (see Figure 5), or the causes of those anomalies might have been shifted or removed since 1981. E8 is located near the new dock, and it is noted that there has been dredging in front of the dock to get fill during the dock's construction.

At E8, twenty-one jet probe holes were driven in the bottom (2 meter spacing on an x-y axis) with an average penetration of only 4 feet to the point of refusal (consolidated coral confirmed by an air lift test excavation). Obviously, the remaining (post dredging) sediment layer appears to be too thin to hide a buried shipwreck at this location.

Probing at E9, which is only 200 feet to the southeast of E8, resulted, after 21 holes and our test air lift excavation, in the finding of a tangled mass of discarded, bent 1/2" reinforcing rod and assorted wire rope which produced the anomaly. Penetration of the probe at this site averaged ten feet in the well sorted, course, sandy sediments. The southwesterly flowing currents at E9 generally exceeded three knots. No evidence of a shipwreck was found at either anomaly sites E8 or E9.

E126

This anomaly measured $+90\gamma$ on the original survey and -45γ was recorded on resurvey. In the area there was scattered ferrous debris, including a triangle of heavy steel plate, 3 feet on a side, and two large joined steel pipes of 8" in diameter and 2 feet and 5 feet in length.

Jet probing 21 holes to an average sediment penetration depth of 9 feet produced no evidence of a buried shipwreck or other explanation for the anomaly at the site (save for the ferrous debris on the seabed surface). E126 may also be caused in part by the known presence of a burried, long abandoned, old armored submarine telephone cable to

Water Island which we were not able to find due to the small size of the cable and the proximity of four large steel water barges moored adjacent to the site which seriously affected the magnetometer sensor, masking smaller anomalies in the area.

E127

E127 was originally recorded as a -200γ anomaly. On resurvey, a very confused magnetic situation of multiple anomalies in a broad area was recorded including a maximum -165γ reading. The cause of this anomaly was found to be two (crossing), heavy 2" diameter steel armored power or telephone cables. Power cables are not generally laid straight, but instead snake across the bottom so there is sufficient slack to pick them up to the surface for repair if needed. Secondly, these abandoned cables have been cut and the ends dragged about by being snagged by boat anchors or dredges or whatever, resulting in a very complex and convoluted anomaly.

Therefore, anomaly site E127 (and associated anomalies E7, E4) and other new ones to the west of E127 are not a shipwreck, but are quite definitely abandoned underwater power or telephone cable. In the area of E127, fourteen (14) jet probe test holes were run and bedrock or hard coral was encountered less than two to six feet from the harbor bed surface. Seventy-five feet west-southwest of E127, there is a crossing of two cables on the seabed. One end of one of these extends nearly 200 feet in a northerly direction (355° Magnetic) and another more than 300 feet in a southwesterly direction (approximately 230° Magnetic). Other cable pieces are present in the area (where the sediment base is too shallow to contain a major wreck) and clearly account for the numerous small magnetic anomalies in the general area.

E17

Recorded as a -26γ anomaly on the original survey, this proved to be a small area of associated anomalies -- -35γ, and -50γ being the largest readings.

Diver investigation, 20 probe holes and one test excavation produced no evidence of a shipwreck and simultaneously documented extensive scattered modern ferrous debris in the slick clay and mud bottom sediments which are found in this area. The major anomaly was caused by a cluster of old chain and engine parts -- perhaps an abandoned mooring buried in the mud.

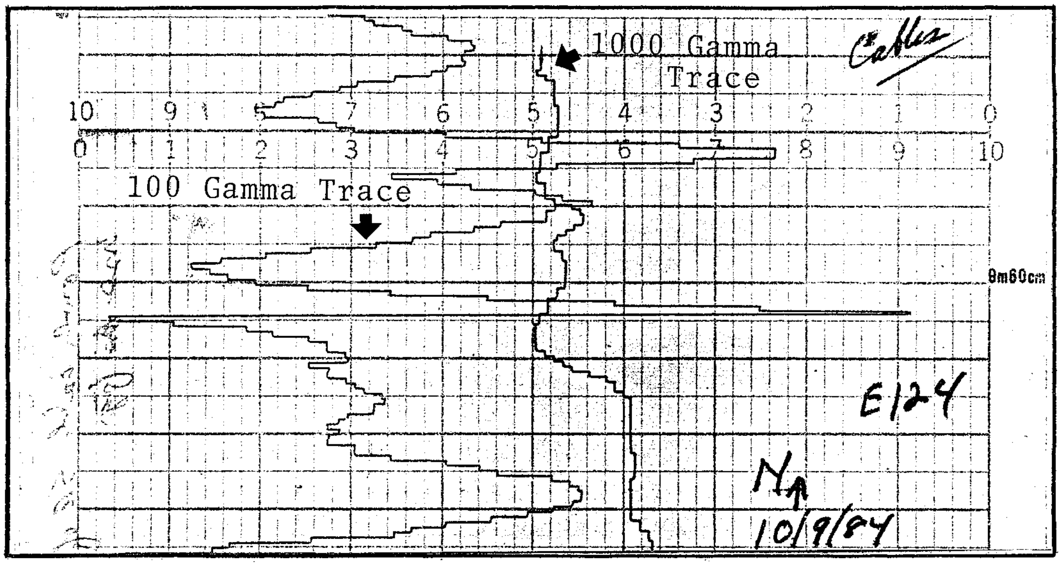
E10

This was originally recorded as +50γ in strength and on resurvey +12γ. Two items of modern ferrous debris were found on the surface, a twisted coil of 1" diameter wire rope, and a 2-1/2 ft. x 3 ft. x 4 ft. strong-box-like structure made of heavy steel wire mesh (definitely not a fish pot).

E13

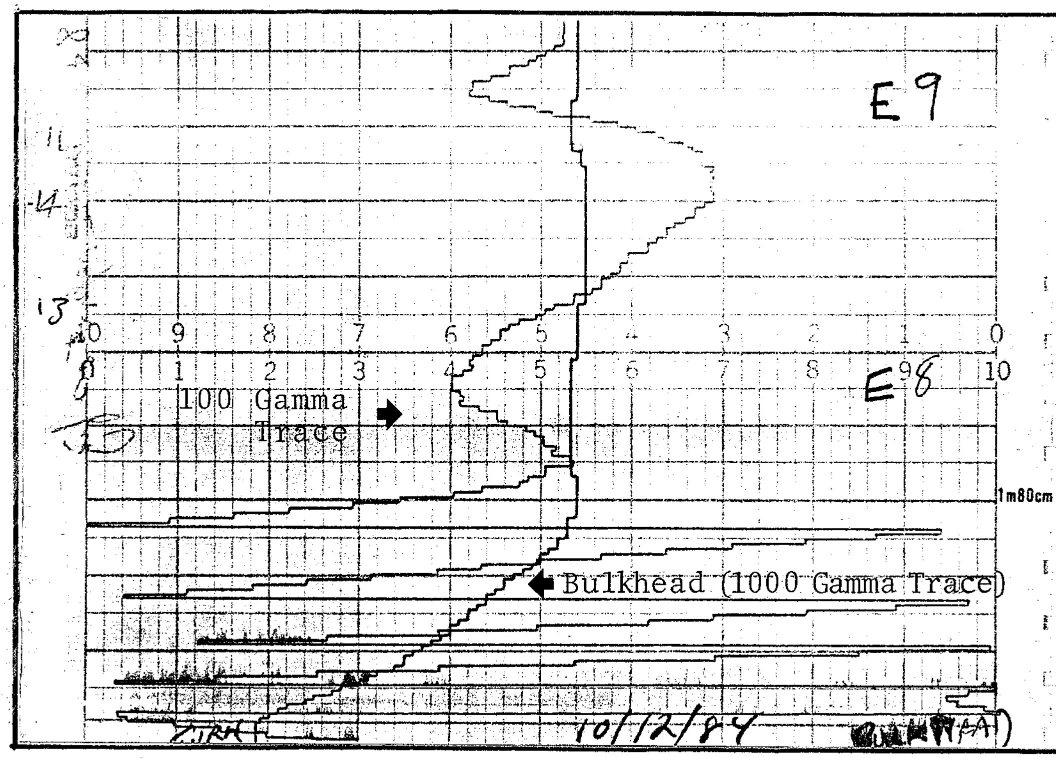
E13 was recorded as a -520γ reading on the nearby modern steel and concrete bulkhead. Reinvestigation conclusively confirmed this finding.

FIGURE 5C



E124 Armored steel cables southwest of E124.

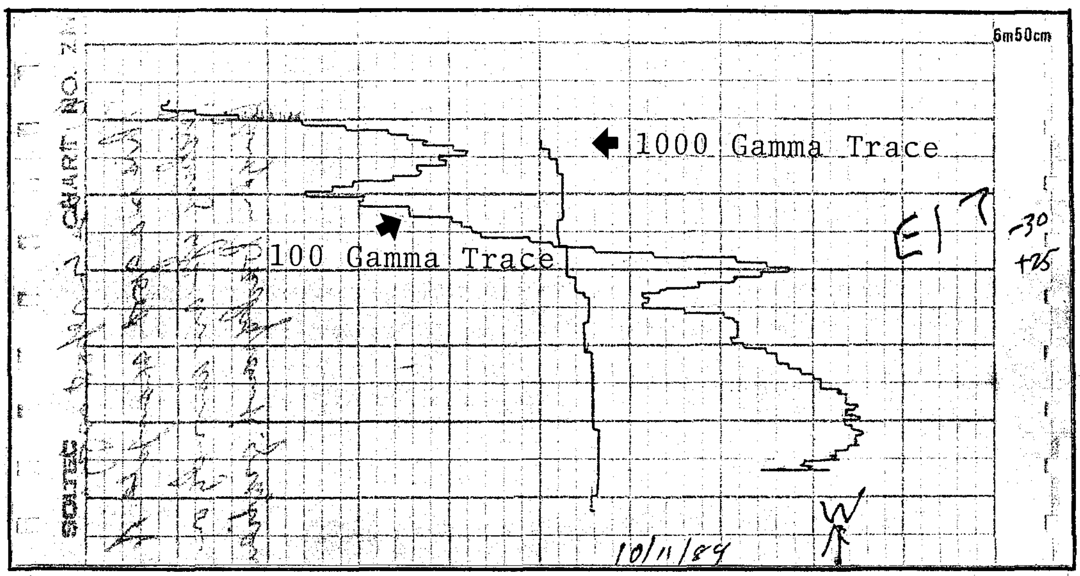
FIGURE 5D



E8 and E9 Signatures showing the massive signature of heavy steel sheet piling bulkhead in the new Port Authority dock (southeast corner), now covered with steel reinforced concrete cap.

*****

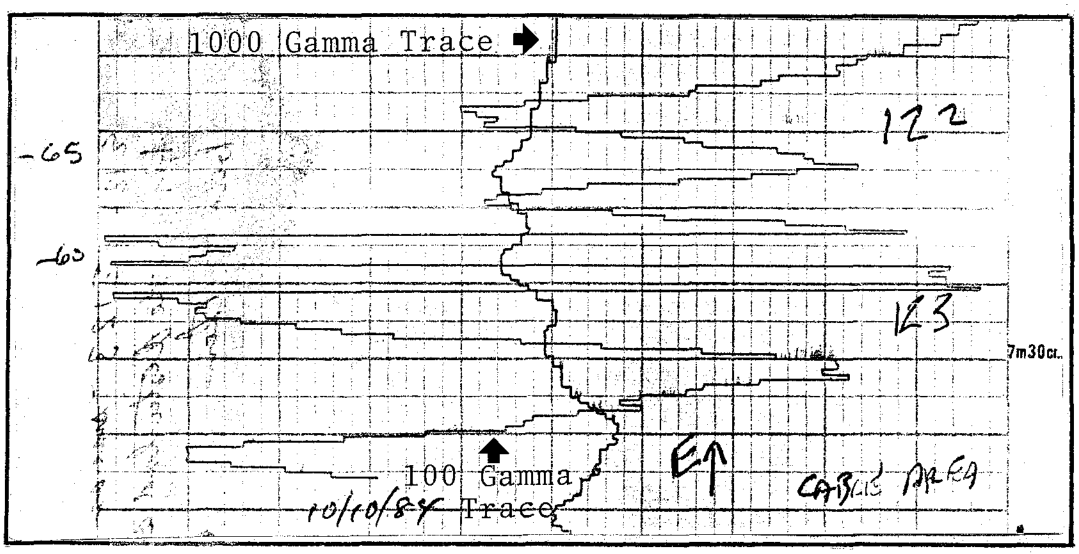
FIGURE 5A



E17 Illustrates an anomaly (-30γ, +25γ) against a larger background signature.

*****

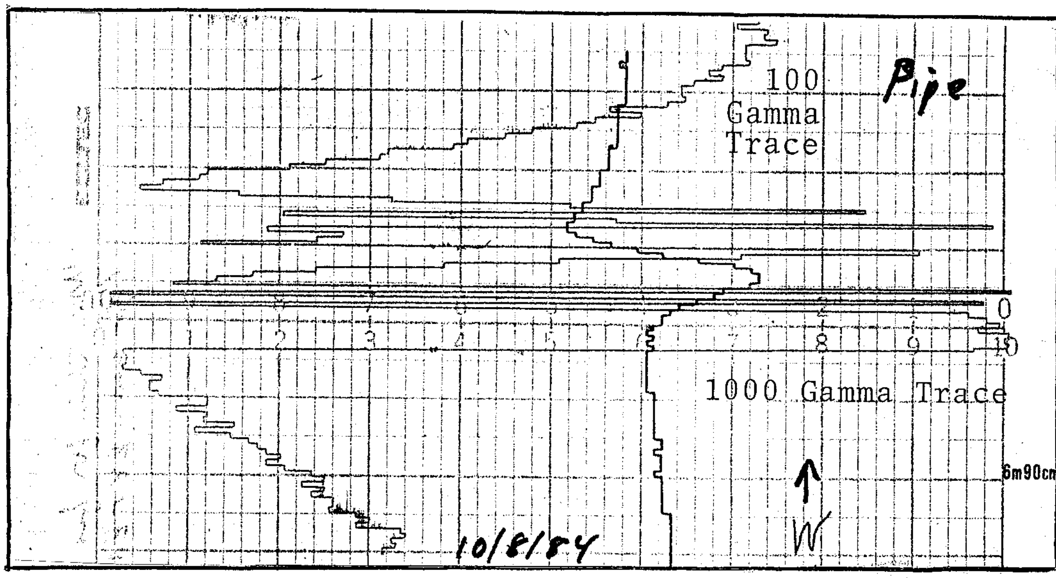
FIGURE 5B



E122 and 123 Note disturbed area between these anomaly signatures - resulting from an extended area of abandoned, tangled broken, submarine cable largely buried in the soft sediment.

*****

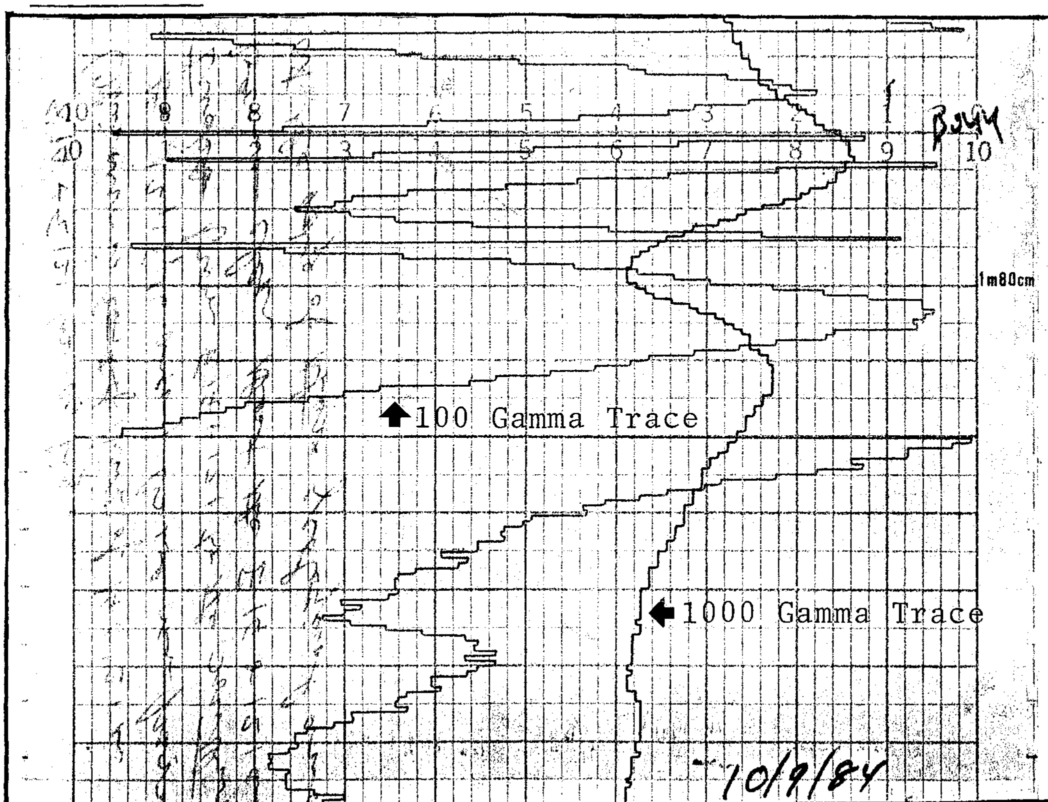
FIGURE 5E



E8 and E9 Area — Anomaly signature of a large steel pipe on the seabed near E8 and E9.

*****

FIGURE 5F



E14 and E21 — Shows the area slightly south of E14 and 121 illustrating the edge of significant geological anomalies.

*****

6.0 REFERENCES

Albright, Alan B. Proton Magnetometer Survey of Marine Archaeological Sites in the Virgin Islands. Caribbean Research Institute, College of the Virgin Islands, St. Thomas, U.S. Virgin Islands. 1975

Arnold, J. Barto III. A marine archaeological application of automated data acquisition and processing. Newsletter of Computer Archaeology, 11(1):5-11. 1975

______________. An underwater archaeological magnetometer survey and site test excavation project off Padre Island, Texas. Texas Antiquities Committee Publication 3. Austin, Texas. 1976

______________. 1977 underwater site test excavations off Padre Island, Texas. Texas Antiquities Committee Publication 5. Austin, Texas. 1976.

______________. A marine archaeological magnetometer survey in the Galveston, Texas area. In Underwater archaeology; the challenge before us: the proceedings of the Twelfth Conference on Underwater Archaeology, Gordon P. Watts, Jr., ed. pp. 209-217. Fathom Eight, San Marino, California. 1981.

______________. A Matagorda Bay Magnetometer Survey and Site Test Excavation Project. Texas Antiquities Committee Publication 9. Austin, Texas. 1982.

______________ and Carl J. Clausen. A magnetometer survey with electronic positioning control and calculator-plotter system. International Journal of Nautical Archaeology, Vol.4:26-40. 1975.

______________ and Robert S. Weddle. The nautical archeology of Padre Island: the Spanish shipwrecks of 1554. Academic Press, New York. 1978

Breiner, Sheldon. Applications manual for portable magnetometers. Geometrics. Palo Alto, California. 1973.

McGuire, J.W. Geographic Dictionary of the Virgin Islands of the United States. U.S. Department of Commerce, U.S. Coast and Geodetic Survey, Special Publication No. 103. 1925.

References (Continued)

Murphy, Larry. Survey Methodology: specific site survey, Biscayne National Monument, 1980. U.S. Department of the Interior, National Park Service, Southwest Cultural Resources Center, Submerged Cultural Resources Unit, Santa Fe, New Mexico. 1980.

______________, Ed. Submerged Cultural Resources Inventory, Shipwreck Survey, Point Reyes National Seashore and Point Reyes-Farallon Islands National Marine Sanctuary. Phase I--Reconnaissance, Sections I and II, 1982. U.S. Department of the Interior, Submerged Cultural Resources Unit, Santa Fe, New Mexico. 1983.

Olsen, Erik J. Magnetometer Survey of Crown Bay, St. Thomas, U.S. Virgin Islands. Prepared for the Virgin Islands Port Authority (TC-3462). Tetra-Tech, Inc., Jacksonville, Florida. 1981.

Towle, E.L., Marx, R., and Albright, A. Shipwrecks of the Virgin Islands: An Inventory (1523-1825). Second edition. Island Resources Foundation, St. Thomas, U.S.V.I. 1976.

U.S. Naval Oceanographic Office. Sailing Directions for the West Indies (Chapter II Virgin islands, H.O. 22). Washington, D.C. 1968.

Virgin Islands Port Authority. Environmental Assessment Report, Crown Bay Port Expansion and Gregerie Channel Improvement. St. Thomas, U.S.V.I. 1983

APPENDIX I

CROWN BAY ANOMOLY TESTING

Magnetometer Survey Parameters

Geometrics 806A Proton Precision Mag.
250' tow system. Mag. Serial No. 9066
Soltec Dual channel strip chart recorder (VP-6723S)

Cycle time 1/sec.; Sensitivity 1γ

Tuning - Coarse 37-45; Fine 3

Scale (strip chart) 0-99γ (red pen); 0-999γ (black pen)

Chart speed 4cm/min

Vessel speed 4½ - 5 knots (one engine dead slow)

Estimated 8-9' depth for sensor

Distance behind vessel of sensor - 76½ ft.

Background field strength 40400-40500γ

Typical noise level $\pm$ 1-2γ

Survey vessel: LADY PLEASANT, 31' fiberglass, twin diesel

JBA/srt
10/11/84

CROWN BAY MARINE ARCHAEOLOGICAL SURVEY
NEW ANOMALIES - OCTOBER 1984

Anomaly (New)	Anomaly Strength 1981 Survey	Maximum Strength on Initial Location 1984	COMMENTS
Pipe near E8	--	-200γ; -100γ,+145γ	Large pipe -- about 20 feet long and 12 inches in diameter.
H-beam near E9		+380γ	Large H-beam -- about 2 feet x 1-1/2 feet x 25 feet.
Armored cable SW of E124		+70γ	Cable -- broken, looped and coiled