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Architectural and Engineering Services for Engineering Site and Assessment, Conceptual Design and Related Services

Feasibility Study of Island Development at the Pacific Entrance of the Panama Canal

Final Report, Technical Appendices

Volume 3 of 4

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MOFFATT & NICHOL ENGINEERS

Golder Associates

LOUIS BERGER GROUP

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Architectural and Engineering Services for Engineering Site and Assessment, Conceptual Design and Related Services

Assessment of Materials for Construction of an Artificial Island at the Pacific Entrance to the Panama Canal

Prepared by:

for

December, 2002

REPORT ON

ASSESSMENT OF MATERIALS

FOR

CONSTRUCTION OF AN ARTIFICAL ISLAND

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1 INTRODUCTION

1.1 Background

The Panama Canal Authority (ACP) is evaluating the feasibility of building additional locks to accommodate larger ships and to generally increase the capacity of the canal (commonly referred to as the Third Locks Project). The Third Locks Project will require extensive excavations (refer to Figure 1), and constructive uses or disposal sites will have to be found for the material taken from the excavations. One of the constructive uses being considered is the creation of an artificial island near the Pacific entrance to the canal. The island would be used primarily for port facilities.

We understand that dredging, conventional dry earth moving methods (involving backhoes, loaders, dozers, scrapers and trucks), and drill-and-blast excavation methods will be used. The selection of the excavation methods will be the responsibility of the contractor, but ACP may place reasonable constraints on the contractor that are beneficial for the construction of the artificial island.

Moffatt & Nichol Engineers evaluated several options as methods of transport of excavated materials to the artificial island site, including truck haul, a dedicated rail line, and a conveyor system. As reported in December 2001, a rail-based system was chosen as the most economical transport system to move rock and other materials from the excavation sites to the island.

1.2 Scope

Golder Associates Inc. (Golder) was retained by Moffatt & Nichol Engineers (MN) to support its work on the Feasibility Study for Construction of an Artificial Island at the Pacific Entrance of the Panama Canal. Golder's role in this evaluation is to provide geotechnical services involving:

- Characterization of material to be excavated through analysis of available geologic and geotechnical data and observations made at the site;
- Evaluation of suitability of excavated material in artificial island construction as armor stone, underlayer stone, underwater rock fill, compacted rock fill, compacted soil fill, and hydraulic fill;
- Review and refinement of geologic plan (Figure 1) and profiles (Figures 2-5) constructed by the Panama Canal Authority (ACP) for estimation of available quantities of each material type by MN;
- Recommendation of bulking/shrinkage factors for each geologic unit; and
- Comments on the size, shape and specific gravity of the excavated rock.

This report provides the geotechnical evaluation of the materials to be excavated and associated recommendations on material suitability in artificial island construction. In addition, a recommended method for estimating excavation volumes of the various material types is given.

1.3 Source Information

Data and information available to and acquired by Golder for this study include the following:

- Panama Canal Authority Preliminary Study of Island Development at the Pacific Entrance of the Panama Canal: Final Report, December 2001 (Moffatt & Nichol Engineers);
- Selected Panama Canal Company boring logs completed from 1939-1945 (Third Locks Studies);
- Panama Canal Authority boring logs completed during 2001 (Third Locks Investigation);
- Test results for soil and rock from borings advanced in 2001 (Third Set of Locks Project, Summary of Test results on Rock formations, August 2001);
- 2002 Panama Canal Authority geologic map/ boring location plan (Third Locks Investigation) (Figure 1);
- 2002 Panama Canal Authority geologic profiles (Third Locks Investigation) (Figures 2-5); and
- Transactions of the International Engineering Congress, 1915: Volume 1-The Panama Canal, Paper No. 3: Outline of Canal Zone Geology.

A summary list of boring logs utilized by Golder in this study is found in Appendix A.

1.4 Methodology

The following steps were taken to evaluate the geotechnical characteristics of the material from the proposed third locks excavation:

1. Available data was compiled and analyzed.
2. Construction needs were recognized.
3. Material properties and behavior were generalized.
4. ACP geologic map and profiles were reviewed.
5. Suitability of each material type for construction purposes was evaluated.

2 CONSTRUCTION NEEDS

It is our understanding that the material excavated for the construction of the third set of locks will be used, where technically feasible, as armor stone, underlayer stone, underwater rock fill, compacted rock fill, compacted soil fill, and hydraulic fill in the construction of the proposed railway, causeway, artificial island, and associated breakwater. The construction needs and specifications as understood by Golder are presented below.

2.1 Armor Stone

Armor stone will be necessary in artificial island, causeway, and breakwater construction as a means of wave protection for the structures. The role of armor stone requires durable material capable of withstanding wave action in the area. The armor stone should be sound and free from detrimental cracks, seams, and other defects which tend to increase deterioration or which cause breakage during handling. Preliminary size requirements indicated in the MN Preliminary Study are 5 tonne (1.2-m diameter) stone for the causeway and island, and a combination of 3 tonne (1.0-m diameter), 10 tonne (1.5-m diameter), and 15 tonne (1.7-m diameter) stone for use in breakwater construction.

In the case that sufficient armor stone is not available in the excavation area, Golder understands from communication with ACP and MN that there are local quarries that produce basaltic and andesitic rock of appropriate size and durability.

2.2 Underlayer Stone

Another potential use for excavated material is as underlayer stone in causeway construction. Underlayer stone should be of the same quality and durability as required for armor stone; however, according to the MN Preliminary Study, it should be approximately ½ tonne (0.55-m diameter) in size. The role of causeway underlayer stone will be as armor stone on the east side of the causeway, and it will underlay the larger, 5 tonne armor stone on the west side.

2.3 Underwater Rock Fill

Rock fill will be required for artificial island, causeway, and breakwater construction. We anticipate that the material will be dumped from barges or end dumped into water from the advancing fill to create these structures. The rock for this construction must be durable in an underwater environment.

Industry experience with rock fill in dam construction (placed under dry conditions) has shown that point-to-point contact of hard rock particles will be achieved by compacting durable material that has a maximum of 50 percent smaller than 25 mm. With point-to-point contact of hard rock particles, fines migrating through the rock fill should cause minimal

settlement. The rock fill is typically placed in layers one meter thick and compacted with large vibratory rollers. The maximum particle size is typically limited to two-thirds of the layer thickness, or about 0.65 m.

For underwater rock fill placed without compaction, we recommend limiting the percentage smaller than 25 mm to 40 percent to provide greater assurance of point-to-point contact of hard rock particles. There is no technical requirement for the maximum particle size, but this will be limited by the size of the loading, hauling and dumping equipment.

Golder has recent experience at a port facility in western Canada with the performance of underwater rock fill ("Foundations for a Concrete Caisson Wharf for Ocean-Going Ships on the West Coast of Canada" by N.R. McCammon & T. P. Fitzell, published in the *Proceedings of the 44th Canadian Geotechnical Conference*, Calgary, Alberta, 1991). Settlement has been compared for two facilities supported by rock fill: an initial wharf structure and an extension of the wharf constructed several years later. Estimated post-construction settlement of the initial wharf facility supported on uncompacted rock fill 0.5 to 8 m thick was about 380 mm.

Over a similar period of time, recorded post-construction settlement of the wharf extension supported on compacted rock fill 8 to 11 m thick was 140 to 170 mm. Construction of the wharf extension occurred several years later, using vibro-compaction to penetrate the full 11-m thickness of rockfill. The maximum particle size of the compacted rock fill of the wharf extension was limited to 150 mm, whereas the maximum particle size in initial wharf construction was 450 mm.

Based on this experience, it may be beneficial to compact underwater rock fill where it will support settlement-sensitive structures. Where the underwater rock fill is less than about 9 m thick, deep dynamic compaction (DDC) may be used to densify the fill. With DDC a crane is used to drop a large weight on a grid pattern on the surface of the fill. Where the underwater rock fill is thicker than about 9 m, DDC may not be effective in densifying the material in the lower part of the fill. In such cases, vibro-compaction may be used. Vibro-compaction requires specialized equipment, so it is usually more costly than DDC. Also, the vibro-probe may be unable to penetrate fill with particle sizes greater than 100 to 150 mm. Therefore, additional processing of the material would be required should this compaction method be used.

2.4 Compacted Rock Fill

Compacted rock fill can be used in artificial island and causeway construction above the water level. It can also be used in foundations and embankments for roadways, railways, buildings, etc.

Compacted rock fill should have an average particle size of at least 50 mm, but no more than 40% of the average sample should pass a 25-mm screen. The fill should be spread in

1.0-m layers and compacted by at least 4 passes of a 10-tonne vibratory roller. The maximum stone size should be no more than 2/3 of the layer thickness, or about 0.65 m. In areas where higher demands are placed on the quality of the fill, such as where settlement is critical and where the fill slopes are steep, lift thickness and maximum particle size should be decreased and lifts should be watered during placement and compaction.

2.5 Compacted Soil Fill

Compacted soil fill can be used in artificial island and causeway construction above the water level. Compacted soil fill can also be used in railway embankments and building foundations. The soils and degradable rock used as fill should have a maximum particle size of 100 to 150 mm and should be spread in lifts of 200 to 300 mm. The soils should be compacted to at least 90 percent of Modified Proctor maximum density and should be low in plasticity and near optimum moisture content. In critical locations, such as immediately beneath structures, a higher level of compaction may be needed

2.6 Filter Layers

Filter layers will be needed to control migration of fines from soil fills into rock fill. A material with a gradation ranging from fine sand to gravel, such as a typical road base material, is recommended for this zone. Horizontal filter layers should be at least 0.5 m thick, and vertical layers should be at least 3 m thick. Filters should be lightly compacted by four passes of a 10-tonne roller.

3 GEOLOGY

3.1 Rock

Five rock formations are represented on geologic plans and profiles prepared by ACP in the excavation area of the third locks. Included are the Basaltos, Pedro Miguel Formation, La Boca Formation, Cucaracha Formation, and Culebra Formation (Figure 1). The complexity of the geology has been influenced by faulting and igneous activity along the alignment. We understand that the interpretations made by ACP on geologic plans and profiles (Figures 1-5) are based on information obtained from boring logs and limited geologic mapping. As indicated on the ACP geologic map and profiles, the Basaltos, Pedro Miguel, and La Boca Formations are most common in the excavation area, while the Cucaracha and Culebra Formations will be encountered less frequently. Zones of fault gouge are also anticipated within the excavation area. This material is relatively insignificant compared to the rock in which it occurs; therefore, in this report, we are treating the material as having the same characteristics as the rock types in which it occurs. Generalized characteristics and behaviors of the rock formations, as deduced from analysis of the available boring logs, are described in Table 1.

3.2 Overburden

The rock formations are overlain in most areas by overburden consisting of weathered rock, residual soil, and/or fill material derived from previous canal excavation. The thickness of the overburden in borings ranges from 0 to 52 meters. The overburden soils are quite variable in respect to their particle size, consistency, moisture content, plasticity, and dry strength.

Boring logs indicate that the fill material is commonly gravelly and often contains boulders. Fill consisting primarily of hard basalt boulders has been noted in several borings, with zones ranging in thickness from 3 to 12 meters. These borings are located within the excavation limits and east of the centerline between Station 6+800 and Station 7+300.

4 MATERIAL SUITABILITY

The various material and rock types that will be excavated have been characterized, and their suitability for the anticipated construction uses has been evaluated. The excavated materials may be divided into the following four categories:

- Basalt
- Agglomerate
- Sedimentary Rocks
- Overburden

Table 2 identifies the four categories of material, as they are potentially suitable for use in construction.

4.1 Basalt

A large portion of the excavation area is composed of the Basaltos Formation, consisting of sound, strong to very strong, basalt and diabase. Although diabase has been identified as a component of the Basaltos Formation on boring logs and geologic plans and profiles, it is considered to behave similarly to the basalt. Therefore, these rock types will be treated as one geotechnical unit (basalt) in this report. Excavation of basalt is projected along the alignment from approximately Station 1+500 through 2+900 and Station 5+000 through 10+000.

The typical spacing of joints in the Basaltos Formation is moderately close to close (0.06 to 0.6 meters). We anticipate that well-designed blasts will produce angular pieces that typically grade from a few millimeters to 0.6 m. Data on specific gravity of the basalt is provided in Table 1. Large rubber-tired loaders should be suitable for excavating and loading the shot rock. Some pieces larger than 0.6 m should be expected. They may be used in the underwater rock fill up to the size that can be handled by the equipment. Alternatively, they may be set aside for use as armor stone or broken down further by blasting or hoe-ramming.

Field data and test results indicate that the basalt has high strength. The average strength resulting from point load tests performed by ACP was approximately 70 MPa. High strength is typically indicative of durable material. Core logs indicate that zeolites are locally present along fracture surfaces within the basalt. Zeolites can weather and expand over time, resulting in degradation of rock particles that appear to be sound when excavated. We do

not anticipate this type of degradation of the basalt, however, since zeolites were only identified along joint surfaces and not within the rock matrix.

We anticipate based on our understanding of ACP's experience with the basalt, that testing will show the basalt is durable. Therefore, we anticipate that shot rock obtained from the basalt may be used directly (without processing to adjust the gradation) in underwater rock fill. With limited processing to remove oversize material, it should also be suitable in compacted rock fill. Test blasts are recommended in the early stages of the excavations in the basalt to determine the blast hole spacing and powder factor that yield a gradation suitable for the fills and that provide a level of rock fragmentation that is acceptable to the contractor.

Because of the joint spacing in the basalt, we anticipate that underlayer stone may be obtained by processing the shot rock (if testing shows the basalt is durable). However, we do not expect that significant quantities of material large enough for armor stone will be available in the basalt.

Basalt that is found to be non-durable is suitable for use only as compacted soil fill. The non-durable basalt will need to be fragmented by blasting for use as compacted soil fill. Significant break-down of the basalt during handling should not be expected.

4.2 Agglomerate

Excavation of agglomerate is projected along the alignment from Station 1+500 through 7+000, approximately. The sound agglomerate of the Pedro Miguel Formation is medium strong to strong, and its durability varies. The matrix of the agglomerate can locally be more tuffaceous; hence, it will be more erodable and less durable. The average strength resulting from point load tests performed by ACP was approximately 30 MPa. The typical joint spacing of the agglomerate is close to wide (0.6 to 2.0 meters).

Several boring logs indicate that the agglomerate exhibits a tendency to hydrate, swell, and disintegrate upon exposure to air. However, ACP geologist Pastora Franceschi has indicated that these comments on the logs are questionable. Golder recommends further investigation of the agglomerate in the next phase of work. Additional testing, including the methods listed below, should be performed for a better understanding of its durability:

- ASTM C535 Standard Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine; and
- ASTM D5240 Standard Test Method for Testing Rock Slabs to Evaluate Soundness of Riprap by Use of Sodium Sulfate or Magnesium Sulfate.

We anticipate that well-designed blasts will produce angular pieces that typically grade from a few millimeters to one meter. Data on specific gravity of the agglomerate is provided in

Table 1. Large rubber-tired loaders should be suitable for excavating and loading the shot rock. Some pieces larger than one meter should be expected. If the agglomerate is found to be durable, these larger pieces may be used in the underwater rock fill up to the size that can be handled by the equipment. Alternatively, they may be set aside for use as armor stone (if durability is acceptable) or broken down further by blasting or hoe-ramming.

Based on reports of ACP's experience with the agglomerate, it is expected that testing will show that a significant percentage of the agglomerate is durable. Where soundness testing shows the agglomerate is durable, the shot rock obtained from the agglomerate may be used directly (without processing to adjust the gradation) in underwater rock fill. With limited processing to remove oversize material, it should also be suitable in compacted rock fill. Test blasts are recommended in the early stages of the excavations in the agglomerate to determine the blast hole spacing and powder factor that yield a gradation that is suitable for the fills and provides a level of rock fragmentation that is acceptable to the contractor.

Due to the joint spacing in the agglomerate, we anticipate that underlayer stone and armor stone may be obtained by processing the shot rock (if testing shows the agglomerate is durable), but because of the uncertainty about its durability, we recommend relying on other sources for purposes of the feasibility study.

Any agglomerate that is found to be non-durable will need to be fragmented by blasting or broken down during handling so that it can be used as compacted soil fill. The gradation of the non-durable agglomerate produced by blasting will likely be similar to that expected for the sedimentary rocks, discussed in Section 4.3.

4.3 Sedimentary Rocks

Sedimentary rocks will be derived from several formations in the excavation area. Interbedded sandstone, siltstone, conglomerate, and tuffaceous beds of varying thickness comprise the La Boca Formation. The Cucaracha Formation is comprised predominantly of shale with local sandstone or conglomerate layers. The Pedro Miguel Formation sporadically contains tuff layers. Excavation of sedimentary rocks is projected along the alignment from approximately Station 1+000 through 4+000, Station 6+000 through 6+400, Station 6+900 through 7+600, and Station 8+300 through 10+000.

The sedimentary rocks within the excavation area are typically soft to medium soft and of weak to moderate strength. The average strength resulting from point load tests performed by ACP was approximately 10 MPa. In addition, they exhibit a tendency to hydrate, swell, and disintegrate upon exposure to air. We anticipate that the sedimentary rocks will be excavated primarily by ripping; locally harder or more massive zones of conglomerate and sandstone may require blasting. Particle sizes from the excavation operations are expected

to range from a few millimeters to a meter. With handling and exposure to moisture, the smaller particles are likely to breakdown further into silt and fine sand sizes.

The poor durability of these materials will limit their use in construction to compacted soil fill. They should be treated like soil materials and compacted in layers less than 300 mm thick. This will require removing or breaking down pieces larger than 150 mm.

4.4 Overburden

Overburden materials include weathered rock, residual soil, and fill material derived from previous canal excavation. Most of the overburden materials should be suitable for use as compacted soil fill; however, some of the materials have high moisture contents and will not be suitable. To identify these soils, the available index test results were analyzed.

Through consideration of the plastic limit as an approximation of optimum moisture content, soil samples 10% wetter than optimum moisture content are likely to be unsuitable. Based on this criterion, an estimated one-third of the overburden will be unsuitable for construction purposes. It is anticipated that the unsuitable soil types that will be encountered most frequently during excavation are silts, sands, and clays of high moisture content. These soils will serve no practical use in construction of the artificial island and should be considered waste material.

Some of the overburden may also be excavated by dredging. Because of its high moisture content, dredged material will not be suitable for use in the artificial island and should be considered waste material.

5 MATERIAL VOLUMES

The approximate lateral extents of basalt, agglomerate, and sedimentary rocks beneath the overburden are presented on Figure 1. In addition, approximate vertical extents of these materials and of overburden soils may be inferred from the ACP geologic profiles (Figures 2-5). A recommended method for volume estimate calculations using the ACP profiles is found in Appendix B.

5.1 Bulking and Shrinkage Factors

Prior to excavation, in situ rock typically has a density similar to the specific gravity of the rock as it has a negligible void ratio (little to no air space within the rock mass). Upon blasting or ripping, the rock mass breaks into discrete particles of rock which are piled randomly against each other. This causes bulking of the material, as there are voids between contact points of the rock fragments. The amount of bulking that occurs is a function of the rock type. Hard, strong rock will produce angular fragments with point-to-point contact that results in considerable void space, whereas soft, weak rock will break into smaller particles with more contact between the particles and less void space. Thus, bulking factors (or volume increases) are expected in the range of 30% to 40% for the basalt and agglomerate. For the sedimentary rocks, which will break down and be used as soil fill, the bulking factors should being the range of 10% to 20%.

Unlike the rock material, shrinkage factors (volume decreases) are expected for the overburden material. Factors affecting the amount of shrinkage include the relative density between the borrow and fill materials, losses of material during transportation, and settlement of the material. No project-specific data is available for estimating shrinkage factors, but based on our experience on other projects, we expect shrinkage in the range of 15 to 20%, excluding losses due to settlement.

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Table 1

Generalized Characteristics of Materials in the Proposed Excavation Area[1]

Formation[2]	Material	Hardness	Strength	Weathering	Specific Gravity	Joint Spacing	Joint Width	Joint Descriptions	Bedding	Grain Size	Clast Description	Matrix	Other Notes
Basaltos	**Weathered Basalt**	Medium Soft to Hard	Weak to Strong	Moderately to Highly Weathered	2.7	Close to Very Close (<0.06 m to 0.2 m)	Closed to Open (1 mm to 30 mm)	Stepped, Undulating, Planar, Rough, few are Smooth and Slickensided Dip angles: **30º**,45º,70º, 90º	N/A	Varies	N/A	N/A	
	Sound Basalt	Hard to Very Hard	Strong to Very Strong	Slightly Weathered to Sound	2.7	Moderately Close to Close (0.06 m to 0.6 m)	Very Closed to Moderately Open (<1 mm 10 mm)	Stepped, Undulating, Planar, Smooth to Rough, Occasionally Slickensided Dip angles: **30º**,45º, 60º, 70º, 90º	N/A	Varies	N/A	N/A	
Pedro Miguel Formation	**Weathered Agglomerate**	Soft to Medium Hard	Weak to Moderate	Slightly to Completely Weathered	2.4	Very Close to Close (<0.06 to 0.2 m)	Closed to Open (1 mm to 30 mm)	Rough Dip angles vary	N/A	Very Fine to Fine 1/16 to 1/4 mm	Angular to Sub-rounded Basaltic, Andesitic, and Tuffaceous Clasts	Massive, Tuffaceous	
	Sound Agglomerate	Medium Hard to Hard	Medium Strong to Strong	Slightly Weathered to Sound	2.4	Close to Wide (0.06 m to 2.0 m)	Closed to Moderately Open (1 mm to 10 mm)	Rough, Planar, Stepped Dip angles: 70º,45º, 50º, 30º, 40º, 60º	Occasionally Thinly Bedded or Laminated	Very Fine to Fine 1/16 to 1/4 mm	Angular to Sub-rounded Basaltic, Andesitic, and Tuffaceous Clasts	Massive, Tuffaceous	
La Boca Formation	**Tuff**	Medium Soft	Weak	---	2.1	Very Close (<0.06 m)	Open (10 mm to 30 mm)	Slickensided	Massive	Very Fine to Fine 1/16 to 1/4 mm	N/A	N/A	Hydrates, Swells, and Disintegrates Upon Exposure to Air
	Sandstone	Medium Soft to Medium Hard	Weak to Moderate	Sound to Moderately Weathered	2.2	Close to Wide (0.06 m to 2.0 m)	Closed to Open (1 mm to 30 mm)	Planar, Stepped, Rough, Occasionally Slickensided Dip angles: 30º and 45º	Usually thin (0.06 to 0.2 m), Often dip 30º	Very Fine to Medium 1/16 to 1/2 mm	N/A	Some Is Calcareous	Hydrates, Swells, and Disintegrates Upon Exposure to Air
	Siltstone	Soft to Medium Hard	Weak to Moderate	Moderately to Highly Weathered	2.2	Very Close to Moderately Close (<0.06 m to 0.6 m)	Closed to Open (1 mm to 30 mm)	Planar, Stepped, Undulating, Rough, Smooth, Slickensided Dip angles: 45º and 30º	Varies, Often dips 30º	Very Fine to Fine 1/16 to 1/4 mm	N/A	N/A	Hydrates, Swells, and Disintegrates Upon Exposure to Air
	Conglomerate	Soft to Medium Hard	Weak to Moderate	---	2.3	Close (0.06 m to 0.20 m)	Open (10 mm to 30 mm)	Slickensided	N/A	Fine to Medium 1/8 to 1/2 mm	Angular to Sub-rounded Clasts/Pebbles	Sandy, Tuffaceous	Hydrates, Swells, and Disintegrates Upon Exposure to Air
Cucaracha Formation[3]	**Shale**	Soft to Medium Hard	Weak	---	2.2	Very Close	Open	Slickensided	Massive	Fine 1/8 to 1/4 mm	Contains Calcareous Concretions	Sandy	Hydrates, Swells, and Disintegrates Upon Exposure to Air
	Sandstone	Mediium Soft to Medium Hard	Weak to Moderate	---	2.2	Moderately Close to Wide	Open	Slickensided	Massive	Fine 1/8 to 1/4 mm	N/A	Tuffaceous	Hydrates, Swells, and Disintegrates Upon Exposure to Air

Notes:
[1] This table represents only the *typical* characteristics of frequently encountered materials as deduced from limited data including boring logs, index test results, and prior analyses by other agencies.
[2] The Culebra Formation is also included in the excavation area to a very limited extent. This formation includes alternating layers of sandstone, siltstone, and conglomerate of varying thickness.
[3] The Cucaracha Formation occasionally contains a weak conglomerate with a tuffaceous matrix.

Table 2
Material Suitability for Construction

Construction Need	Potential Material Sources
Armor Stone	Off-Site Quarries
Underlayer Stone	Basalt[1] (with processing)
Underwater Rock Fill	Basalt[1], Durable Agglomerate
Compacted Rock Fill	Basalt[1] & Durable Agglomerate (with limited processing)
Compacted Soil Fill	Non-durable Agglomerate, Sedimentary Rocks, Overburden
Waste (Unsuitable Soils)	Overburden, dredged material

Notes:
[1]Basalt is suitable only if further testing shows it is durable.

2001 Panama Canal Authority Boring Logs (Third Locks Investigation)	Date	Depth (meters below ground surface)
TP1-1	3/30/2001	65.6
TP1-3	3/27/2001	82.55
TP1-4	3/14/2001	60.2
TP1-5	3/19/2001	45.39
TP1-6	3/20/2001	41
TP1-7	4/2/2001	45.5
TP1-8	3/12/2001	41.65
TP2-1	6/19/2001	26.5
TP2-2	6/20/2001	39.62
TP2-3	6/21/2001	35.5
TP2-4	6/23/2001	42.3
TP2-5	6/25/2001	39.92
TP2-6	6/26/2001	37.7
TP2-9	3/13/2001	37
TP1C-1	9/27/2001	55
TP1C-2	9/28/2001	40
TP1C-3	9/29/2001	30.3
TP1C-4	9/26/2001	32
TP1C-5	9/22/2001	31
TP1C-6i	9/26/2001	55
TP1C-7	10/5/2001	4.5
TP1C-8	9/21/2001	85
TP1C-9	9/25/2001	65
TP1C-10	9/20/2001	40
TP1C-11i	9/18/2001	60
TP1C-12i	9/8/2001	65
TP1C-13	9/22/2001	70.3
TP1C-14i	9/17/2001	65
TP1C-15	9/20/2001	65.5
TP1C-16	9/14/2001	70.2
TP1C-17	9/13/2001	35
TP1C-18	9/11/2001	25
TP1C-19	9/8/2001	20
TP1C-20	9/6/2001	30
TP1C-21	9/25/2001	4.9
TP1C-21i	9/26/2001	65
TP1C-22i	9/3/2001	35
TP1C-23	9/4/2001	20
TP1C-23i	9/5/2001	36
TP1C-24	8/20/2002	32
TP1C-25	8/23/2001	35
TP1C-26	8/18/2001	45
TP1C-27	8/25/2001	40
TP1C-28	9/3/2001	50
TP1C-29	8/30/2001	55
TP1C-30	9/10/2001	51
TP1C-31	9/8/2001	55
TP1C-32	9/13/2001	45
TP1C-33	9/10/2001	50
TP1C-34	9/12/2001	40

1940-1941 Panama Canal Company Boring Logs (Third Locks Studies)	Date	Depth (feet below ground surface)
PM 21	8/10/1939	124.5
PM 24	4/5/1939	196
PM 68	5/28/1940	467.3
PM 96	6/22/1940	303.9
PM 105	7/3/1940	327
PM 106	7/3/1940	100
PM 109	7/9/1940	150.2
PM 113	7/17/1940	220
PM 143	9/18/1940	61
PM 148	10/1/1940	141
PM 223	12/19/1940	122
PM 272	10/22/1941	120.8
PM 282	10/29/1941	57.3
PM 293	11/24/1941	80.7
PM 437	7/27/1942	123
M 8	5/26/1939	152.5
M 12	6/13/1939	190.2
M 19	8/7/1939	189
M 27	1/3/1940	230.5
M 29	1/8/1940	78.5
M 32	1/11/1940	78.6
M 37	1/23/1940	80.6
M 38	1/30/1940	78.3
M 40	2/1/1940	80.1
M 43	2/5/1940	81.4
M 50	2/12/1940	78
M 52	2/13/1940	77
M 85	4/10/1940	60.1
M 90	4/15/1940	60.5
M 186	1/10/1941	43.2
M 196	1/17/1941	82
M 197	1/24/1941	131.2
M 201	2/1/1941	87
M 202	1/29/1941	95
M 203	1/25/1941	77
M 207	1/29/1941	49.5
M 247	3/26/1941	70
M 250	3/29/1941	70
M 274	9/5/1941	75.2
M 283	9/26/1941	47.2
M 322	3/5/1942	45.3
M 346	7/6/1942	34.9
M 352	7/9/1942	32.1

Appendix B – Method used for Calculation of Materials Volumes

Geologic units in the canal excavation area have been grouped into the following four materials:

- Basalt
- Agglomerate
- Sedimentary Rocks
- Overburden.

PCA has provided a geologic map and five geologic profiles along the canal excavation alignment. On the northern segment of the alignment, there is an east profile and a west profile. On the southern segment of the alignment, there is an east profile, a centerline profile, and a west profile.

Step 1

Determine the total area of each material as it appears within the excavation boundary on each geologic profile. Vertical exaggeration must be accounted for. (The four materials may be distinguished by color. Assign a value of 0 when a material is not present on a profile.)

Step 2

<u>Northern Segment</u>

On the northern segment of the alignment, there is an east profile and a west profile. For each of the four materials, calculate the average of the areas obtained on the east and west profiles. Multiply each average area by the distance between the profiles (the canal width) to estimate the total volume of each material along the northern segment.

<u>Southern Segment</u>

On the southern segment of the alignment, there is an east profile, a centerline profile, and a west profile.

A) For each of the four materials, calculate the average of the areas obtained on the east and center profiles. Multiply each average area by the distance between the two profiles to estimate a volume of each material.

B) For each of the four materials, calculate the average of the areas obtained on the west and center profiles. Multiply each average area by the distance between the two profiles to estimate a volume of each material.

The sum of the material volumes from A) and B) equals the total volume of each material along the southern segment.

Step 3

Add the total volume of each material along the northern and southern segment to obtain the total volume of each material in the entire excavation area.

Step 4

Add the total volumes of each material in the entire excavation area to obtain the total excavation volume (V1).

Step 5

Create a TIN of the upper bound of the excavation area using the topography. Create a TIN of the lower bound of the excavation area using the canal bottom and side slope excavation elevations. Calculate the total excavation volume (V2).

Step 6

Compare the total excavation volumes V1 and V2. Determine a multiplier (x), such that V1(x) = V2.

Step 7

Apply the multiplier (x) to the total volume of each material (found in Step 3).

Panama Canal - New Locks Material Volume Calculations (P1)

Southern Region - Sections 1, 2 and 3

Material Classification	Profile Area (m^2)	Volume (m3)	Comments
Note: Area calculations shown below are based on geologic profiles provided by ACP on drawings created June and Feb 2002			
Section 1			
Overburden	35,920		
Sedimentary Rock	6,350		
Basalt	36,650		
Section 2			
Overburden	41,850		
Sedimentary Rock	11,285		
Basalt	30,830		
Section 3			
Overburden	49,235		
Sedimentary Rock	14,575		
Basalt	32,535		

Volume Calculations (using end area method)

Material Classification	Average Profile Area (m^2)	Volume (m3)	Comments
Sections 1 and 2			
Overburden	38,885	3,214,622.95	Average area x distance between profiles
Sedimentary Rock	8,818	728,942.73	Average area x distance between profiles
Basalt	33,740	2,789,285.80	Average area x distance between profiles
Distance between profiles 1 and 2 (m)	82.67		
Total Volume		***6,732,851***	
Sections 2 and 3			
Overburden	45,543	4,920,867.13	Average area x distance between profiles
Sedimentary Rock	12,930	1,397,086.50	Average area x distance between profiles
Basalt	31,683	3,423,294.13	Average area x distance between profiles
Distance between profiles 2 and 3 (m)	108.05		
Total Volume		***9,741,248***	

Northern Region - Section 1 + 2

Material Classification	Average Profile Area (m^2)	Volume (m3)
Overburden	50,300	9,054,000
Sedimentary Rock	15,278	2,749,950
Basalt	39,240	7,063,200
Agglomerate	71,308	12,835,350
Distance between sections (m)	180	
Total Volume		***31,702,500***

Complete Canal/Locks

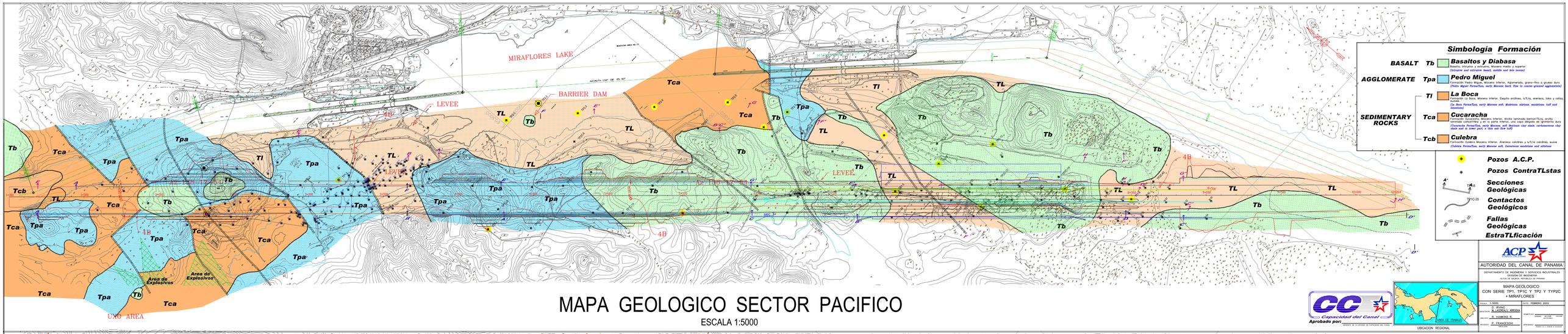
Material Classification	Volume (m3)
Overburden	17,189,490
Sedimentary Rock	4,875,979
Basalt	13,275,780
Agglomerate	12,835,350
Total Volume (from Geologic Profiles)	48,176,599
Total Excavated Volume (per Harza report)	69,350,000
Multiplication Factor (Exc. Vol ÷ Geol. Vol)	1.439

Complete Canal/Locks - Factored Volumes

Material Classification	Volume (m3)	Estimated Dry Volume	Estimated Wet Volume
Overburden	24,744,194	2,474,419	22,269,775
Sedimentary Rock	7,018,950	701,895	6,317,055
Basalt	19,110,426	1,911,043	17,199,383
Agglomerate	18,476,429	1,847,643	16,628,786
Total (Check)	69,350,000		

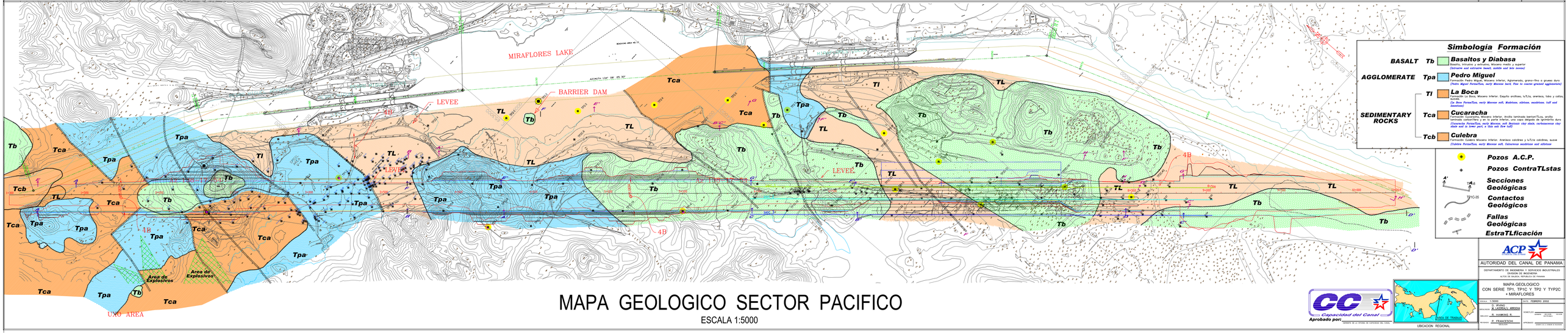
Harza Calculations

Material from Channel			% of total	% of rock or overburden
Wet Overburden	1450000 m3	Taken from Harza report	2.1%	10%
Dry Overburden	12420000 m3	Taken from Harza report	17.9%	90%
Wet Rock	5820000 m3	Taken from Harza report	8.4%	10%
Dry Rock	49660000 m3	Taken from Harza report	71.6%	90%



MAPA GEOLOGICO SECTOR PACIFICO

ESCALA 1:5000



MAPA GEOLOGICO SECTOR PACIFICO

ESCALA 1:5000

SOIL	TYPE E	TYPE E	TYPE E	TYPE E	TYPE E	TYPE E	
WR	TYPE D	TYPE D	TYPE D	TYPE D	TYPE D	TYPE D	
SR	TYPE B	TYPE B	TYPE B	TYPE A	TYPE A	TYPE C	TYPE C / TYPE A
RMT							

CUT SLOPES TYPES

SEDIMENTARY ROCKS

OVERBURDEN

AGGLOMERATE

BASALT

LEYENDA

- BASALTO/BASALT
- DIABASA/DIABASE
- SUELO RESIDUAL/OVERBURDEN
- FORMACION LA BOCA/ LA BOCA FORMATION
- FORMACION PEDRO MIGUEL/ PEDRO MIGUEL FORMATION
- M-86 NOMBRE DEL POZO/NAME OF BORING
- 2.96 ELEVACION/ELEVATION
- 18.35 PROF. DEL POZO/LENGTH OF BORING
- CONTACTO/CONTACT
- FALLA/FAULT
- FALLA PROBABLE/PROBABLE FAULT
- TWR INICIO DE ROCA METEORIZADA/TOP OF WEATHERED ROCK
- TSR INICIO DE ROCA SANA/TOP OF SOUND ROCK
- PISO DE ESCLUSAS PROPUESTO/PROPOSED LOCKS FLOOR

LEGEND

PERCENTAGE SCALE

RQD% CR% UCS (MPa) PLT - UCS (MPa)

AUTORIDAD DEL CANAL DE PANAMA

DEPARTAMENTO DE INGENIERIA Y SERVICIOS INDUSTRIALES
DIVISION DE INGENIERIA
ALTOS DE BALBOA, REPUBLICA DE PANAMA

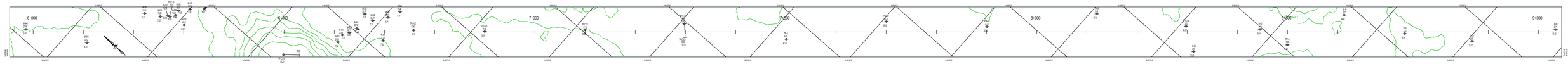
TERCER JUEGO DE ESCLUSAS

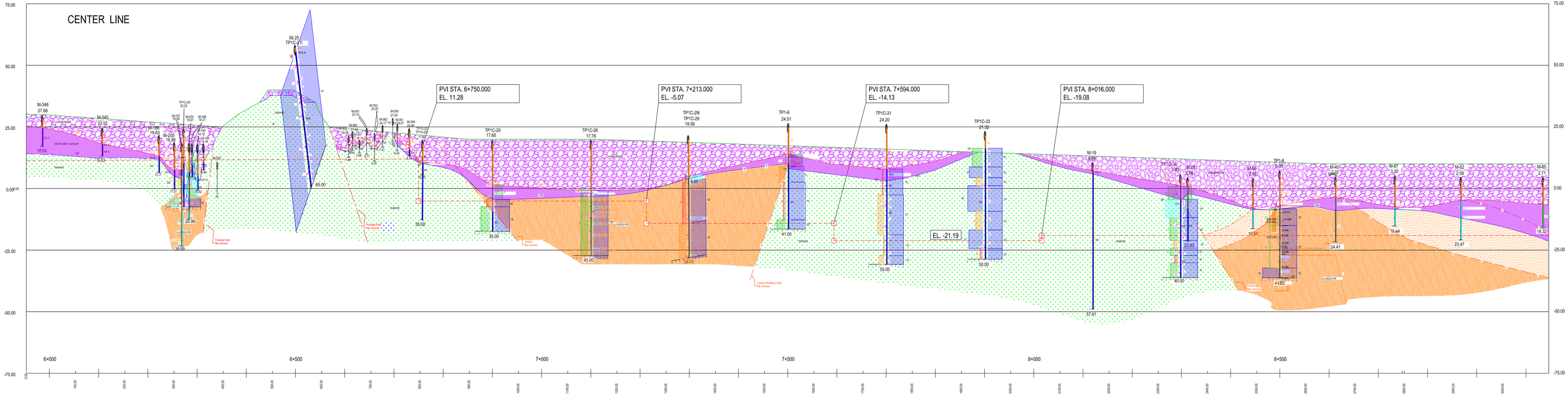
PACIFICO — ALINEAMIENTO P1

SECCION LONGITUDINAL MOSTRANDO VALORES DE CR%, RQD%, UCS, y PLT

PERFIL 1 (ESTE)

ESCALA: 1:2000 Horiz / 1:400 Vert	FECHA: FEBRERO 2002
GEOLOGOS: P. FRANCESCHI & J. ARROCHA & D. IRVING	REVISADO: GERENTE DE SECCION
DIBUJADO POR: J. RAMESCH / R. HAWKINS	
VERIFICADO POR: R. PINILLA	APROBADO: GERENTE, DIVISION DE INGENIERIA





SOIL	TYPE E	TYPE E	TYPE E	TYPE E	TYPE E	TYPE E
WR	TYPE D		TYPE D	TYPE D	TYPE D	TYPE D
SR	TYPE B	TYPE B	TYPE C	TYPE A	TYPE A / TYPE C	TYPE C / TYPE C
RMT						

CUT SLOPES TYPES

SEDIMENTARY ROCKS

OVERBURDEN

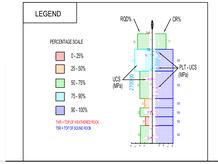
AGGLOMERATE

BASALT

BASALTO/BASALT
DIABASA/DIABASE
SUELO RESIDUAL/OVERBURDEN
FORMACION LA BOCA
LA BOCA FORMATION
FORMACION PEDRO MIGUEL
PEDRO MIGUEL FORMATION
TWR BASE DE ROCA METEORIZADA/TOP OF WEATHERED ROCK
TSR BASE DE ROCA SANA/TOP OF SOUND ROCK
PISO DE ESCLUSAS PROPUESTO/PROPOSED LOCKS FLOOR
NOMBRE DEL PERFIL/NAME OF SERIES
ELEVACION/ELEVATION
POZ DEL PERFIL/DEPTH OF SERIES
CONTACTO/CONTACT
FALLA/FAULT
FALLA PROBABLE/PROBABLE FAULT

LEGEND

PERCENTAGE SCALE
0 - 25%
26 - 50%
50 - 75%
75 - 90%
90 - 100%
TWR / TSR OF WEATHERED ROCK
TSR / TSR OF SOUND ROCK



ACP AUTORIDAD DEL CANAL DE PANAMA

DIVISION DE INGENIERIA

TERCER JUEGO DE ESCLUSAS

PACIFICO ATLANTICO

ALINEAMIENTO (P)

SECCION LONGITUDINAL MOSTRANDO VALORES DE CR%, RQD%, UCS, y PLT

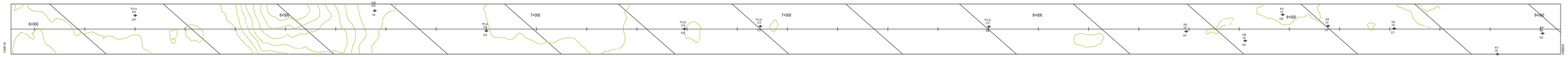
PERFIL 2 (CENTRO)

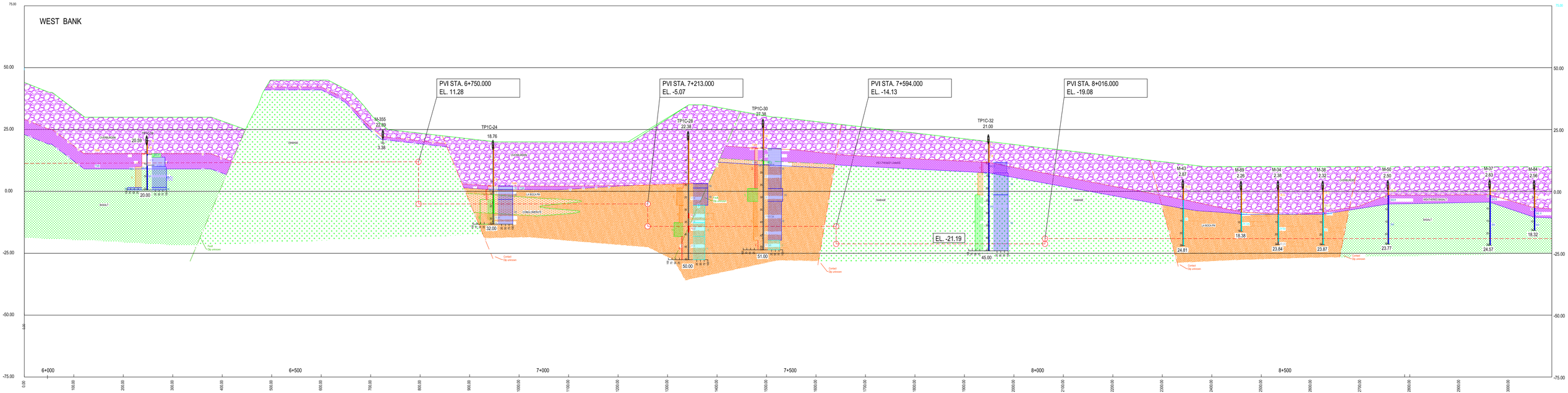
ESCALA: 1:2000 Horiz. / 1:400 Vert. FECHA: FEBRERO 2003

GEOLOGOS: A. FRANCISCO M. G. ARRIOLA
G. D. DIANA

DIBUJADO POR: J. BARSOLO / A. HANKINS REVISADO

VERIFICADO POR: R. PERILLA APROBADO





OB	TYPE E	TYPE E	TYPE E	TYPE E	TYPE E	TYPE E	TYPE E
WR	TYPE D	TYPE D	TYPE D	TYPE D	TYPE D	TYPE D	TYPE D
SR	TYPE B	TYPE B	TYPE C	TYPE C	TYPE A	TYPE C	TYPE A

CUT SLOPES TYPES

SR SEDIMENTARY ROCKS

OB OVERBURDEN

WR AGGLOMERATE

BASALT

LEYENDA

BASALT/TOB/BASALT
DIABASA/DIABASE
SUELO RESIDUAL/OVERBURDEN
FORMACION LA BOCA
LA BOCA FORMATION
ZONA DE FALLA/FAULT ZONE
RMR INDICE DE ROCA MEDIANA/TOP OF WEATHERED ROCK
TSR INDICE DE ROCA SANA/TOP OF SOUND ROCK
PISO DE ESCLUSAS PROPUESTO/PROPOSED LOCKS FLOOR
NORTE DEL FOZAMIENTO EXPRO
SOUTH EXPRO
PICO DE POZO/DEPTH EXPRO
CONTACTO/CONTACT
FALLA/FAULT
FALLA PROBABLE/FAULT
LEGEND

PERCENTAGE SCALE
0 - 25%
25 - 50%
50 - 75%
75 - 90%
90 - 100%

RMR = TOP OF WEATHERED ROCK
TSR = TOP OF SOUND ROCK

RQD% CR% UCS (MPa) PLT-UCS (MPa)

ACP AUTORIDAD DEL CANAL DE PANAMA
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ALTOS DE BALBOA, REPUBLICA DE PANAMA

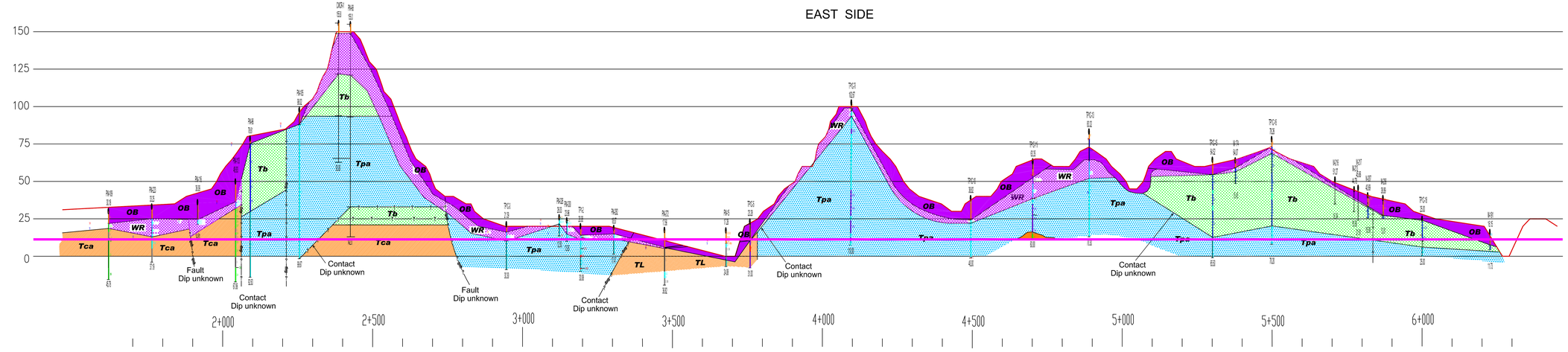
TERCER JUEGO DE ESCLUSAS

PACIFICO ALINEAMIENTO P1

SECCION LONGITUDINAL MOSTRANDO VALORES DE CR%, RQD%, UCS, y PLT
PERFIL 3 (OESTE)

ESCALA: H 2000 Horiz / V 400 Vert	FECHA: FEBRERO 2003		
GEOLOGOS:	A. CARRASQUILLA, MARCOS ALVARADO, J. CHAVEZ	REVISADO:	GERENTE DE SECCION
DIBUJADO POR:	J. CHAVEZ / L. R. VASQUEZ		
VERIFICADO POR:	R. ARGILLA	APROBADO:	GERENTE DIVISION DE INGENIERIA

EAST SIDE



Overburden (OB)	Type E						Type E						Type E					Type E
Weathered Rock (WR)	Type D						Type D						Type D					Type D
Sound Rock (SR)	Type D		Type B			Type B / Type D			Type B			Type C			Type B			Type B

CUT SLOPE TYPE

Simbología Formación

Tb — **Basaltos y Diabasa**
Basalto, intrusivo y extrusivo, Mioceno medio y superior
(Intrusive and extrusive basalt, middle and late Iocene)

Tpa — **Pedro Miguel**
Formación Pedro Miguel, Mioceno inferior, Aglomerado, grano-fino a grueso duro
(Pedro Miguel FormaTLon, early Miocene hard, Fine to coarse-grained agglometate)

TL — **La Boca**
Formación La Boca, Mioceno inferior. Esquito arcilloso, luTLta, arenisca, toba y caliza, suaves.
(La Boca FormaTLon, early Miocene soft, Mudstone, siltstone, sandstone, tuff and limestone)

Tca — **Cucaracha**
Formación Cucaracha, Mioceno inferior. Arcilla laminada bentonITLca, arcilla laminada carbonífera y en la parte inferior, una capa delgada de ignimbrita dura
(Cucaracha FormaTLon, early Miocene, soft Bentonic clay shale, carbonaceous clay shale and in lower part, a thin ash flow tuff)

Tcb — **Culebra**
Formación Culebra Mioceno inferior. Arenisca calcárea y luTLta calcárea, suave
(Culebra FormaTLon, early Miocene soft, Calcareous sandstone and siltstone

OB — **OVERBURDEN**

WR — **WEATHERED ROCK**

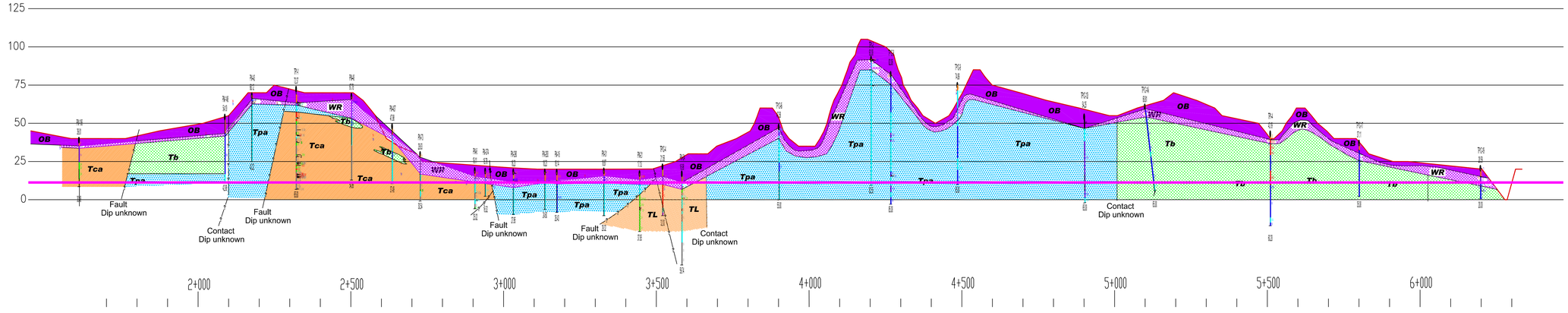
SEDIMENTARY ROCKS

OVERBURDEN

AGGLOMERATE

BASALT

WEST SIDE



Overburden (OB)	Type E						Type E						Type E					Type E
Weathered Rock (WR)	Type D						Type D						Type D					Type D
Sound Rock (SR)	Type D		Type B			Type D			Type B			Type D			Type B			Type B

CUT SLOPE TYPE

Capacidad del Canal

Aprobado por: _____
GERENTE DE LA OFICINA DE CAPACIDAD DEL CANAL

ACP
AUTORIDAD DEL CANAL DE PANAMA

AUTORIDAD DEL CANAL DE PANAMA

DEPARTAMENTO DE INGENIERIA Y SERVICIOS INDUSTRIALES
DIVISION DE INGENIERIA
ALTOS DE BALBOA, REPUBLICA DE PANAMA

MAPA GEOLOGICO
CON SERIE TP1, TP1C Y TP2 Y TYP2C
+ MIRAFLORES

ESCALA: 1:5000	DATE: JUNIO 5 de 2002
GEOLOGOS: J. ARROCHA / D. IRVING / P. FRANCESCHI	SOMETIDO: GERENTE IPC SECCION
DIBUJADO: J. RAMESCH / R. HAWKINS	
REVISADO: R. PINILLA, GEOLOGA	APROBADO: GERENTE DE LA DIVISION DE PROYECTOS (IPC)

APPENDIX B - TRANSPORTATION COST MODELING

Panama - Artificial Island Development Study

PRELIMINARY COST ESTIMATE		DATE PREPARED 30-Jan-04
CLIENT: AUTORIDAD DEL CANAL DE PANAMA	PROJECT NO.: 4594-06	
	ESTIMATED BY: MOFFATT & NICHOL	
PROJECT TITLE: Island Feasibility Study	STATUS OF DESIGN: Feasibility	

Typical Transportation Costs to Island

Item	Quantity	Unit	Unit Cost	Total
Transportation Costs				
Rail (Includes related infrastructure costs)	87,381,000	m^3	$4.84	$422,822,634
Barge	87,381,000	m^3	$6.44	$562,962,332
Road	87,381,000	m^3	$9.36	$818,220,169
Conveyor	87,381,000	m^3	$5.45	$475,951,520
General				
Mobilization and Demobilization	1	LS	$2,500,000.00	$2,500,000
Associated Island Construction Costs				
Permanent Trestle	200	m	$42,456.08	$8,491,215
Causeway	4,333,333	m^3	$4.91	$21,264,687
Causeway Bridge Approaches (MSE Wall)	26,000	m^2	$450.00	$11,700,000
Causeway Bridge	100	m	$60,977.91	$6,097,791
Island Revetment	79,642,269	m^3	$3.92	$312,199,577
Offshore Breakwater	5,200,000	m^3	$13.00	$67,600,000
Dredging				
Dredging in soft material /1	8,183,400	m^3	$2.00	$16,366,800
Dredging in Weathered Rock /2	648,700	m^3	$12.00	$7,784,400
Dredging in Dense Rock /2	680,540	m^3	$25.00	$17,013,500
Pre-dredging at island and causeway	3,977,550	m^3	$2.00	$7,955,100
Demurrage /3	30	days	$20,000.00	$600,000
Total Cost - Island Construction				***$479,573,071***
Engineering and Construction Administration			4.00%	$19,182,923
Contingencies			20.00%	$99,751,199
Grand Total Cost (Including Rail Transportation)				***$1,021,329,827***
Cost per sq. metre for Island Construction				***$312***
Grand Total Cost (Including Barge Transportation)				***$1,161,469,525***
Cost per sq. metre for Island Construction				***$355***
Grand Total Cost (Including Road Transportation)				***$1,416,727,362***
Cost per sq. metre for Island Construction				***$432***
Grand Total Cost (Including Conveyor Transportation)				***$1,074,458,713***
Cost per sq. metre for Island Construction				***$328***

Backup Calculations

Project Specifications - Train Haul

Item	Unit	Qty	Price/Rate	Total	Comments
Railway Construction Data					
Formation (Section) Length	m	23600			
No. main-line tracks (Standard Gauge - 1435mm)	no.	2			
Formation cut volume	m3	2700000			
Formation fill volume	m3	2000000			
Width at Base of Formation	m	30			Estimated average base width
Ballast Depth (top of tie to formation)	m	0.6			
Ballast Width	m	6			
Spacing of ties	m	0.6			
Wood tie dimensions					
width	m	0.2			
depth	m	0.15			
length	m	2.6			
volume	m3	0.078			
Annual Maintenance	$/year/km	$ 40,000			Factored from 1993/94 Westrail data
Quantity Calculations					
Total Track Length	m	57,200			Includes 10,000m for marshalling yard
Total no. ties	no.	95,333			
Ballast volume	m3	238,516			
Ballast mass @ 1.8 t/m3	t	429,329			

Railway Construction Costs

Item	Unit	Qty	Price/Rate	Total	Comments
Track Laying on Formation					
Survey	Ha	472	$ 3,000.00	$ 1,416,000	200m Corridor to shoreline, guesstimate
Boreholes	ea	47.2	$ 2,400.00	$ 113,280	Assuming 20m deep @ $120 per metre ($35 per foot) - every 500m
Clearing and Stripping	Ha	70.8	$ 14,820.00	$ 1,049,256	Assume $6000 per Acre
Formation/Roadbed Earthworks	m3	4,700,000	$ 3.00	$ 14,100,000	Cut + Fill Volumes
Ballast	t	429,329	$ 34.00	$ 14,597,179	
Treated Wood Ties	ea	95,333	$ 58.00	$ 5,529,333	
Tie plates	ea	190,666	$ 8.60	$ 1,639,728	
132lb Rail	m	114,400	$ 62.34	$ 7,131,234	
Track spikes	ea	381,333	$ 6.26	$ 2,387,147	
Rail anchors	ea	190,667	$ 5.90	$ 1,124,933	Anchor pattern: 1 tie in 2
Turnout (#10)	ea	15	$ 30,000.00	$ 450,000	
Total Cost - Track on Formation				***$ 49,538,090***	
Unit Cost per km				***866,100***	

MATERIAL TRANSPORTATION - RAIL

General Specifications

Item	Unit	Qty	Price/Rate	Total	Comments
General Parameters					
Total Material to be Hauled	m3	**87,381,000**			
Time to transport material	year	5.0			
Material Required for Causeway & Offshore Railway	m3	**6,000,000**			Transport from excavation to stockpile
Time to transport	day	**118**			
Remaining Material direct to island	m3	**81,381,000**			Transport from excavation direct to island site
Time to transport	day	**1,607**			
Working Days	day/year	345			
Total Working Days	day	1,725			
Calculated Target Production (total material/working days)	m3/day	**50,656**			
Working Hours per day	hr	21.0			
Equipment Parameters					
CAT 5230B Mass Excavator/Shovel (17m3 bucket)					Not costed - logistics check
Single Bucket Capacity	m3	17.0			
Bucket Fill Factor	no.	55%			
Factored Bucket Capacity	m3	9.35			
Bucket Cycle Time	sec	30.0			
Production Rate for Excavator	m3/hr	1122.0			Comparison: Harza Report, 1200m3/hr
Daily Loading Rate per Excavator	m3/day	23,562.00			
No. Excavators Required to maintain Target Rate	**no.**	**3.0**			
Hourly Loading Rate for 3 Excavators	**m3/hr**	**3,366.0**			
CAT 994D Front End Loader (20m^3 Capacity)					
Single Bucket Capacity	m3	20.0			
Bucket Fill Factor	no.	70%			
Factored Bucket Capacity	m3	14			
Dig/Load Cycle Time	sec	45.0			
Production Rate for Loader	m3/hr	1120.0			Comparison: Harza Report, 1200m3/hr
Daily Loading Rate per Loader	m3/day	23,520.00			
No. Loaders Required to maintain Target Rate	**no.**	**3.0**			
Hourly Loading Rate for 3 Loaders	**m3/hr**	**3,360.0**			

CAT 789C Off-Road Truck (105m3 Capacity)

Truck Capacity (Max.)	m3	105	
Truck Capacity (Struck)	m3	73	
Total Truck Trips Required to Meet Target	no.	1,197,000	
Calculated truck trips per day	no.	694.0	
Max. load/unload time per truck *	hr	0.030	Note: logistics check

* Note: If this value is less than either calculated load or unload time below, then load/unload maximum is exceeded - increase time to completion

Trains

Rail Car Capacity	m3	40	
Rail Cars Per Train	no.	50	
Locos per Train	no.	2	Ruling Grade @ 1.8%
Total Train Capacity	m3	2,000	
Train Trips Required Per Day to Meet Target	no.	25	To meet target, requires 2 tracks at unloading site
Max. load/unload time per train *	hr/train	0.827	Note: logistics check

* Note: If this value is less than either calculated load or unload time below, then load/unload maximum is exceeded - increase time to completion

Rail Transportation Cycle 1

Avg. track distance (material transfer to disposal site)	km	13.0	
Average Train Speed	km/hr	15	factors included for train movements and delays
Time to Load Train	hr	0.60	
Average Travel Time (Round Trip)	hr	1.73	
Time to Unload Train	hr	1.25	Dual-car dumpers, 2min per car per dumper
Total trip cycle time	**hr**	**3.58**	
No. trains loading/dumping simultaneously	no.	1.50	Indicates no. of trains loading/unloading to meet production target
Calculated Trips Per Train Per Day	no.	5.9	
No. of Train Consists Required	**no.**	**5.0**	
No. Rail Cars Required	**no.**	**250.0**	
No. Locos Required	**no.**	**10.0**	

Rail Transportation Cycle 2

Avg. track distance (material transfer to disposal site)	km	23.6	
Average Train Speed	km/hr	15	factors included for train movements and delays
Time to Load Train	hr	0.60	
Average Travel Time (Round Trip)	hr	3.15	
Time to Unload Train	hr	1.25	3min per car - 2 at a time
Total trip cycle time	**hr**	**4.99**	
No. trains loading/dumping simultaneously	no.	1.50	Indicates no. of trains loading/unloading to meet production target
Calculated Trips Per Train Per Day	no.	4.2	
No. of Train Consists Required	**no.**	**7.0**	
No. Rail Cars Required	**no.**	**350.0**	
No. Locos Required	**no.**	**14.0**	

Truck Transportation Cycle 1

Stockpile to island

Average one-way distance (excavation to train loader)	km	4.0	Source: site plan
Average Truck Travel Speed		25	
Estimated Load Time	hr	0.022	1.3 minutes
Estimated Travel Time (Round Trip)	hr	0.320	Calculated round-trip distance of 8 km
Estimated Unload Time	hr	0.017	1 minutes per truck
Total Cycle Time	**hr**	**0.36**	
Calculated Trips Per Truck per Day	no.	58.6	
No. 105m3 Trucks Required	**no.**	**12.0**	
No. 41.5m3 Trucks Required (short haul < 1km)	**no.**	**3.0**	Arbitrary no. used to maintain continuous flow

Equipment Costs

CAT 5230B Mass Excavator/Shovel (17m3 bucket)

Hourly Rate	$/hr		$ 592.95	
Daily Rate per Excavator	$/day		$ 14,231	24 pay hours
Daily Rate for 3 Excavators	$/day	3.0	$ 42,692	

CAT 789C Off-Road Truck (105m3 Capacity)

Hourly Rate	$/hr		$ 331.45	
Daily Rate per truck	$/day		$ 7,955	24 pay hours per day
Daily Rate for 12 trucks	$/day	12.0	$ 95,456	

CAT 775E Off-Road Truck (41.5m^3 Capacity)

Hourly Rate	$/hr		$ 275.00	confirm rate
Daily Rate per truck	$/day		$ 6,600	24 pay hours
Daily Rate for 3 trucks	$/day	3.0	$ 19,800	

CAT 994D Front End Loader (20m^3 Capacity)

Hourly Rate	$/hr		$ 600.00	confirm rate
Daily Rate per loader	$/day		$ 14,400	24 pay hours
Daily Rate for 2 loaders	$/day	2.0	$ 28,800	

Rollingstock

Locomotive - Purchase Cost	ea	$ 2,200,000	Research results
Locomotive - Salvage Value (@ 20%)	ea	$ 440,000	Research results
Side-dump rail car - Purchase Cost	ea	$ 80,000	Research results
Side-dump rail car - Salvage Value (@ 20%)	ea	$ 16,000	Research results
Locomotive operating cost	$/day/unit	$ 1,500	Research results
Locomotive maintenance cost	$/day/unit	$ 1,000	Research results
Rail car operating/maintenance cost	$/day/unit	$ 100	Research results

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Railway Operation and Maintenance Costs

Rollingstock					
Daily Operating Cost for 10 Locos	$/day	10	$ 15,000		
Daily Maintenance Cost for 10 Locos	$/day	10	$ 10,000		
Daily Maintenance Cost for 250 Rail Cars	$/day	250	$ 25,000		
Rollingstock					
Daily Operating Cost for 14 Locos	$/day	14	$ 21,000		
Daily Maintenance Cost for 14 Locos	$/day	14	$ 14,000		
Daily Maintenance Cost for 350 Rail Cars	$/day	350	$ 35,000		
Track					
No. Mainline Tracks	no.	2			
Daily maintenance cost	$/km/day	47.2	$ 750.00	$	35,400

Haul Roads

Construction Cost per km	$/km		$3,000,000.00		
Maintenance Cost per km per day	$/km/day		$1,000.00		
Daily maintenance cost for 10 km of haul road	$/day	10.0	$10,000.00		

Conveyor System

Stockpile System - Electrical Power	kWh/day	142,200	$0.06	$	8,532

Transportation Costs

Item	Unit	Qty	Price/Rate		Total	Comments
Railway Equipment and Construction						
20m3 Front End Loader	day	1,725	$ 28,800	$	49,680,000	Transfer from stockpile to truck and island earthworking
105m3 Off-Road Trucks	day	118	$ 95,456	$	11,306,433	Transfer from excavtion stockpiles to train loading system
41.5m3 Off-Road Trucks	day	1,607	$ 19,800	$	31,809,535	Excavation site to transfer station
Railcar Loading Station	no.	4	$ 3,000,000	$	12,000,000	Source: EDC report April 2003
Railway Equipment/Maint/Operation	tonne.km	3,505,725,720	$ 0.050	$	175,286,286	** Cost comparison provided by 'Rollingstock Costs' below
Railway Construction	track.km	57	$ 866,100	$	49,540,920	Including survey, boreholes, formation & trackwork
Railway Bridge (Pan American Highway)	LS	1	$ 3,500,000	$	3,500,000	
Railway culverts	no.	22	$ 120,000	$	2,640,000	
Grade crossings	no.	3	$ 20,000	$	60,000	
Track Maintenance	day	1,725	$ 35,400	$	61,065,000	
Haul Roads						
Haul Road Construction	km	8.0	$ 3,000,000	$	24,000,000	Stockpile to island for causeway and railway formation material
Haul Road Culverts	no.	5.0	$ 150,000	$	750,000	
Haul Road Maintenance	day	118	$ 10,000	$	1,184,460	Duration of caueway + formation construction only

Total Cost - Material Transportation	**$422,822,634**
Unit cost of transport per m^3	**$4.84**

Rollingstock Costs

Item	Unit	Qty	Price/Rate		Comments
Rollingstock Purchase Costs					
Phase1					Transport to stockpile only
Locomotives	no.	12	$ 2,200,000	$ 26,400,000	Includes backup loco(s)
Rail cars	no.	260	$ 80,000	$ 20,800,000	Includes backup rail cars
Phase2					Transport to island
Additional Locomotives	no.	4	$ 2,200,000	$ 8,800,000	Includes backup loco(s)
Additional Rail cars	no.	100	$ 80,000	$ 8,000,000	Includes backup rail cars
Operating/Maintenance Costs					
Phase1					Transport to stockpile only
Operational cost of locomotives	day	118	$ 15,000	$ 1,776,690	
Maintenance cost of locomotives	day	118	$ 10,000	$ 1,184,460	
Maintenance cost of rail cars	day	118	$ 25,000	$ 2,961,150	
Phase2					Transport to island
Operational cost of locomotives	day	1607	$ 21,000	$ 33,737,386	
Maintenance cost of locomotives	day	1607	$ 14,000	$ 22,491,590	
Maintenance cost of rail cars	day	1607	$ 35,000	$ 56,228,976	
Salvage Value					
Locomotives	no.	16	$ 440,000	$ (7,040,000)	
Rail cars	no.	360	$ 16,000	$ (5,760,000)	

**** Total Cost - Rollingstock**	**$169,580,251**

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Backup Calculations

Project Specifications - Barge Haul

Item	Unit	Qty	Price/Rate	Total	Comments
Cells requiring user input are highlighted thus:					
General Parameters					
Total Material to be Hauled	m3	**87,381,000**			
Time to transport material	year	5.00			
Working Days per Year	day/year	345			
Total Working Days	day	1,725			
Calculated Target Production	m3/day	**50,656**			
ACP Production Rate - Dry	m3/day	22,609			based on published average production rate of 150,000m3/week
Working Hours per day	hr	21			
Equipment Parameters					
4600m3 Scow					
Scow Capacity	m3	2,760			Assume 60% fill factor
Total scow trips required to move material	no.	31,660			
Scow/Tug trips required per day	no.	18.35			
41m3 Clamshell Bucket Dredge					used to calculate transport cycles
Single Bucket Capacity	m3	41.3			
Bucket Fill Factor	no.	45%			
Factored Bucket Capacity	m3	18.585			
Bucket Cycle Time	sec	120			
Production Rate for 41m3 clamshell + crane	m3/hr	557.55			Compares with CEDEP (Corps of Engineers cost model)
Daily Loading Rate (hourly rate x working hours)	m3/day	11,708.55			
No. Dredges Required to maintain 1/2 Target Rate	**no.**	**5.0**			
Hourly Loading Rate for 5 dredge(s)	**m3/hr**	**2,787.8**			Indicates train loading rate
CAT 994D Front End Loader (20m^3 Capacity)					Used for hopper loading at transfer station
Single Bucket Capacity	m3	20.0			
Bucket Fill Factor	no.	70%			
Factored Bucket Capacity	m3	14			
Dig/Load Cycle Time	sec	45.0			
Production Rate for Loader	m3/hr	1120.0			Comparison: Harza Report, 1200m3/hr
Daily Loading Rate per Loader	m3/day	23,520.00			
No. Loaders Required to maintain Target Rate	**no.**	**3.0**			
Hourly Loading Rate for 3 Loaders	**m3/hr**	**3,360.0**			
CAT 789C Off-Road Truck (105m3 Capacity)					
Truck Capacity (Max.)	m3	105			
Truck Capacity (Struck)	m3	73			
Total Truck Trips Required to Meet Target	no.	1,197,000			
Calculated truck trips per day	no.	694.0			
Max. load/unload time per truck *	hr	0.030			Note: logistics check
* Note: If this value is less than either calculated load or unload time below, then load/unload maximum is exceeded - increase time to completion					
Truck Transportation Cycle					Excavation site to transfer station
Average one-way distance	km	4.5			Source: site plan
Average Truck Travel Speed		30			
Estimated Load Time	hr	0.022			1.3 minutes
Estimated Travel Time (Round Trip)	hr	0.300			Calculated round-trip distance of 9 km
Estimated Unload Time	hr	0.042			2.5 minutes
Total Cycle Time	**hr**	**0.36**			
Calculated Trips Per Truck per Day	no.	57.8			
No. 105m3 Trucks Required (long haul)	**no.**	**13.0**			
No. 41.5m3 Trucks Required (short haul < 1km)	**no.**	**3.0**			Arbitrary no. used to maintain continuous flow from excavation site
Scow Transportation Cycle					Transfer to disposal
Average one-way distance (transfer station to disposal site)	km	16.6			Ref: site plan
Average Scow/Tug Travel Speed	km/hr	7			
Time to Load Scow	hr	0.82			
Average Travel Time (round Trip)	hr	4.74			
Time to Berth and Dump Scow	hr	0.50			
Total trip cycle time	**hr**	**6.06**			
Max trips per scow per day (assuming 21 operating hours)	no.	3.46			
No. Scow(s) required	**no.**	**7.0**			
No. Tow Tug(s) required	**no.**	**7.0**			Tug estimate based on cycle time

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Equipment Costs

Scow/Tugs				
46000m3 scow (includes labor and operating costs)	$/day		$ 2,579	Source: Corps of Engineers, divide monthly cost by 30.4375
4000HP towing tug (includes labor and operating costs)	$/day		$ 11,253	Source: Corps of Engineers, divide monthly cost by 30.4375
Total cost for 7 scow(s)	$/day	7.00	$ 18,053	
Total cost for 7 tow tug(s)	$/day	7.00	$ 78,768	
230t Manitowoc Crane + 41m3 Clamshell Bucket				
Hourly Rate (inclusive)	$/hr		$ 500	
Daily rate per crane	$/day		$ 12,000	24 pay hours per day
Daily cost for crane(s) (loading 21 hours per day)	$day	5.00	$ 60,000	
CAT 789C Off-Road Truck (105m3 Capacity)				
Hourly Rate	$/hr		$ 331.45	
Daily Rate per truck	$/day		$ 7,955	24 pay hours per day
Daily Rate for 13 trucks	$/day	13.00	$ 103,411	
CAT 775E Off-Road Truck (41.5m^3 Capacity)				
Hourly Rate	$/hr		$ 275.00	
Daily Rate per truck	$/day		$ 6,600	24 pay hours
Daily Rate for 3 trucks	$/day	3.0	$ 19,800	
CAT 994D Front End Loader (20m^3 Capacity)				
Hourly Rate	$/hr		$ 600.00	
Daily Rate per loader	$/day		$ 14,400	24 pay hours
Daily Rate for 3 loader(s)	$/day	3.0	$ 43,200	

Haul Roads

Construction Cost per km	$/km	$750,000.00	
Maintenance Cost per km per day	$/km/day	$1,000.00	
Daily maintenance cost for km of haul road	$/day	$5,000.00	grader + water truck

Conveyor System

Barge Loader	kWh/day	22,500	$0.06	$ 1,350	

Transportation Costs

Item	Unit	Qty	Price/Rate	Total	Comments
Equipment					
105m3 Off-Road Trucks	day	1,725.0	$ 103,411	$ 178,384,237	Excavation site to transfer station
41.5m3 Off-Road Trucks	day	1,725.0	$ 19,800	$ 34,155,000	Excavation site to transfer station
20m3 Front End Loader	day	1,725.0	$ 43,200	$ 74,520,000	Barge loading
4600m3 Scow	day	1,725.0	$ 18,053	$ 31,142,094	
4000HP Tug	day	1,725.0	$ 78,768	$ 135,874,743	
41m3 Clamshell Bucket Dredge	day	897.0	$ 60,000	$ 53,820,000	Clamshell not required until fill elevation is above -5m (MLWS)
Transfer Station					
Equipment/Construction					
Barge Loader	LS	1.0	$ 9,000,000	$ 9,000,000	
Berth Structure	m2	2,000.0	$ 1,300	$ 2,600,000	
Operation and Maintenance					
Barge Loader	tonne	152,916,750.0	$ 0.09	$ 13,762,508	
Electrical Power					
Barge Loader	day	1,725.0	$ 1,350	$ 2,328,750	
Haul Roads					
Haul Road Construction	km	6.0	$ 3,000,000	$ 18,000,000	
Haul Road Culverts	no.	5.0	$ 150,000	$ 750,000	
Haul Road Maintenance	day	1,725.0	$ 5,000	$ 8,625,000	1 grader + 1 water truck

Total Cost - Material Transportation	**$562,962,332**
Unit cost of truck and scow haul per m^3	**$6.44**

Backup Calculations

Project Specifications - Truck Haul

Item	Unit	Qty	Price/Rate	Total	Comments
Cells requiring user input are highlighted thus:					
General Parameters					
Total Material to be Hauled	m3	**87,381,000**			
Time to transport material	year	5.00			
Working Days per Year	day/year	345			
Total Working Days	day	1,725			
Calculated Target Production	m3/day	**50,656**			
ACP Production Rate - Dry	m3/day	22,609			based on published average production rate of 150,000m3/week
Working Hours per day	hr	21			
Equipment Parameters					
CAT 5230B Mass Excavator/Shovel (17m3 bucket)					Excavation site material removal - cost not included (production check)
Single Bucket Capacity	m3	17.0			
Bucket Fill Factor	no.	55%			
Factored Bucket Capacity	m3	9.35			
Bucket Cycle Time	sec	30.0			
Production Rate for Excavator	m3/hr	1122.0			Comparison: Harza Report, 1200m3/hr
Daily Loading Rate per Excavator	m3/day	23,562.00			
No. Excavators Required to maintain Target Rate	**no.**	**3.0**			
Hourly Loading Rate for 3 Excavator(s)	m3/hr	**3,366.0**			
CAT 994D Front End Loader (20m^3 Capacity)					Intermediate transfer to ensure continuous removal from excavation site
Single Bucket Capacity	m3	20.0			
Bucket Fill Factor	no.	70%			
Factored Bucket Capacity	m3	14			
Dig/Load Cycle Time	sec	45.0			
Production Rate for Loader	m3/hr	1120.0			Comparison: Harza Report, 1200m3/hr
Daily Loading Rate per Loader	m3/day	23,520.00			
No. Loaders Required to maintain Target Rate	**no.**	**3.0**			
Hourly Loading Rate for 3 Loaders	**m3/hr**	**3,360.0**			
CAT 789C Off-Road Truck (105m3 Capacity)					
Truck Capacity (Max.)	m3	105			
Truck Capacity (Struck)	m3	73			
Total Truck Trips Required to Meet Target	no.	1,197,000			
Calculated truck trips per day	no.	694.0			
Max. load/unload time per truck *	hr	0.030			Note: logistics check
* Note: If this value is less than either calculated load or unload time below, then load/unload maximum is exceeded - increase time to completion					
Truck Transportation Cycle					
Average one-way distance (excavation site to shoreline stockpile)	km	18.5			Source: site plan
Average Truck Travel Speed		30			
Estimated Load Time	hr	0.022			1.3 minutes
Estimated Travel Time (Round Trip)	hr	1.233			Calculated round-trip distance of 37 km
Estimated Unload Time	hr	0.042			2.5 minutes
Total Cycle Time	**hr**	**1.30**			
Calculated Trips Per Truck per Day	no.	16.2			
No. 105m3 Trucks Required (long haul)	**no.**	**43.0**			
No. 41.5m3 Trucks Required (short haul < 1km)	**no.**	**6.0**			Arbitrary no. used to maintain continuous flow at transfer station

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Equipment Costs

CAT 789C Off-Road Truck (105m3 Capacity)				
Hourly Rate	$/hr		$ 331.45	
Daily Rate per truck	$/day		$ 7,955	24 pay hours per day
Daily Rate for 43 trucks	$/day	43	$ 342,052	
CAT 775E Off-Road Truck (41.5m^3 Capacity)				
Hourly Rate	$/hr		$ 275.00	
Daily Rate per truck	$/day		$ 6,600	24 pay hours
Daily Rate for 6 trucks	$/day	6.0	$ 39,600	
CAT 994D Front End Loader (20m^3 Capacity)				
Hourly Rate	$/hr		$ 600.00	
Daily Rate per loader	$/day		$ 14,400	24 pay hours
Daily Rate for 3 loader	$/day	3	$ 43,200	
Haul Roads				
Construction Cost per km	$/km		$3,000,000.00	
Daily maintenance cost of haul road	$/day		$10,000.00	2 graders + 2 water trucks

Transportation Costs

Item	Unit	Qty	Price/Rate	Total	Comments
Equipment					
105m3 Off-Road Trucks	day	1,725.0	$ 342,052	$ 590,040,169	
41.5m3 Off-Road Trucks	day	1,725.0	$ 39,600	$ 68,310,000	
20m3 Front End Loader	day	1,725.0	$ 43,200	$ 74,520,000	
Haul Roads					
Haul Road Construction	km	20.0	$ 3,000,000	$ 60,000,000	
Haul Road Bridge (Pan American Highway)	no.	1.0	$ 4,800,000	$ 4,800,000	
Haul Road Culverts	no.	22.0	$ 150,000	$ 3,300,000	
Haul Road Maintenance	day	1,725.0	$ 10,000	$ 17,250,000	

Total Cost - Material Transportation	**$818,220,169**
Unit cost of truck haul per m^3	**$9.36**

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Backup Calculations

Project Specifications - Truck and Scow Haul to M4

Item	Unit	Qty	Price/Rate	Total	Comments
Cells requiring user input are highlighted thus:					
General Parameters					
Total Material to be Hauled	m3	**87,381,000**			
Material for Causeway & Initial Offshore Railway Formation	m3	**6,000,000**			
Total rock required > 600mm for protection	m3	**3,074,548**			Causeway and revetment protection
Causeway/formation core material		**2,925,452**			Transported from stockpile to island
Material to be transported by conveyor	m3	**84,306,452**			
Time to transport material	year	5.00			
Working Days per Year	day/year	345			
Total Working Days	day	1,725			
Working Days (Large Material)	day	670			
Working Days (Causeway/Formation Material)	day	58			
Calculated Target Production	m3/day	**50,656**			excludes large rock to be transported by road
ACP Production Rate - Dry	m3/day	22,609			based on published average production rate of 150,000m3/week
Working Hours per day	hr	21			
Equipment Parameters					
CAT 994D Front End Loader (20m^3 Capacity)					Intermediate transfer to ensure continuous removal from excavation site
Single Bucket Capacity	m3	20.0			
Bucket Fill Factor	no.	70%			
Factored Bucket Capacity	m3	14			
Dig/Load Cycle Time	sec	45.0			
Production Rate for Loader	m3/hr	1120.0			Comparison: Harza Report, 1200m3/hr
Daily Loading Rate per Loader	m3/day	23,520.00			
No. Loaders Required to maintain Target Rate	**no.**	**3.0**			
Hourly Loading Rate for 3 Loaders	**m3/hr**	**3,360.0**			
CAT 789C Off-Road Truck (105m3 Capacity)					
Truck Capacity (Max.)	m3	105			
Truck Capacity (Struck)	m3	73			
Total Truck Trips Required to Meet Target (large material)	no.	42,117			
Total Truck Trips Required to Meet Target (causeway/formation)	no.	40,075			
Calculated truck trips per day (large material)	no.	63.0			
Calculated truck trips per day (causeway/formation material)	no.	691.0			
Max. load/unload time per truck *	hr	0.333			Note: logistics check
* Note: If this value is less than either calculated load or unload time below, then load/unload maximum is exceeded - increase time to completion					
Truck Transportation Cycle 1					Material > 600mm from excavation site to island
Average one-way distance (excavation site to island)	km	18.6			Source: site plan
Average Truck Travel Speed	km/hr	30			
Estimated Load Time	hr	0.033			2 minutes - assumed loading by 2 loaders
Estimated Travel Time (Round Trip)	hr	1.240			Calculated round-trip distance of 37.2 km
Estimated Unload Time	hr	0.042			2.5 minutes
Total Cycle Time	**hr**	**1.31**			
Calculated Trips Per Truck per Day	no.	16.0			
No. 105m3 Trucks Required (long haul)	**no.**	**4.0**			Large material from excavation site
Truck Transportation Cycle 2					Stockpile to excavation site, prior to installation of railway access
Average one-way distance (excavation site to island)	km	8.0			Source: site plan
Average Truck Travel Speed	km/hr	25			
Estimated Load Time	hr	0.033			2 minutes - assumed loading by 2 loaders
Estimated Travel Time (Round Trip)	hr	0.640			Calculated round-trip distance of 16 km
Estimated Unload Time	hr	0.042			2.5 minutes
Total Cycle Time	**hr**	**0.71**			
Calculated Trips Per Truck per Day	no.	29.4			
No. 105m3 Trucks Required	**no.**	**24.0**			causeway & formation material
Equipment Costs					
CAT 789C Off-Road Truck (105m3 Capacity)					
Hourly Rate	$/hr		$ 331.45		
Daily Rate per truck	$/day		$ 7,955		24 pay hours per day
Daily Rate for 4 trucks	$/day	4	$ 31,819		Transport of large material
Daily Rate for 24 trucks	$/day	24	$ 190,913		Transport from stockpile to causeway/formation
CAT 994D Front End Loader (20m^3 Capacity)					
Hourly Rate	$/hr		$ 600.00		
Daily Rate per loader	$/day		$ 14,400		24 pay hours
Daily Rate for 5 loader(s)	$/day	5	$ 72,000		3 @ loading sites + 2 @ transfer stockpile/island earthworks
Haul Roads					
Construction Cost per km	$/km		$3,000,000.00		
Maintenance Cost per km per day	$/km/day				
Daily maintenance cost for 8 km of haul road	$/day	8	$5,000.00		1 grader + 1 water truck
Conveyor System					
Loading Stations - Electrical Power	kWh/day	121,500	$0.06	$ 7,290	Source: EDC Material Handling Report - April 2003
Overland Conveyor - Electrical Power	kWh/day	202,500	$0.06	$ 12,150	Source: EDC Material Handling Report - April 2003
Stacker - Electrical Power	kWh/day	14,400	$0.06	$ 864	Source: EDC Material Handling Report - April 2003

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Transportation Costs

Item	Unit	Qty	Price/Rate	Total	Comments
Equipment					
105m3 Off-Road Trucks - Cycle 1	day	670.0	$ 31,819	$ 21,318,607	Transport of large material (>600mm)
105m3 Off-Road Trucks - Cycle 2	day	58.0	$ 190,913	$ 11,072,948	Transport from stockpile to causeway/island
20m3 Front End Loader	day	1,725.0	$ 72,000	$ 124,200,000	
Haul Roads					
Haul Road Construction	km	18.6	$ 3,000,000	$ 55,800,000	
Haul Road Bridge (Pan American Highway)	no.	1.0	$ 4,800,000	$ 4,800,000	
Haul Road Culverts	no.	22.0	$ 150,000	$ 3,300,000	
Haul Road Maintenance	day	670.0	$ 5,000	$ 3,350,000	
Material Handling (Conveyor) System					
Construction					
Loading Stations	no.	4.00	$ 3,000,000	$ 12,000,000	Material recovery at excavation site
Overland Conveyor	LS	1.00	$ 55,000,000	$ 55,000,000	
Conveyor Bridge (Pan American Highway)	LS	1.00	$ 2,500,000	$ 2,500,000	
Stacker	LS	1.00	$ 3,000,000	$ 3,000,000	Stacking and sorting at shoreline stockpile
Operation and Maintenance					
Loading Stations	tonne	147,536,291	$0.30	$ 44,260,887	
Overland Conveyor	tonne	147,536,291	$0.61	$ 89,997,138	
Stacker	tonne	147,536,291	$0.07	$ 10,327,540	
Electrical Power					
Loading Stations	day	1,725	$7,290.00	$ 12,575,250	
Overland Conveyor	day	1,725	$12,150.00	$ 20,958,750	
Stacker	day	1,725	$864.00	$ 1,490,400	

Total Cost - Material Transportation	**$475,951,520**
Unit cost of conveyor haul per m^3	**$5.45**

CAUSEWAY CONSTRUCTION

General Specifications

Core Material Required for Causeway	m^3	3,798,183	includes bridge approaches, excludes armor
Armor Required	m^3	535,150	
Total Material Required for Causeway	m^3	4,333,333	
Loading Rate of Truck Loader	m3/hr	2,571	Conveyor/hopper loader at stockpile site (@ 4500 TPH)
Working Hours	hr	21	
Pay Hours	hr	24	
Production Target	m3/day	54,000	
Estimated Time to Completion	**days**	**80**	0.24 Years - excl. time to transport and place armor

Equipment Specifications

CAT 789 Off-Road Truck

Truck Capacity (Max.)	m3	105	
Truck Capacity (Struck)	m^3	73	Ref: Caterpillar web site
Total Truck Trips Required to Meet Target	no.	52,030	
Calculated truck trips per day	no.	651	
Max. load/unload time per truck *	hr	0.032	1.94 minutes per truck - logistics check

Truck Transportation Cycle

Average one-way distance (shoreline stockpile to island)	km	10.0	Source: site plan
Average Truck Travel Speed		25	
Estimated Load Time	hr	0.028	Truck capacity / Shovel Production
Estimated Travel Time	hr	0.400	
Estimated Unload Time	hr	0.05	3 minutes
Total Cycle Time	hr	0.478	
Calculated Trips Per Truck per Day	no.	43.9	
No. 105m3 Trucks Required	**no.**	**15.0**	

CAT D-9 Bulldozer

Working Rate per Dozer / Hour	m3/hr	1,300	Arbitrary estimate
Working Rate per Dozer / Day	m3/day	27,300	
Estimated Bulldozers Required	**no.**	**2.0**	

Equipment Costs

CAT 789C Off-Road Truck (105m3 Capacity)

Hourly Rate	$/hr		$ 331.45	
Daily Rate per truck	$/day		$ 7,955	24 pay hours per day
Daily Rate for 15 trucks	$/day	15	$ 119,321	

CAT D-9 Bulldozer

Hourly Cost per Dozer	$/hr		$ 213.99	Based on Harza Estimate. Incl. Maint, O/H, Taxes, Bonds and Profit
Daily Cost per Dozer @ 20 pay hours per day	$/day		$ 5,136	24 pay hours per day
Daily Cost for 2 dozer(s)	$/day	2	$ 10,272	

CAT 16H Grader

Estimated no. required	**no.**	**1**		Arbitrary estimate
Hourly Rate	$/hr		$ 101.20	Based on Harza Estimate. Incl. Maint, O/H, Taxes, Bonds and Profit
Daily Rate per truck	$/day		$ 2,429	24 pay hours per day
Daily Cost for 1 grader(s)	$/day	1	$ 2,429	

Construction Costs

Item	Unit	Qty	Price/Rate	Total	Comments
Equipment Costs					
CAT 789 Trucks	day	80	$119,320.56	$ 9,545,645	
CAT D-9 Bulldozers	day	80	$10,271.67	$ 821,734	
CAT 16H Graders	day	80	$2,428.86	$ 194,309	
Armor Stone Placement	m^3	535,150	$ 20.00	$ 10,703,000	

Total Cost - Causeway	**$21,264,687**
Unit cost per m^3	**$4.91**

ISLAND CONSTRUCTION

General Specifications

Material Available for Island Fill	m^3	79,642,269	remainder excluding breakwater, causeway and revetment volumes
Material Required for Revetment	m^3	979,398	
Total Material Required for Island	m^3	80,621,667	
Loading Rate of Truck Loader	m3/hr	2,571	Conveyor/hopper loader at stockpile site (@ 4500 TPH)
Working Hours	hr	21	
Pay Hours	hr	24	
Production Target	m3/day	54,000	
Estimated Time to Completion	**days**	**1,480**	4.29 Years - Truck Transport Component

Equipment Specifications

CAT 789 Off-Road Truck

Truck Capacity (Max.)	m3	105	
Truck Capacity (Struck)	m^3	73	Ref: Caterpillar web site
Total Truck Trips Required to Meet Target	no.	1,090,990	
Calculated truck trips per day	no.	738	
Max. load/unload time per truck *	hr	0.028	1.71 minutes per truck - logistics check

Truck Transportation Cycle

Average one-way distance (excavation site to shoreline stockpile)	km	15.0	Source: site plan
Average Truck Travel Speed		25	
Estimated Load Time	hr	0.028	Truck capacity / Shovel Production
Estimated Travel Time	hr	0.600	
Estimated Unload Time	hr	0.05	3 minutes
Total Cycle Time	hr	0.678	
Calculated Trips Per Truck per Day	no.	31.0	
No. 105m3 Trucks Required	**no.**	**24.0**	

CAT D-9 Bulldozer

Working Rate per Dozer / Hour	m3/hr	1,300	Arbitrary estimate
Working Rate per Dozer / Day	m3/day	27,300	
Estimated Bulldozers Required	**no.**	**2.0**	

Equipment Costs

CAT 789C Off-Road Truck (105m3 Capacity)

Hourly Rate	$/hr		$ 331.45	
Daily Rate per truck	$/day		$ 7,955	24 pay hours per day
Daily Rate for 24 trucks	$/day	24	$ 190,913	

CAT D-9 Bulldozer

Hourly Cost per Dozer	$/hr		$213.99	Based on Harza Estimate. Incl. Maint, O/H, Taxes, Bonds and Profit
Daily Cost per Dozer @ 20 pay hours per day	$/day		$5,135.84	
Daily Cost for 2 dozer(s)	$/day	2.0	$10,271.67	

CAT 16H Grader

Estimated no. required	**no.**	**1**		Arbitrary estimate
Hourly Rate	$/hr		$ 101.20	Based on Harza Estimate. Incl. Maint, O/H, Taxes, Bonds and Profit
Daily Rate per truck	$/day		$ 2,429	24 pay hours per day
Daily Cost for 1 grader(s)	$/day	1	$ 2,429	

Construction Costs

Item	Unit	Qty	Price/Rate	Total	Comments
Equipment Costs					
CAT 789 Trucks	day	1,480	$190,912.90	$ 282,551,086	
CAT D-9 Bulldozers	day	1,480	$10,271.67	$ 15,202,077	
CAT 16H Graders	day	1,480	$2,428.86	$ 3,594,709	
Revetment					
Armor Stone Placement	m^3	979,398	$ 15.00	$ 14,690,967	

Total Cost - Island Fill	**$316,038,839**
Unit cost per m^3	**$3.92**

BREAKWATER

Breakwater Costs

Item	Unit	Qty	Price/Rate	Total	Comments
Breakwater Construction					
Armor Placement	m^3	1,560,000	20	$ 31,200,000	
Core Placement	m^3	3,640,000	10	$ 36,400,000	

TOTAL COST - BREAKWATER	**$67,600,000**
Unit cost of breakwater per m^3	**$13.00**

Panama - Artificial Island Development Study

Estimated Cost - Dredging

Item	Units	Quantity	Unit Price	Cost
Soft Mat'l Around Island				**$7,955,100**
Island	m^3	3,600,000	$2.00	$7,200,000
Causeway	m^3	377,550	$2.00	$755,100
Navigation Channel				**$41,164,700**
Total Dredged Volume	m^3	9,512,640		
Dredging in Soft Material	m^3	8,183,400	$2.00	$16,366,800
Dredging in Weathered Rock	m^3	648,700	$12.00	$7,784,400
Dredging in Dense Rock	m^3	680,540	$25.00	$17,013,500
TOTAL				**$49,119,800**

Panama - Artificial Island Development Study

Item	Quantity	Unit	Comments
Material from Channel			
Wet Overburden	1,450,000	m^3	Taken from Harza report
Dry Overburden	12,420,000	m^3	Taken from Harza report
Wet Rock	5,820,000	m^3	Taken from Harza report
Dry Rock	49,660,000	m^3	Taken from Harza report
Bulking Factors (placed:in-situ)			
Wet Overburden	1.3		Materials handbook
Dry Overburden	1.3		Materials handbook
Wet Rock	1.30		Materials handbook
Dry Rock	1.30		Materials handbook
Bulked Volumes			Used for transportation and fill calculations
Wet Overburden	1,885,000	m^3	
Dry Overburden	16,146,000	m^3	
Total Overburden	**18,031,000**	**m^3**	
Wet Rock	7,566,000	m^3	
Dry Rock	64,558,000	m^3	
Total Rock	**72,124,000**	**m^3**	
Total Material Available (gross)	**90,155,000**		
Causeway Volume Calcs			
Length	3850	m	Total causeway length (excluding trestle and bridge)
Avg. Crest Elevation (PLD)	6	m	Converted from PLD
Avg. Bottom Elevation (PLD)	-4.7	m	Calculated from DTM profile
Avg. Height	12.45	m	Includes 1.75m settlement
Crest Width	55	m	Preliminary Design
Avg. Base Width	104.8	m	Calculated
Avg. Sectional Area - Armor	139	m^2	
Sectional Area - Core	855.755	m^2	
Material consumed			
Bridge Approaches	**666,667**		used in retained-earth approaches
Causeway Fill Volume - Total	**3,666,667**	**m^3**	Volume of rock required for causeway (DTM volume + shrinkage + settlement)
Causeway Volume- Armor	**535,150**	**m^3**	Calculated from Avg Area x Length - for cost estimate
Causeway Volume- Core	**3,131,517**	**m^3**	Total volume - armor volume
Breakwater Volume Calcs			
Length	3400	m	Refer report Figure 9-5
Bottom elevation (MLWS)	-16	m	Includes 3m settlement
Sectional Area - Armor	442.00	m^2	Refer report Figure 9-4 for typical geometry
Sectional Area - Core	1053.00	m^2	Refer report Figure 9-4 for typical geometry
Material consumed			
Armor Volume	**1,560,000**	**m^3**	30% of total volume
Core Volume	**3,640,000**	**m^3**	70% of total volume
Total Volume	**5,200,000**	**m^3**	Volume of rock required for breakwater (DTM volume + shrinkage + settlement)
Island Assumptions/Criteria			
MHWS Elevation (PLD)	2.7	m	
Freeboard Allowance	3.3	m	
Finished Surface Elevation (PLD)	6		
Island Revetment Volume Calcs			
Perimeter (revetment) Length	8,000	m	Based on layout as shown in report Figure 9-5
Average Island Height Above Seabed	21.9	m	
Revetment Side Slopes	2H:1V		
Sectional Area - Armor	122.42	m^2	
Armor Volume	**979,398**	m^3	Used for revetment cost item
Island Fill Calculation			
Total Material Available for Island & Revetment Construction (1)	**80,621,667**	**m^3**	Excludes causeway and breakwater volumes
Remaining Material for Island Fill	**79,642,269**	**m^3**	Used to calculate island construction cost (excludes revetment armor)
Bulked Overburden from Excavation (2)	18,031,000	m^3	
Min. Overburden Depth	4	m	Allows for utilities and spread footing construction

Calculated Island Area (1)	**368.14**	**Ha**	**Maximum from available material volume (incl. revetment)**
Calculated Island Area (2)	**450.78**	**Ha**	**Maximum (Overburden vol / Overburden depth)**

Actual Area as Designed	**328.00**	**Ha**	**Refer report figure xx**

Panama - Artificial Island Development Study

Table of Standard Input Values

Item	Unit	Total	Comments
Equipment Specifications			
CAT 789 Off-Road Truck (105m^3 Capacity)			
Hourly Rate	$/hr	$ 331.45	
Load Capacity	m3	105.00	
Average Speed	km/h	20	
CAT 5230 Front Shovel (17m^3 bucket)			
Hourly Rate	$/hr	$ 592.95	
Single Bucket Capacity	m3	17.00	
Hourly Dig/Load Production Rate	m3/hr	1,200.00	
CAT 994D Front End Loader (20m^3 Capacity)			
Hourly Rate	$/hr	$ 600.00	
CAT D-9 Bulldozer			
Hourly Rate	$/hr	$ 213.99	
Hourly Production	m3/hr	1,000	
CAT 16H Grader			
Hourly Rate	$/hr	$ 101.20	
Rail Haul + Equipment			
One-way Haul Distance	km	23	
Daily Target (loading)	m3	48000	Applies to island earthworking also
Average Train Speed	km/h	20	
Rail Car Capacity	m3	40	
Rail Cars per Unit Train	no.	50	
Train Set Capacity	m3	2000	
Locomotive - Purchase Cost	ea	$ 2,200,000	Research results
Locomotive - Salvage Value (@ 30%)	ea	$ 660,000	Research results
Side-dump rail car - Purchase Cost	ea	$ 120,000	Research results
Side-dump rail car - Salvage Value (@ 40%)	ea	$ 48,000	Research results
Locomotive operational cost	$/day/unit	$ 1,300	Research results
Locomotive maintenance cost	$/day/unit	$ 900	Research results
Rail car maintenance cost	$/day/unit	$ 75	Research results

APPENDIX C - ACP GEOTECHNICAL REPORTS

Panama Canal Authority

Engineering and Projects Department

Engineering Division

Geotechnical Branch

Artificial Island Proposed Railroad Alignment Project

Requested: Canal Capacity Division

Prepared by:
Itza Díaz, Geologist
Xenia Ríos, Eng. Technician
Carlos Rodríguez

July 25, 2002

Attachments

- ***Local Area Map***
- ***Geological data***
- ***Laboratory Test***
- ***Table Classification***

The following report demonstrates the results of the PITS investigation for the right-of-way for the rails line on the west bank of the canal. (Atch, local maps). This investigation had the objective of classify the soil supporting the right-of-way to be used for the transportation of spoil material from the third locks areas to the dumpsites.

Work Method

A survey was accomplished to locate the best areas for each of the PITS. This was based on geological factors and terrain features.

The dimensions of each PIT were approximately 2.50 m deep, 4.00 m long and 2.50 m wide.

The excavations were accomplished by using a D6 to remove standing overgrowth and a backhoe to dig the PIT.

Each recovered soil sample was sent to the Geotechnical laboratories for analysis.

Results

From each PIT there was recovered two samples for lab analysis, each was properly packaged and tagged. Test to be accomplished were dry density, wet density, specific gravity, moisture content, passing test, maximum liquid limit, plasticity limit. The following field results were obtained:

PIT-1:

0.00 a 0.15 m organic soil, de 0.15 m a 1.75 m soil classification MH

PIT-2:

0.00 a 0.15 m organic soil, de 0.15 m a 1.55 m soil classification SM

PIT-3:

0.00 a 0.42 m organic soil, de 0.42 m a 1.48 m soil classification SM

PIT-4:

0.00 a 0.23 m organic soil, de 0.23 m a 1.93 m soil classification SM

PIT-5:

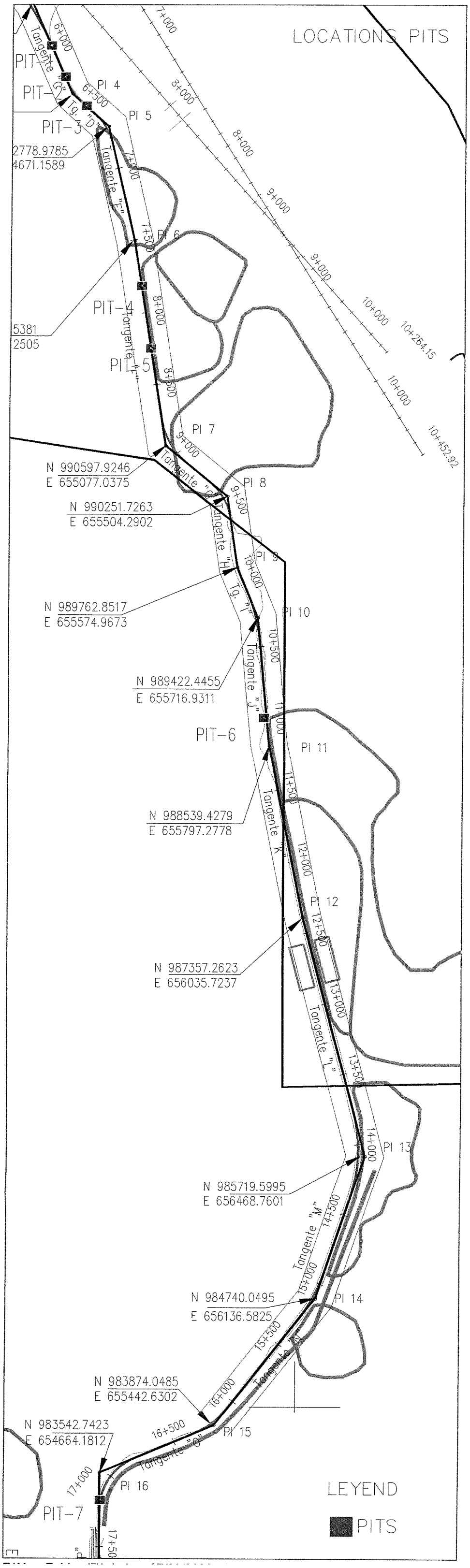
0.00 a 0.12 m organic soil, de 0.12 m a 2.29 m soil classification CH and MH

PIT-6:

0.00 a 0.27 m organic soil, de 0.27 m a 2.09 m soil classification SC and SM

PIT-7:

0.00 a 0.75 m organic soil, de 0.75 m a 1.14 m soil classification SC and SM


LOCATIONS PITS
PIT-1
PIT-2
PIT-3
PIT-4
PIT-5
PIT-6
PIT-7
PI 4
PI 5
PI 6
PI 7
PI 8
PI 9
PI 10
PI 11
PI 12
PI 13
PI 14
PI 15
PI 16
Tangente "C"
Tg. "D"
Tangente "E"
Tangente "F"
Tangente "G"
Tangente "H"
Tg. "I"
Tangente "J"
Tangente "K"
Tangente "L"
Tangente "M"
Tangente "N"
Tangente "O"
2778.9785
4671.1589
5381
2505
N 990597.9246
E 655077.0375
N 990251.7263
E 655504.2902
N 989762.8517
E 655574.9673
N 989422.4455
E 655716.9311
N 988539.4279
E 655797.2778
N 987357.2623
E 656035.7237
N 985719.5995
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N 983874.0485
E 655442.6302
N 983542.7423
E 654664.1812
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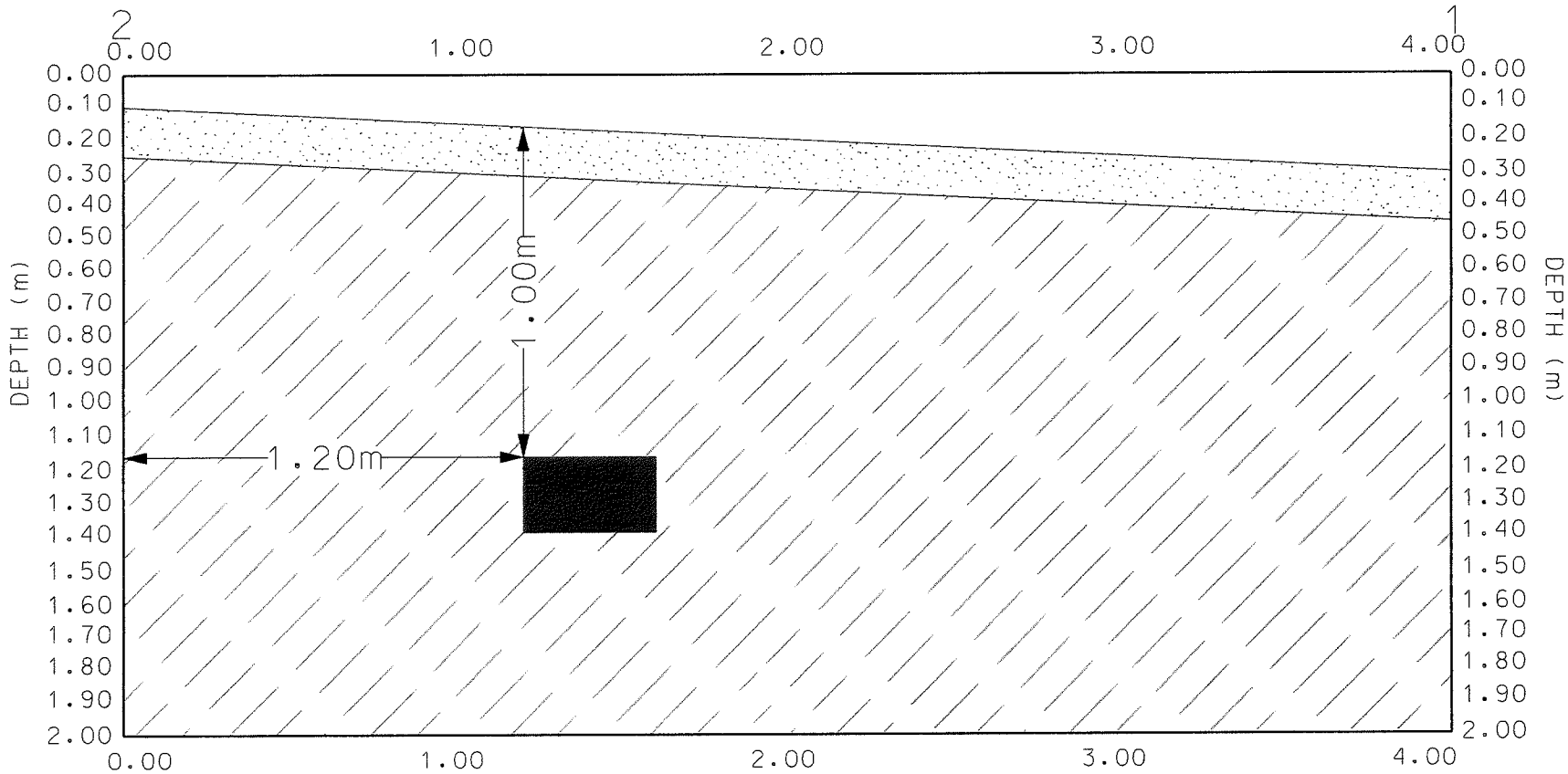
13+500
14+000
14+500
15+000
15+500
16+000
16+500
17+000
17+500
10+264.15
10+452.92
LEYEND
PITS

ARTIFICIAL ISLAND PROPOSED RAILROAD ALIGNMENT
TEST PIT RESULTS
PIT-1/FACE-A

Geology: Itza E. Diaz G.
Laboratory Analyst: Xenia Rios

Date: 06/06/02
SCALE: 1:20



Clasification:

Overburden, OC-2 to OC-3, medium soft to medium hard overburden consistency, low to medium dry strength, low to moderate plasticity, low to moderate water content, consists of residual, saprolitic, fine-grained clay, silt and some sand, contains cobbles and pebbles of basalt probably from road construction, contains organic material, organic material consisting of roots, leaves, humus and wood debris. Color: dark brown.

Overburden, OC-3 to OC-4, medium hard to hard overburden consistency, strong strength, moderate plasticity, low to moderate water content, consists of residual, saprolitic fine grained sand and silt, contains some roots. Color mottled very light green and reddish brown.

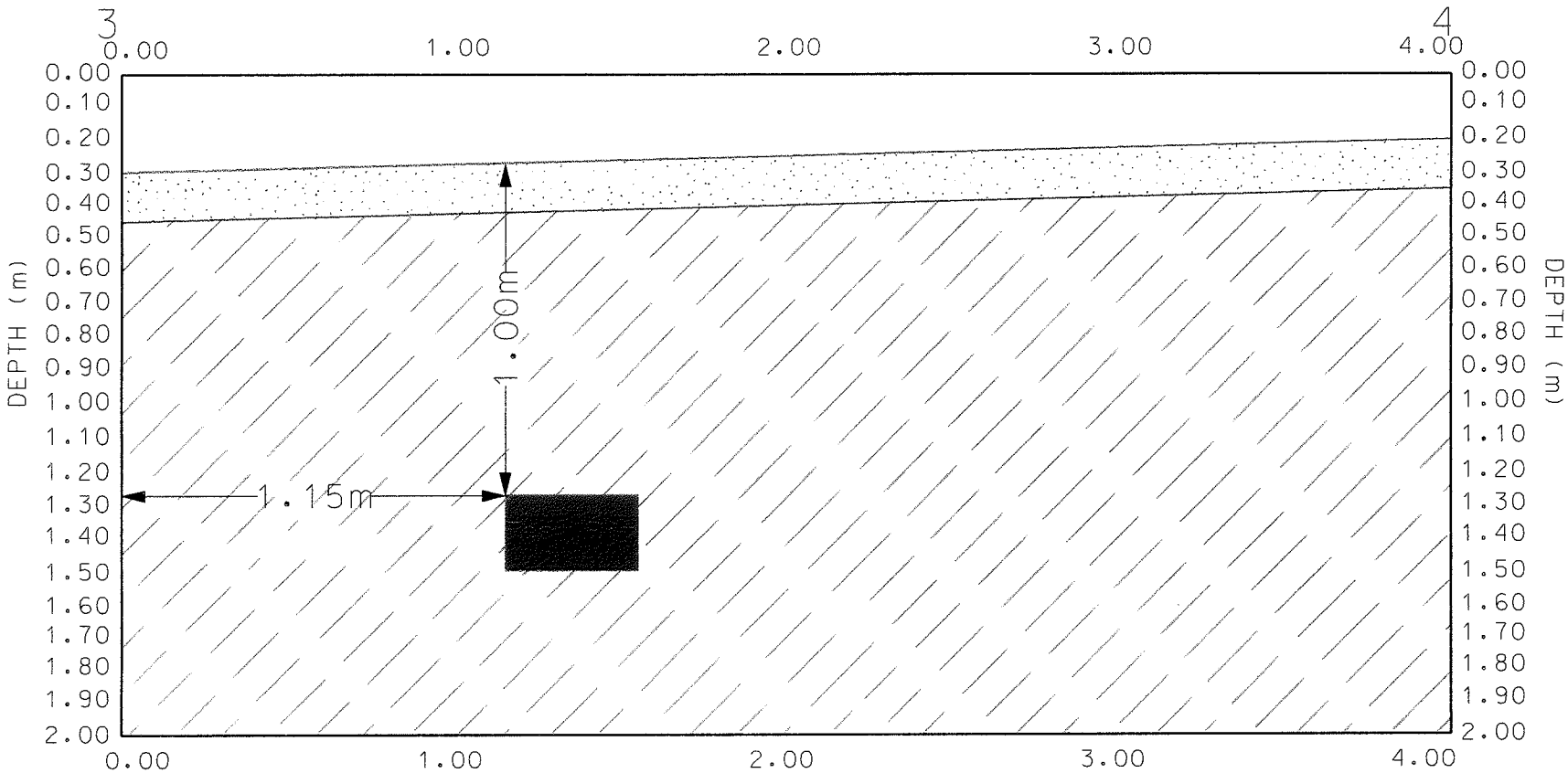
Notes:

This material has been excavated in area of tipical secondary forest growth consisting of trees of medium height and low growth bushes.
The samples were removed from the walls of the pit for laboratory anaylisis for liquid limit, specific gravity, field density, moisture content and sieve test.

ARTIFICIAL ISLAND PROPOSED RAILROAD ALIGNMENT
TEST PIT RESULTS
PIT-1/FACE-B

Geology: Itza E. Diaz G.
Laboratory Analyst: Xenia Rios

Date: 06/06/02
SCALE: 1:20



Clasification:

Overburden, OC-2 to OC-3, medium soft to medium hard overburden consistency, low to medium dry strength, low to moderate plasticity, low to moderate water content, consists of residual, saprolitic, fine-grained clay, silt and some sand, contains cobbles and pebbles of basalt probably from road construction, contains organic material, organic material consisting of roots, leaves, humus and wood debris. Color: dark brown.

Overburden, OC-3 to OC-4, medium hard to hard overburden consistency, strong strength, moderate plasticity, low to moderate water content, consists of residual, saprolitic fine grained sand and silt, contains some roots. Color mottled very light green and reddish brown.

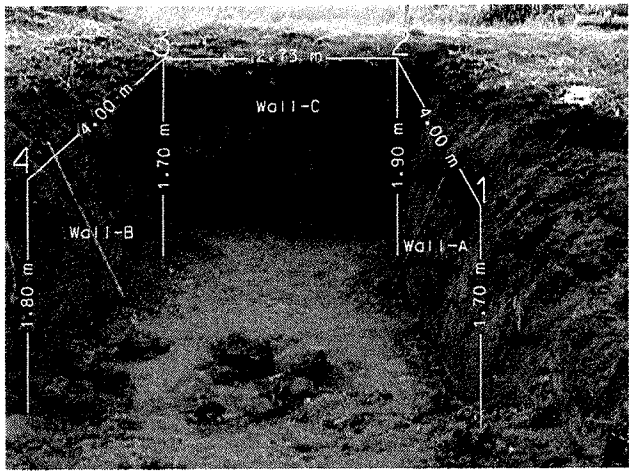
Notes:

This material has been excavated in area of tipical secondary forest growth consisting of trees of medium height and low growth bushes.
The samples were removed from the walls of the pit for laboratory anaylisis for liquid limit, specific gravity, field density, moisture content and sieve test.

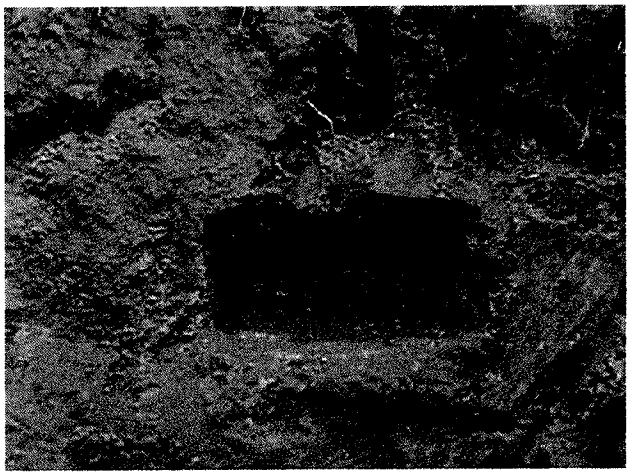
ARTIFICIAL ISLAND PROPOSED RAILROAD ALIGNMENT
TEST PIT RESULTS
PIT-1

Geology: Itza E. Diaz G.
Laboratory Analyst: Xenia Rios

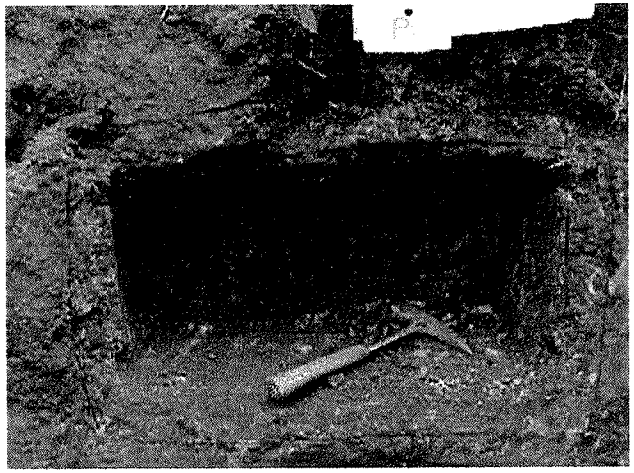
Date: 06/06/02
SCALE: 1:20



Pit Dimensions



Face-A Material



Face-B Material

Face-C Material

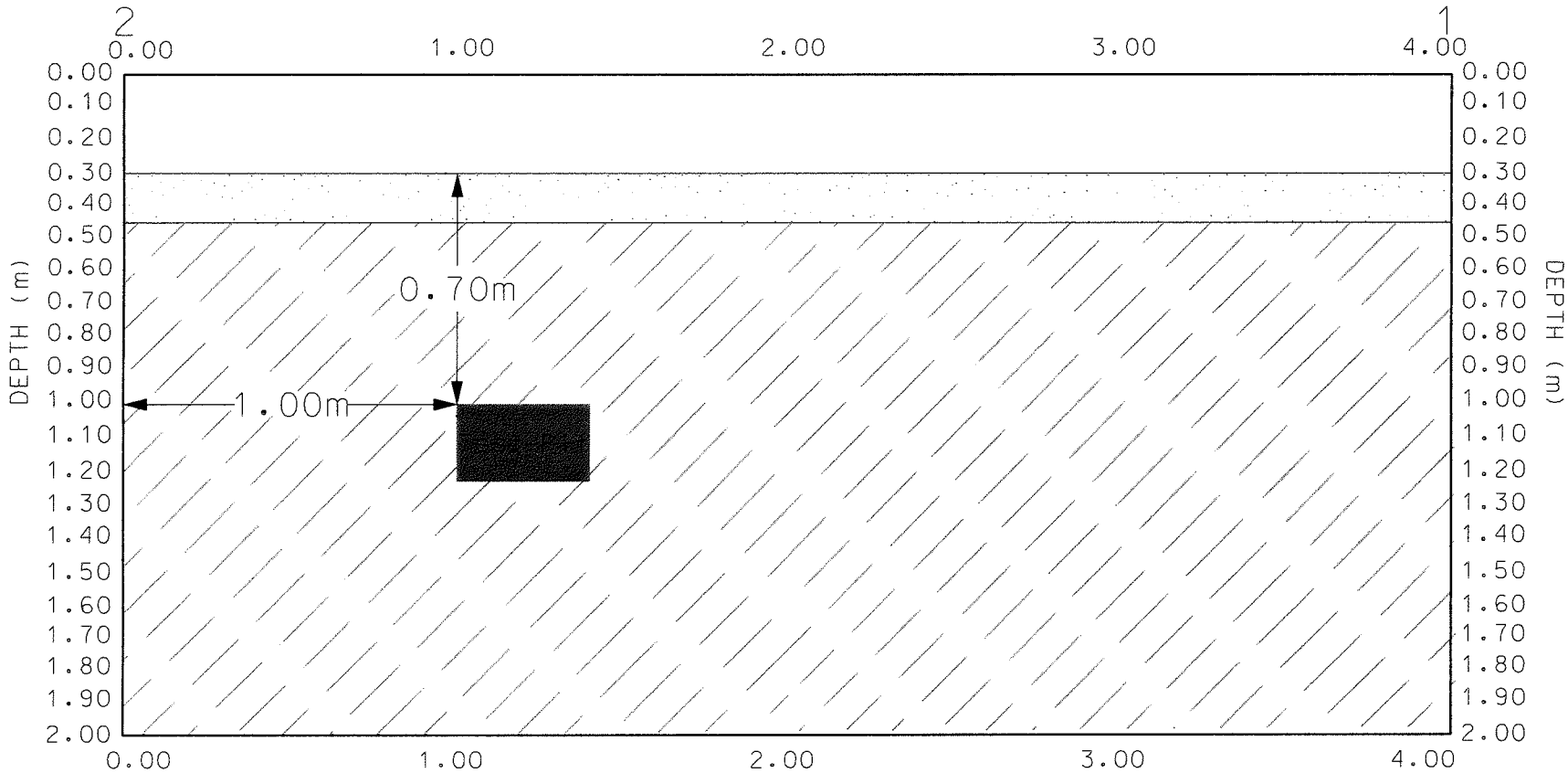
Location: West Side of Canal, Cocoli

Easting:	654274.53	993331.43
Easting:	654276.03	993326.65
Easting:	654270.26	993330.00
Easting:	654270.26	993330.00

ARTIFICIAL ISLAND PROPOSED RAILROAD ALIGNMENT
TEST PIT RESULTS
PIT-2/FACE-A

Geology: Itza E. Diaz G.
Laboratory Analyst: Xenia Rios

Date: 06/07/02
SCALE: 1:20



Clasification:

Overburden, OC-2 to OC-3, medium soft to medium hard overburden consistency, low to medium dry strength, low to moderate plasticity, low to moderate water content, consists of residual, saprolitic, fine-grained clay, silt and some sand, contains organic material, consisting of roots, leaves, humus and woods debris. Color: dark brown.

Overburden, OC-3 to OC-4, medium hard to hard overburden consistency, strong strength, moderate plasticity, moderate water content, consists of residual, saprolitic fine-grained silt and sand, contains some roots. Color mottled very light green and reddish brown.

Notes:

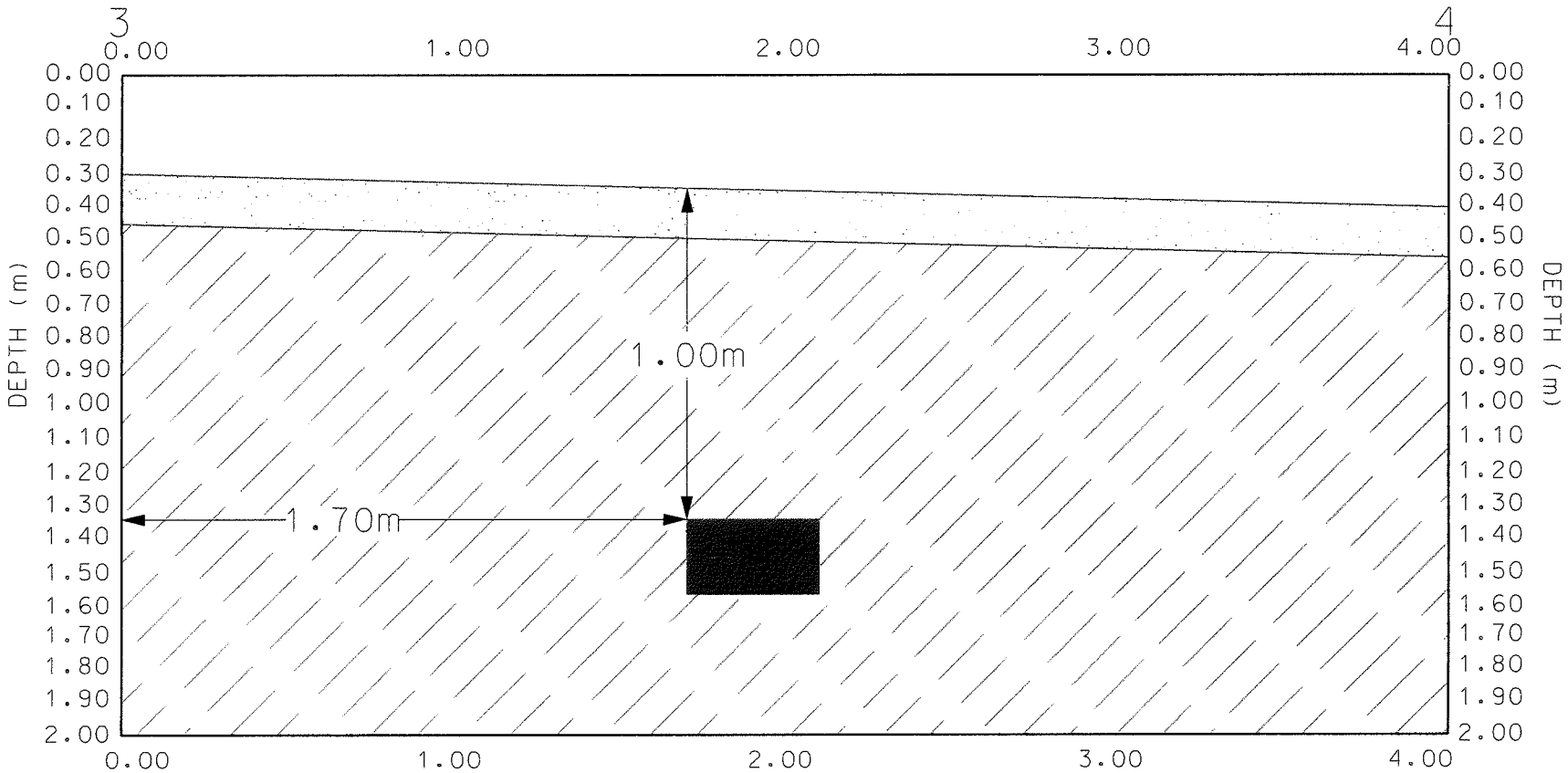
This material has been excavated in area of tipical primary forest growth consisting of trees of medium to high height.

The samples were removed from the walls of the pit for laboratory anaylisis for liquid limit, specific gravity, field density, moisture content and sieve test.

ARTIFICIAL ISLAND PROPOSED RAILROAD ALIGNMENT
TEST PIT RESULTS
PIT-2/FACE-B

Geology: Itza E. Diaz G.
Laboratory Analyst: Xenia Rios

Date: 06/07/02
SCALE: 1:20



Clasification:

Overburden, OC-2 to OC-3, medium soft to medium hard overburden consistency, low to medium dry strength. low to moderate plasticity, low to moderate water content, consists of residual, saprolitic, fine-grained clay, silt and some sand, contains organic material, consisting of roots, leaves, humus and woods debris. Color: dark brown.

Overburden, OC-3 to OC-4, medium hard to hard overburden consistency, strong strength, moderate plasticity, moderate water content, consists of residual, saprolitic fine-grained silt and sand, contains some roots. Color mottled very light green and reddish brown.

Notes:

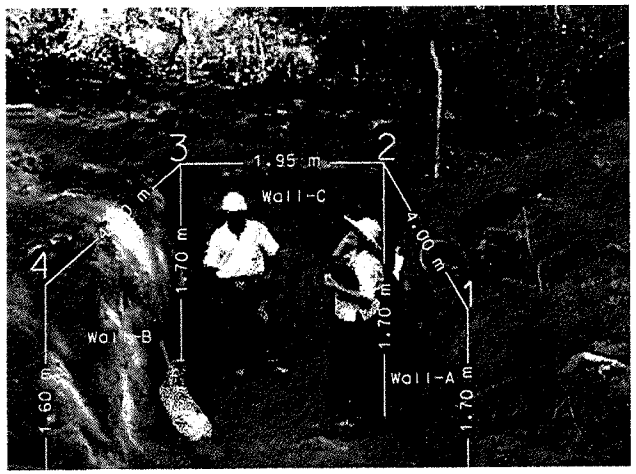
This material has been excavated in area of tipical primary forest growth consisting of trees of medium to high height.

The samples were removed from the walls of the pit for laboratory anaylisis for liquid limit, specific gravity, field density, moisture content and sieve test.

ARTIFICIAL ISLAND PROPOSED RAILROAD ALIGNMENT
TEST PIT RESULTS
PIT-2

Geology: Itza E. Diaz G.
Laboratory Analyst: Xenia Rios

Date: 06/07/02
SCALE: 1:20



Pit Dimensions

Face-A Material

Face-B Material

Face-C Material

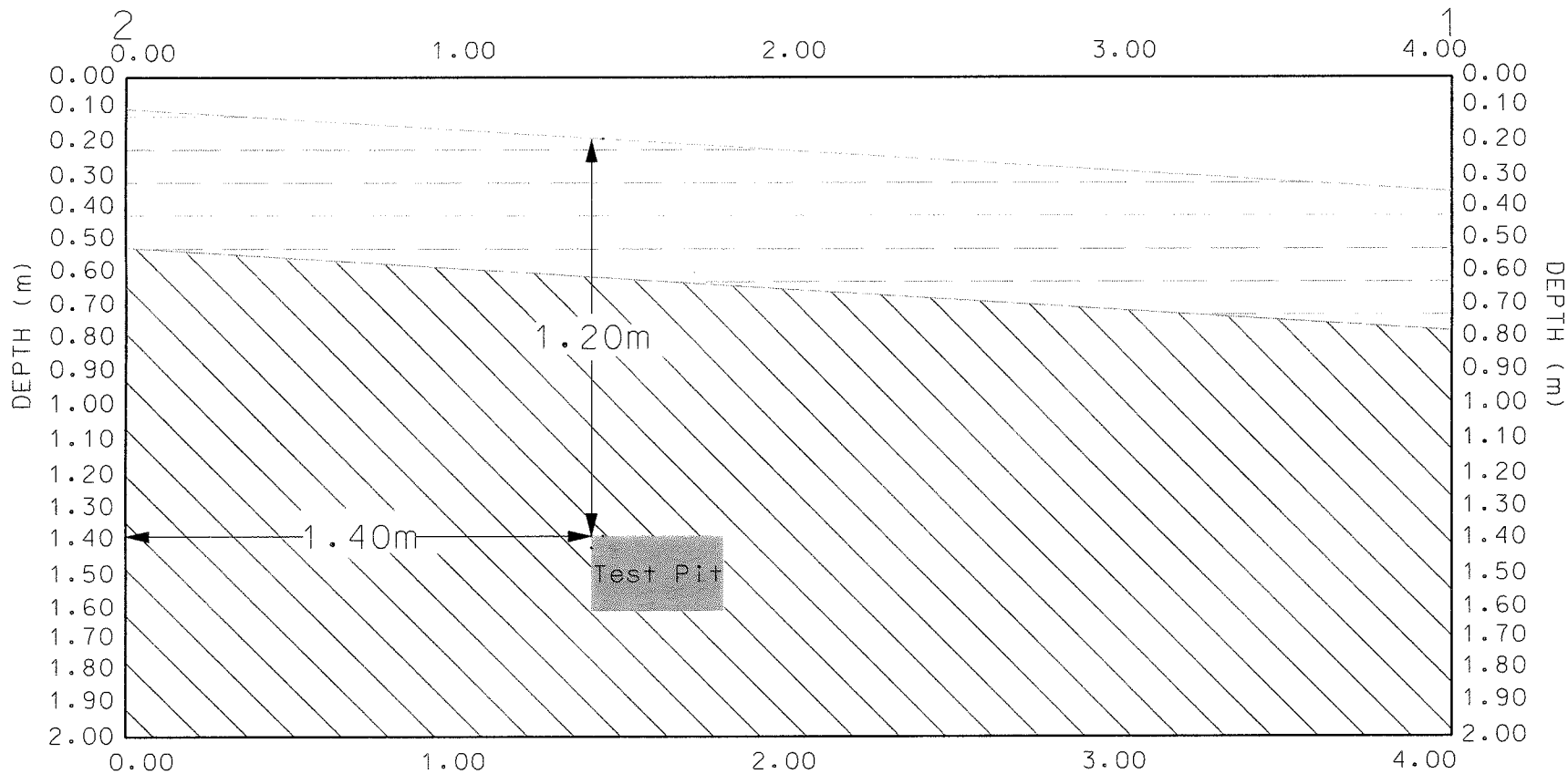
Location: West Side of Canal, Cocoli

Easting:	654366.55	993118.38
Easting:	654369.68	993119.42
Easting:	654371.02	993115.49
Easting:	654367.91	993114.81

ARTIFICIAL ISLAND PROPOSED RAILROAD ALIGNMENT
TEST PIT RESULTS
PIT-3/FACE-A

Geology: Itza E. Diaz G.
Laboratory Analyst: Xenia Rios

Date: 06/07/02
SCALE: 1:20



Clasification:

Overburden, OC-3 to OC-4, medium hard to hard overburden consistency, strong strength, moderate to high plasticity, moderate water content, consists of residual, saprolitic, fine-grained clay and some silt, contains organic material, consisting of roots, leaves, and woods debris. Color: light red

Overburden, OC-4, hard overburden consistency, high strength, moderate plasticity, moderate water content, consists of residual, saprolitic fine-grained silt and sand material, contains some roots. Color: dark brown.

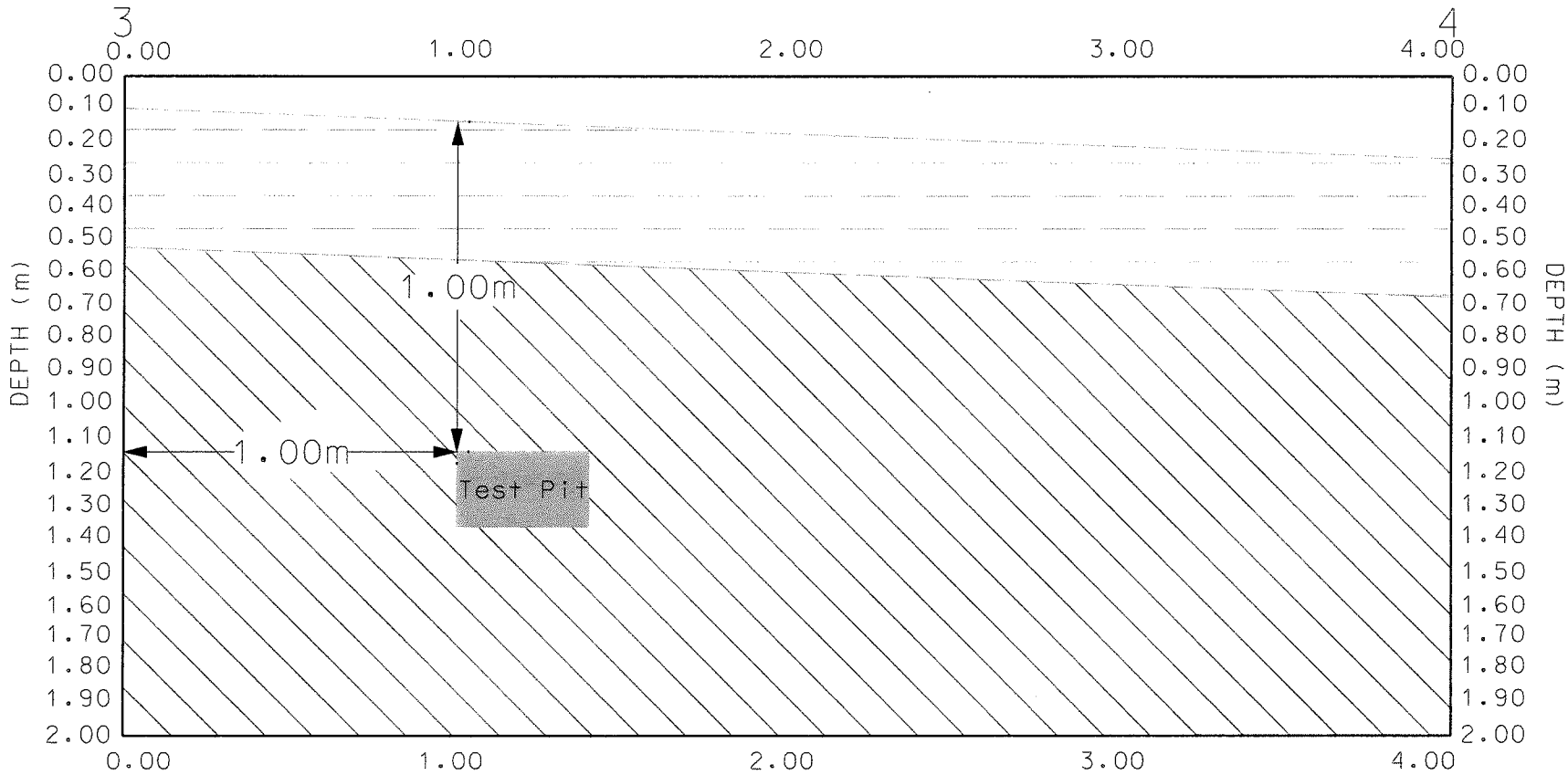
Notes:

This material has been excavated in area of tipical primary and secondary forest growth consisting of trees of medium to high height and low growth bushes.
The samples were removed from the walls of the pit for laboratory anaylisis for liquid limit, specific gravity, field density, moisture content and sieve test.

ARTIFICIAL ISLAND PROPOSED RAILROAD ALIGNMENT
TEST PIT RESULTS
PIT-3/FACE-B

Geology: Itza E. Diaz G.
Laboratory Analyst: Xenia Rios

Date: 06/07/02
SCALE: 1:20



Clasification:

Overburden, OC-3 to OC-4, medium hard to hard overburden consistency, strong strength, moderate to high plasticity, moderate water content, consists of residual, saprolitic, fine-grained clay and some silt, contains organic material, consisting of roots, leaves, and woods debris. Color: light red

Overburden, OC-4, hard overburden consistency, high strength, moderate plasticity, moderate water content, consists of residual, saprolitic fine-grained silt and sand material, contains some roots. Color: dark brown.

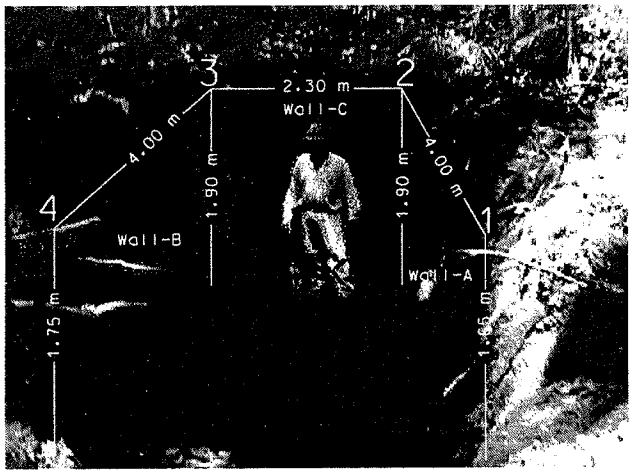
Notes:

This material has been excavated in area of tipical primary and secondary forest growth consisting of trees of medium to high height and low growth bushes.
The samples were removed from the walls of the pit for laboratory anaylisis for liquid limit, specific gravity, field density, moisture content and sieve test.

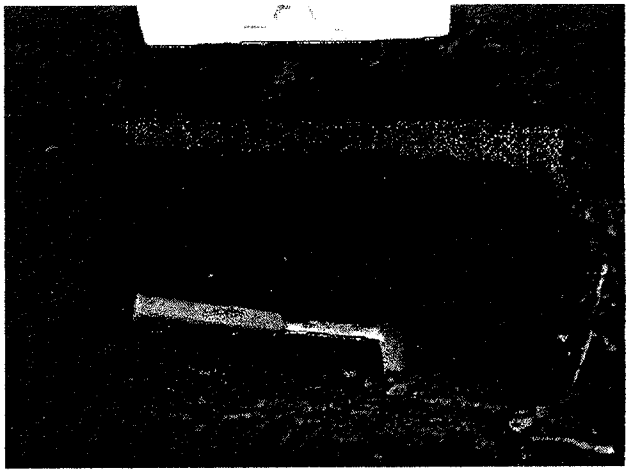
ARTIFICIAL ISLAND PROPOSED RAILROAD ALIGNMENT
TEST PIT RESULTS
PIT-3

Geology: Itza E. Diaz G.
Laboratory Analyst: Xenia Rios

Date: 06/07/02
SCALE: 1:20

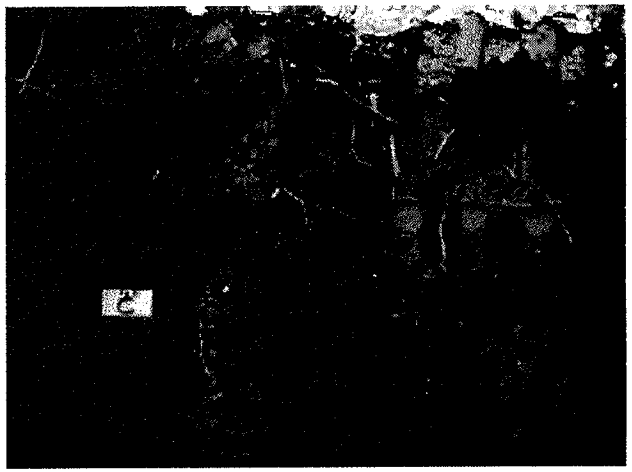


Pit Dimensions



Face-A Material

Face-B Material



Face-C Material

Location: West Side of Canal, Cocoli

Easting:	654517.16	992916.59
Easting:	654515.78	992914.68
Easting:	654513.03	992916.76
Easting:	654514.36	992918.69

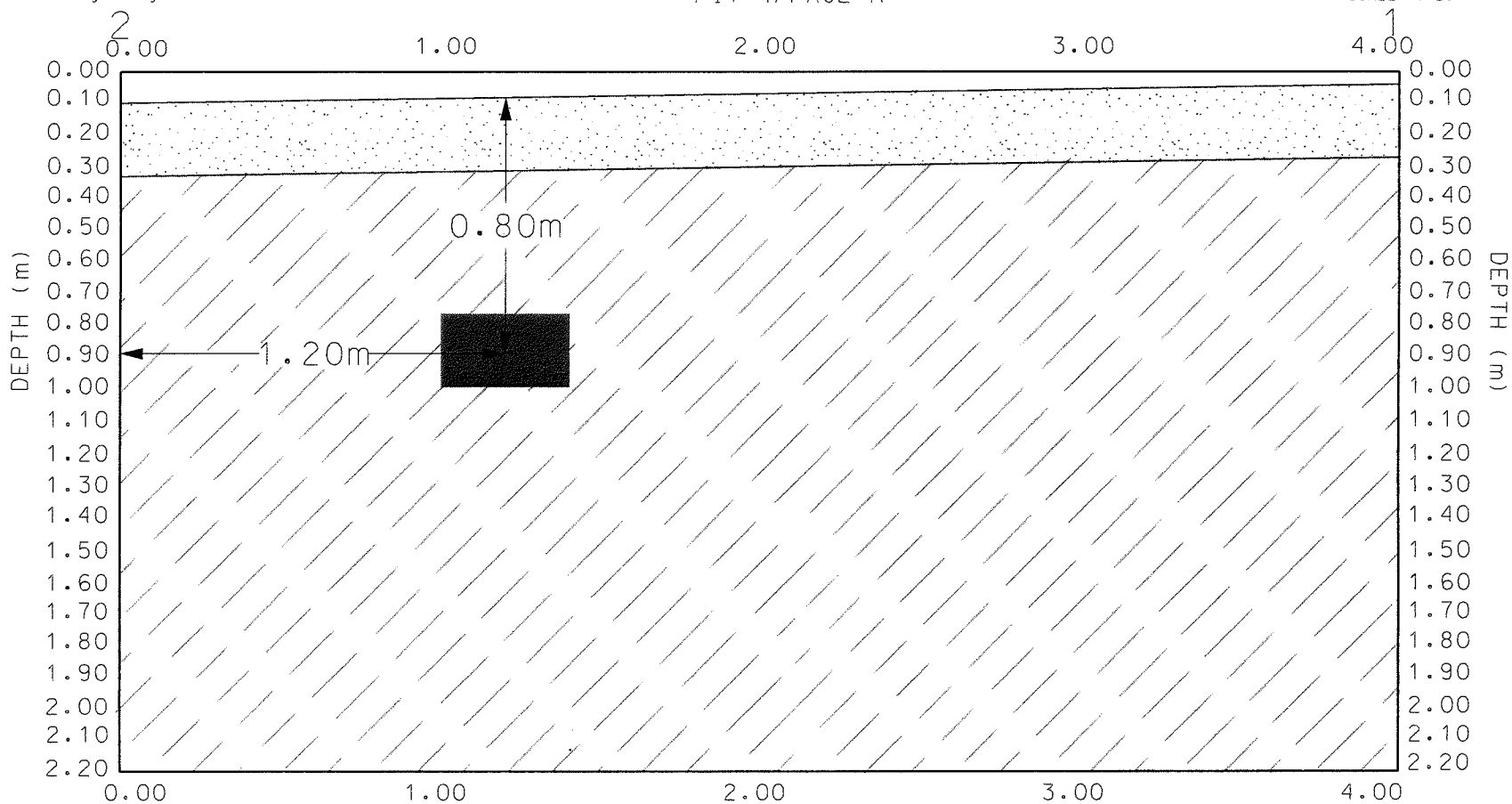
ARTIFICIAL ISLAND PROPOSED RAILROAD ALIGNMENT

TEST PIT RESULTS

PIT-4/FACE-A

Geology: Itza E. Diaz G.
Laboratory Analyst: Xenia Rios

Date: 06/12/02
SCALE: 1:20



Clasification:

Overburden, OC-1 to OC-3, soft to medium hard overburden consistency, low to medium dry strength, low to moderate plasticity, low to moderate water content, consists of residual, saprolitic, fine-grained clay and some silt, contains organic material, consisting of roots, leaves, humus and woods debris. Color: dark brown.

Overburden, OC-3 to OC-5, medium hard to very hard overburden consistency, strong strength, hardnees and strength increses with the depth, in wall-A after 1.30 m, moderate plasticity, moderate water content, consists of residual, saprolitic fine-grained silt and sand, contains some roots. Color: motted very light green and reddish brown.

Notes:

This material has been excavated in area of tipical primary forest growth consisting of trees of medium to high height.

The samples were removed from the walls of the pit for laboratory anaylisis for liquid limit, specific gravity, field density, moisture content and sieve test.

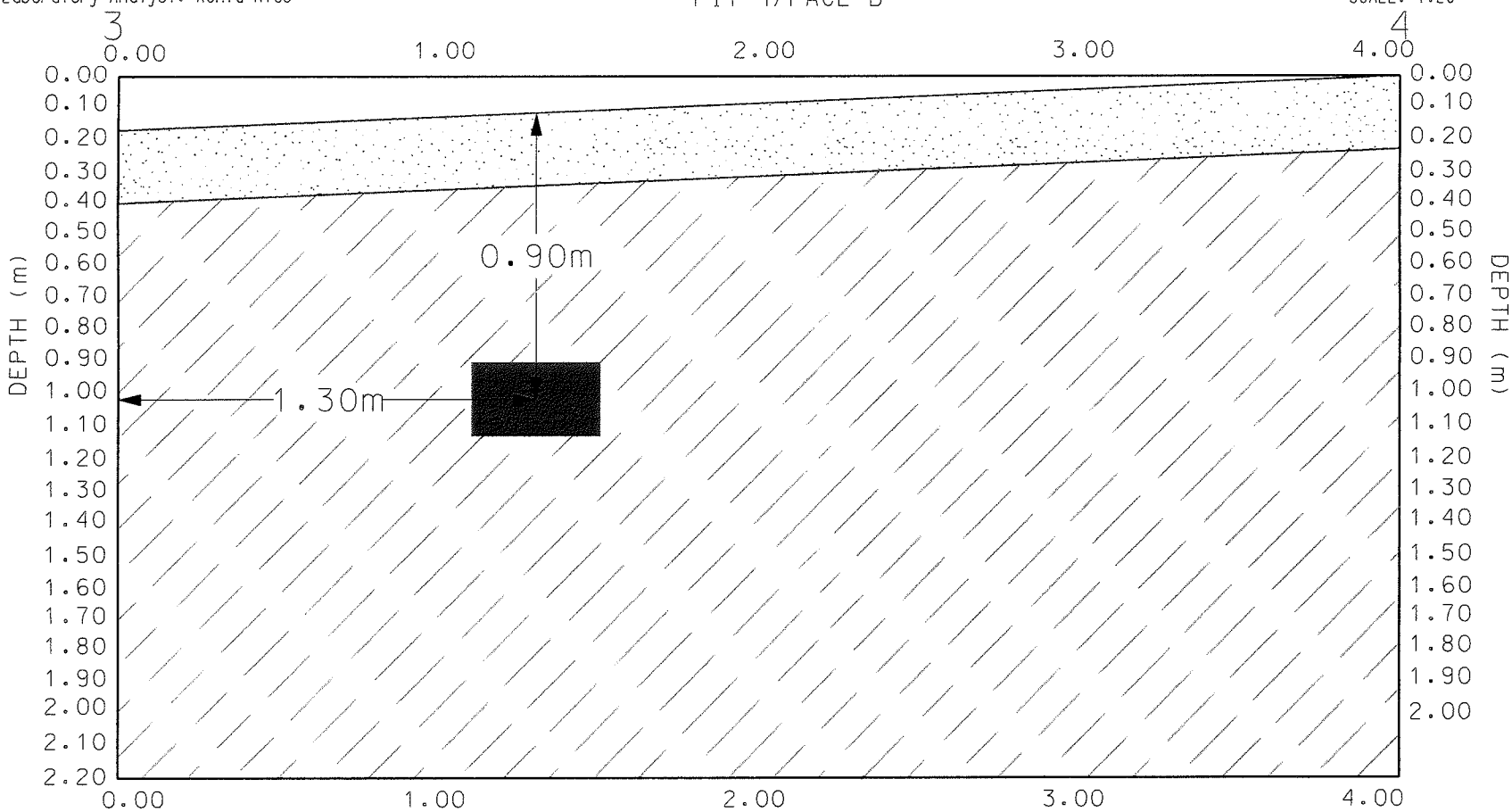
ARTIFICIAL ISLAND PROPOSED RAILROAD ALIGNMENT

TEST PIT RESULTS

PIT-4/FACE-B

Geology: Itza E. Diaz G.
Laboratory Analyst: Xenia Rios

Date: 06/12/02
SCALE: 1:20



Clasification:

Overburden, OC-1 to OC-3, soft to medium hard overburden consistency, low to medium dry strength low to moderate plasticity, low to moderate water content, consists of residual, saprolitic, fine-grained clay and some silt, contains organic material, consisting of roots, leaves, humus and woods debris. Color: dark brown.

Overburden, OC-3 to OC-5, medium hard to very hard overburden consistency, strong strength, hardness and strength increses with the depth, in wall-B after 1.20 m, moderate to high plasticity, moderate water content, consists of residual, saprolitic fine-grained silt and sand, contains some roots. Color: motted very light green and red.

Notes:

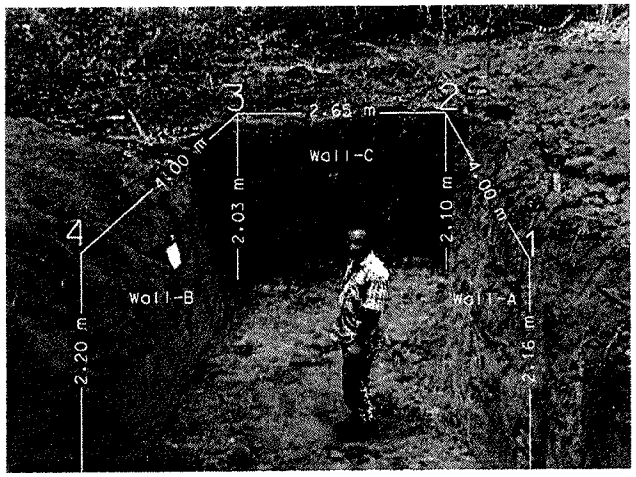
This material has been excavated in area of tipical primary forest growth consisting of trees of medium to high height.

The samples were removed from the walls of the pit for laboratory anaylisis for liquid limit, specific gravity, field density, moisture content and sieve test.

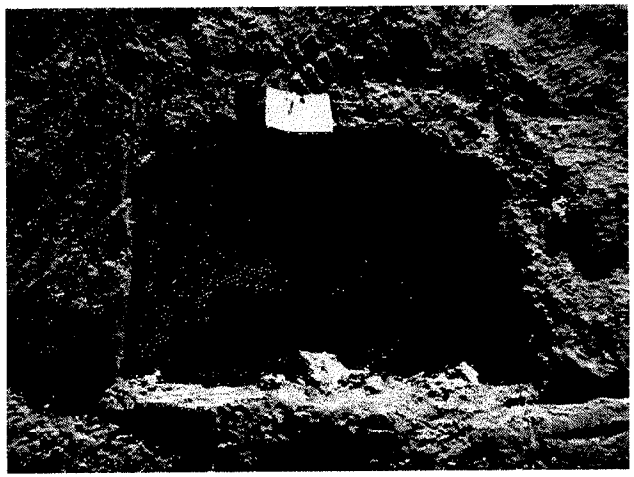
ARTIFICIAL ISLAND PROPOSED RAILROAD ALIGNMENT
TEST PIT RESULTS
PIT-4

Geology: Itza E. Diaz G.
Laboratory Analyst: Xenia Rios

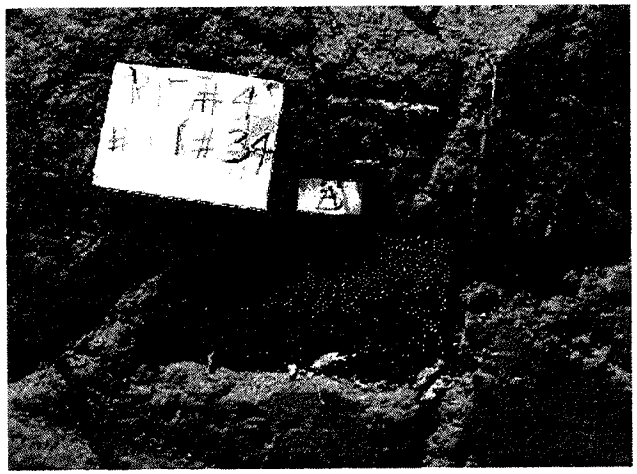
Date: 06/12/02
SCALE: 1:20



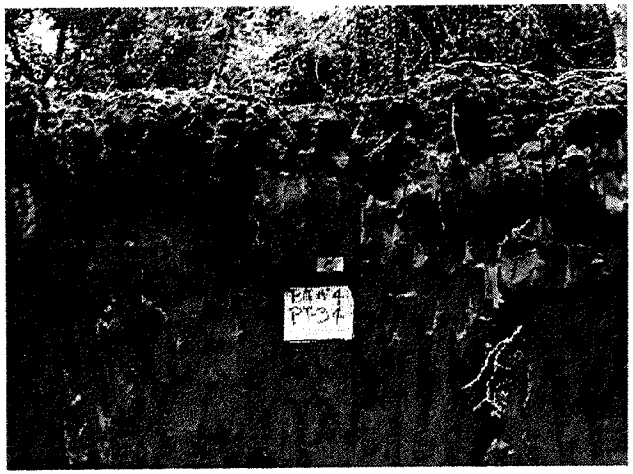
Pit Dimensions



Face-A Material



Face-B Material



Face-C Material

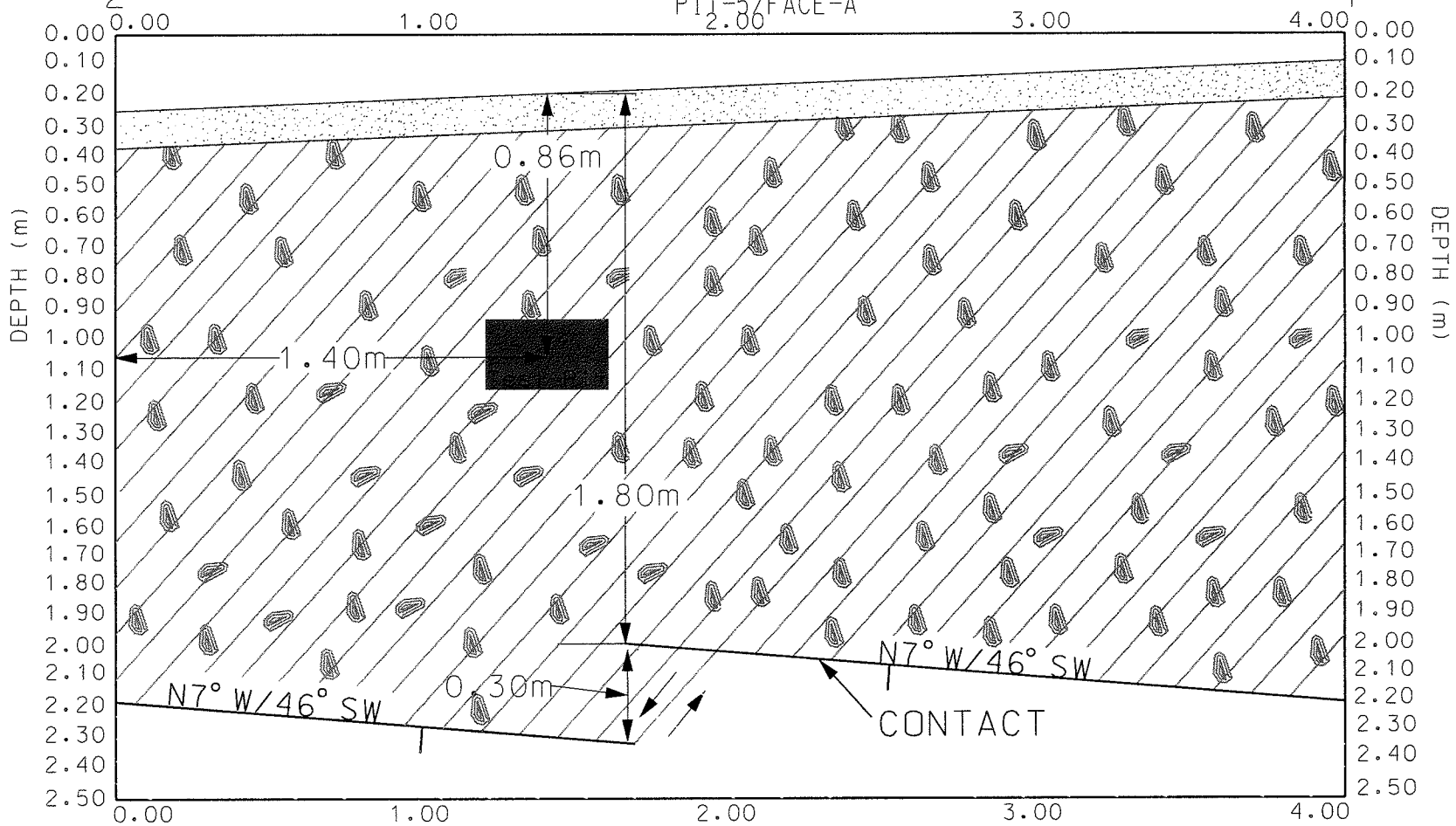
Location: West Side of Canal, Horoko Golf Club

Easting:	654907.66	991695.89
Easting:	654909.49	991690.53
Easting:	654906.58	991689.17
Easting:	654904.48	991694.58

Geology: Itza E. Diaz G.
Laboratory Analyst: Xenia Rios

ARTIFICIAL ISLAND PROPOSED RAILROAD ALIGNMENT
TEST PIT RESULTS
PIT-5/FACE-A

Date: 06/13/02
SCALE: 1:20



Clasification:

Overburden, OC-1 to OC-3, soft to medium hard overburden consistency, low to medium dry strength, low to moderate plasticity, low water content, consists of residual, saprolitic, fine-grained clay and silt, contains organic material, consisting of roots, leaves and humus. Color: dark brown.

Overburden, OC-3 to OC-4, medium hard to hard overburden consistency, high strength, moderate plasticity, moderate water content, consists of residual, saprolitic fine-grained sand and clay. Color: mottled very light green and reddish brown.

Overburden, OC-3 to OC-4, medium hard to hard overburden consistency, strong strength, high plasticity, moderate water content, consists of residual, saprolitic fine-grained sand and silt. In the contac between material at 1.80 m the fault contains gouge with 5 cm thick approximately. Color: light yellowish brown.

Notes:
This material has been excavated in area of tipical secondary forest growth consisting low growth bushes.
The samples were removed from the walls of the pit for laboratory anaylisis for liquid limit, specific gravity, field density, moisture content and sieve test.

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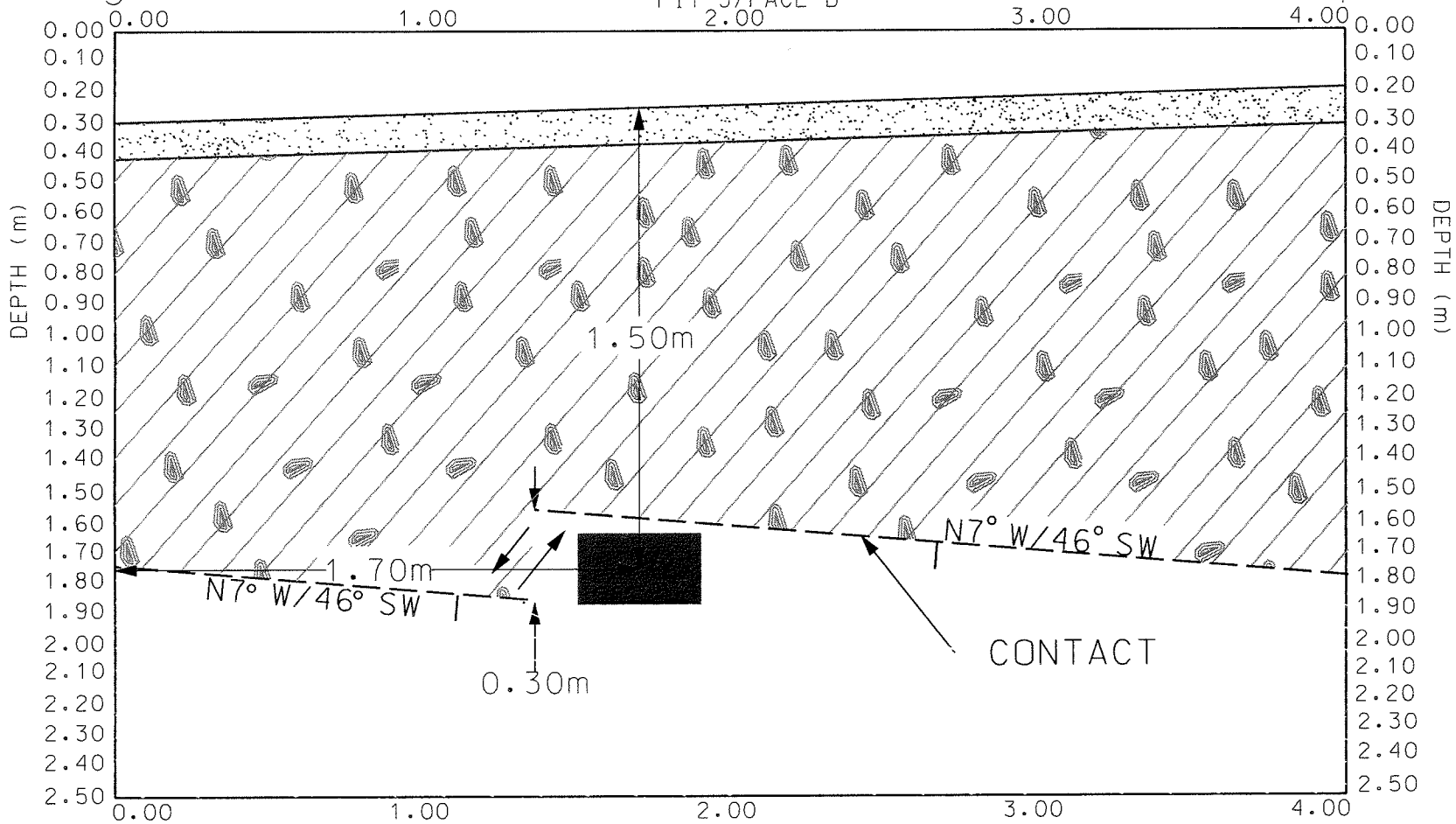
Geology: Itza E. Diaz G.
Laboratory Analyst: Xenia Rios

ARTIFICIAL ISLAND PROPOSED RAILROAD ALIGNMENT

TEST PIT RESULTS
PIT-5/FACE-B

Date: 06/13/02
SCALE: 1:20



Clasification:

Overburden, OC-1 to OC-3, soft to medium hard overburden consistency, low to medium dry strength, low to moderate plasticity, low water content, consists of residual, saprolitic, fine-grained clay and silt, contains organic material, consisting of roots, leaves and humus. Color: dark brown.

Overburden, OC-3 to OC-4, medium hard to hard overburden consistency, high strength, moderate plasticity, moderate water content, consists of residual, saprolitic fine-grained sand and clay. Color: mottled very light green and reddish brown.

Overburden, OC-3 to OC-4, medium hard to hard overburden consistency, strong strength, high plasticity, moderate water content, consists of residual, saprolitic fine-grained sand and silt. In the contac between material at 1.50 m the fault contains gouge with 5 cm thick approximately. Color: light yellowish brown.

Notes:

This material has been excavated in area of tipical secondary forest growth consisting low growth bushes.
The samples were removed from the walls of the pit for laboratory anaylisis for liquid limit, specific gravity, field density, moisture content and sieve test.
The fault located on Face B is inferred.

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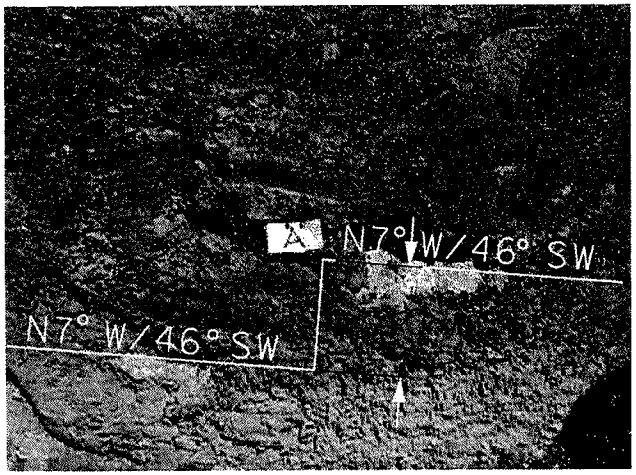
Geology: Itza E. Diaz G.
Laboratory Analyst: Xenia Rios

ARTIFICIAL ISLAND PROPOSED RAILROAD ALIGNMENT
TEST PIT RESULTS
PIT-5

Date: 06/13/02
SCALE: 1:20

Face-B Material

Face-C Material



Goush Material

Excavation Material

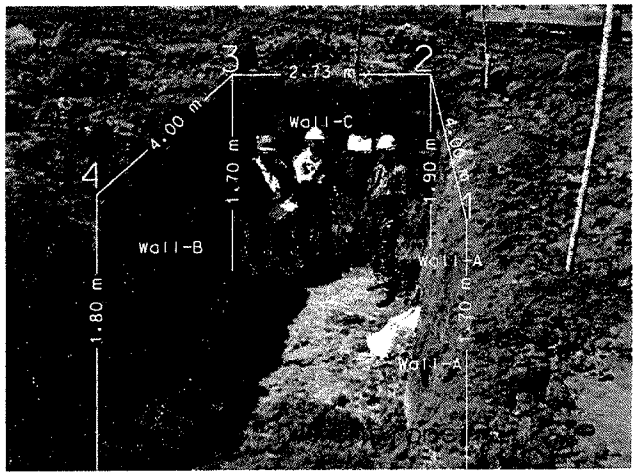
Location: West Side of Canal, Horoko Golf Club

Easting:	654971.40	991262.48
Easting:	654974.23	991262.80
Easting:	654973.84	991268.30
Easting:	654970.67	991268.12

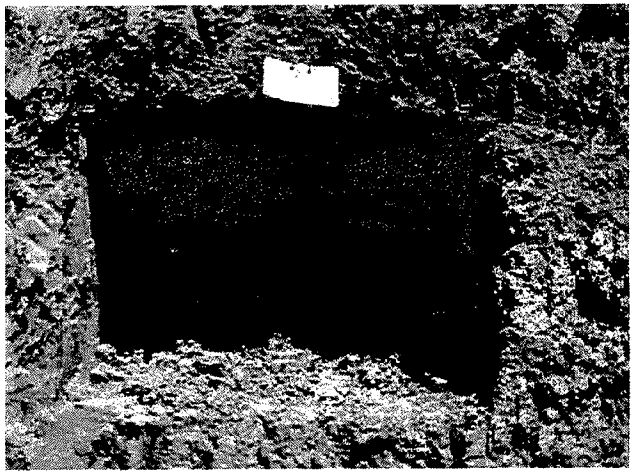
Geology: Itza E. Diaz G.
Laboratory Analyst: Xenia Rios

ARTIFICIAL ISLAND PROPOSED RAILROAD ALIGNMENT
TEST PIT RESULTS
PIT-5

Date: 06/13/02
SCALE: 1:20



Pit Dimensions



Face-A Material

Face-A Material

Face-B Material

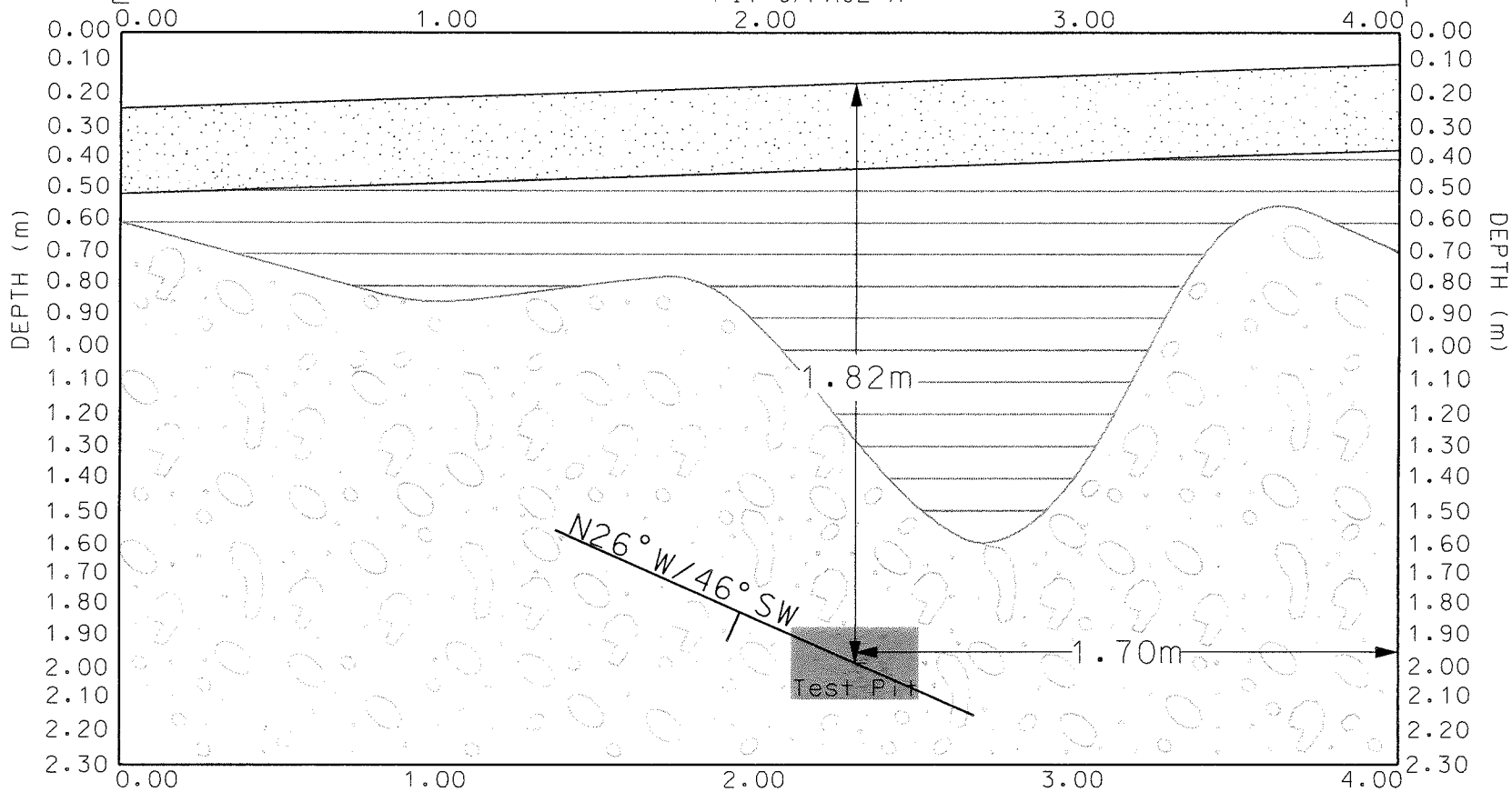
Location: West Side of Canal, Horoko Golf Club

Easting:	654971.40	991262.48
Easting:	654974.23	991262.80
Easting:	654973.84	991268.30
Easting:	654970.67	991268.12

Geology: Itza E. Diaz G.
Laboratory Analyst: Xenia Rios

ARTIFICIAL ISLAND PROPOSED RAILROAD ALIGNMENT
TEST PIT RESULTS
PIT-6/FACE-A

Date: 06/26/02
SCALE: 1:20



Clasification:

Overburden, OC-2 to OC-3, medium soft to medium hard overburden consistency, low to medium dry strength low plasticity, low to moderate water content, consists of residual, saprolitic, fine-grained clay, silt and some sand, contains organic material, organic material consisting of roots, leaves, humus, and wood debris. Color: brown

Overburden, OC-3 to OC-4, medium hard to hard overburden consistency, strong strength, moderate plasticity, moderate water content, consists of residual, saprolitic fine-grained silt and sand. Color: reddish brown.

Weathered rock, OC-5 to RH-1, very hard overburden consistency to soft rock, highly weathered to completely weathered material, close to very close jointing, joints are open, iron-stained and oxidized, joints dip N26°W/46°SW, joints are rough, fine-grained material, altered to clay minerals, weathered decreases with the depth. Color: light gray.

Notes:

This material has been excavated in area of tipical primary forest growth consisting of trees of medium to high height.

The samples were removed from the walls of the pit for laboratory anaylisis for liquid limit, specific gravity, field density, moisture content and sieve test.

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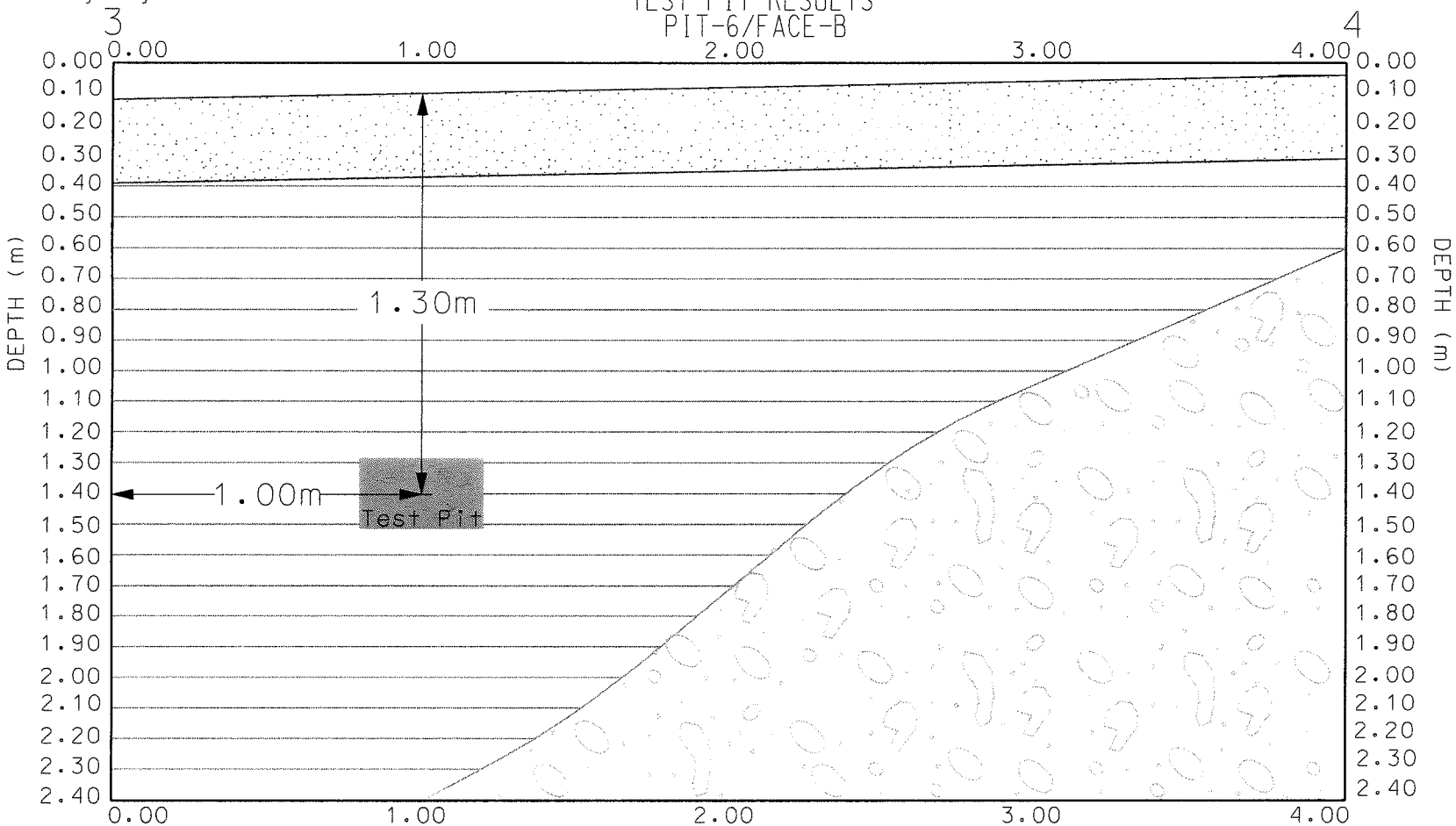
Geology: Itza E. Diaz G.
Laboratory Analyst: Xenia Rios

ARTIFICIAL ISLAND PROPOSED RAILROAD ALIGNMENT
TEST PIT RESULTS
PIT-6/FACE-B

Date: 06/26/02
SCALE: 1:20



Clasification:

Overburden, OC-2 to OC-3, medium soft to medium hard overburden consistency, low to medium dry strength, low plasticity, low to moderate water content, consists of residual, saprolitic, fine-grained clay, silt and some sand, contains organic material, organic material consisting of roots, leaves, humus, and wood debris. Color: brown

Overburden, OC-3 to OC-4, medium hard to hard overburden consistency, strong strength, moderate plasticity, moderate water content, consists of residual, saprolitic fine-grained silt and sand. Color: reddish brown.

Weathered rock, OC-5 to RH-1, very hard overburden consistency to soft rock, highly weathered to completely weathered material, close to very close jointing, joints are open, iron-stained and oxidized, joints are rough, fine-grained material, altered to clay minerals, weathered decreases with the depth. Color: light gray.

Notes:

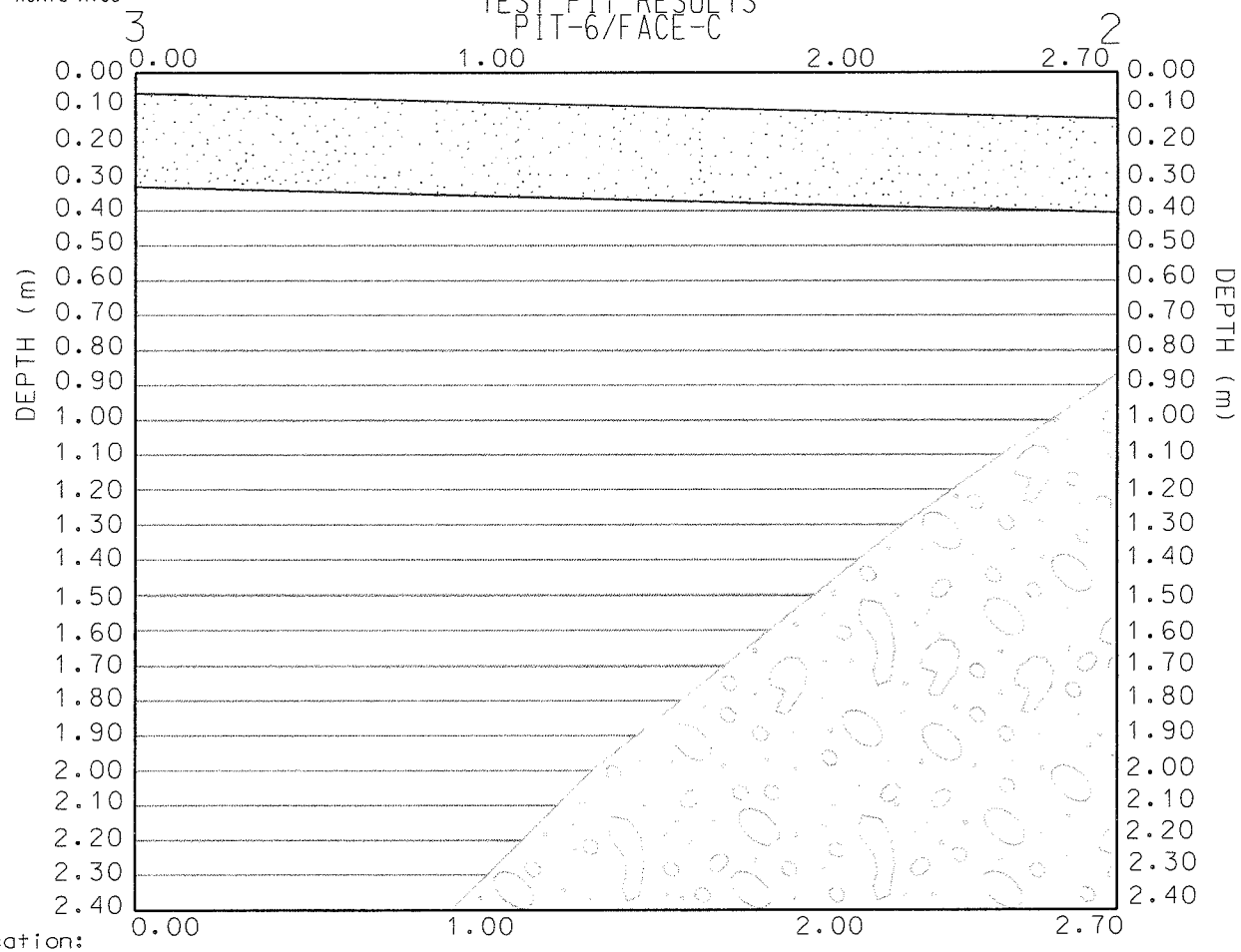
This material has been excavated in area of tipical primary forest growth consisting of trees of medium to high height.

The samples were removed from the walls of the pit for laboratory anaylisis for liquid limit, specific gravity, field density, moisture content and sieve test.

Geology: Itza E. Diaz G.
Laboratory Analyst: Xenia Rios

ARTIFICIAL ISLAND PROPOSED RAILROAD ALIGNMENT
TEST PIT RESULTS
PIT-6/FACE-C

Date: 06/26/02
SCALE: 1:20



Clasification:

Overburden, OC-2 to OC-3, medium soft to medium hard overburden consistency, low to medium dry strength, low plasticity, low to moderate water content, consists of residual, saprolitic, fine-grained clay, silt and some sand, contains organic material, organic material consisting of roots, leaves, humus, and wood debris. Color: brown

Overburden, OC-3 to OC-4, medium hard to hard overburden consistency, strong strength, moderate plasticity, moderate water content, consists of residual, saprolitic fine-grained silt and sand. Color: reddish brown.

Weathered rock, OC-5 to RH-1, very hard overburden consistency to soft rock, highly weathered to completely weathered material, close to very close jointing, joints are open, iron-stained and oxidized, joints are rough, fine-grained material, altered to clay minerals, weathered decreases with the depth, Color: light gray.

Notes:

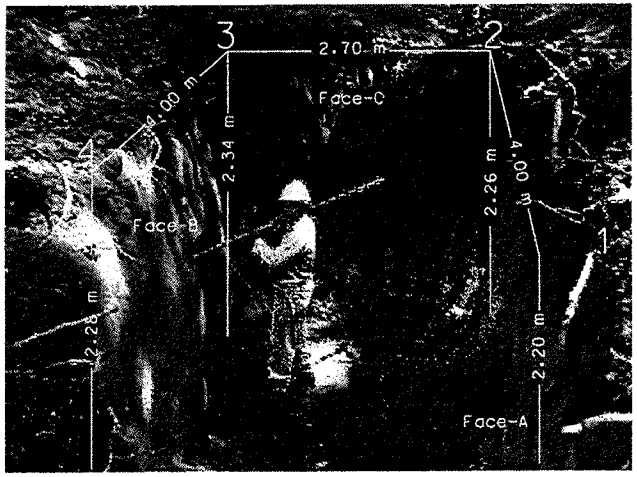
This material has been excavated in area of tipical primary forest growth consisting of trees of medium to high height.

The samples were removed from the walls of the pit for laboratory anaylisis for liquid limit, specific gravity, field density, moisture content and sieve test.

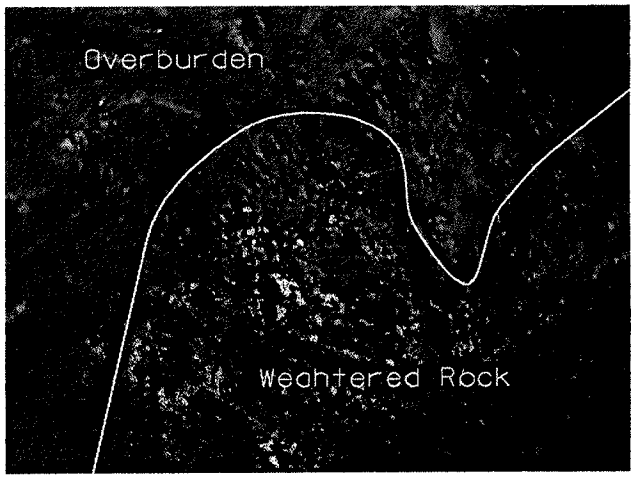
ARTIFICIAL ISLAND PROPOSED RAILROAD ALIGNMENT
TEST PIT RESULTS
PIT-6

Geology: Itza E. Diaz G.
Laboratory Analyst: Xenia Rios

Date: 06/26/02
SCALE: 1:20

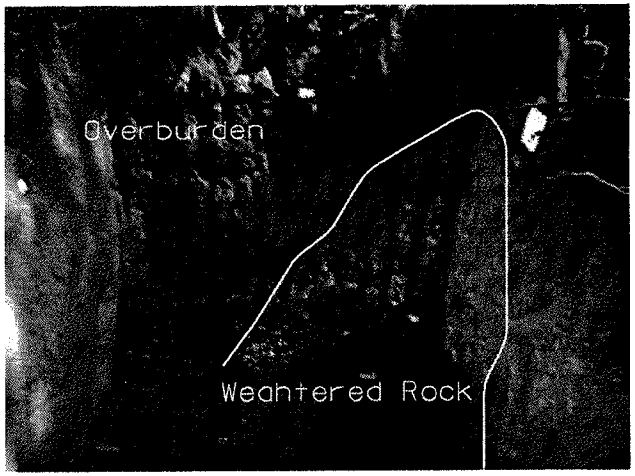


Pit Dimensions



Face-A Material

Face-A Material



Face-B Material

Location: West Side of Canal, Farfan

Easting:	655764.75	988733.18
Easting:	655762.94	988732.64
Easting:	655762.11	988735.53
Easting:	655764.02	988736.18

ARTIFICIAL ISLAND PROPOSED RAILROAD ALIGNMENT
TEST PIT RESULTS
PIT-7

Geology: Itza E. Diaz G.
Laboratory Analyst: Xenia Rios

Date: 06/13/02
SCALE: 1:20

Face-C Material

Face-C Material

Field Density Test

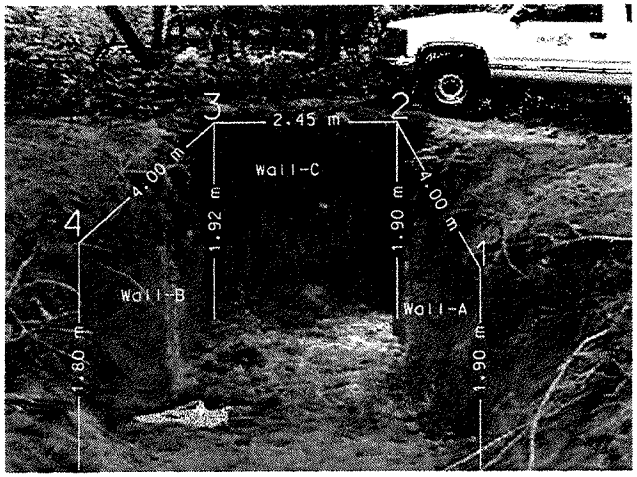
Location: West Side of Canal, Vera Cruz

Easting:	654670.55	983348.14
Easting:	654671.18	983351.54
Easting:	654668.48	983351.75
Easting:	654668.09	983348.50

ARTIFICIAL ISLAND PROPOSED RAILROAD ALIGNMENT
TEST PIT RESULTS
PIT-7

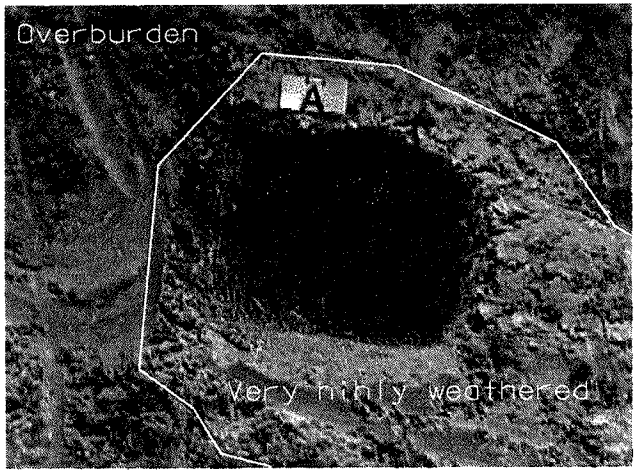
Geology: Itza E. Diaz G.
Laboratory Analyst: Xenia Rios

Date: 06/13/02
SCALE: 1:20



Pit Dimensions

Face-A Material



Face-A Material

Face-B Material

Location: West Side of Canal, Vera Cruz

Easting:	654670.55	983348.14
Easting:	654671.18	983351.54
Easting:	654668.48	983351.75
Easting:	654668.09	983348.50

PANAMA CANAL AUTHORITY

ENGINEERING AND PROJECTS DEPARTMENT

ENGINEERING ENGINEERING DIVISION

SOILS AND MATERIAL LABORATORY

SUMMARY RESULTS OF INDEX TESTS

Project: Artificial Island Proposed Railroad Alignment
Location: West Bank

PIT No.	Sample	Depth m	Wet Density (lb/ft^3)	Dry Density (lb/ft^3)	Specific Gravity Gs	Moisture Content (%)	Passing No.200 (%)	Liquid Limit LL	Plastic Limit PL	Plastic Index PI	Classific. U.C.S.	Name	Color
PIT-1	A	1.00	121	91	2.53	32.89	56.97	73	35	38	MH	Sandy elastic silt	Reddish brown
PIT-1	B	0.80			2.53	30.95	56.97	73	35	38	MH	Sandy elastic silt	Reddish brown
PIT-2	A	0.70	112	84	2.57	33.21	25.40	59	36	23	SM	Silty sand	Reddish brown
PIT-2	B	1.00			2.57	33.51	25.40	59	36	23	SM	Silty sand	Reddish brown
PIT-3	A	1.00	119	90	2.55	31.86	28.37	64	36	28	SM	Silty sand	Brown
PIT-3	B	1.20			2.39	32.61	28.92	66	36	30	SM	Silty sand	Brown
PIT-4	A	0.90	127	97	2.42	30.40	32.65	60	32	28	SM	Silty sand	Light brown
PIT-4	B	0.80			2.42	29.50	32.65	60	32	28	SM	Silty sand	Light brown
PIT-5	A	1.50	119	85	2.32	40.67	60.39	78	34	44	CH	Sandy fat clay	Brown
PIT-5	B	0.86			2.20	52.06	51.49	73	43	30	MH	Sandy elastic silt	Light yellowish brown
PIT-6	A	1.82	122	98	2.49	25.06	32.84	47	27	20	SC	Clayey sand	Light gray
PIT-6	B	1.30			2.64	37.14	13.44	69	39	30	SM	Silty sand	Reddish brown
PIT-7	A	1.10	116	100	2.39	16.34	30.07	54	28	26	SC	Clayey sand	Light reddish brown
PIT-7	B	1.34			2.57	17.70	34.69	54	31	23	SM	Silty sand	Reddish brown

Tested By: Carlos Rodriguez and Xenia Rios.
Prepared By: Xenia Rios
Checked by: Gustavo Guerra B.
File: Pits Isla Artificial
Date: 07/24/02

TABLE CLASSIFICATION

AC	ASPHALTIC CONCRETE
PCC	PORTLAND CEMENT CONCRETE
GW	WELL - GRADED GRAVEL
GW - GM	WELL - GRADED GRAVEL W/SILT
GW - GC	WELL - GRADED GRAVEL W/CLAY
GP	POORLY - GRADED GRAVEL
GP - GM	POORLY - GRADED GRAVEL W/SILT
GP - GC	POORLY - GRADED GRAVEL W/CLAY
GM	SILTY GRAVEL
GM - GC	SILTY-CLAYEY GRAVEL
GC	CLAYEY GRAVEL
SW	WELL - GRADED SAND
SW - SM	WELL - GRADED SAND W/SILT
SW - SC	WELL - GRADED SAND W/CLAY
SP	POORLY – GRADED SAND
SP - SM	POORLY - GRADED AND W/SILT
SP - SC	POORLY - GRADED SAND W/CLAY
SM	SILTY SAND
SC	CLAYEY SAND
ML	INORGANIC SILTS OF LOW PLASTICITY
ML - CL	SILT - CLAY OF LOW PLASTICITY
CL	CLAY OF LOW PLASTICITY
OL	ORGANIC SILT OR CLAY OF LOW PLASTICITY
MH	INORGANIC SILTS OF HIGH PLASTICITY
CH	INORGANIC CLAY OF HIGH PLASTICITY
OH	ORGANIC SILT OR CLAY OF HIGH PLASTICITY
PT	PEAT OR HIGH ORGANIC SOIL
COBBLES:	PARTICLES OF ROCK THAT WILL PASS A 12 - INCH SQUARE OPENING AND BE RETAINED ON A 3 - INCH SIEVE.
BOULDER:	PARTICLES OF ROCK THAT WILL NOT PASS A 12 - INCH SQUARE OPENING.
MC	MOISTURE CONTENT
LL	LIQUID LIMIT
PL	PLASTIC LIMIT
PI	PLASTICITY INDEX
R	RESISTIVITY
PH	PH
S	SULPHATE CONTENT

PANAMA CANAL AUTHORITY
ENGINEERING DIVISION
GEOTECHNICAL BRANCH
SOILS AND MATERIALS LABORATORY

GEOTECHNICAL LABORATORY TESTING ON SAMPLES OF SAND FROM VERACRUZ BEACH

(PACIFIC ENTRANCE)

LABORATORY SAMPLING TESTING

PREPARED BY: GUSTAVO GUERRA B.
XENIA RIOS
CARLOS RODRIGUEZ

JULY 2002

ACP
AUTORIDAD DEL CANAL DE PANAMÁ

19 12:11 PM

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- Sample #2 sand from the beach during the middle range tide.....
- Sample# 3 sand from the beach during the high level tide.....

2. **Hydrometer test**

- Sample #1 sand from the beach during the low level tide.....
- Sample #2 sand from the beach during the middle range tide.....
- Sample# 3 sand from the beach during the high level tide.....

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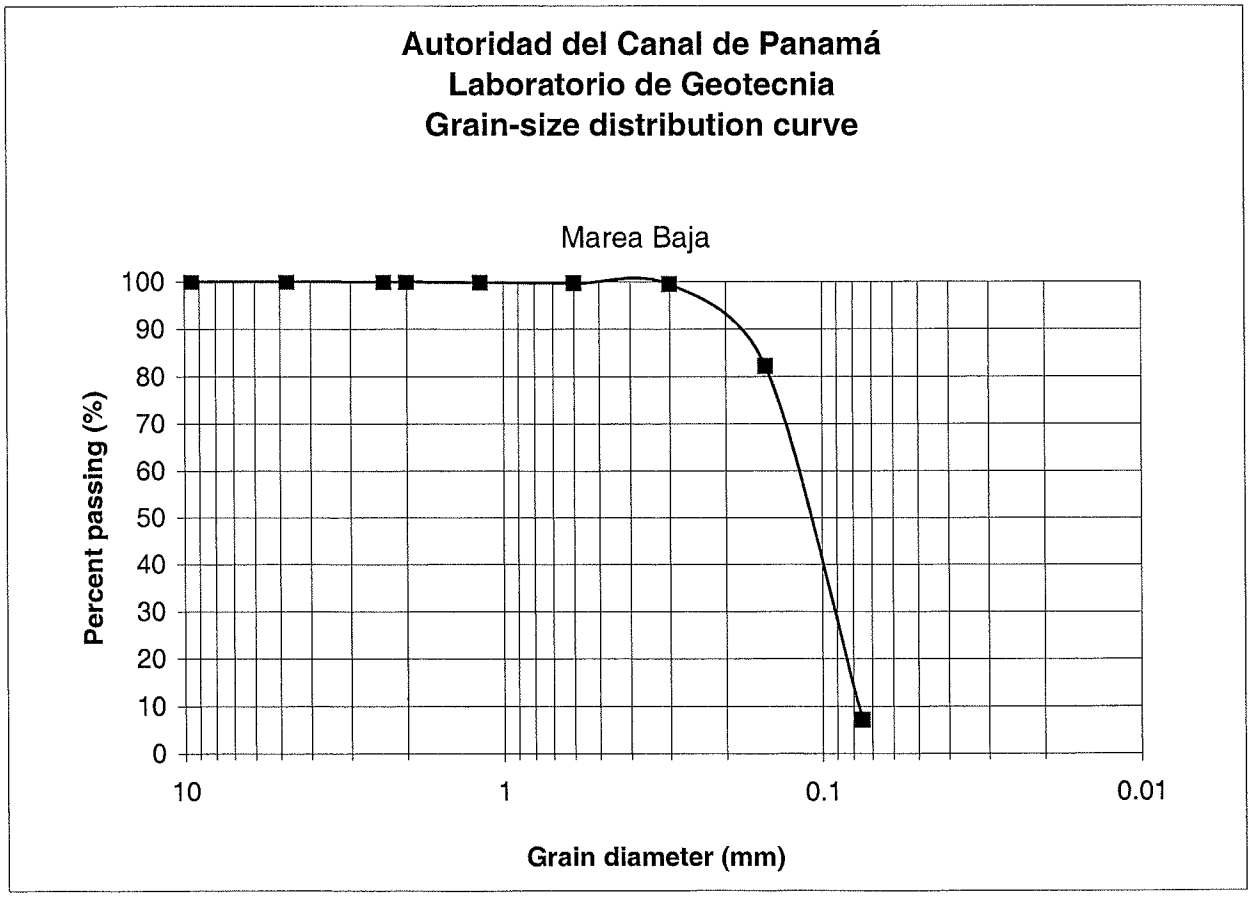
DIVISION DE INGENIERIA
SECCION DE GEOTECNIA

GRAIN SIZE ANALYSIS-MECHANICAL TEST

Project:	Isla Artificial	**Date:**	6/20/02	**Archivo:**	Is10530B
Location:	Veracruz	**Shot No.:**	106	**El:**	-1.784 PLD
Description of soil:	Arena de Playa sample#1	**Northing:**	982392.23	**Ubicación:**	Marea Baja
Weight of dry sample:	127.2	**Easting:**	654529.528	**Tested By:**	X.Rios

Sieve No.	Sieve Opening(mm)	Retained	% of weight retained	Cumulative % retained	Percent finer (%)
3/8	9.5	0	0.00	0.00	100.00
4	4.75	0	0.00	0.00	100.00
8	2.36	0.1	0.08	0.08	99.92
10	2	0	0.00	0.08	99.92
16	1.18	0.2	0.16	0.24	99.76
30	0.6	0.1	0.08	0.31	99.69
50	0.3	0.3	0.24	0.55	99.45
100	0.15	22.0	17.30	17.85	82.15
200	0.075	95.5	75.08	92.92	7.08
bot		0.2			



Prepared By: X. Rios
Source: Canal Capacity
File: SieveIslaArtificial

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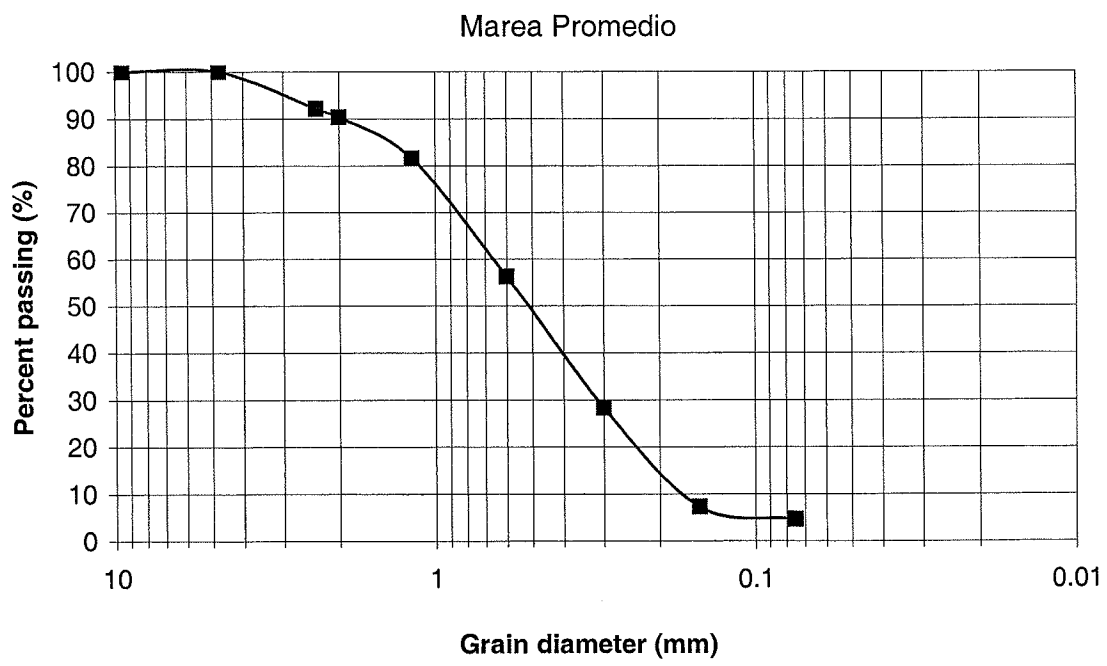
GRAIN SIZE ANALYSIS-MECHANICAL TEST

Project:	Isla Artificial	**Date:**	6/20/02	**Archivo:**	Is10531B
Location:	Veracruz	**Shot No.:**	36	**El:**	-0.03 PLD
Description of soil:	Arena de Playa sample#2	**Northing:**	982911.48	**Ubicación:**	Marea Promedio
Weight of dry sample:	128	**Easting:**	654062.660	**Tested By:**	X.Rios

Sieve No.	Sieve Opening(mm)	Retained	% of weight retained	Cumulative % retained	Percent finer (%)
3/8	9.5	0	0.00	0.00	100.00
4	4.75	0	0.00	0.00	100.00
8	2.36	10.1	7.89	7.89	92.11
10	2	2.3	1.80	9.69	90.31
16	1.18	11.2	8.75	18.44	81.56
30	0.6	32.4	25.31	43.75	56.25
50	0.3	35.70	27.89	71.64	28.36
100	0.15	27.00	21.09	92.73	7.27
200	0.075	3.30	2.58	95.31	4.69
bot		0.10			

Autoridad del Canal de Panamá
Laboratorio de Geotecnia
Grain-size distribution curve



Prepared By: X. Rios
Source: Canal Capacity
File: SieveIslaArtificial

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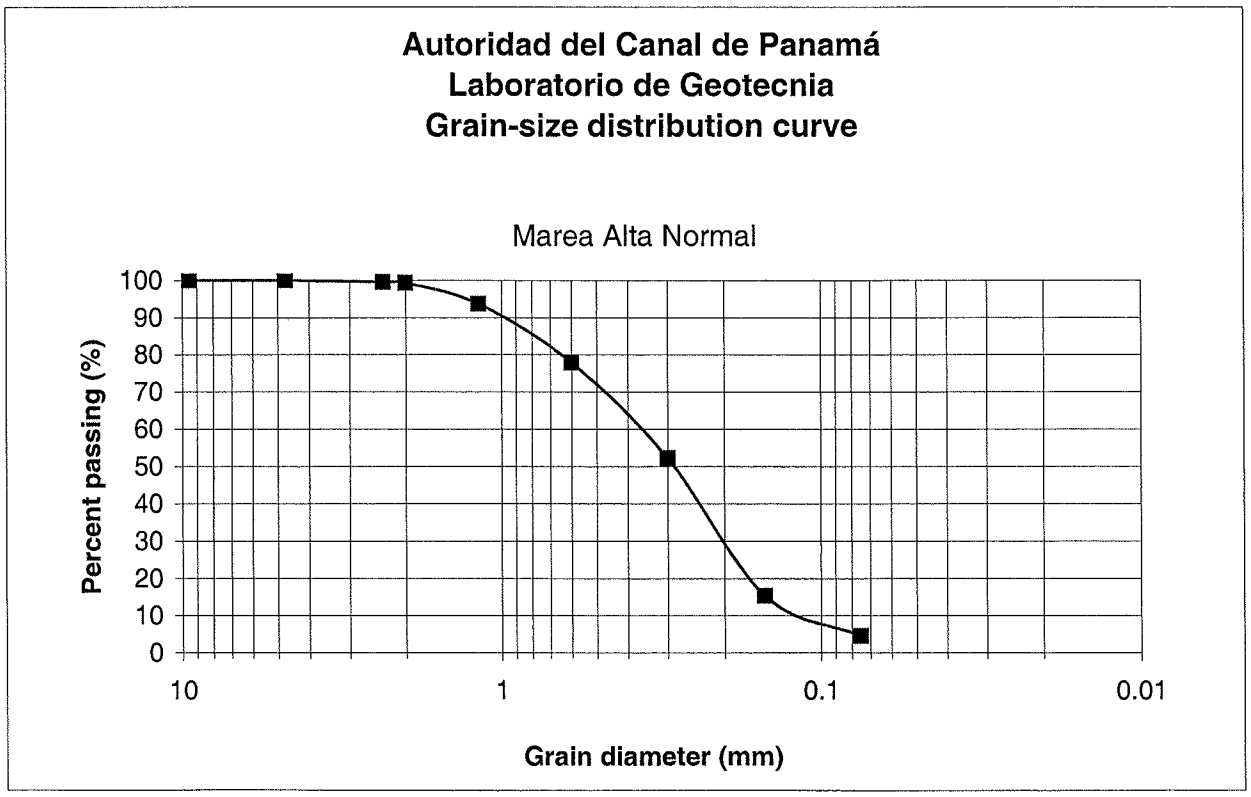
GRAIN SIZE ANALYSIS-MECHANICAL TEST

Project:	Isla Artificial	**Date:**	6/20/02	**Archivo:**	Is10531B
Location:	Veracruz	**Shot No.:**	334	**El:**	3.78m PLD
Description of soil:	Arena de Playa sample#3	**Northing:**	983137.85	**Ubicación:**	Marea Alta Normal
Weight of dry sample:	130	**Easting:**	654116.92	**Tested By:**	X.Rios

Sieve No.	Sieve Opening(mm)	Retained	% of weight retained	Cumulative % retained	Percent finer (%)
3/8	9.5	0	0.00	0.00	100.00
4	4.75	0	0.00	0.00	100.00
8	2.36	0.58	0.45	0.45	99.55
10	2	0.37	0.28	0.73	99.27
16	1.18	7.22	5.55	6.28	93.72
30	0.6	20.63	15.87	22.15	77.85
50	0.3	33.35	25.65	47.81	52.19
100	0.15	47.96	36.89	84.70	15.30
200	0.075	14.09	10.84	95.54	4.46
bot		0.04			



Prepared By: X. Rios
Source: Canal Capacity
File: SieveIslaArtificial

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GRAIN SIZE ANALYSIS-HYDROMETER ASTM-422

Project:	Isla artificial	**Date:**	6/24/02
Location:	Sector Pacífico	**Boring:**	Grad. Cyl. No:10
Description:	Arena de playa	**Sample No.:**	1 — Container No:25
Tested by:	X. Rios	**Depth:**	Marea baja
CLASSIFICATION:		**Blows:**	

Hydrometer data

Hydrometer No. :	152 H	**Wt. of soil Ws:**	100.5
Gs:	2.67	**Zero correction:**	4
Hygrosc. moisture:	1	**Dispersing agent:**	NaPo3
Correction factor a:	0.995	**Meniscus correct.:**	1

RESULTS OBTAINED FROM MECHANICAL SIEVE ANALYSIS

Sieve No.	Wt. Ret		D (mm)	% of soil finer
No. 4	0	0.0	4.7500	100.0
No. 10	0	0.0	2.0000	100.0
No. 40	1.1	1.1	0.4250	98.9
No. 200	92.9	93.1	0.0750	6.9
bottom	0.2			

RESULTS OBTAINED FROM HYDROMETER TEST

Time of reading	Elapsed time(min)	Temp. C	Actual Hyd. reading Rc	Correc. of temp. Ct	Corr. Hyd. reading Rc	Hyd. Corr. only for meniscus R	L from table 2	K from table 3	D (mm)	% of soil finer
	2	25.5	8.5	1.48	5.98	9.5	15.8	0.0127	0.0357	5.9
	5	26	8	1.65	5.65	9	15.9	0.0126	0.0225	5.6
	8	26	7.5	1.65	5.15	8.5	15.9	0.0126	0.0178	5.1
	15	26.5	7	1.83	4.83	8	16.0	0.0126	0.0130	4.8
	30	27	7	2	5	8	16.0	0.0125	0.0091	5.0
	60	27	7	2	5	8	16.0	0.0125	0.0065	5.0
	250	27	7	2	5	8	16.0	0.0125	0.0032	5.0
	1440	27	7	2	5	8	16.0	0.0125	0.0013	5.0

Prepared: Xenia Rios

Source: Canal Capacity

File: HydIslaArtificial

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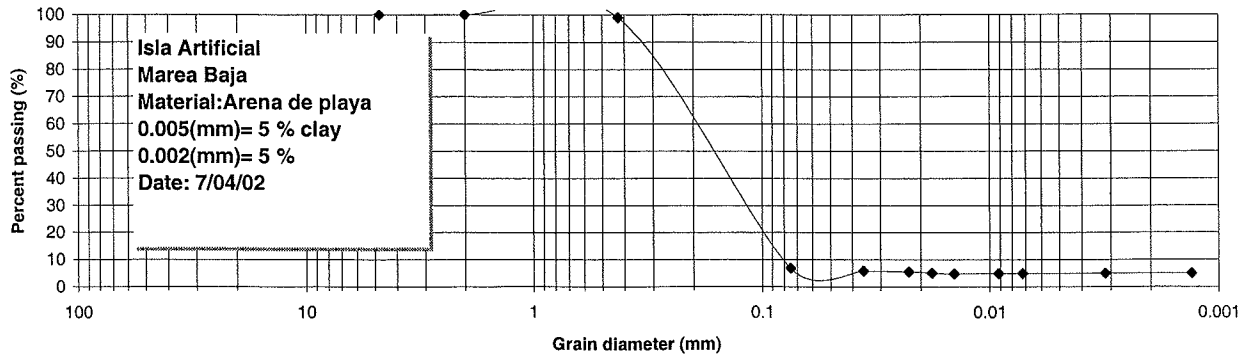
Geotechnical Laboratory
Grain-size distribution curve



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GRAIN SIZE ANALYSIS-HYDROMETER ASTM-422

Project: Isla artificial
Location: Sector Pacífico
Description: Arena de playa
Tested by: X. Rios
CLASSIFICATION:

Date: 6/25/02
Boring:
Sample No.: 3
Depth: Marea alta normal
Blows:

Grad. Cyl. No:12
Container No:15

Hydrometer data

Hydrometer No. : 152 H
Gs: 2.73
Hygrosc. moisture: 1
Correction factor a: 0.983

Wt. of soil Ws: 100.7
Zero correction: 4
Dispersing agent: NaPo3
Meniscus correct.: 1

RESULTS OBTAINED FROM MECHANICAL SIEVE ANALYSIS

Sieve No.	Wt. Ret		D (mm)	% of soil finer
No. 4	0	0.0	4.7500	100.0
No. 10	0	0.0	2.0000	100.0
No. 40	31.9	31.1	0.4250	68.9
No. 200	64.4	94.0	0.0750	6.0
bottom	0.1			

RESULTS OBTAINED FROM HYDROMETER TEST

Time of reading	Elapsed time(min)	Temp. C	Actual Hyd. reading Rc	Correc. of temp. Ct	Corr. Hyd. reading Rc	Hyd. Corr. only for meniscus R	L from table 2	K from table 3	D (mm)	% of soil finer
	2	25.5	6.5	1.48	3.98	7.5	16.1	0.01279	0.0363	3.9
	5	26	6	1.65	3.65	7	16.2	0.01272	0.0229	3.6
	8	26.5	5.5	1.83	3.33	6.5	16.3	0.01265	0.0180	3.2
	15	27	5.5	2	3.5	6.5	16.3	0.05258	0.0548	3.4
	30	27	5.5	2	3.5	6.5	16.3	0.01258	0.0093	3.4
	60	27	5.5	2	3.5	6.5	16.3	0.01258	0.0066	3.4
	250	27	5	2	3	6	16.4	0.01258	0.0032	2.9
	1440	27	5	2	3	6	16.4	0.01258	0.0013	2.9

Prepared: Xenia Rios
Source: Canal Capacity
File: HydIslaArtificial

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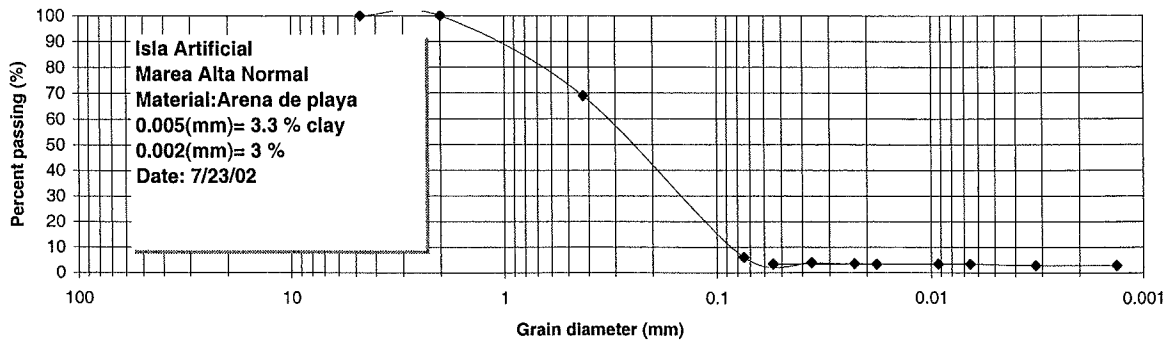
Geotechnical Laboratory
Grain-size distribution curve



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GRAIN SIZE ANALYSIS-HYDROMETER ASTM-422

Project: Isla artificial
Location: Sector Pacífico
Description: Arena de playa
Tested by: X. Rios
CLASSIFICATION:

Date: 6/25/02
Boring:
Sample No.: 2
Depth: Marea promedio
Blows:

Grad. Cyl. No:15
Container No:38

Hydrometer data

Hydrometer No. : 152 H
Gs: 2.66
Hygrosc. moisture: 1
Correction factor a: 0.998

Wt. of soil Ws: 100.7
Zero correction: 4
Dispersing agent: NaPo3
Meniscus correct.: 1

RESULTS OBTAINED FROM MECHANICAL SIEVE ANALYSIS

Sieve No.	Wt. Ret		D (mm)	% of soil finer
No. 4	0	0.0	4.7500	100.0
No. 10	0	0.0	2.0000	100.0
No. 40	49.9	49.4	0.4250	50.6
No. 200	45.6	94.6	0.0750	5.4
bottom	0.1			

RESULTS OBTAINED FROM HYDROMETER TEST

Time of reading	Elapsed time(min)	Temp. C	Actual Hyd. reading Rc	Correc. of temp. Ct	Corr. Hyd. reading Rc	Hyd. Corr. only for meniscus R	L from table 2	K from table 3	D (mm)	% of soil finer
	2	25.5	7.5	1.3	4.8	8.5	15.9	0.01275	0.0360	4.8
	5	26	7	1.65	4.65	8	16.0	0.01268	0.0227	4.6
	8	26.5	6.5	1.83	4.33	7.5	16.1	0.01265	0.0180	4.3
	15	27	6	1.83	3.83	7	16.2	0.01261	0.0131	3.8
	30	27	6	2	4	7	16.2	0.01254	0.0092	4.0
	60	27	6	2	4	7	16.2	0.01254	0.0065	4.0
	250	27	6	2	4	7	16.2	0.01254	0.0032	4.0
	1440	27	6	2	4	7	16.2	0.01254	0.0013	4.0

Prepared: Xenia Rios
Source: Canal Capacity
File: HydIslaArtificial

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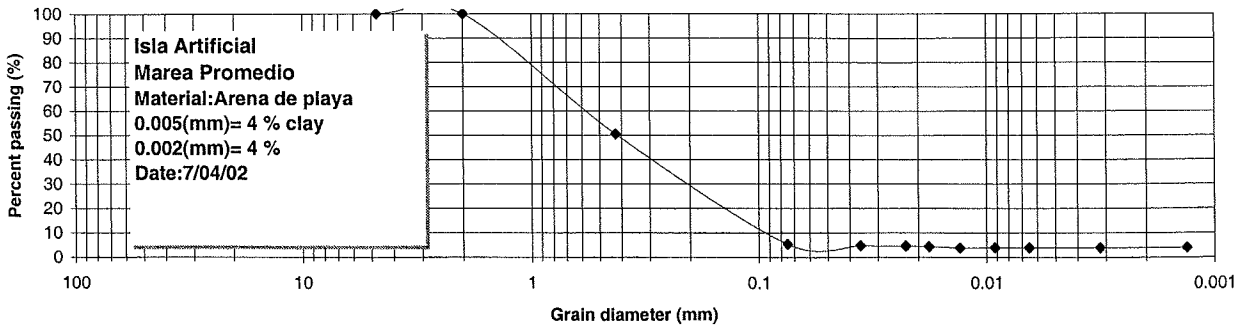
Geotechnical Laboratory
Grain-size distribution curve



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PANAMA CANAL AUTHORITY
ENGINEERING DIVISON
GEOTECHNICAL BRANCH
SOILS AND MATERIAL LABORATORY

Laboratory Testing Program for The Railroad to Artificial Island Project Site Investigation

Prepared By:
Gustavo Guerra B.

Assisted by:
Xenia Ríos
Rodrigo Lam
Adalberto Guzmán
Carlos Rodriguez

September 2002

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3.2 Appendix B: Unconfined Compression Test
3.3 Appendix C: Point Load Test / Triaxial Test
3.4 Appendix D: Photos of Materials
3.5 Appendix E: Map of Boring Locations

INTRODUCTION

The purpose of this report is to present the results from tests conducted on samples obtained from borings of the Railroad to Artificial Island Project Site Investigation. Samples are representative of the La Boca Formation, Tertiary basalt, Pacific Muck and Panama Formation, located at the pacific side of the Canal.

The samples were obtained from 8 holes. The standard penetration tests were made every 1.05 meter. Soils samples from the SPT sampler were stored in plastic bags and rock samples were covered with plastic and sealed with paraffin, and transported to the laboratory for storage.

In the laboratory all samples were taken out from the bags and dried in the work area. The following index tests were carried out: water content, Atterberg Limits, specific gravity and sieve analysis. All these tests were made on the 56 standard penetration test samples, that is, 168 tests to determine the classification of the materials.

Three types of strength tests were conducted namely, unconfined compression test, and point load test and triaxial test.

The compression test was performed on intact rock having a nominal diameter of 2.6 in. and loaded at constant rate until the failure was reached.

All these test, have been performed according to ASTM standards and performed by personnel of the Soils and Materials Laboratory of the Geotechnical Branch, Engineering Division.

The results are summarized in the tables presented in the appendixes.

2.2 General Procedures

2.1 Sample Preparation

All samples were prepared for index properties requiring for classification soils. The soils as received from the field to air at room temperature until dried thoroughly. We break up the aggregations in the mortar with rubber-covered pestle quartering and selecting portion for different tests.

2.2 Sieving ASTM D422

The soil sample is tested for grain size distribution by passing the sample through number of sieves of different size openings. Mechanical shaker should agitate the sieves, over a period of time. When the sieving operation has been completes, the weight of the soils particles retained on each sieve is determined from and the percentage passing each sieve is calculated. The test results are presented on semi logarithmic scale.

2.3 Atterberg limits ASTM D4318

The sample at its material water content was air dried for 48 hours. The material was then ground in a mortar using a rubber-tipped pestle until a powder was produced that would pass the no. 40 sieve.

We place a sample in the brass cup of the liquid limit device, cut the standard groove, and then count the number of drops of device that are required to close the groove. The liquid limit is that water content of the soil at which the standard groove is closed a distance of ½ in be exactly 25 drops. This is determined by plotting on semilogaritmic graph paper. For determine the plastic limit soil is crumbled by loosing moisture and soil no longer can be rolled into a thread at this point is assumed to have been reached.

2.4 Specific gravity ASTM C-128

The procedure is to put the soil sample (100 gr,) in a pycnometer, which is then filled with water then weight the pycnometer with water and soil and measured the temperature. With these data now known the specific gravity can be calculated by dividing the weight of solid by the weight of an n equal volume of water.

2.5 Unconfined Compresion Test ASTM 2938

Unconfined compression test were performed on the samples on the fields samples (1.86 and 2.5 in. diam) with the ends trimmed provide a length to diameter ratio 2. The specimens were tested under controlled strain conditions; the loading rate was about 50-150 lbs/s. The moisture condition of samples at time of test is as received from the field. To determine the unconfined compressive strength of the specimen this is obtain by dividing the maximum load carried by specimen during the test by cross-sectional area calculated.

2.6 Point load Test ASTM 5731

Point load test is used as an index test for strength classification of rock materials. This method is performed of either core (the diametral and axial test), cut blocks (block test) or irregular lumps (the irregular lump test) by application of concentrated load through of truncated, conical platens. Little or no specimen preparation is required.

The rocks is inserted in the test device and close the platens to make contact along core diameter, record the height of specimens an steadily increase the load such that failures occurs within 10 to 60 s. and record failure load. After the test calculation of point load strength is determined.

APPENDIX A: INDEX TEST

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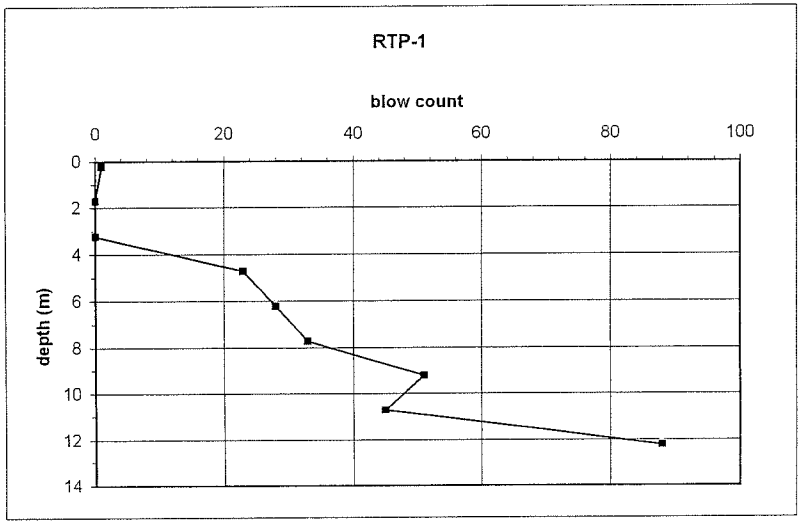
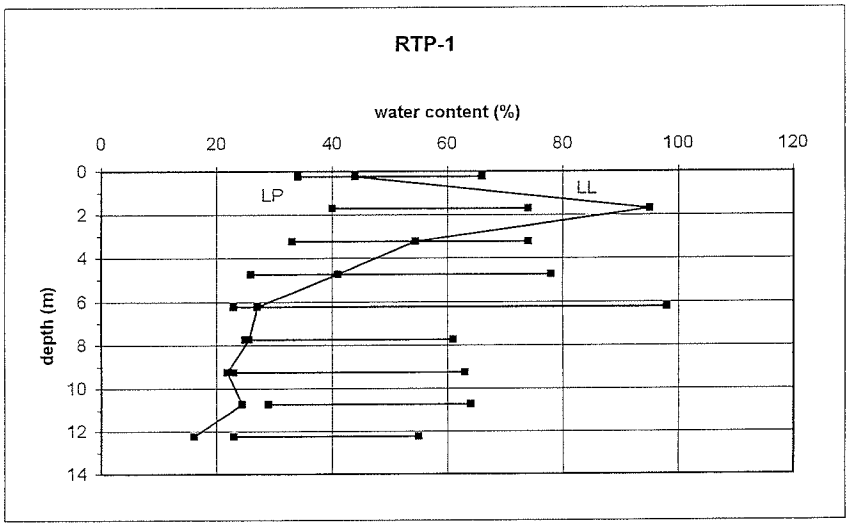
SUMMARY RESULTS OF INDEX TESTS

Project: Railroad to Artificial Island
Location: Pacific side

Borehole	SPT No.	Depth (m)	Blows (N)	Specific Gravity Gs	Moisture Content (%)	Passing No.200 (%)	Liquid Limit LL	Plastic Limit PL	Plastic Index PI	Classific. U.C.S.	Name	Color
RTP-1	1	0.00-0.45	1-1-0		44.00	+	66	34	32	MH	Elastic silt	Brown
RTP-1	2	1.50-1.95	1-0-0		95.05	41.94	74	40	34	SM	Silty sand	Dark gray
RTP-1	3	3.00-3.45	1-0-0		54.43	54.03	74	33	41	CH	Sandy fat clay	Grayish brown
RTP-1	4	4.50-4.95	6-9-14		41.02	83.57	78	26	52	CH	Fat clay with sand	Light brownish gray
RTP-1	5	6.00-6.45	7-10-18		27.02	86.03	98	23	75	CH	Fat clay	Pale brown
RTP-1	6	7.50-7.95	11-15-18		25.64	51.89	61	25	36	CH	Sandy fat clay	Light gray
RTP-1	7	9.00-9.45	11-19-32		21.84	72.71	63	23	40	CH	Fat clay with sand	Pale yellow
RTP-1	8	10.50-10.95	10-15-30		24.37	71.62	64	29	35	CH	Fat clay with sand	Light brownish gray
RTP-1	9	12.00-12.45	11-38-50		16.05	59.19	55	23	32	CH	Sandy fat clay	Light brownish gray

Remarks:(+) means "insufficient material"
Tested By: C. Rodriguez, and X. Rios.
Date: 08/08/2002
File: RTP
Prepared By: Xenia Rios
Checked by: Gustavo Guerra B.





AUTORIDAD DEL CANAL DE PANAMA
DIVISION DE INGENIERIA
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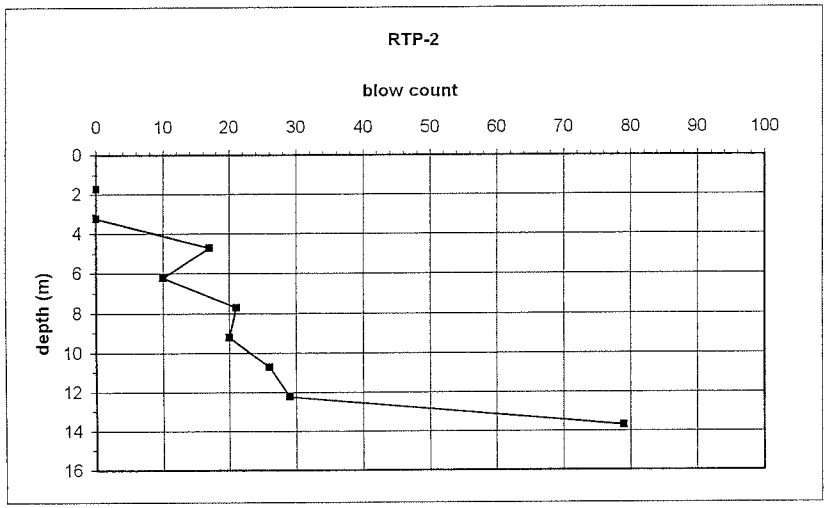
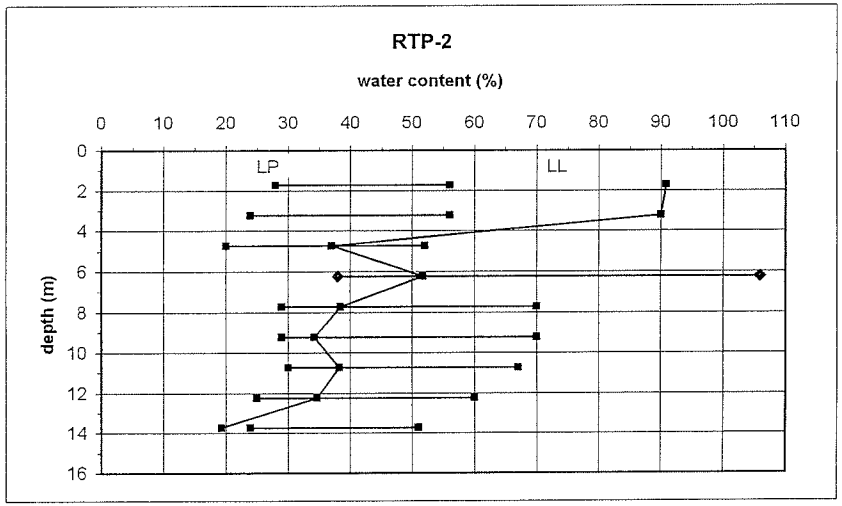
SUMMARY RESULTS OF INDEX TESTS

Project: Railroad to Artificial Island
Location: Pacific side

Borehole	SPT No.	Depth (m)	Blows (N)	Specific Gravity Gs	Moisture Content (%)	Passing No.200 (%)	Liquid Limit LL	Plastic Limit PL	Plastic Index PI	Classific. U.C.S.	Name	Color
RTP-2	1	1.50-1.95	1-0-0		90.78	+	56	28	28	**CH**	Fat clay	Gray
RTP-2	2	3.00-3.45	1-0-0		89.97	+	56	24	32	**CH**	Fat clay	Gray
RTP-2	3	4.50-4.95	3-8-9		37.01	42.46	52	20	32	**SC**	Clayey sand	Light yellowish brown
RTP-2	4	6.00-6.45	3-4-6		51.72	81.25	106	38	68	**CH**	Fat clay with sand	Light yellowish brown
RTP-2	5	7.50-7.95	6-9-12		38.48	70.69	70	29	41	**CH**	Fat clay with sand	Brown
RTP-2	6	9.00-9.45	6-8-12		34.22	61.86	70	29	41	**CH**	Sandy fat clay	Brown
RTP-2	7	10.50-10.95	7-11-15		38.23	63.31	67	30	37	**CH**	Sandy fat clay	Light brownish gray
RTP-2	8	12.00-12.45	9-12-17		34.61	+	60	25	35	**CH**	Fat clay	Grayish brown
RTP-2	9	13.50-13.95	17-29-50		19.35	54.02	51	24	27	**CH**	Sandy fat clay	Gray

Remarks:(+) means "insufficient material"
Tested By: C. Rodriguez, and X. Rios.
Date: 08/08/2002
File: RTP
Prepared By: Xenia Rios
Checked by: Gustavo Guerra B.





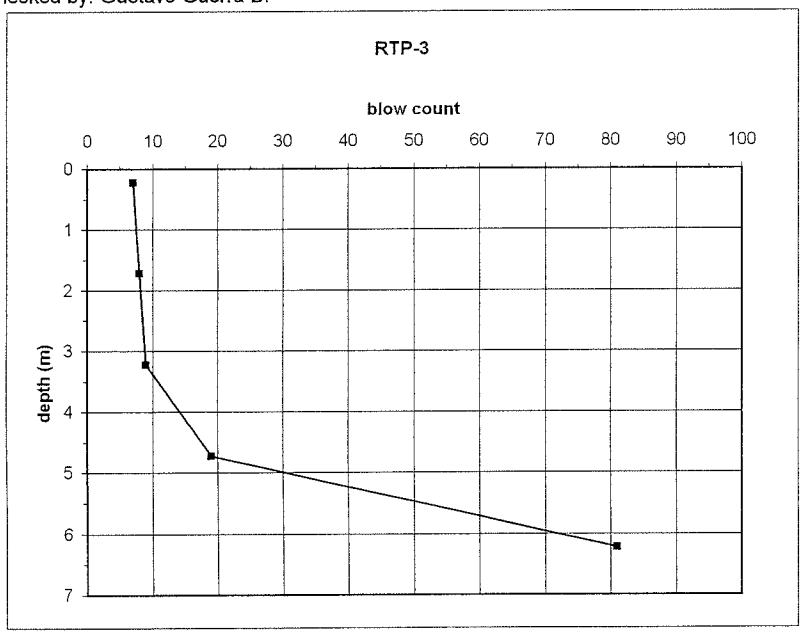
AUTORIDAD DEL CANAL DE PANAMA
DIVISION DE INGENIERIA
SECCION DE GEOTECNIA

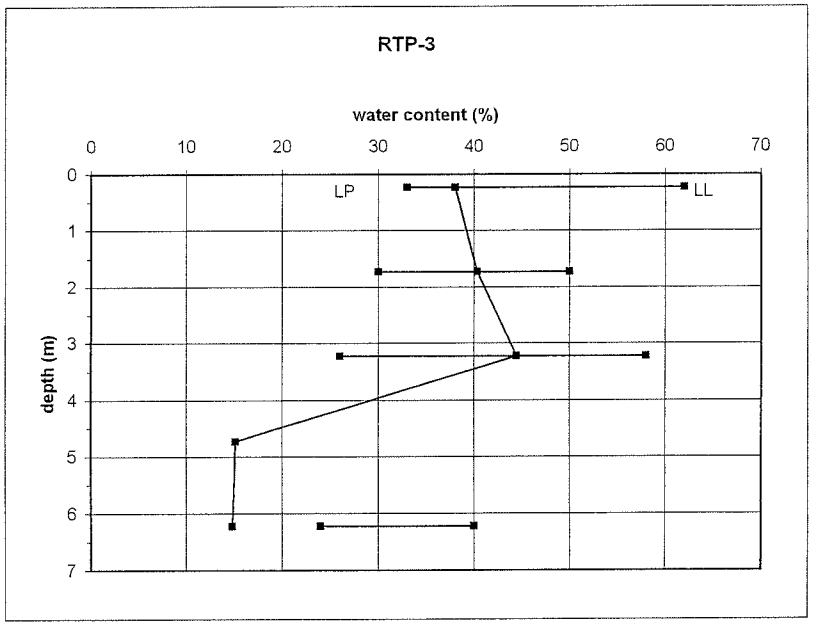
SUMMARY RESULTS OF INDEX TESTS

Project: Railroad to Artificial Island
Location: Pacific side

Borehole	SPT No.	Depth (m)	Blows (N)	Specific Gravity Gs	Moisture Content (%)	Passing No.200 (%)	Liquid Limit LL	Plastic Limit PL	Plastic Index PI	Classific. U.C.S.	Name	Color
RTP-3	1	0.00-0.45	1-3-4		38.04	37.35	62	33	29	SM	Silty sand	Brown
RTP-3	2	1.50-1.95	3-4-4		40.31	31.05	50	30	20	SM	Silty sand	Light yellowish brown
RTP-3	3	3.00-3.45	2-3-6		44.44	37.13	58	26	32	SC	Clayey sand	Pale brown
RTP-3	4	4.50-4.95	8-11-8		15.14	18.43	+	+	+			
RTP-3	5	6.00-6.45	17-31-50		14.82	+	40	24	16	CL	Lean clay	Light gray

Remarks:(+) means "insufficient material"
Tested By: C. Rodriguez, and X. Rios.
Date: 08/08/2002
File: RTP
Prepared By: Xenia Rios
Checked by: Gustavo Guerra B.





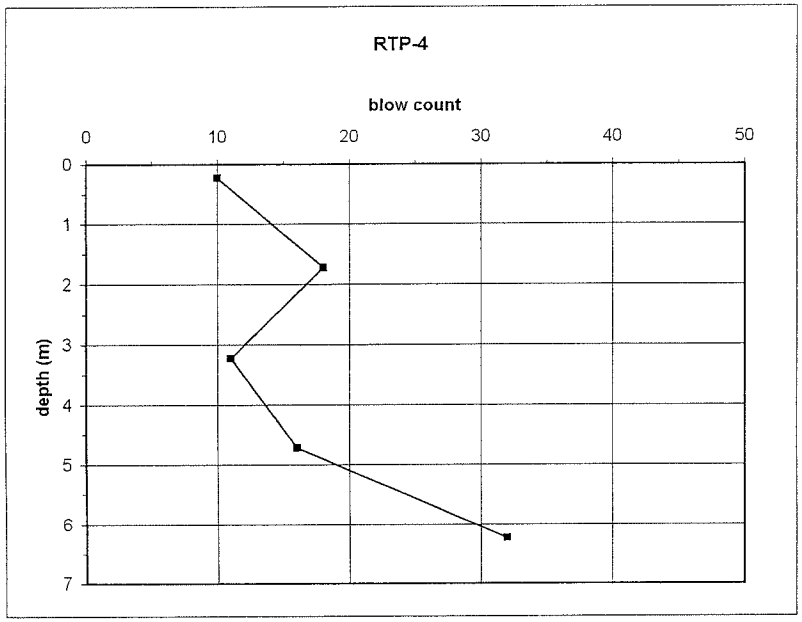
AUTORIDAD DEL CANAL DE PANAMA
DIVISION DE INGENIERIA
SECCION DE GEOTECNIA

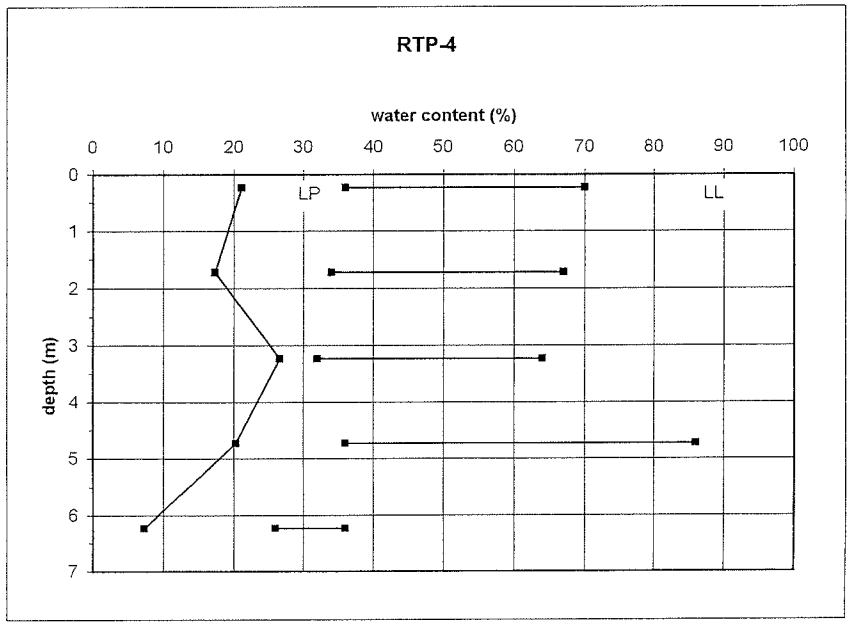
SUMMARY RESULTS OF INDEX TESTS

Project: Railroad to Artificial Island
Location: Pacific side

Borehole	SPT No.	Depth (m)	Blows (N)	Specific Gravity Gs	Moisture Content (%)	Passing No.200 (%)	Liquid Limit LL	Plastic Limit PL	Plastic Index PI	Classific. U.C.S.	Name	Color
RTP-4	1	0.00-0.45	4-4-6		21.16	34.02	70	36	34	SM	Silty sand	Reddish brown
RTP-4	2	1.50-1.95	4-8-10		17.26	34.20	67	34	33	SM	Silty sand	Reddish brown
RTP-4	3	3.00-3.45	4-4-7		26.63	37.32	64	32	32	SM	Silty sand	Reddish brown
RTP-4	4	4.50-4.95	4-6-10		20.29	42.72	86	36	50	SC	Clayey sand	Brown
RTP-4	5	6.00-6.45	10-17-15		7.26	35.08	36	26	10	SM	Silty sand	Light gray

Remarks:(+) means "insufficient material"
Tested By: C. Rodriguez, and X. Rios.
Date: 08/08/2002
File: RTP
Prepared By: Xenia Rios
Checked by: Gustavo Guerra B.





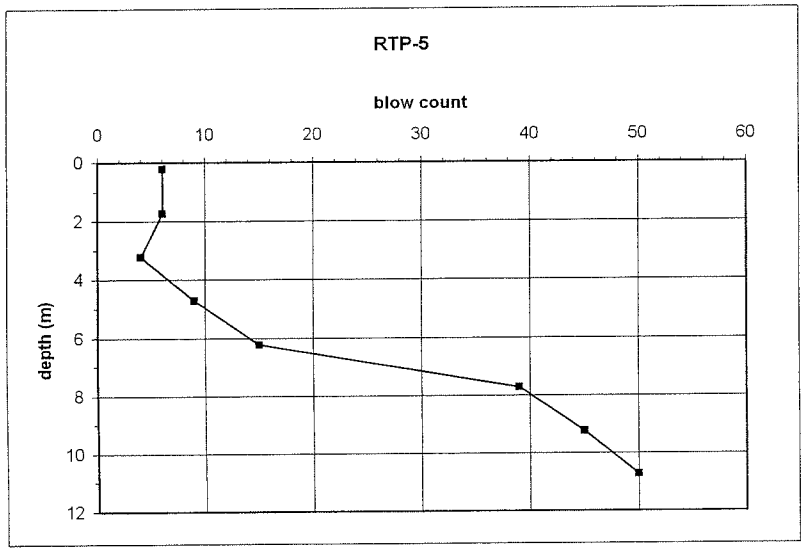
AUTORIDAD DEL CANAL DE PANAMA
DIVISION DE INGENIERIA
SECCION DE GEOTECNIA

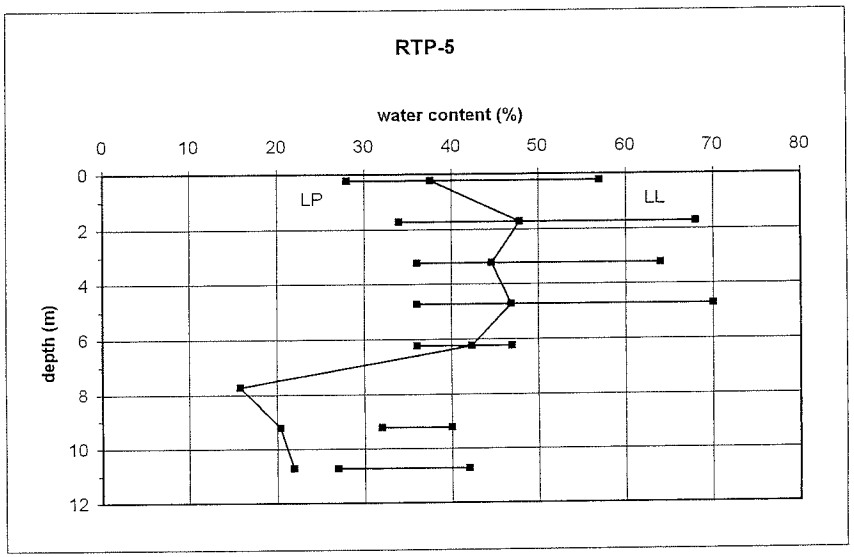
SUMMARY RESULTS OF INDEX TESTS

Project: Railroad to Artificial Island
Location: Pacific side

Borehole	SPT No.	Depth (m)	Blows (N)	Specific Gravity Gs	Moisture Content (%)	Passing No.200 (%)	Liquid Limit LL	Plastic Limit PL	Plastic Index PI	Classific. U.C.S.	Name	Color
RTP-5	1	0.00-0.45	1-2-4		37.58	26.78	57	28	29	SC	Clayey sand	Brown
RTP-5	2	1.50-1.95	2-3-3		47.88	40.64	68	34	34	SM	Silty sand	Brown
RTP-5	3	3.00-3.45	2-2-2		44.61	34.83	64	36	28	SM	Silty sand	Brown
RTP-5	4	4.50-4.95	2-3-6		46.88	34.39	70	36	34	SM	Silty sand	Brown
RTP-5	5	6.00-6.45	5-6-9		42.36	33.23	47	36	11	SM	Silty sand	Light gray
RTP-5	6	7.50-7.95	16-21-18		15.84	8.24	+	+	+			
RTP-5	7	9.00-9.45	4-14-31		20.42	27.36	40	32	8	SM	Silty sand with gravel	Light brownish gray
RTP-5	8	10.50-10.95	50-0-0		21.98	20.73	42	27	15	SM	Silty sand with gravel	Grayish brown

Remarks:(+) means "insufficient material"
Tested By: C. Rodriguez, and X. Rios.
Date: 08/08/2002
File: RTP
Prepared By: Xenia Rios
Checked by: Gustavo Guerra B.





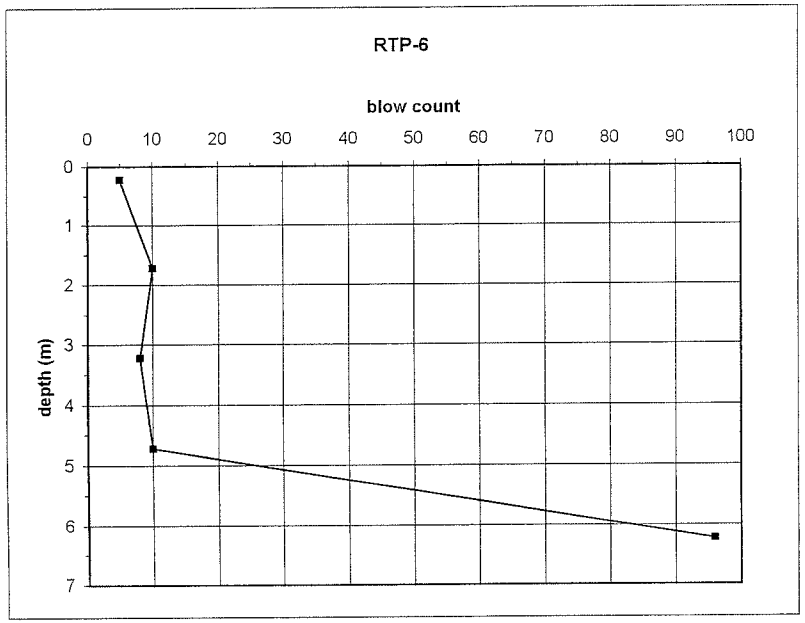
AUTORIDAD DEL CANAL DE PANAMA
DIVISION DE INGENIERIA
SECCION DE GEOTECNIA

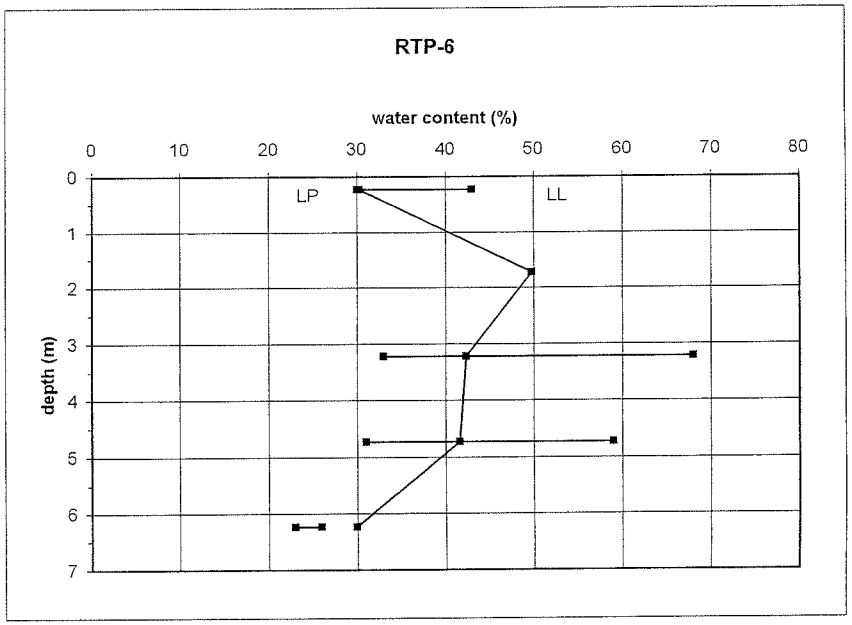
SUMMARY RESULTS OF INDEX TESTS

Project: Railroad to Artificial Island
Location: Pacific side

Borehole	SPT No.	Depth (m)	Blows (N)	Specific Gravity Gs	Moisture Content (%)	Passing No.200 (%)	Liquid Limit LL	Plastic Limit PL	Plastic Index PI	Classific. U.C.S.	Name	Color
RTP-6	1	0.00-0.45	1-3-2		30.23	40.18	43	30	13	SM	Silty sand	Light brownish gray
RTP-6	2	1.50-1.95	5-5-5		49.73	33.77	+	+	+			
RTP-6	3	3.00-3.45	3-3-5		42.30	47.88	68	33	35	SC	Clayey sand	Pale brown
RTP-6	4	4.50-4.95	3-4-6		41.60	38.55	59	31	28	SM	Silty sand	Light brownish gray
RTP-6	5	6.00-6.45	11-46-50		29.95	32.16	26	23	3	SM	Silty sand	Light yellowish brown

Remarks:(+) means "insufficient material"
Tested By: C. Rodriguez, and X. Rios.
Date: 08/08/2002
File: RTP
Prepared By: Xenia Rios
Checked by: Gustavo Guerra B.





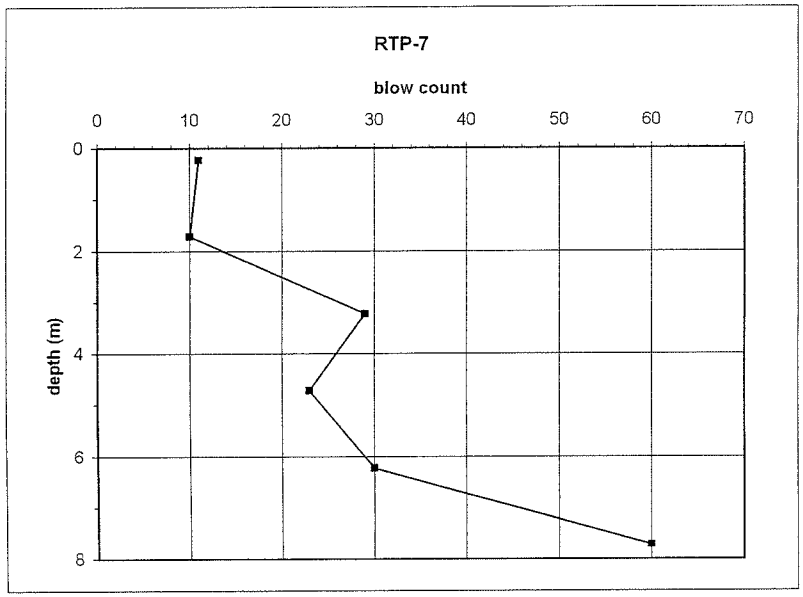
AUTORIDAD DEL CANAL DE PANAMA
DIVISION DE INGENIERIA
SECCION DE GEOTECNIA

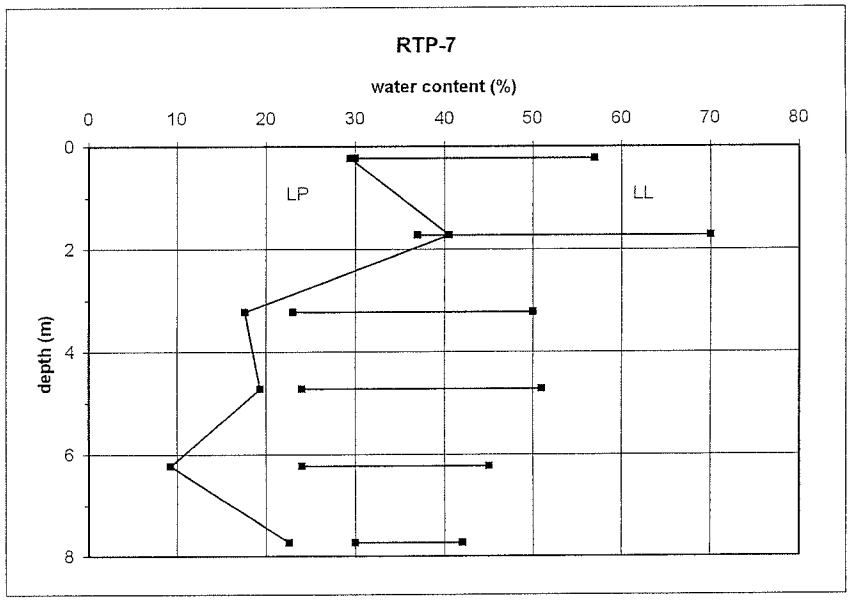
SUMMARY RESULTS OF INDEX TESTS

Project: Railroad to Artificial Island
Location: Pacific side

Borehole	SPT No.	Depth (m)	Blows (N)	Specific Gravity Gs	Moisture Content (%)	Passing No.200 (%)	Liquid Limit LL	Plastic Limit PL	Plastic Index PI	Classific. U.C.S.	Name	Color
RTP-7	1	0.00-0.45	2-5-6		29.41	37.17	57	30	27	SM	Silty sand	Light brown
RTP-7	2	1.50-1.95	5-5-5		40.49	44.57	70	37	33	SM	Silty sand	Light brown
RTP-7	3	3.00-3.45	8-14-15		17.62	30.15	50	23	27	SC	Clayey sand with gravel	Very pale brown
RTP-7	4	4.50-4.95	9-9-14		19.32	46.19	51	24	27	SC	Clayey sand	Very pale brown
RTP-7	5	6.00-6.45	7-15-15		9.29	31.54	45	24	21	SC	Clayey sand	Light yellowish brown
RTP-7	6	7.50-7.95	10-50		22.57	49.88	42	30	12	SM	Silty sand	Very pale brown

Remarks:(+) means "insufficient material"
Tested By: C. Rodriguez, and X. Rios.
Date: 08/08/2002
File: RTP
Prepared By: Xenia Rios
Checked by: Gustavo Guerra B.





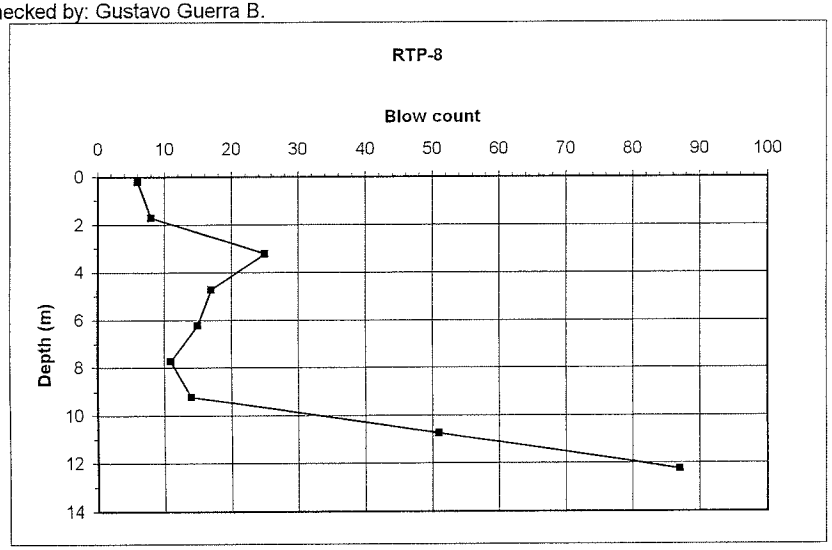
AUTORIDAD DEL CANAL DE PANAMA
DIVISION DE INGENIERIA
SECCION DE GEOTECNIA

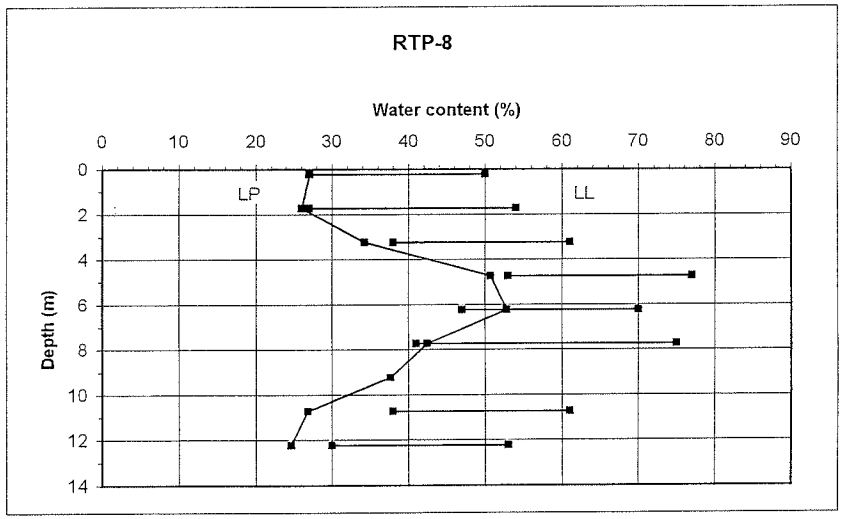
SUMMARY RESULTS OF INDEX TESTS

Project: Railroad to Artificial Island
Location: Pacific side

Borehole	SPT No.	Depth (m)	Blows (N)	Specific Gravity Gs	Moisture Content (%)	Passing No.200 (%)	Liquid Limit LL	Plastic Limit PL	Plastic Index PI	Classific. U.C.S.	Name	Color
RTP-8	1	0.00-0.45	2-2-4		27.03	27.77	50	27	23	SC	Clayey sand	Brown
RTP-8	2	1.50-1.95	2-4-4		25.98	27.48	54	27	27	SC	Clayey sand	Light brown
RTP-8	3	3.00-3.45	7-10-15		34.20	23.49	61	38	23	SM	Silty sand	Light brown
RTP-8	4	4.50-4.95	4-8-9		50.79	37.95	77	53	24	SM	Silty sand	Light reddish brown
RTP-8	5	6.00-6.45	4-6-9		52.84	32.61	70	47	23	SM	Silty sand	Brown
RTP-8	6	7.50-7.95	4-5-6		42.40	32.57	75	41	34	SM	Silty sand	Yellowish brown
RTP-8	7	9.00-9.45	5-5-9		37.65	32.86	+	+	+			
RTP-8	8	10.50-10.95	17-21-30		26.77	28.21	61	38	23	SM	Silty sand	Yellowish brown
RTP-8	9	12.00-12.45	37-50		24.62	35.65	53	30	23	SM	Silty sand	Light olive brown

Remarks:(+) means "insufficient material"
Tested By: C. Rodriguez, and X. Rios.
Date: 09/11/2002
File: RTP
Prepared By: Xenia Rios
Checked by: Gustavo Guerra B.





AUTORIDAD DEL CANAL DE PANAMA
DIVISION DE INGENIERIA
SECCION DE GEOTECNIA

SUMMARY RESULTS OF UNCONFINED COMPRESSIVE STRENGTH ON INTACT ROCK
Project: Railroad To Artificial Island
RTP

	Boring	Depth (m)	Sample No.	Unit weight Kg/m3	Elastic Modulus E (Mpa)	Unconf. Comp. σc (Mpa)	Specific gravity	Water %	Type of rock	Formation
1	RTP-2	20.77-21.30	1-1	2193		5		16.17	Breccia	La Boca
2	RTP-2	21.30-21.70	2-1	2345		7		11.92	Breccia	La Boca
3	RTP-2	21.30-21.70	2-2	2091		4		19.00	Breccia	La Boca
4	RTP-2	21.30-21.71	2-3	2290		2		12.5	Breccia	La Boca
5	RTP-2	21.70-22.02	3-1	2268		4		16.21	Breccia	La Boca
6	RTP-2	21.70-22.03	3-2	2353		9		10.96	Breccia	La Boca
7	RTP-3	9.76-9.98	1-1	2437		5		5.7	Brecciated basalt	La Boca
8	RTP-3	11.73-12.00	4-1	2624		3		7.31	Brecciated basalt	La Boca
9	RTP-5	14.62-14.80	2-1	2212		18		13.07	Sandstone agglomeratic	La Boca
10	RTP-6	9.89-10.30	1-1	2802		106		0.92	Basalt	Basalt
11	RTP-6	10.30-10.70	2-1	2870		84		0.73	Basalt	Basalt
12	RTP-6	11.52-11.80	3-1	2798		83		1.31	Basalt	Basalt
13	RTP-7	11.00-11.20	1-1	2637		17		2.87	Agglomerate	Panamá
14	RTP-7	11.30-11.50	2-1	2652		19		3.06	Agglomerate	Panamá
15	RTP-7	12.20-12.42	3-1	2664		51		2.01	Agglomerate	Panamá
16	RTP-8	13.32-13.57	1-1	2149		1		21.21	Agglomerate	La Boca
17	RTP-8	13.70-14.03	2-1	2055		1		18.86	Agglomerate	La Boca

Remarks: rock color :

Sandstone agglomeratic: Medium gray
Breccia: Med. Light gray
Brecciated basalt: Medium to dark gray
Agglomerate: Light gray
Basalt: Medium to dark gray

Natural joints

Tested and prepared By: R. Lam, X. Rios and G. Guerra 09/15/2002

AUTORIDAD DEL CANAL DE PANAMA
DIVISION DE INGENIERIA
SECCION DE GEOTECNIA

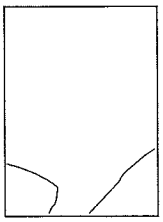
UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS ASTM 2938

Project:	Railroad to Artificial Island	Date:	09/09/2002
Location:		No. Sample:	1-1
Boring:	RTP-2	Testing time:	120
Depth:	20.77-21.30 m	Tested By:	R. Lam
Description:	Breccia		A. Guzmán

TEST ESPECIMEN DATA

Avg. Diameter Do(cm):	6.5	Moisture condition:	Air
Avg. Length Lo(cm):	13.8	Porcentage of absorption(%):	
Weight(grs):	1004.2	Water content Wo%:	56.17
Cross-sect. Area(cm2):	5.1	Specific gravity:	
Unit weight(kg/m3):	2193	Type of failure(shape):	shear
Time of failure(lb/seg):	33	Mode:	
Lo / Do ratio:	2.12	Angle of failure:	
Factor correction:	1.0070	Deformation rate:	0.54
Elastic modulus E(MPa):		Uniaxial compressive strenght(psi):	790
Classification Strength:	very low	(Kgf/cm2):	56
		(MPa):	5

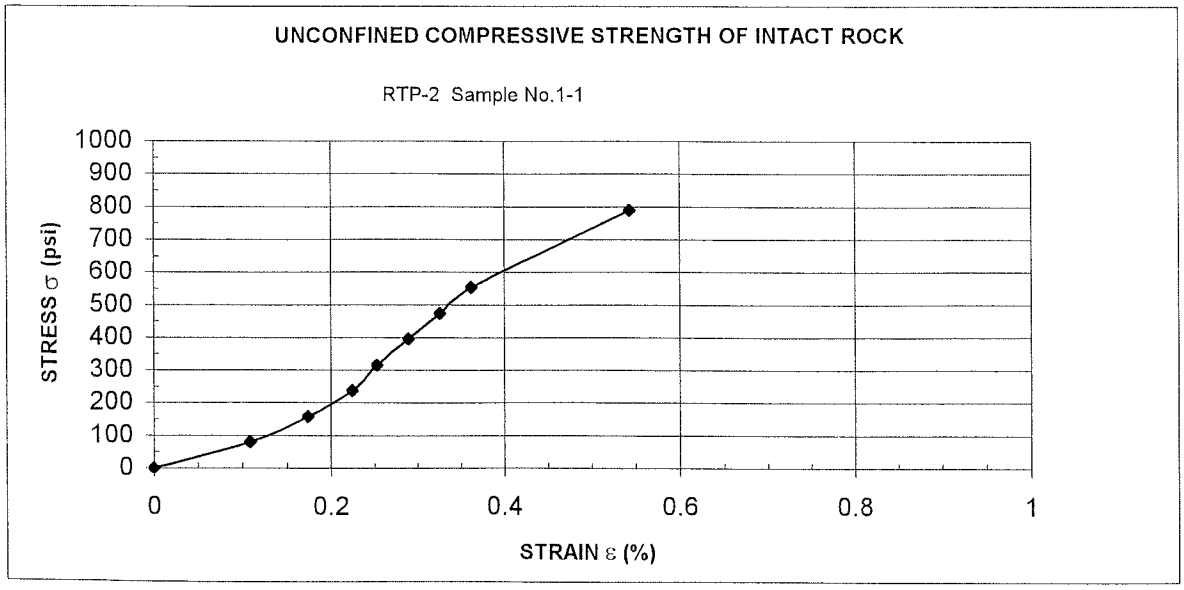
Type of Failure



AXIAL LOADING DATA

Time (min.seg)	Deformation gauge (x10-3)	LOAD GAUGE (lb.)	Cross-sectional area (in.2)	Vertical strain e%	STRESS (psi)
0	0	0	0	0	0
	15	400	5.1	0.11	79
	24	800	5.1	0.17	158
	31	1200	5.1	0.22	237
	35	1600	5.1	0.25	316
	40	2000	5.1	0.29	395
	45	2400	5.1	0.33	474
	50	2800	5.1	0.36	553
	75	4000	5.1	0.54	790

Tested, prepared and checked by: R. Lam, X. Rios and G. Guerra
File: UnconfRTP



AUTORIDAD DEL CANAL DE PANAMA
DIVISION DE INGENIERIA
SECCION DE GEOTECNIA

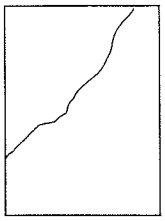
UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS ASTM 2938

Project:	Railroad to Artificial Island	Date:	09/09/2002
Location:		No. Sample:	2-1
Boring:	RTP-2	Testing time:	150
Depth:	21.30-21.70 m	Tested By:	R. Lam
Description:	Breccia		A. Guzmán

TEST ESPECIMEN DATA

Avg. Diameter Do(cm):	6.5	Moisture condition:	Air
Avg. Length Lo(cm):	13.8	Porcentage of absorption(%):	
Weight(grs):	1073.6	Water content Wo%:	11.92
Cross-sect. Area(cm2):	5.1	Specific gravity:	
Unit weight(kg/m3):	2345	Type of failure(shape):	shear
Time of failure(lb/seg):	32	Mode:	
Lo / Do ratio:	2.12	Angle of failure:	
Factor correction:	1.0070	Deformation rate:	0.49
Elastic modulus E(MPa):		Uniaxial compressive strenght(psi):	948
Classification Strength:	very low	(Kgf/cm2):	67
		(MPa):	7

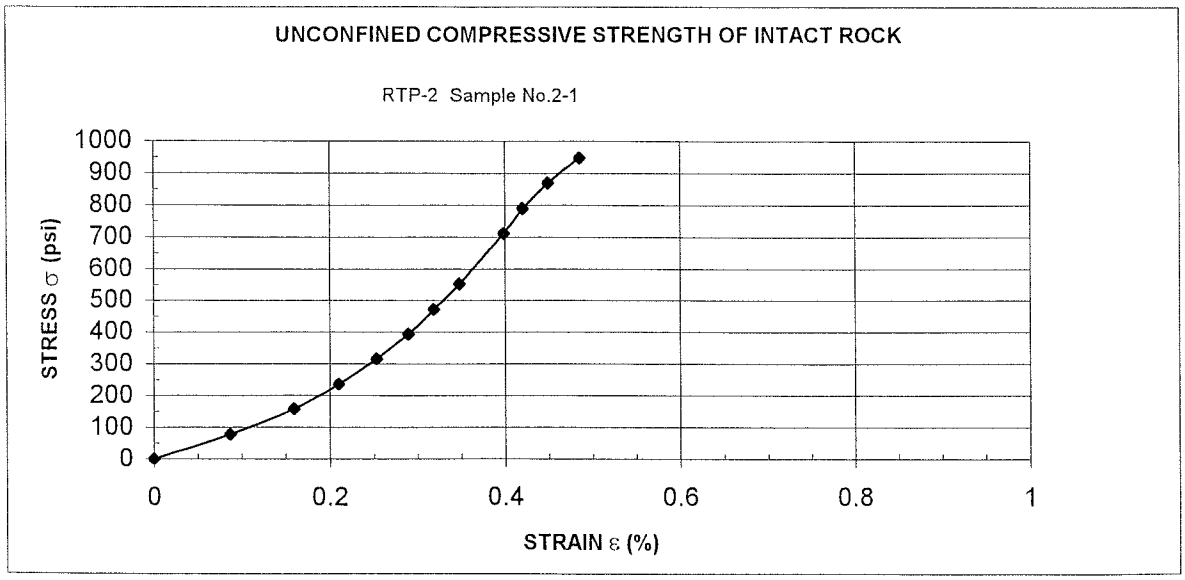
Type of Failure



AXIAL LOADING DATA

Time (min.seg)	Deformation gauge (x10-3)	LOAD GAUGE (lb.)	Cross-sectional area (in.2)	Vertical strain e%	STRESS (psi)
0	0	0	0	0	0
	12	400	5.1	0.09	79
	22	800	5.1	0.16	158
	29	1200	5.1	0.21	237
	35	1600	5.1	0.25	316
	40	2000	5.1	0.29	395
	44	2400	5.1	0.32	474
	48	2800	5.1	0.35	553
	55	3600	5.1	0.40	711
	58	4000	5.1	0.42	790
	62	4400	5.1	0.45	869
	67	4800	5.1	0.49	948

Tested, prepared and checked by: R. Lam, X. Rios and G. Guerra
File: UnconfRTP



AUTORIDAD DEL CANAL DE PANAMA
DIVISION DE INGENIERIA
SECCION DE GEOTECNIA

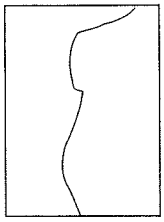
UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS ASTM 2938

Project:	Railroad to Artificial Island	Date:	09/09/2002
Location:		No. Sample:	2-2
Boring:	RTP-2	Testing time:	160
Depth:	21.30-21.70 m	Tested By:	R. Lam
Description:	Breccia		A. Guzmán

TEST ESPECIMEN DATA

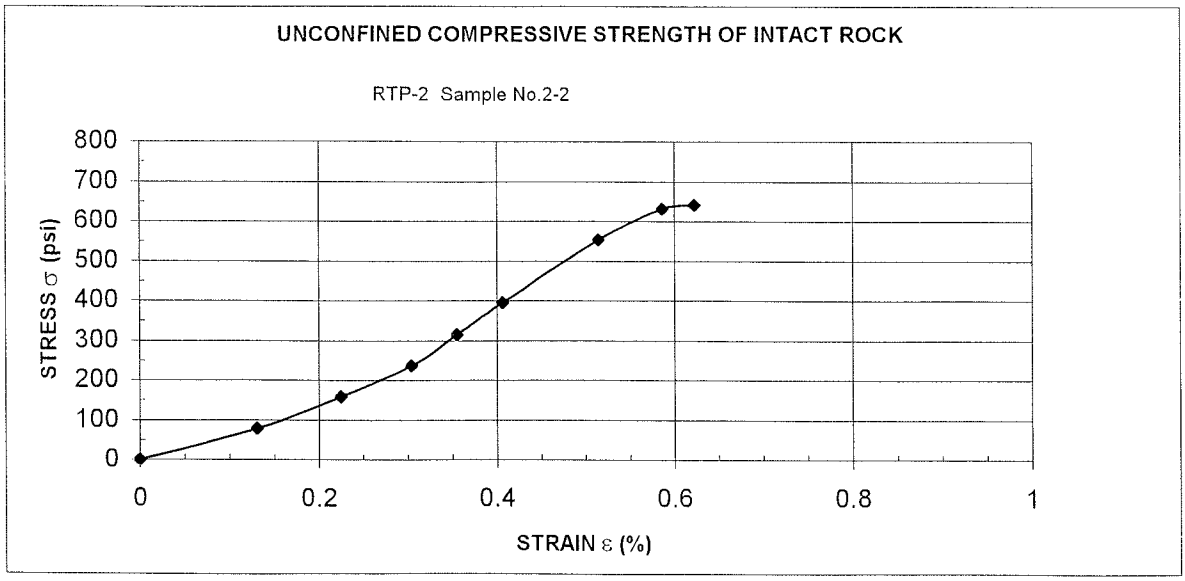
Avg. Diameter Do(cm):	6.5	Moisture condition:	Air
Avg. Length Lo(cm):	13.8	Porcentage of absorption(%):	
Weight(grs):	957.2	Water content Wo%:	19.0
Cross-sect. Area(cm2):	5.1	Specific gravity:	
Unit weight(kg/m3):	2091	Type of failure(shape):	shear
Time of failure(lb/seg):	20	Mode:	
Lo / Do ratio:	2.12	Angle of failure:	
Factor correction:	1.0070	Deformation rate:	0.62
Elastic modulus E(MPa):		Uniaxial compressive strenght(psi):	642
Classification Strength:	very low	(Kgf/cm2):	45
		(MPa):	4

Type of Failure



AXIAL LOADING DATA					
Time (min.seg)	Deformation gauge (x10-3)	LOAD GAUGE (lb.)	Cross-sectional area (in.2)	Vertical strain e%	STRESS (psi)
0	0	0	0	0	0
	18	400	5.1	0.13	79
	31	800	5.1	0.22	158
	42	1200	5.1	0.30	237
	49	1600	5.1	0.36	316
	56	2000	5.1	0.41	395
	71	2800	5.1	0.51	553
	81	3200	5.1	0.59	632
	86	3250	5.1	0.62	642

Tested, prepared and checked by: R. Lam, X. Rios and G. Guerra
File: UnconfRTP



AUTORIDAD DEL CANAL DE PANAMA
DIVISION DE INGENIERIA
SECCION DE GEOTECNIA

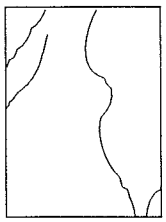
UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS ASTM 2938

Project:	Railroad to Artificial Island	Date:	09/09/2002
Location:		No. Sample:	2-3
Boring:	RTP-2	Testing time:	90
Depth:	21.30-21.70 m	Tested By:	R. Lam
Description:	Breccia		A. Guzmán

TEST ESPECIMEN DATA

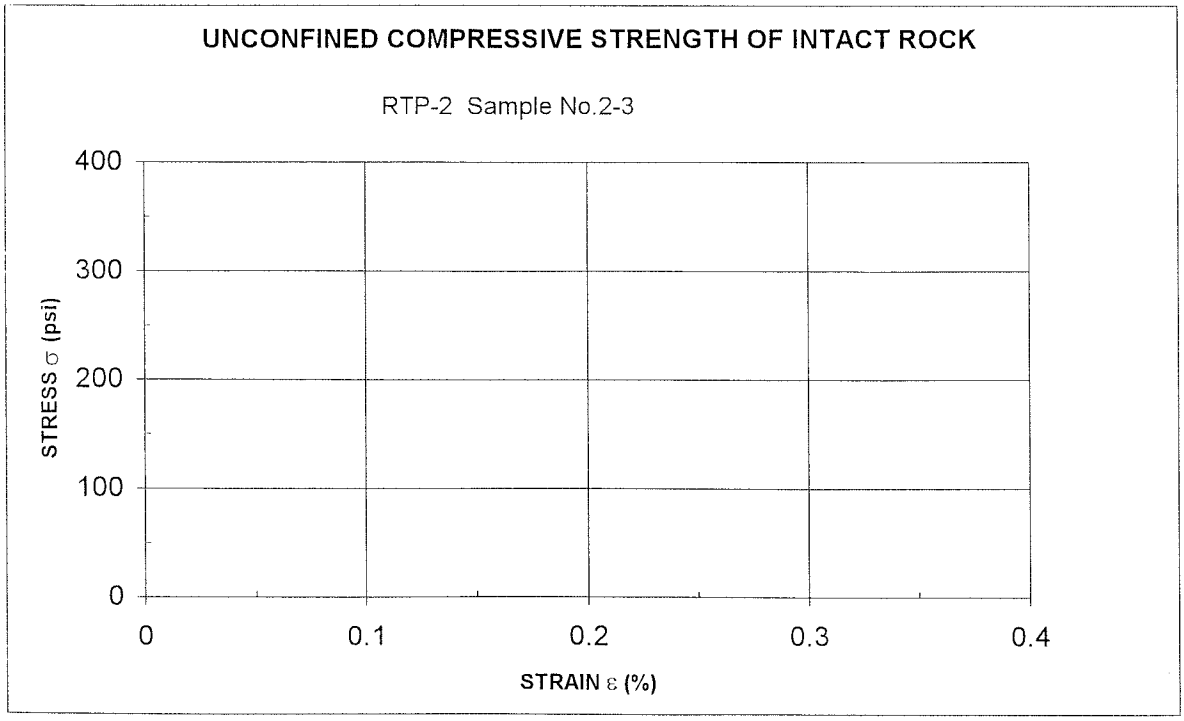
Avg. Diameter Do(cm):	6.5	Moisture condition:	Air
Avg. Length Lo(cm):	13.9	Porcentage of absorption(%):	
Weight(grs):	1056.2	Water content Wo%:	12.5
Cross-sect. Area(cm2):	5.1	Specific gravity:	
Unit weight(kg/m3):	2290	Type of failure(shape):	shear
Time of failure(lb/seg):	17	Mode:	
Lo / Do ratio:	2.14	Angle of failure:	
Factor correction:	1.0078	Deformation rate:	0.32
Elastic modulus E(MPa):		Uniaxial compressive strenght(psi):	296
Classification Strength:	very low	(Kgf/cm2):	21
		(MPa):	2

Type of Failure



AXIAL LOADING DATA					
Time (min.seg)	Deformation gauge (x10-3)	LOAD GAUGE (lb.)	Cross-sectional area (in.2)	Vertical strain e%	STRESS (psi)
0	0	0	0	0	0
	45	1500	5.1	0.32	296

Tested, prepared and checked by: R. Lam, X. Rios and G. Guerra
File: UnconfRTP



AUTORIDAD DEL CANAL DE PANAMA
DIVISION DE INGENIERIA
SECCION DE GEOTECNIA

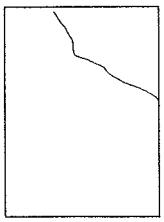
UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS ASTM 2938

Project:	Railroad to Artificial Island	Date:	09/09/2002
Location:		No. Sample:	3-1
Boring:	RTP-2	Testing time:	105
Depth:	21.70-22.02 m	Tested By:	R. Lam
Description:	Breccia		A. Guzmán

TEST ESPECIMEN DATA

Avg. Diameter Do(cm):	6.4	Moisture condition:	Air
Avg. Length Lo(cm):	13.7	Porcentage of absorption(%):	
Weight(grs):	995.8	Water content Wo%:	16.2
Cross-sect. Area(cm2):	5.0	Specific gravity:	
Unit weight(kg/m3):	2268	Type of failure(shape):	shear
Time of failure(lb/seg):	29	Mode:	
Lo / Do ratio:	2.13	Angle of failure:	
Factor correction:	1.0075	Deformation rate:	0.59
Elastic modulus E(MPa):		Uniaxial compressive strenght(psi):	605
Classification Strength:	very low	(Kgf/cm2):	43
		(MPa):	4

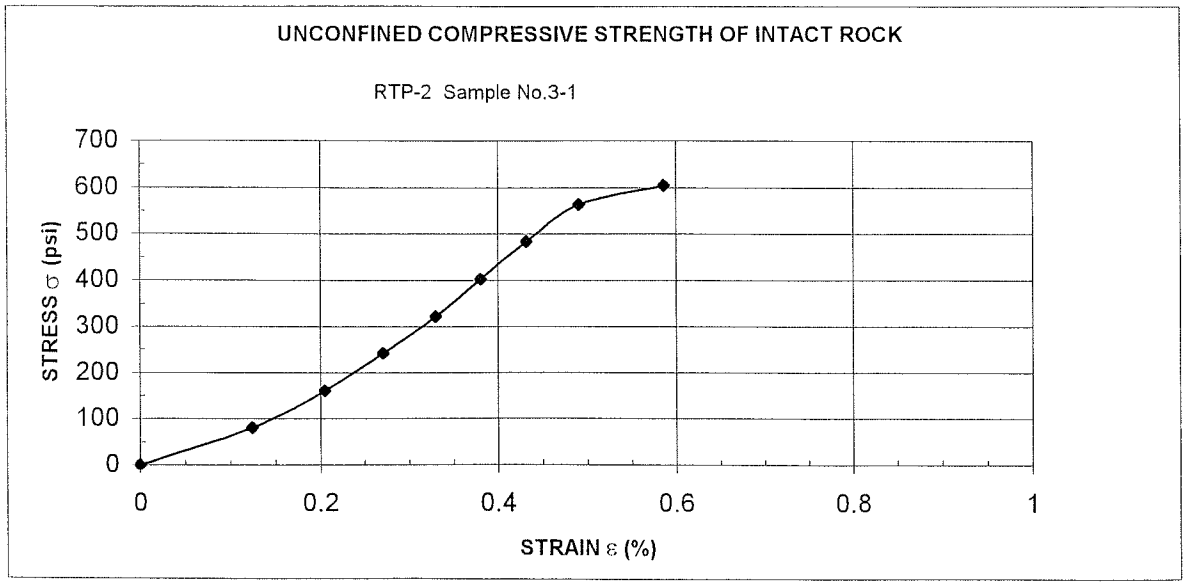
Type of Failure



AXIAL LOADING DATA

Time (min.seg)	Deformation gauge (x10-3)	LOAD GAUGE (lb.)	Cross-sectional area (in.2)	Vertical strain e%	STRESS (psi)
0	0	0	0	0	0
	17	400	5	0.12	81
	28	800	5	0.21	161
	37	1200	5	0.27	242
	45	1600	5	0.33	322
	52	2000	5	0.38	403
	59	2400	5	0.43	484
	67	2800	5	0.49	564
	80	3000	5	0.59	605

Tested, prepared and checked by: R. Lam, X. Rios and G. Guerra
File: UnconfRTP



AUTORIDAD DEL CANAL DE PANAMA
DIVISION DE INGENIERIA
SECCION DE GEOTECNIA

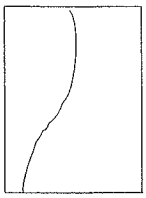
UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS ASTM 2938

Project:	Railroad to Artificial Island	Date:	09/09/2002
Location:		No. Sample:	3-2
Boring:	RTP-2	Testing time:	240
Depth:	21.70-22.02 m	Tested By:	R. Lam
Description:	Breccia		A. Guzmán

TEST ESPECIMEN DATA

Avg. Diameter Do(cm):	6.4	Moisture condition:	Air
Avg. Length Lo(cm):	13.8	Porcentage of absorption(%):	
Weight(grs):	1044.3	Water content Wo%:	10.96
Cross-sect. Area(cm2):	5.0	Specific gravity:	
Unit weight(kg/m3):	2353	Type of failure(shape):	shear
Time of failure(lb/seg):	27	Mode:	
Lo / Do ratio:	2.16	Angle of failure:	
Factor correction:	1.0088	Deformation rate:	0.51
Elastic modulus E(MPa):		Uniaxial compressive strenght(psi):	1321
Classification Strength:	very low	(Kgf/cm2):	93
		(MPa):	9

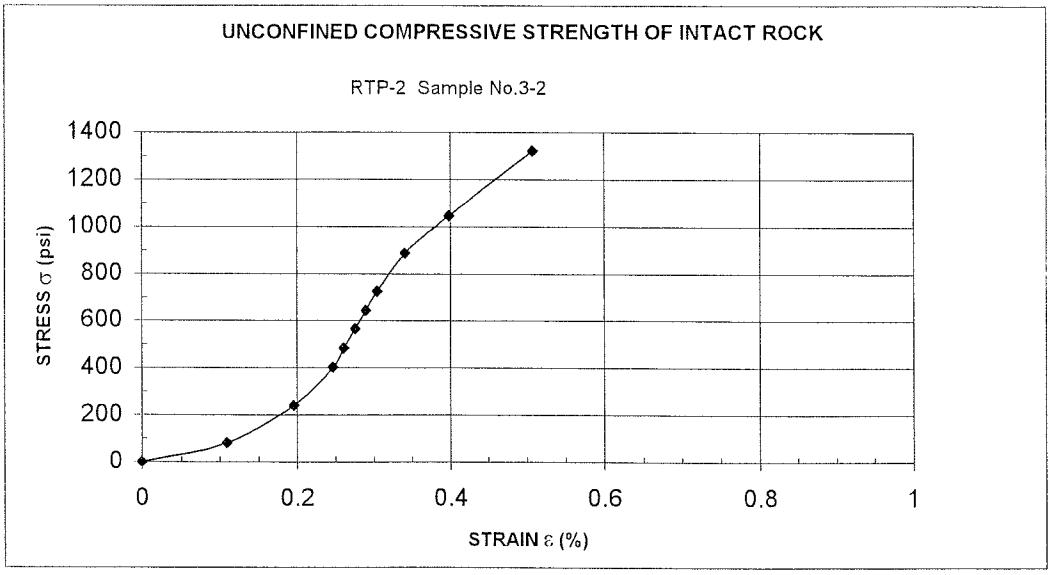
Type of Failure



AXIAL LOADING DATA

Time (min.seg)	Deformation gauge (x10-3)	LOAD GAUGE (lb.)	Cross-sectional area (in.2)	Vertical strain e%	STRESS (psi)
0	0	0	0	0	0
	15	400	5	0.11	81
	27	1200	5	0.20	242
	34	2000	5	0.25	404
	36	2400	5	0.26	484
	38	2800	5	0.28	565
	40	3200	5	0.29	646
	42	3600	5	0.30	726
	47	4400	5	0.34	888
	55	5200	5	0.40	1049
	70	6550	5	0.51	1321

Tested, prepared and checked by: R. Lam, X. Rios and G. Guerra
File: UnconfRTP



AUTORIDAD DEL CANAL DE PANAMA
DIVISION DE INGENIERIA
SECCION DE GEOTECNIA

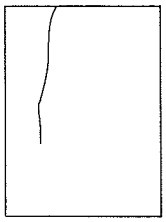
UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS ASTM 2938

Project:	Railroad to Artificial Island	Date:	09/12/2002
Location:		No. Sample:	1-1
Boring:	RTP-3	Testing time:	129
Depth:	9.76-9.98 m	Tested By:	R. Lam
Description:	Brecciated basalt		A. Guzmán

TEST ESPECIMEN DATA

Avg. Diameter Do(cm):	10.2	Moisture condition:	Air
Avg. Length Lo(cm):	16.1	Porcentage of absorption(%):	
Weight(grs):	3206.2	Water content Wo%:	5.70
Cross-sect. Area(cm2):	12.7	Specific gravity:	
Unit weight(kg/m3):	2437	Type of failure(shape):	shear
Time of failure(lb/seg):	78	Mode:	
Lo / Do ratio:	1.58	Angle of failure:	
Factor correction:	0.9689	Deformation rate:	0.26
Elastic modulus E(MPa):		Uniaxial compressive strenght(psi):	763
Classification Strength:	very low	(Kgf/cm2):	54
		(MPa):	5

Type of Failure

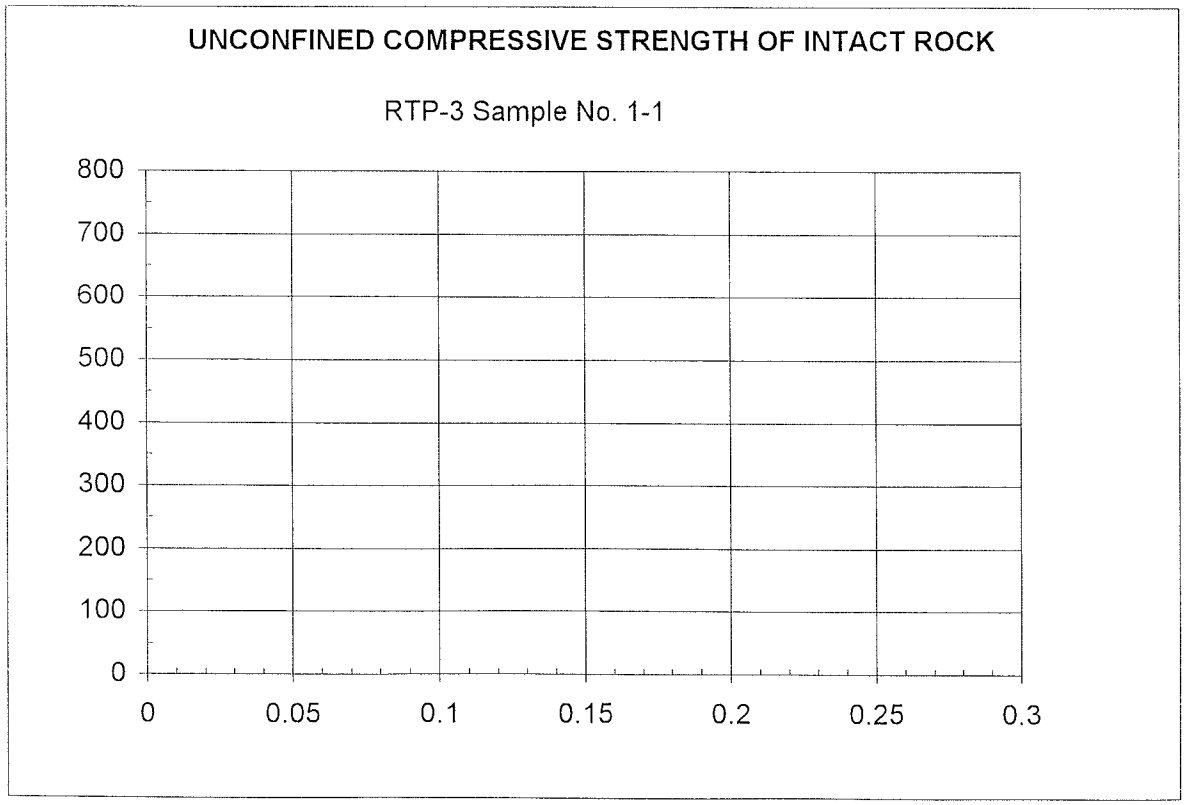


natural joints

AXIAL LOADING DATA

Time (min.seg)	Deformation gauge (x10-3)	LOAD GAUGE (lb.)	Cross-sectional area (in.2)	Vertical strain e%	STRESS (psi)
0	0	0	0	0	0
	107	5000	12.7	0.13	381
	211	10000	12.7	0.26	763

Tested, prepared and checked by: R. Lam, X. Rios and G. Guerra
File: UnconfRTP



AUTORIDAD DEL CANAL DE PANAMA
DIVISION DE INGENIERIA
SECCION DE GEOTECNIA

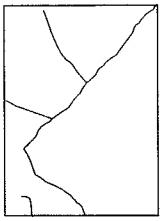
UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS ASTM 2938

Project:	Railroad to Artificial Island	Date:	09/10/2002
Location:		No. Sample:	4-1
Boring:	RTP-3	Testing time:	156
Depth:	11.73-12.00 m	Tested By:	R. Lam
Description:	Agglomerate		A. Guzmán

TEST ESPECIMEN DATA

Avg. Diameter Do(cm):	9.5	Moisture condition:	Air
Avg. Length Lo(cm):	20.1	Porcentage of absorption(%):	
Weight(grs):	3737.7	Water content Wo%:	7.31
Cross-sect. Area(cm2):	11.0	Specific gravity:	
Unit weight(kg/m3):	2624	Type of failure(shape):	shear
Time of failure(lb/seg):	32	Mode:	
Lo / Do ratio:	2.12	Angle of failure:	
Factor correction:	1.0066	Deformation rate:	0.20
Elastic modulus E(MPa):		Uniaxial compressive strenght(psi):	458
Classification Strength:	very low	(Kgf/cm2):	32
		(MPa):	3

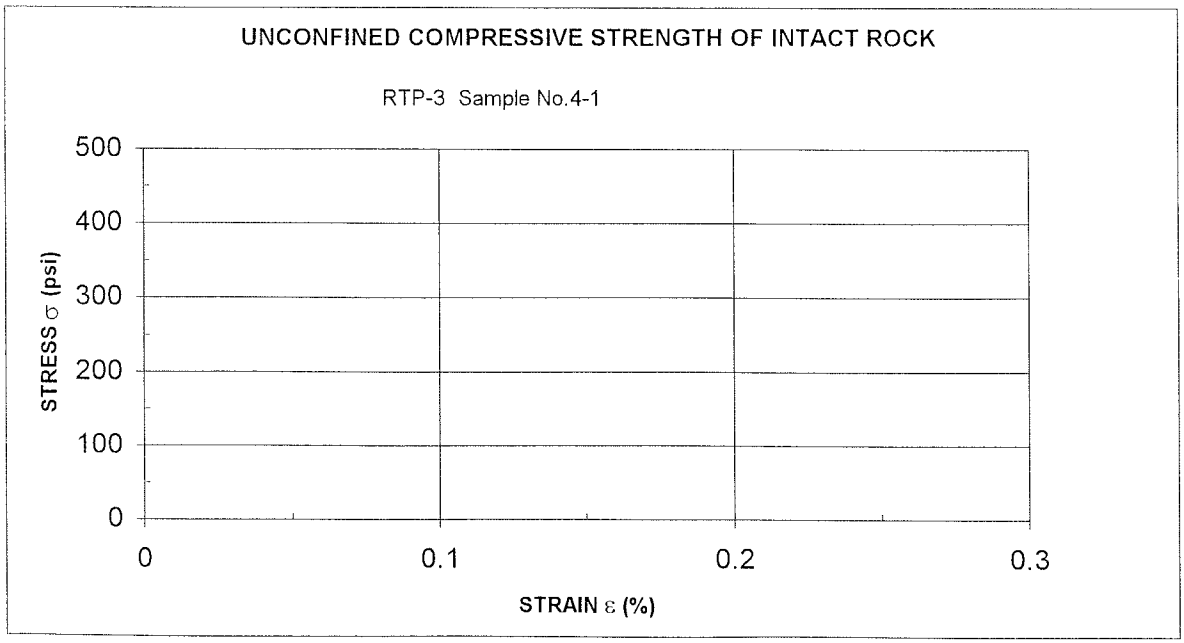
Type of Failure



natural joints

AXIAL LOADING DATA					
Time (min.seg)	Deformation gauge (x10-3)	LOAD GAUGE (lb.)	Cross-sectional area (in.2)	Vertical strain e%	STRESS (psi)
0	0	0	0	0	0
	40	5000	11	0.20	458

Tested, prepared and checked by: R. Lam, X. Rios and G. Guerra
File: UnconfRTP



AUTORIDAD DEL CANAL DE PANAMA
DIVISION DE INGENIERIA
SECCION DE GEOTECNIA

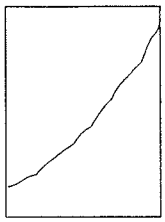
UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS ASTM 2938

Project:	Railroad to Artificial Island	Date:	09/11/2002
Location:		No. Sample:	2-1
Boring:	RTP-5	Testing time:	218
Depth:	14.62-14.80 m	Tested By:	R. Lam
Description:	Sandstone agglomerate		A. Guzmán

TEST ESPECIMEN DATA

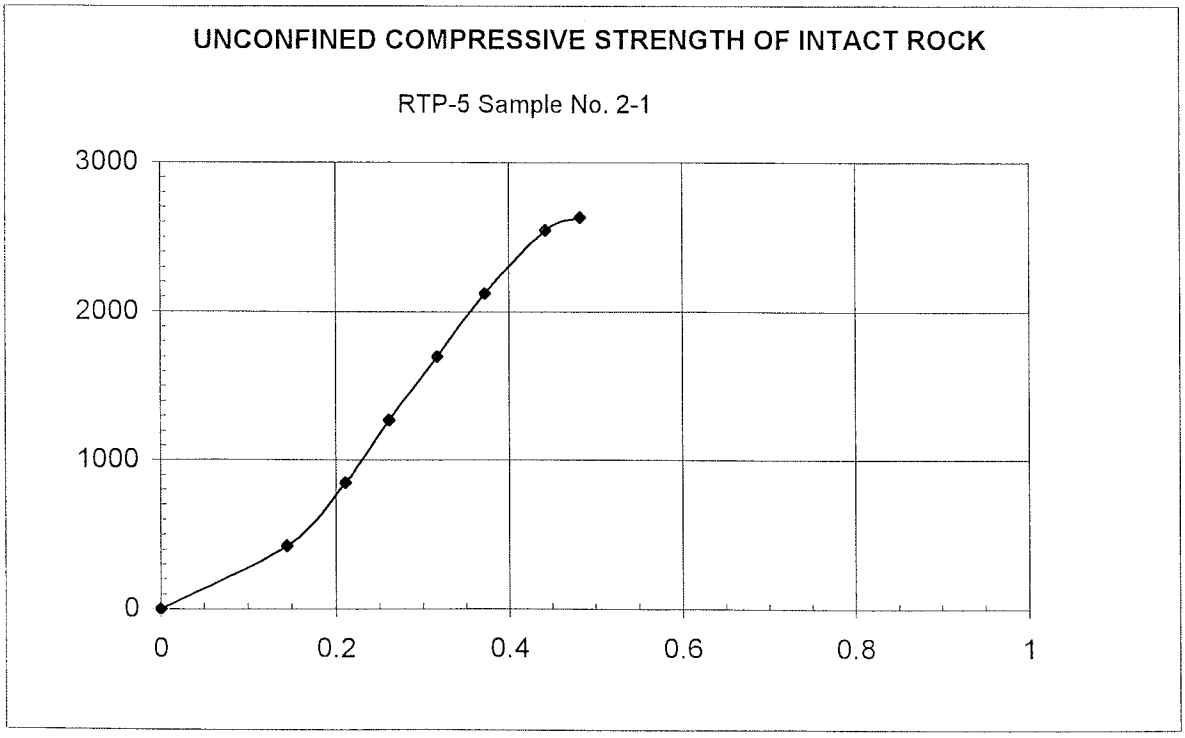
Avg. Diameter Do(cm):	9.9	Moisture condition:	Air
Avg. Length Lo(cm):	19.9	Porcentage of absorption(%):	
Weight(grs):	3353.6	Water content Wo%:	13.07
Cross-sect. Area(cm2):	11.8	Specific gravity:	
Unit weight(kg/m3):	2212	Type of failure(shape):	shear
Time of failure(lb/seg):	142	Mode:	violent
Lo / Do ratio:	2.02	Angle of failure:	
Factor correction:	1.0012	Deformation rate:	0.48
Elastic modulus E(MPa):		Uniaxial compressive strenght(psi):	2630
Classification Strength:	very low	(Kgf/cm2):	185
		(MPa):	18

Type of Failure

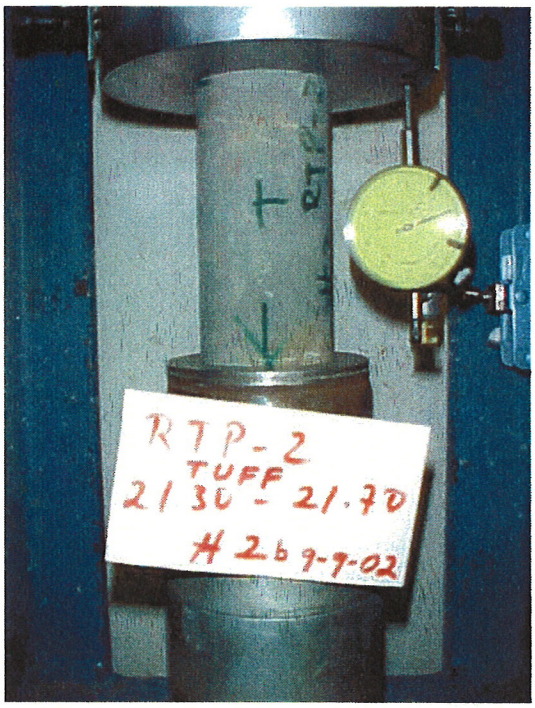


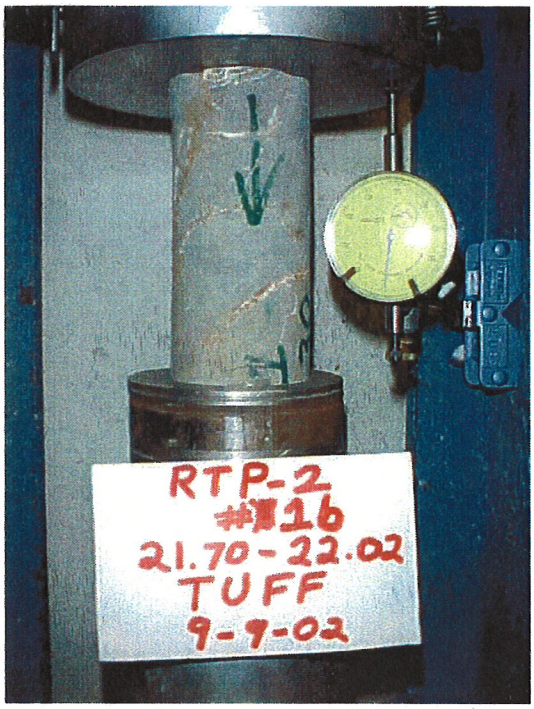
AXIAL LOADING DATA					
Time (min.seg)	Deformation gauge (x10-3)	LOAD GAUGE (lb.)	Cross-sectional area (in.2)	Vertical strain e%	STRESS (psi)
0	0	0	0	0	0
	144	5000	11.8	0.14	424
	210	10000	11.8	0.21	848
	260	15000	11.8	0.26	1273
	315	20000	11.8	0.32	1697
	370	25000	11.8	0.37	2121
	440	30000	11.8	0.44	2545
	480	31000	11.8	0.48	2630

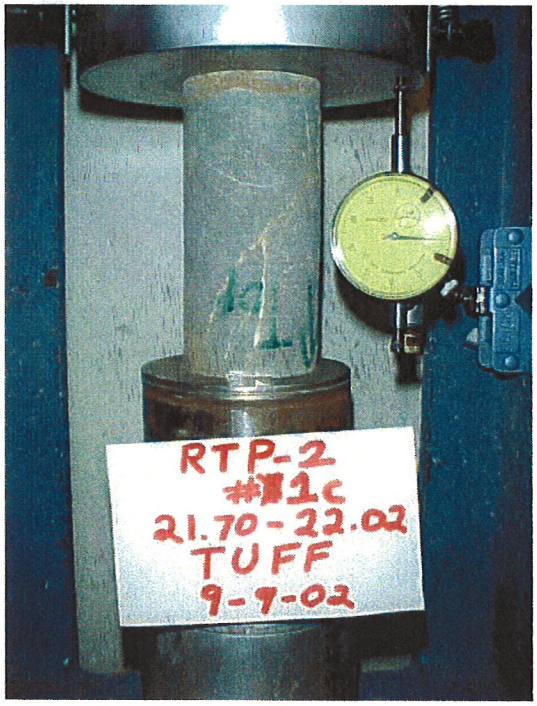
Tested, prepared and checked by: R. Lam, X. Rios and G. Guerra
File. UnconfRTP

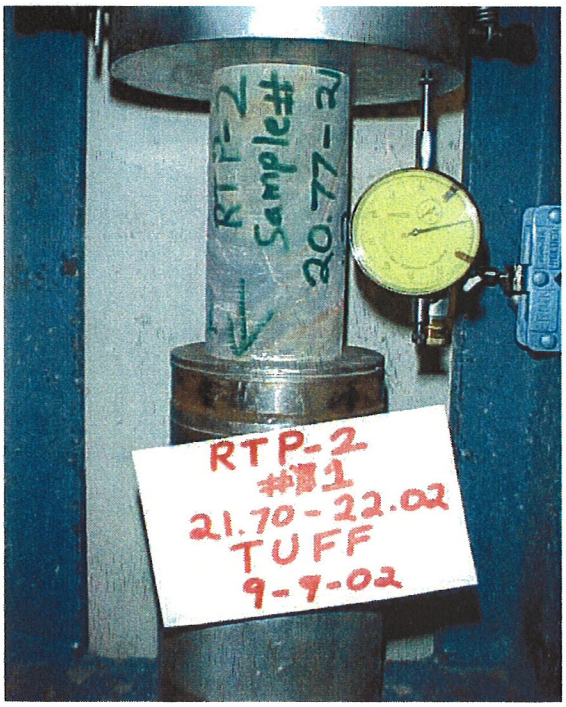


APPENDIX D: PHOTOS OF MATERIALS

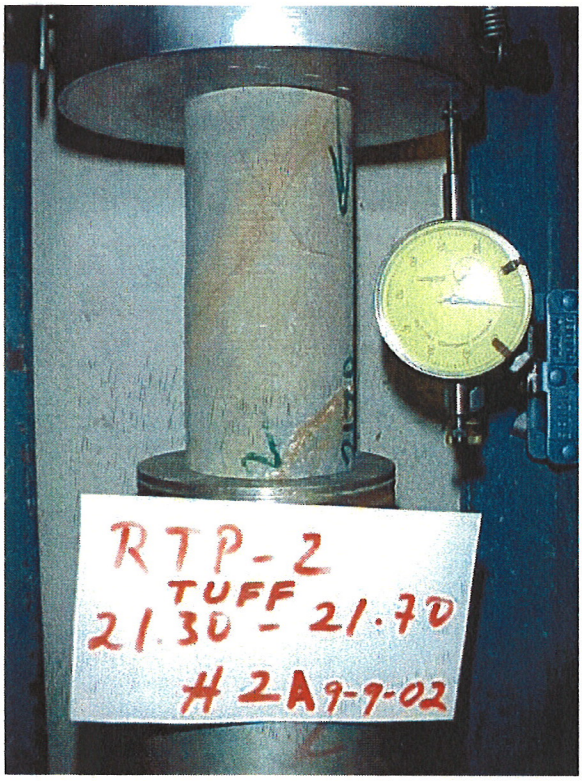

RTP-2
TUFF
21.30 - 21.70
#2b 9-9-02


RTP-2
#1b
21.70 - 22.02
TUFF
9-9-02


RTP-2
#1c
21.70 - 22.02
TUFF
9-9-02


RTP-2
Sample#
20.77 - 21
RTP-2
#1
21.70 - 22.02
TUFF
9-9-02

RTP-2
#9
21.70-22.02
TUFF
9-9-02


RTP-2
TUFF
21.30 - 21.70
#2A 9-9-02

RTP-7
11.30 - 11.50
Agglomerate
#2
12-9-02

RTP-7
12.20 - 12.40
Agglomerate
#3
12-9-02

RTP-3
9.76 - 9.98
BASALT
#1
12-9-02

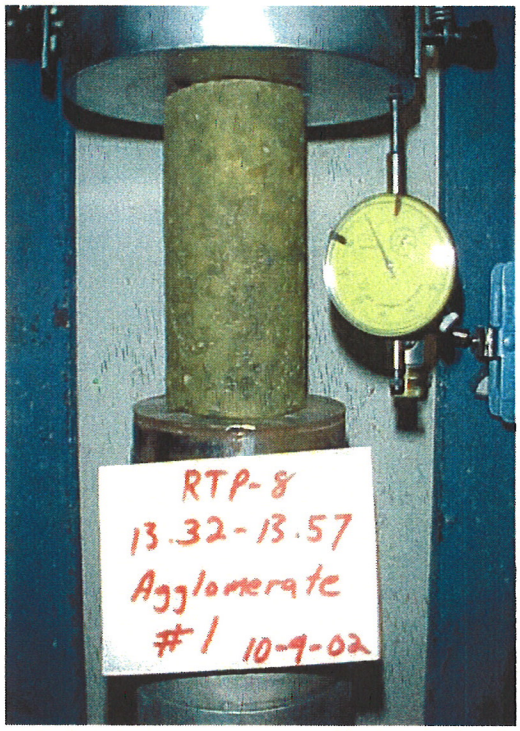
RTP-5
14.62 - 14.80
Sandstone Agg.
#2
11-9-02

RTP-8
13.70 - 14.03
Agglomerate
#2
11-9-02

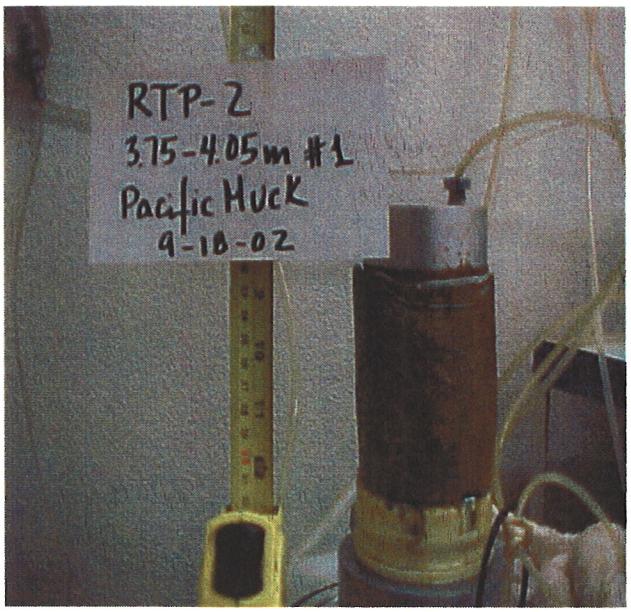
RTP-6
9.89 - 10.30
Basalt
#1
10-9-02

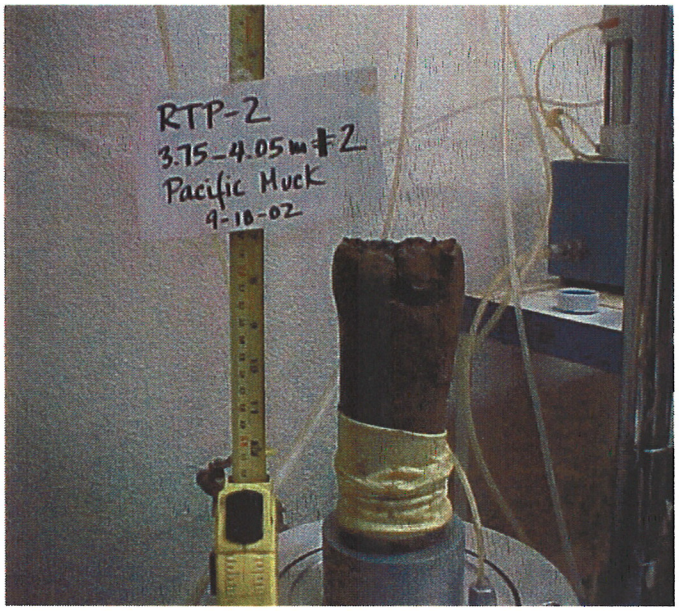
RTP-3
11.73 - 12.00
Agglomerate
#4

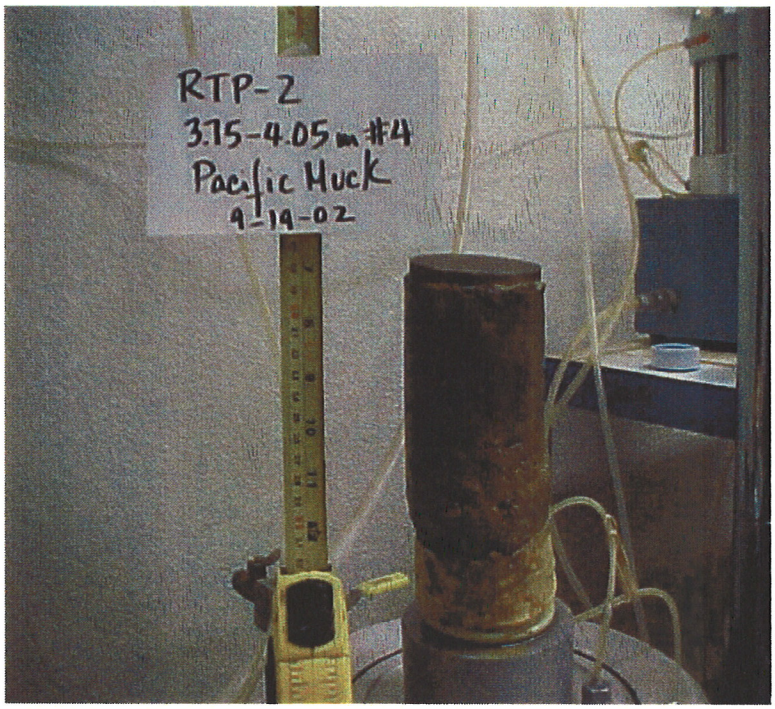
RTP-6
11.52 - 11.80
Basalt
#3
10-9-02


RTP-8
13.32-13.57
Agglomerate
#1 10-9-02

RTP-6
10.30 - 10.70
Basalt
#2
12-9-02


RTP-2
3.75-4.05m #1
Pacific Muck
9-18-02


RTP-2
3.75-4.05m #2
Pacific Muck
9-18-02


RTP-2
3.75-4.05m #4
Pacific Muck
9-19-02

SAMPLE# 3

APPENDIX E: MAP OF BORING LOCATIONS

INSERT MAP OF BORING LOCATIONS

APPENDIX D - TIDAL MEASUREMENTS – ACP REPORTS

AUTORIDAD DEL CANAL DE PANAMA
DIVISIÓN DE ADMINISTRACIÓN AMBIENTAL
SECCIÓN DE MANEJO DE CUENCA
Unidad de Operaciones

MEDICION DE CORRIENTES MARINAS EN LA BAHÍA DE PANAMA

CAMPAÑAS 1, 2 Y 3

Por

Oscar Baloyes

Gerardo Leis R.

Tomás García

Supervisor Hidrólogo
Ing. Jaime Massot

Pedro Miguel, Panamá
Junio de 2002

RECONOCIMIENTO

Este documento es la culminación de un esfuerzo conjunto del personal de la Unidad de Operaciones, que participaron en las mediciones de campo, los técnicos hidrólogos Eduardo Medrano, Clímaco Abadía, Ayax Murillo y Nelson Guerra. Igualmente a Indira Mendoza, programadora ambiental, por su apoyo en la confección del material cartográfico.

Se agradece el apoyo y colaboración del personal de la Sección de Topografía y Cartografía, Unidad de Hidrografía, por el valioso aporte brindado para la efectiva ejecución de este proyecto; especialmente al supervisor Ricardo Delevante y a los señores César Carrizo, Juan Montenegro, Luis Alvarado y Rafael Pinto

Un reconocimiento especial a la supervisión general de este reporte y al apoyo en la campaña a Jaime Massot Supervisor de la Unidad de Operaciones.

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REFERENCIAS

ANEXO 1 DATOS Y GRAFICAS DE CORRIENTES

ANEXO 2 TABLAS

ANEXO 3 MAPAS

ANEXO 4 DOCUMENTOS Y FORMULARIOS

ANEXO 5 FOTOGRAFIAS.

I INTRODUCCIÓN

A. Antecedentes

La División de Capacidad del Canal (IPC) solicitó la medición de corrientes marinas en la Bahía de Panamá como parte de los estudios que se están realizando para el proyecto de construcción denominado "Canales de Navegación". Estas mediciones son necesarias para calibrar el modelo hidrodinámico de corrientes marinas que utilizará la empresa Moffatt & Nichol (M & N)

B. Justificación

La construcción de una isla artificial en la Bahía de Panamá requiere de las mediciones de las corrientes marinas del área de estudio que se utilizarán como variables de diseño.

C. Objetivo

Generar información sobre las características dinámicas de las corrientes marinas (velocidad y dirección), del viento (velocidad y dirección) y temperatura en 11 sitios del área de influencia del proyecto de construcción de la isla artificial en la Bahía de Panamá.

D. Definición de términos

1. *Bajamar o marea baja:* Estado de la marea existente cuando el nivel del agua es mínimo para un ciclo de mareas dado. Mínimo nivel alcanzado por un curso de agua o un lago (estiaje)

2. *Campaña de mediciones de corrientes:* Se refiere a un conjunto de mediciones en ciertas condiciones de las mareas (sicigia de menor o mayor amplitud, de cuadratura, etc.)

3. Correntímetro: Instrumento para medir dirección y velocidad de las corrientes de agua, algunos están equipados con otros sensores que miden, temperatura, presión, etc.

4. *Corriente:* Movimiento horizontal del agua. Puede clasificarse en corrientes de marea y corrientes marinas.

5. Corrientes de marea: Se aplica casi exclusivamente a las corrientes periódicas producidas por las mareas. Por lo general, son débiles en alta mar pero pueden adquirir cerca de la costa velocidades suficientes para arrastrar las materias del fondo removidas por las olas. Estas corrientes cambian, teóricamente, de sentido en el momento que el mar alcanza su nivel medio. Cuando el mar está por encima de ese nivel, hay corrientes de flujo, cuando está por debajo, hay corrientes de reflujo cuyo sentido es opuesto al primero.

6. *Corrientes marinas:* Corrientes propiamente dichas, constituyen los movimientos de un sistema circulatorio general

7. *Cuadratura de la luna:* Posición de la Luna cuando su longitud difiere 90° de la longitud del Sol.

8. *Ecosonda:* Aparato electrónico, transmisor y receptor de sonidos de alta frecuencia, que permite medir las profundidades de las bahías, mares y océanos.

9. *Escala de marea:* Dispositivo para medir la altura de la marea.

10. *Marea muerta:* Marea de pequeña amplitud que se produce dos veces al mes cuando la luna esta en cuadratura de fase.

11. *Marea de sicigia:* Marea de gran amplitud en los periodos de luna llena y luna nueva

12. *Marea:* Elevación y descenso periódicos del agua en los mares o en grandes lagos debidos a la atracción gravitatoria de la luna y el sol

13. Mareógrafo: Instrumento que registra automáticamente el ascenso

14. *Marea media:* Es el nivel medio del agua, relativo al punto de referencia (nivel de referencia)

15. *Marea media bajando o subiendo:* Período entre el nivel de marea media hacia bajamar o pleamar respectivamente.

16. *Medición de corriente:* Procedimiento mediante el cual se mide la corriente del agua con el uso de un correntímetro.

17. *Oleaje:* Oscilación vertical de agua durante un período relativamente corto y de gran velocidad relativa.

18. *Pleamar o Marea Alta:* Nivel máximo alcanzado por una marea creciente. Este nivel puede ser efecto exclusivo de mareas periódicas, o pueden sumarse a éstas los efectos de las condiciones meteorológicas prevalecientes.

19. *Tabla de mareas:* Folleto que dan las predicciones diarias de las alturas y tiempo de ascenso y descenso de las mareas.

E. Delimitación del trabajo:

Las mediciones se realizaron en tres alineaciones establecidas por M & N en la Bahía de Panamá (anexo 2 - tabla 1). En cada alineación se especificaron varios sitios de medición y en cada sitio tres profundidades (a diez pies del fondo, a media profundidad y a diez pies de la superficie)

Las alineaciones y sitios establecidos fueron (anexo 3 - mapa 1):

1. Alineación A: "Pacora", al sur de la desembocadura del río Pacora, compuesta de cuatro sitios (A1, A2, A3, A4)

2. Alineación B: "New Island", al sur de Punta Bruja, compuesta por cinco sitios (B1, B2, B3, B4 y B5)

3. Alineación C: "Punta Chame", al noreste de Punta Chame, compuesta por tres sitios de medición (C1, C2 y C3)

F. Limitaciones:

La limitación más importante que impidieron realizar algunas mediciones fueron los fuertes oleajes (mediciones del 26 y 28 de mayo)

En la primera campaña, del 12 al 14 de mayo, se presentaron dificultades en el anclaje de la nave, en consecuencia fueron desplazados ligeramente los tiempos de medición planificados en algunos sitios (anexo 1 - gráficas)

El 27 de mayo a las 11:34 a.m., se perdió la aleta inferior del correntímetro Valeport en el lecho marino.

II METODOLOGÍA

A. Equipos utilizados.

Los principales equipos que se utilizaron en las campañas fueron:

1. Correntímetro Valeport® 308
2. software Datalog®
3. Anemómetro y veleta Belfort®
4. Ecosonda Odom ®
5. Torno de aforo
6. Sistema de posicionamiento global (GPS)
7. Fuente externa de 12 voltios
8. Computadora portátil.

Antes de iniciar la campaña de mediciones, se evaluaron las propiedades y el funcionamiento del correntímetro Valeport® 308 y el programa de manejo Datalog®

B. Mediciones:

1. La empresa M & N proporcionó tres alineaciones A, B, y C en la Bahía de Panamá con 11 sitios de medición, las fechas y horas de las diferentes campañas (anexo 4 - documentos) en función de las fases lunares y las condiciones de las mareas.

2. Los sitios de medición fueron ubicados por georreferenciación con el GPS, de alta precisión de la lancha "Tritón" de la Unidad de Hidrografía.

3. El anclaje de la nave se realizó con una ancla en la proa y la otra en la popa, el tiempo de este proceso duraba entre 10 a 40 minutos en función del oleaje y de la consistencia del material del lecho marino.

4. La inmovilidad lateral de la nave se verificó constantemente con el GPS.

5. Las profundidades totales se midieron con el ecosonda de la nave

6. Se armó el correntímetro Valeport, se conectaron los cables a la computadora y se activo el sistema.

7. El correntímetro se enganchó al cable del torno de aforo montado en una grúa especial dela Unidad de Operaciones fijada en la nave.

8. Con el torno de aforo se medía el nivel cero, correspondiente a la superficie del agua y se determinaba las profundidades para cada medición en los sitios.

9. En cada sitio se midieron los datos de temperatura, velocidad y dirección de las corrientes a tres profundidades: a diez pies desde el fondo, a media profundidad y a diez pies de la superficie.

10. Se registraron las velocidades y direcciones del viento, aproximadamente a cuatro metros de la superficie del agua sobre la proa de la nave, para referencia de la profundidad de las corrientes a diez pies de la superficie del agua.

11. Las informaciones anteriores y las observaciones fueron registradas en un formulario de control de medición de corrientes (anexo 3 – documentos - formulario 1)

C. Procesamiento de la información:

Las mediciones de velocidad y dirección de las corrientes marinas se verificaban en tiempo real con la computadora portátil, para validar la consistencia, mientras se registraba en el sistema del correntímetro.

Al finalizar el período de medición, estas se registraban en el disco duro de la computadora y se hacía una copia de seguridad en disco flexible. Toda la información era verificada en la Unidad de Operaciones.

III PRESENTACIÓN DE LOS DATOS

A. Tablas:

Los datos de las mediciones (anexo 1 – datos y gráficas) están ordenados cronológicamente según la programación de M&N (anexo 4 - documentos)

Se asignó una nomenclatura a cada tabla que se define según el día, la alineación, el sitio y la condición de la marea según la programación. Así la Tabla 13-B5.1 corresponde al día 13, la alineación B, sitio B5 (New Island), y la condición de marea es, por ejemplo, "marea media bajando".

Las elevaciones de las mareas corresponden a la ecuación armónica calculada para Balboa (Diablo), utilizada en la tabla de mareas de la Sección de Meteorología e Hidrología de la Autoridad del Canal de Panamá.

Las tablas de datos y gráficas muestran las unidades de medida tales como se registraron en cada equipo utilizado.

La medición del viento se realizó a cuatro metros de la superficie del agua en la cubierta de la nave. El viento esta definido según la dirección de procedencia.

B. Gráficas

Las gráficas presentadas en este reporte pretenden resumir el volumen de información obtenida en las tres campañas del mes de mayo y verificar la consistencia de los datos. Se confeccionaron dos tipos de gráficas que se complementan mutuamente:

1. Gráficas lineales que presentan la velocidad de las corrientes según los sitios de medición en la alineación correspondiente, las horas y las condiciones de las mareas. La finalidad de estas gráficas es presentar las mediciones

realizadas dentro de la programación planeada por M & N y verificar la consistencia de los datos.

2. Las gráficas polares muestran la dirección y velocidad de las corrientes según las condiciones de las mareas en los conjuntos de mediciones de cada alineación, mostrando el agrupamiento o dispersión de los datos (lo que permite evaluar la consistencia).

Las direcciones de los sitios medidos en el primer tipo de gráfica se pueden relacionar con el segundo tipo de gráfica por las condiciones de las mareas.

IV CONCLUSIONES Y RECOMENDACIONES.

1. Las campañas de medición de las corrientes marinas en la Bahía de Panamá, de acuerdo al plan de M & N, se cumplieron en un 80%.

2. Los controles y verificaciones que se aplicaron para evitar los desplazamientos de la nave, al momento de las mediciones, fueron eficaces en las campañas realizadas.

3. Para evitar el desplazamiento de la nave en el momento de la medición se recomienda la colocación de dos anclas (una en la proa y la otra en la popa), además es necesaria la verificación continua de la posición con un GPS de alta precisión.

4. Se debe instalar una estructura en la lancha que proteja el correntímetro Valeport contra golpes sobre la estructura de la nave o el lecho marino.

5. Es necesario mantener el control continuo de los datos generados en tiempo real mediante la computadora y los formularios de campo.

REFERENCIAS

1. IPGH	Glosario de Términos Mareográficos, Comité de Mareas, 1962.
2. SECCIÓN DE METEOROLOGÍA E HIDROLOGÍA (ACP)	Tabla de Mareas 2002, Balboa Pacífico
3. THE PANAMA CANAL ZONE,	Current Observations off The Pacific Entrance to The Panama Canal, 1945.
4. VALEPORT LIMITED	Operation Manual Model 308
5. WXTIDE 32 VERSIÓN 2.7	Programa para Cálculos de Marea

ANEXO Nº1

DATOS Y GRAFICAS DE MEDICION DE CORRIENTES

Mediciones durante Marea Media (Sicigia de menor amplitud)

Domingo, 12 de mayo de 2002 -Luna Nueva

Toma de datos en alineación A.

Tiempo de Medición:

Marea Media Bajando: 5:30 - 7:30

Bajamar: 9:00 - 11:00

Marea Media Subiendo: 12:00 - 14:00

Pleamar: 14:58 - 16:58

TABLA 12-A1.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
SICIGIA DE MENOR AMPLITUD (MAREA MEDIA BAJANDO)

Alineación	Pacora
Sitio	A1
Fecha	12/5/02

Coordenadas		*Viento	
Latitud N	*995098*	**Velocidad (Kt)**	2
Longitud E	*690160*	**Dirección (°)**	96

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (°C)	Velocidad (m/s)	Dirección (°)
12	6*	11.3	6:06:21	26.91	0.17	182.00
			6:07:21	26.91	0.20	177.30
			6:08:21	26.91	0.16	175.70
			6:09:21	26.91	0.24	182.70
		11.3	6:10:21	26.90	0.14	192.30

TABLA 12-A2.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
SICIGIA DE MENOR AMPLITUD (MAREA MEDIA BAJANDO)

Alineación	Pacora
Sitio	A2
Fecha	12/5/02

Coordenadas		*Viento	
Latitud N	*989567*	**Velocidad (Kt)**	3
Longitud E	*690186*	**Dirección (°)**	20

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (°C)	Velocidad (m/s)	Dirección (°)
55	45	9.4	6:42:50	25.68	0.12	226.60
			6:43:50	25.68	0.11	223.00
			6:44:50	25.68	0.12	205.70
			6:45:50	25.67	0.10	216.10
		9.2	6:46:50	25.68	0.10	223.70
	28	9.1	6:51:00	26.61	0.11	233.30
			6:52:00	26.61	0.11	228.20
			6:53:00	26.61	0.11	210.10
			6:54:00	26.61	0.10	216.50
		8.6	6:55:00	26.60	0.11	220.30
	10*	8.6	6:58:25	26.62	0.10	189.70
			6:59:25	26.63	0.09	154.70
			7:00:25	26.63	0.10	184.80
			7:01:25	26.62	0.08	195.90
		8.4	7:02:25	26.63	0.08	201.50

TABLA 12-A3.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
SICIGIA DE MENOR AMPLITUD (MAREA MEDIA BAJANDO)

Alineación	Pacora
Sitio	A3
Fecha	12/5/02

Coordenadas		*Viento	
Latitud N	*985143*	**Velocidad (Kt)**	5
Longitud E	*690207*	**Dirección (º)**	0

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
85	75	6.5	7:34:15	24.93	0.15	229.10
			7:35:15	24.93	0.15	240.40
			7:36:15	24.93	0.17	250.00
			7:37:15	24.93	0.17	248.10
		6.4	7:38:15	24.93	0.16	239.70
	43	6.3	7:41:25	26.55	0.19	251.70
			7:42:25	26.56	0.20	253.60
			7:43:25	26.53	0.19	261.90
			7:44:25	26.52	0.17	260.10
		6.1	7:45:25	26.52	0.17	252.10
	10*	6.0	7:48:25	26.68	0.14	244.00
			7:49:25	26.67	0.14	242.60
			7:50:25	26.67	0.16	240.40
			7:51:25	26.67	0.15	242.70
		5.7	7:52:25	26.67	0.14	242.60

TABLA 12-A4.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
SICIGIA DE MENOR AMPLITUD (BAJAMAR)

Alineación	Pacora
Sitio	A4
Fecha	12/5/02

Coordenadas		*Viento	
Latitud N	*979613*	**Velocidad (Kt)**	8
Longitud E	*690207*	**Dirección (º)**	55

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
110	100	2.5	9:05:38	23.67	0.08	128.30
			9:06:38	23.67	0.10	148.40
			9:07:38	23.67	0.10	133.30
			9:08:38	23.67	0.11	85.60
		2.3	9:09:38	23.67	0.10	65.00
	50	2.1	9:19:48	25.12	0.25	270.50
			9:20:48	25.12	0.22	250.10
			9:21:48	25.11	0.19	274.70
			9:22:48	25.07	0.14	247.40
		2.0	9:23:48	25.07	0.11	224.10
	10*	1.9	9:32:53	27.42	0.18	305.60
			9:33:53	27.41	0.22	334.10
			9:34:53	27.40	0.27	310.90
			9:35:53	27.40	0.26	303.00
		1.8	9:36:53	27.39	0.26	312.30

TABLA 12-A3.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
SICIGIA DE MENOR AMPLITUD (BAJAMAR)

Alineación	Pacora
Sitio	A3
Fecha	12/5/02

Coordenadas		*Viento	
Latitud N	*985143*	**Velocidad (Kt)**	9
Longitud E	*690207*	**Dirección (º)**	42

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
80	70	2.2	10:44:29	25.32	0.19	1.80
			10:45:29	25.30	0.22	357.50
			10:46:29	25.36	0.22	347.40
			10:47:29	25.40	0.23	350.50
		2.3	10:48:29	25.40	0.28	354.70
	40	2.4	10:52:04	26.46	0.30	11.00
			10:53:04	26.45	0.30	7.50
			10:54:04	26.45	0.30	14.00
			10:55:04	26.45	0.33	13.30
		2.6	10:56:04	26.44	0.33	10.00
	10*	2.6	10:58:24	26.93	0.33	19.30
			10:59:24	26.96	0.41	12.00
			11:00:24	27.02	0.34	6.00
			11:01:24	26.98	0.38	12.30
		2.8	11:02:24	26.95	0.34	25.10

TABLA 12-A2.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
SICIGIA DE MENOR AMPLITUD (MAREA MEDIA SUBIENDO)

Alineación	Pacora
Sitio	A2
Fecha	12/5/02

Coordenadas		*Viento	
Latitud N	*989567*	**Velocidad (Kt)**	6
Longitud E	*690186*	**Dirección (º)**	20

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
50	45	4.0	11:30:59	25.53	0.23	318.10
			11:31:59	25.51	0.13	45.60
			11:32:59	25.51	0.13	19.20
			11:33:59	25.51	0.15	2.20
		4.2	11:34:59	25.52	0.19	334.30
	25	4.3	11:37:59	26.46	0.12	44.80
			11:38:59	26.46	0.26	336.00
			11:39:59	26.25	0.09	29.40
			11:40:59	26.45	0.16	52.40
		4.6	11:41:59	26.47	0.16	349.10
	10*	4.6	11:44:29	26.90	0.19	62.90
			11:45:29	26.89	0.12	30.40
			11:46:29	26.85	0.13	22.70
			11:47:29	26.88	0.12	28.80
		4.9	11:48:29	26.84	0.12	21.90

TABLA 12-A1.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
SICIGIA DE MENOR AMPLITUD (MAREA MEDIA SUBIENDO)

Alineación	Pacora
Sitio	A1
Fecha	12/5/02

Coordenadas		*Viento	
Latitud N	*995098*	**Velocidad (Kt)**	6
Longitud E	*690160*	**Dirección (º)**	0

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
7	5*	6.9	12:23:09	28.03	0.22	18.90
			12:24:09	28.02	0.20	15.20
			12:25:09	28.03	0.25	356.90
			12:26:09	28.03	0.22	12.20
		7.2	12:27:09	28.02	0.29	14.40

TABLA 12-A2.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
SICIGIA DE MENOR AMPLITUD (MAREA MEDIA SUBIENDO)

Alineación	Pacora
Sitio	A2
Fecha	12/5/02

Coordenadas		*Viento	
Latitud N	*989567*	**Velocidad (Kt)**	7
Longitud E	*690186*	**Dirección (º)**	12

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
55	45	9.5	13:08:29	25.70	0.18	344.90
			13:09:29	25.68	0.10	89.60
			13:10:29	25.67	0.22	342.20
			13:11:29	25.65	0.21	340.80
		10.0	13:12:29	25.67	0.12	99.70
	25	10.1	13:15:29	26.53	0.12	44.80
			13:16:29	26.52	0.20	357.80
			13:17:29	26.52	0.30	351.70
			13:18:29	26.52	0.17	4.60
		10.4	13:19:29	26.53	0.15	19.50
	10*	10.4	13:21:59	27.11	0.12	31.40
			13:22:59	27.08	0.12	8.00
			13:23:59	27.11	0.17	352.80
			13:24:59	27.10	0.15	7.40
		10.8	13:25:59	27.06	0.14	3.70

TABLA 12-A3.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
SICIGIA DE MENOR AMPLITUD (MAREA MEDIA SUBIENDO)

Alineación	Pacora
Sitio	A3
Fecha	12/5/02

Coordenadas		*Viento	
Latitud N	*985143*	**Velocidad (Kt)**	8
Longitud E	*690207*	**Dirección (º)**	52

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
91	80	12.6	14:03:39	24.72	0.33	25.60
			14:04:39	24.70	0.35	24.90
			14:05:39	24.70	0.33	22.80
			14:06:39	24.70	0.33	24.90
		12.9	14:07:39	24.72	0.35	22.90
	45	12.9	14:11:04	26.13	0.54	7.70
			14:12:04	26.11	0.55	7.60
			14:13:04	25.77	0.52	3.20
			14:14:04	25.99	0.55	8.60
		13.2	14:15:04	26.13	0.55	10.00
	10*	13.3	14:18:04	27.27	0.31	39.70
			14:19:04	27.28	0.31	39.90
			14:20:04	27.27	0.32	43.20
			14:21:04	27.25	0.32	43.80
		13.5	14:22:04	27.27	0.29	44.50

TABLA 12-A4.4

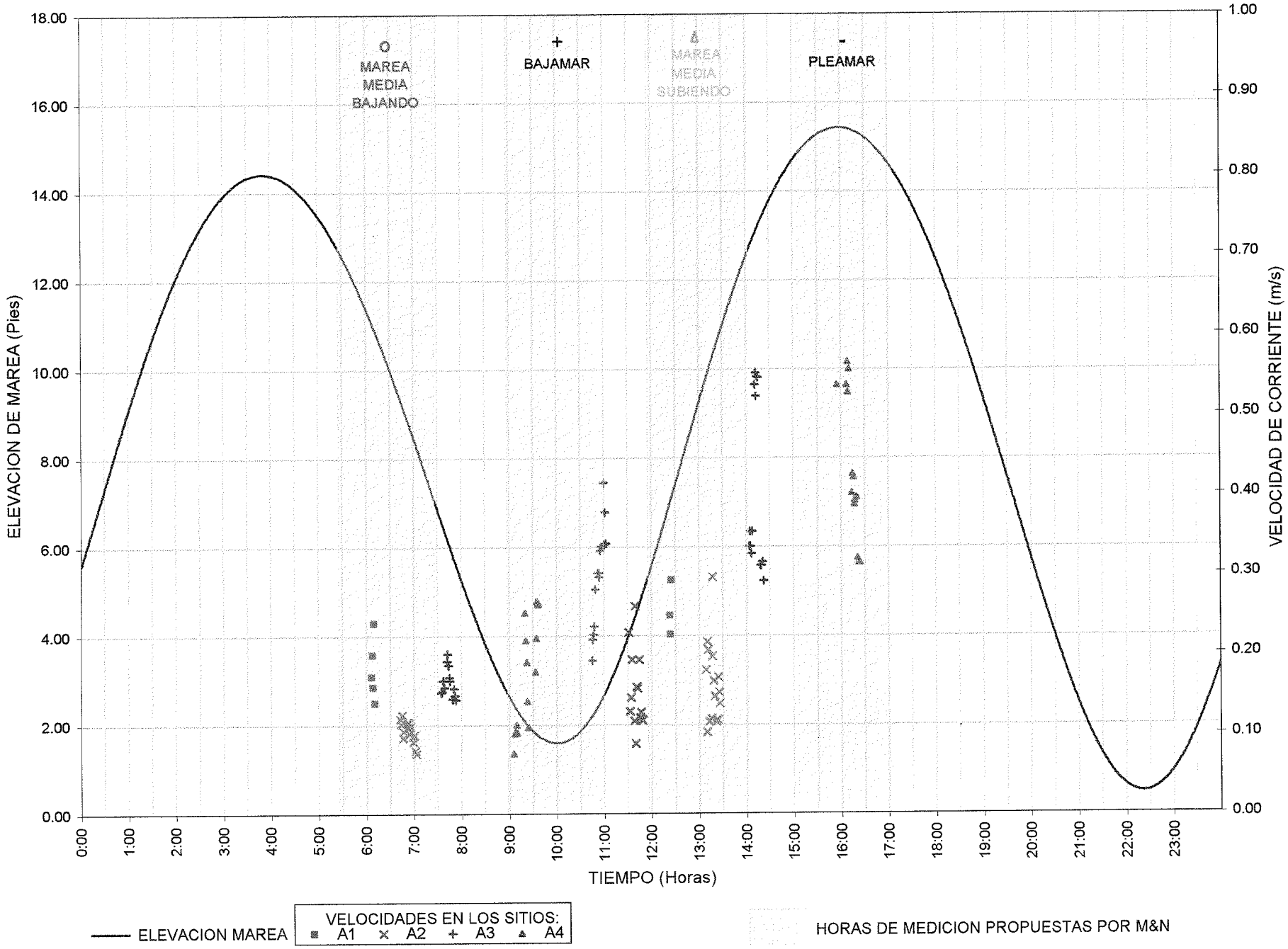
VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
SICIGIA DE MENOR AMPLITUD (PLEAMAR)

Alineación	Pacora
Sitio	A4
Fecha	12/5/02

Coordenadas		*Viento	
Latitud N	*979613*	**Velocidad (Kt)**	11
Longitud E	*690207*	**Dirección (º)**	70

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
120	106	15.4	15:54:59	23.55	0.54	48.10
			16:06:52	23.55	0.54	45.00
			16:07:52	23.54	0.57	45.30
			16:08:52	23.54	0.53	47.00
		15.4	16:09:52	23.55	0.56	48.10
	60	15.4	16:13:27	24.57	0.40	27.80
			16:14:27	24.57	0.43	27.20
			16:15:27	24.56	0.42	26.40
			16:16:27	24.55	0.39	25.00
		15.3	16:17:27	24.54	0.39	28.80
	10*	15.3	16:19:42	28.01	0.40	9.40
			16:20:42	27.99	0.32	9.90
			16:21:42	28.00	0.31	3.00
			16:22:42	28.01	0.32	3.90
		15.3	16:23:42	28.02	0.31	0.00

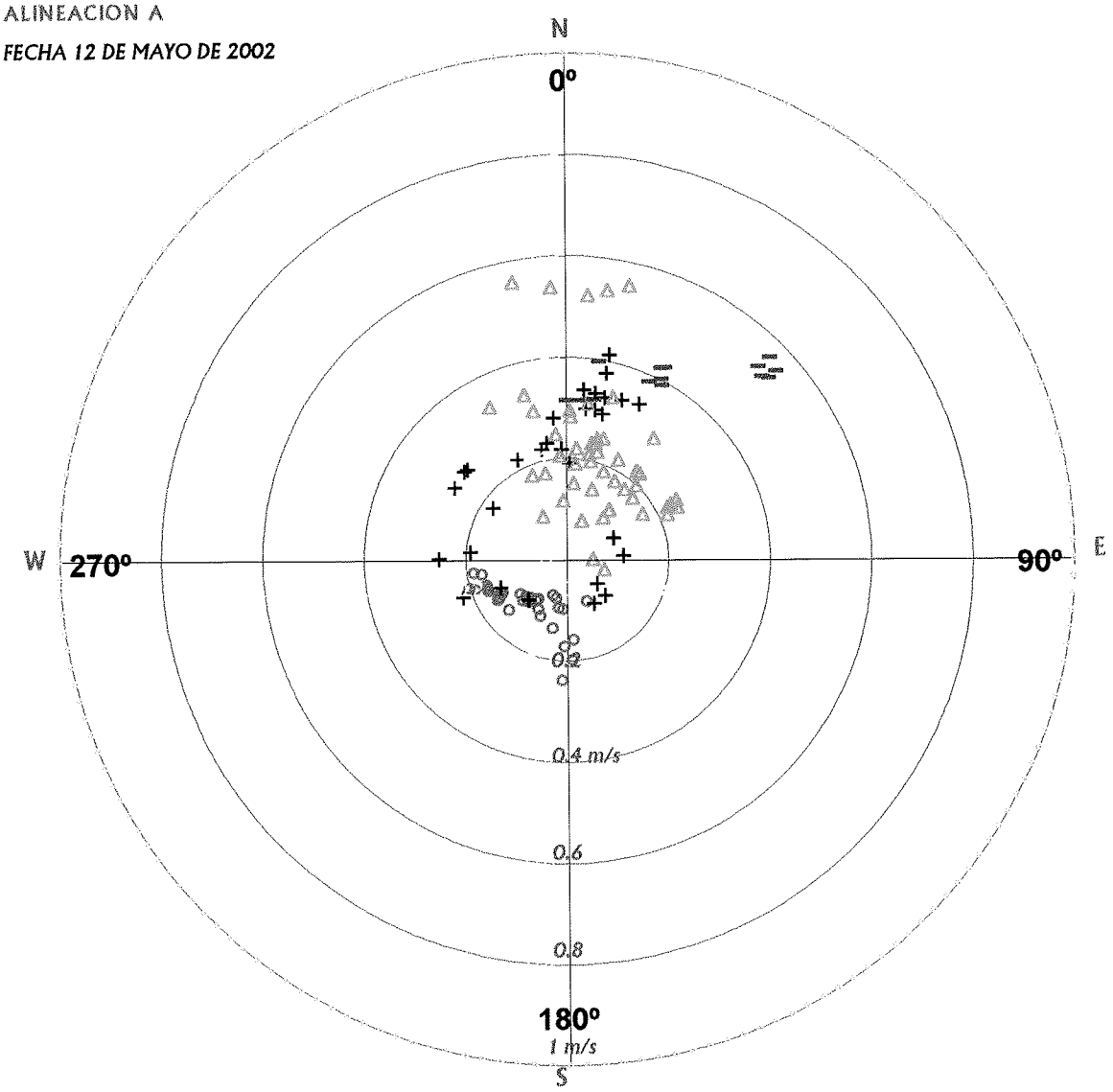
VELOCIDAD DE CORRIENTES MARINAS EN LA BAHIA DE PANAMA SEGUN HORA, CONDICION DE MAREA Y SITIOS DE MEDICION (A1,A2, A3 Y A4) DE ALINEACION A (PACORA). MEDICION DE CORRIENTES #1-12 DE MAYO DE 2002



VELOCIDAD Y DIRECCION DE LAS CORRIENTES MARINAS EN LA BAHÍA DE PANAMÁ SEGÚN CONDICION DE MAREA

ALINEACION A

FECHA 12 DE MAYO DE 2002



- ○ Marea media bajando
- + Bajamar
- △ Marea media subiendo
- – Pleamar

Unidad de Operaciones-ACP

Mediciones durante Marea Media (Sicigia de menor amplitud)

Lunes, 13 de mayo de 2002 - 1 día después de Luna Nueva

Toma de datos en alineación B.

Tiempo de Medición:

Marea Media Bajando: 6:00 - 8:00

Bajamar: 9:35 - 11:35

Marea Media Subiendo: 12:30 - 14:30

Pleamar: 15:34 - 17:34

TABLA 13-B5.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
SICIGIA DE MENOR AMPLITUD (MAREA MEDIA BAJANDO)

Alineación	New Island.
Sitio	B5
Fecha	13/5/2002

Coordenadas		*Viento	
Latitud N	*975602.77*	**Velocidad (Kt)**	8
Longitud E	*657310.57*	**Dirección (º)**	10

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
55	45	12.2	6:22:37	25.06	0.16	224.50
			6:23:37	25.06	0.13	211.70
			6:24:37	25.06	0.13	212.00
			6:25:37	25.07	0.13	211.60
		12.1	6:26:37	25.07	0.14	224.60
	27.5	11.9	6:29:22	26.74	0.25	258.40
			6:30:22	26.79	0.23	258.00
			6:31:22	26.72	0.25	264.30
			6:32:22	26.71	0.23	253.30
		11.8	6:33:22	26.70	0.24	252.80
	10*	11.6	6:37:57	27.91	0.40	237.40
			6:38:57	27.92	0.41	239.80
			6:39:57	27.91	0.41	240.40
			6:40:57	27.91	0.38	235.50
		11.4	6:41:57	27.91	0.43	244.70

TABLA 13-B4.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
SICIGIA DE MENOR AMPLITUD (MAREA MEDIA BAJANDO)

Alineación	New Island.
Sitio	B4
Fecha	13/5/2002

Coordenadas		*Viento	
Latitud N	*978447*	**Velocidad (Kt)**	8
Longitud E	*655775*	**Dirección (º)**	335

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
44	34	10.0	7:10:27	25.78	0.09	253.50
			7:11:27	25.76	0.09	260.40
			7:12:27	25.79	0.09	274.00
			7:13:27	25.80	0.10	307.10
		9.8	7:14:27	25.82	0.02	153.60
	22	9.7	7:17:37	26.32	0.15	214.70
			7:18:37	26.37	0.15	217.40
			7:19:37	26.39	0.19	231.30
			7:20:37	26.43	0.17	221.00
		9.4	7:21:37	26.43	0.14	208.30
	10*	9.2	7:25:02	27.27	0.33	206.20
			7:26:02	27.28	0.31	203.50
			7:27:02	27.34	0.32	193.50
			7:28:02	27.28	0.34	209.60
		9.0	7:29:02	27.29	0.32	203.50

TABLA 13-B3.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
SICIGIA DE MENOR AMPLITUD (MAREA MEDIA BAJANDO)

Alineación	New Island.
Sitio	B3
Fecha	13/5/2002

Coordenadas		*Viento	
Latitud N	*979742*	Velocidad (Kt)	6
Longitud E	*655400*	Dirección (º)	350

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
32	22	7.9	7:48:52	26.96	0.20	221.10
			7:49:52	26.95	0.16	212.00
			7:50:52	26.90	0.13	190.70
			7:51:52	26.88	0.13	172.00
		7.7	7:52:52	26.89	0.17	215.40
	16	7.5	7:55:57	27.21	0.24	221.40
			7:56:57	27.20	0.24	225.30
			7:57:57	27.19	0.19	214.20
			7:58:57	27.19	0.26	233.50
		7.3	7:59:57	27.18	0.23	224.10
	10*	7.1	8:02:47	27.20	0.22	202.90
			8:03:47	27.20	0.25	213.10
			8:04:47	27.18	0.28	222.90
			8:05:47	27.18	0.25	212.80
		6.9	8:06:47	27.17	0.25	210.10

TABLA 13-B2.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
SICIGIA DE MENOR AMPLITUD (MAREA MEDIA BAJANDO)

Alineación	New Island.
Sitio	B2
Fecha	13/5/2002

Coordenadas		*Viento	
Latitud N	*980877*	Velocidad (Kt)	11
Longitud E	*655029*	Dirección (º)	306

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
22	17	5.9	8:25:22	26.81	0.08	151.70
			8:26:22	26.80	0.10	190.80
			8:27:22	26.80	0.08	173.00
			8:28:22	26.80	0.10	159.40
		5.7	8:29:22	26.80	0.11	230.80
	11*	5.4	8:33:02	26.82	0.17	237.00
			8:34:02	26.82	0.12	170.60
			8:35:02	26.82	0.15	224.90
			8:36:02	26.81	0.17	125.50
		5.2	8:37:02	26.82	0.20	250.50

TABLA 13-B1.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
SICIGIA DE MENOR AMPLITUD (BAJAMAR)

Alineación	New Island.
Sitio	B1
Fecha	13/5/2002

Coordenadas		*Viento	
Latitud N	*982350*	**Velocidad (Kt)**	7
Longitud E	*654657*	**Dirección (º)**	30

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
5.3	3*	4.2	8:56:12	27.05	0.13	153.70
			8:57:12	27.05	0.12	149.40
			8:58:12	27.06	0.07	148.50
			8:59:12	27.07	0.15	129.60
			9:00:12	27.07	0.11	139.80
			9:02:37	27.09	0.08	219.40
			9:03:37	27.10	0.14	100.70
			9:04:37	27.09	0.11	122.20
			9:05:37	27.13	0.19	283.70
		4.1	9:06:37	27.12	0.07	114.50

TABLA 13-B1.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
SICIGIA DE MENOR AMPLITUD (BAJAMAR)

Alineación	New Island.
Sitio	B1
Fecha	13/5/2002

Coordenadas		*Viento	
Latitud N	*982350*	**Velocidad (Kt)**	10
Longitud E	*654657*	**Dirección (º)**	310

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
10	5*	2.6	9:33:12	27.07	0.27	16.10
			9:34:12	27.07	0.26	3.40
			9:35:12	27.08	0.22	6.00
			9:36:12	27.09	0.28	6.40
		2.5	9:37:12	27.11	0.32	15.20

TABLA 13-B2.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
SICIGIA DE MENOR AMPLITUD (BAJAMAR)

Alineación	New Island.
Sitio	B2
Fecha	13/5/2002

Coordenadas		*Viento	
Latitud N	*980877*	Velocidad (Kt)	8
Longitud E	*655029*	Dirección (º)	37

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
18	13	1.7	10:06:42	26.83	0.09	273.80
			10:07:42	26.78	0.05	272.50
			10:08:42	26.82	0.03	35.60
			10:09:42	26.76	0.14	283.50
		1.6	10:10:42	26.70	0.05	266.30
	9*	1.6	10:13:32	26.93	0.23	261.30
			10:14:32	26.94	0.08	91.00
			10:15:32	26.90	0.02	154.30
			10:16:32	26.91	0.21	280.60
		1.6	10:17:32	26.94	0.08	126.10

TABLA 13-B3.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
SICIGIA DE MENOR AMPLITUD (BAJAMAR)

Alineación	New Island.
Sitio	B3
Fecha	13/5/2002

Coordenadas		*Viento	
Latitud N	*979742*	Velocidad (Kt)	6
Longitud E	*655400*	Dirección (º)	183

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
26	20	1.5	10:47:42	26.83	0.09	269.60
			10:48:42	26.79	0.08	298.80
			10:49:42	26.79	0.05	348.50
			10:50:42	26.77	0.06	349.10
		1.5	10:51:42	26.78	0.08	301.80
	10*	1.5	10:54:42	26.94	0.14	263.90
			10:55:42	26.95	0.15	267.70
			10:56:42	26.94	0.12	270.20
			10:57:42	26.92	0.18	275.50
		1.6	10:58:42	26.92	0.17	269.70

TABLA 13-B4.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
SICIGIA DE MENOR AMPLITUD (BAJAMAR)

Alineación	New Island.
Sitio	B4
Fecha	13/5/2002

Coordenadas		*Viento	
Latitud N	*978447*	**Velocidad (Kt)**	7
Longitud E	*655775*	**Dirección (º)**	350

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
37	27	1.9	11:13:37	26.59	0.12	294.90
			11:14:37	26.59	0.08	289.90
			11:15:37	26.57	0.10	293.90
			11:16:37	26.57	0.11	296.60
		1.9	11:17:37	26.56	0.12	291.60
	17	1.9	11:20:27	26.88	0.13	294.80
			11:21:27	26.87	0.16	295.60
			11:22:27	26.88	0.14	297.90
			11:23:27	26.86	0.15	293.20
		2.1	11:24:27	26.86	0.11	300.30
	10*	2.2	11:26:32	27.03	0.15	270.70
			11:27:32	27.02	0.17	278.30
			11:28:32	27.00	0.15	277.90
			11:29:32	27.01	0.17	279.50
		2.3	11:30:32	27.01	0.14	290.90

TABLA 13-B5.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
SICIGIA DE MENOR AMPLITUD (BAJAMAR)

Alineación	New Island.
Sitio	B5
Fecha	13/5/2002

Coordenadas		*Viento	
Latitud N	*975602.77*	**Velocidad (Kt)**	1.2
Longitud E	*657310.57*	**Dirección (º)**	0

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
47	37	3.2	11:53:47	26.37	0.15	232.60
			11:54:47	26.41	0.18	255.60
			11:55:47	26.49	0.22	256.80
			11:56:47	26.61	0.24	265.50
		3.4	11:57:47	26.57	0.25	268.50
	23	3.5	12:00:32	27.73	0.29	283.60
			12:01:32	27.73	0.28	282.90
			12:02:32	27.85	0.29	284.30
			12:03:32	27.63	0.30	286.00
		3.7	12:04:32	27.72	0.31	284.20
	10*	3.9	12:06:57	28.11	0.34	289.70
			12:07:57	28.07	0.33	288.10
			12:08:57	28.09	0.33	282.80
			12:09:57	28.08	0.35	290.00
		4.1	12:10:57	28.07	0.36	290.30

TABLA 13-B5.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
SICIGIA DE MENOR AMPLITUD (MAREA MEDIA SUBIENDO)

Alineación	New Island.
Sitio	B5
Fecha	13/5/2002

Coordenadas		*Viento	
Latitud N	*975602.77*	**Velocidad (Kt)**	1
Longitud E	*657310.57*	**Dirección (°)**	105

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (°C)	Velocidad (m/s)	Dirección (°)
50	40	5.6	12:37:22	26.65	0.32	300.10
			12:38:22	26.76	0.34	301.10
			12:39:22	26.98	0.34	298.10
			12:40:22	26.99	0.35	301.00
		5.8	12:41:22	26.96	0.33	289.80
	25	6.0	12:44:17	27.67	0.32	295.90
			12:45:17	27.68	0.32	295.70
			12:46:17	27.66	0.31	286.50
			12:47:17	27.52	0.31	297.60
		6.2	12:48:17	27.60	0.34	305.70
	10*	6.3	12:51:27	28.03	0.34	300.40
			12:52:27	28.02	0.31	287.50
			12:53:27	28.04	0.31	280.40
			12:54:27	28.00	0.33	289.80
		6.7	12:55:27	28.00	0.32	286.80

TABLA 13-B4.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
SICIGIA DE MENOR AMPLITUD (MAREA MEDIA SUBIENDO)

Alineación	New Island.
Sitio	B4
Fecha	13/5/2002

Coordenadas		*Viento	
Latitud N	*978447*	**Velocidad (Kt)**	5
Longitud E	*655775*	**Dirección (°)**	130

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (°C)	Velocidad (m/s)	Dirección (°)
42	30	8.4	13:23:42	27.28	0.27	290.30
			13:24:42	27.25	0.25	293.20
			13:25:42	27.25	0.26	287.70
			13:26:42	27.22	0.25	290.40
		8.7	13:27:42	27.19	0.27	299.90
	21	8.7	13:30:17	27.86	0.33	294.50
			13:31:17	27.87	0.35	300.50
			13:32:17	27.77	0.35	305.40
			13:33:17	27.88	0.36	300.40
		9.1	13:34:17	27.88	0.33	295.10
	10*	9.1	13:36:27	27.95	0.31	291.90
			13:37:27	27.94	0.32	293.50
			13:38:27	27.95	0.31	290.40
			13:39:27	27.95	0.33	291.00
		9.2	13:40:27	27.95	0.31	281.90

TABLA 13-B3.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
SICIGIA DE MENOR AMPLITUD (MAREA MEDIA SUBIENDO)

Alineación	New Island.
Sitio	B3
Fecha	13/5/2002

Coordenadas		*Viento	
Latitud N	*979742*	**Velocidad (Kt)**	7
Longitud E	*655400*	**Dirección (º)**	320

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
35	24	11.0	14:04:42	27.11	0.29	291.30
			14:05:42	27.18	0.23	295.70
			14:06:42	27.18	0.20	310.50
			14:07:42	27.20	0.23	297.30
		11.2	14:08:42	27.18	0.25	295.90
	17	11.2	14:11:12	27.63	0.28	297.80
			14:12:12	27.61	0.31	301.80
			14:13:12	27.57	0.26	301.50
			14:14:12	27.57	0.28	298.10
		11.6	14:15:12	27.62	0.26	295.90
	10*	11.7	14:18:22	27.64	0.28	299.60
			14:19:22	27.64	0.21	294.60
			14:20:22	27.65	0.17	288.90
			14:21:22	27.64	0.22	291.60
		12.0	14:22:22	27.64	0.28	291.90

TABLA 13-B2.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
SICIGIA DE MENOR AMPLITUD (MAREA MEDIA SUBIENDO)

Alineación	New Island.
Sitio	B2
Fecha	13/5/2002

Coordenadas		*Viento	
Latitud N	*980877*	**Velocidad (Kt)**	7
Longitud E	*655029*	**Dirección (º)**	290

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
29	19	13.3	14:53:27	26.78	0.19	259.00
			14:54:27	26.79	0.20	270.90
			14:55:27	26.80	0.21	273.50
			14:56:27	26.82	0.18	269.40
		13.5	14:57:27	26.80	0.16	274.20
	14.5	14.5	15:23:22 **	27.79	0.24	227.20
			15:24:22	28.00	0.14	33.60
			15:25:22	28.01	0.20	231.10
		14.6	15:26:22	28.00	0.10	30.70
	10*	13.6	15:00:02	27.45	0.16	297.10
			15:01:02	27.50	0.14	309.00
			15:02:02	27.44	0.23	259.60
			15:03:02	27.43	0.19	270.20
		13.8	15:04:02	27.46	0.17	277.70

** Error en la hora registrada por el equipo.

TABLA 13-B1.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
SICIGIA DE MENOR AMPLITUD (PLEAMAR)

Alineación	New Island.
Sitio	B1
Fecha	13/5/2002

Coordenadas		*Viento	
Latitud N	*982350*	Velocidad (Kt)	13
Longitud E	*654657*	Dirección (º)	320

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
13	6*	14.6	15:28:32	27.99	0.13	5.30
			15:29:32	27.95	0.27	237.90
			15:30:32	27.95	0.14	17.40
			15:31:32	27.96	0.23	237.10
		14.8	15:32:32	27.94	0.06	21.90

TABLA 13-B1.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
SICIGIA DE MENOR AMPLITUD (PLEAMAR)

Alineación	New Island.
Sitio	B1
Fecha	13/5/2002

Coordenadas		*Viento	
Latitud N	*982350*	Velocidad (Kt)	14
Longitud E	*654657*	Dirección (º)	268

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
13	6*	14.8	15:35:12	27.92	0.08	29.10
			15:36:12	27.92	0.23	215.90
			15:37:12	27.92	0.12	11.70
		14.9	15:38:12	27.92	0.09	260.90

TABLA 13-B2.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
SICIGIA DE MENOR AMPLITUD (PLEAMAR)

Alineación	New Island.
Sitio	B2
Fecha	13/5/2002

Coordenadas		*Viento	
Latitud N	*980877*	**Velocidad (Kt)**	15
Longitud E	*655029*	**Dirección (º)**	285

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
30	20	15.3	16:01:12	27.17	0.19	262.60
			16:02:12	27.09	0.12	299.00
			16:03:12	27.12	0.20	262.50
			16:04:12	27.10	0.22	252.90
		15.4	16:05:12	27.10	0.17	345.60
	10*	15.4	16:07:17	27.50	0.17	232.20
			16:08:17	27.51	0.20	236.00
			16:09:17	27.51	0.20	233.70
			16:10:17	27.50	0.18	233.60
		15.5	16:11:17	27.51	0.21	234.30

TABLA 13-B3.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
SICIGIA DE MENOR AMPLITUD (PLEAMAR)

Alineación	New Island.
Sitio	B3
Fecha	13/5/2002

Coordenadas		*Viento	
Latitud N	*979742*	**Velocidad (Kt)**	10
Longitud E	*655400*	**Dirección (º)**	335

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
42	30	15.6	16:31:47	27.52	0.55	305.50
			16:32:47	27.50	0.48	299.80
			16:33:47	27.51	0.55	315.30
			16:34:47	27.52	0.47	303.50
		15.6	16:35:47	27.54	0.50	299.50
	20	15.6	16:38:32	28.30	0.51	306.20
			16:39:32	28.31	0.45	293.60
			16:40:32	28.34	0.35	284.30
			16:41:32	28.36	0.36	295.00
		15.6	16:42:32	28.38	0.43	305.40
	10*	15.6	16:44:52	28.52	0.39	301.90
			16:45:52	28.57	0.34	291.90
			16:46:52	28.62	0.31	287.40
			16:47:52	28.67	0.35	295.30
		15.6	16:48:52	28.71	0.43	305.50

TABLA 13-B4.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA

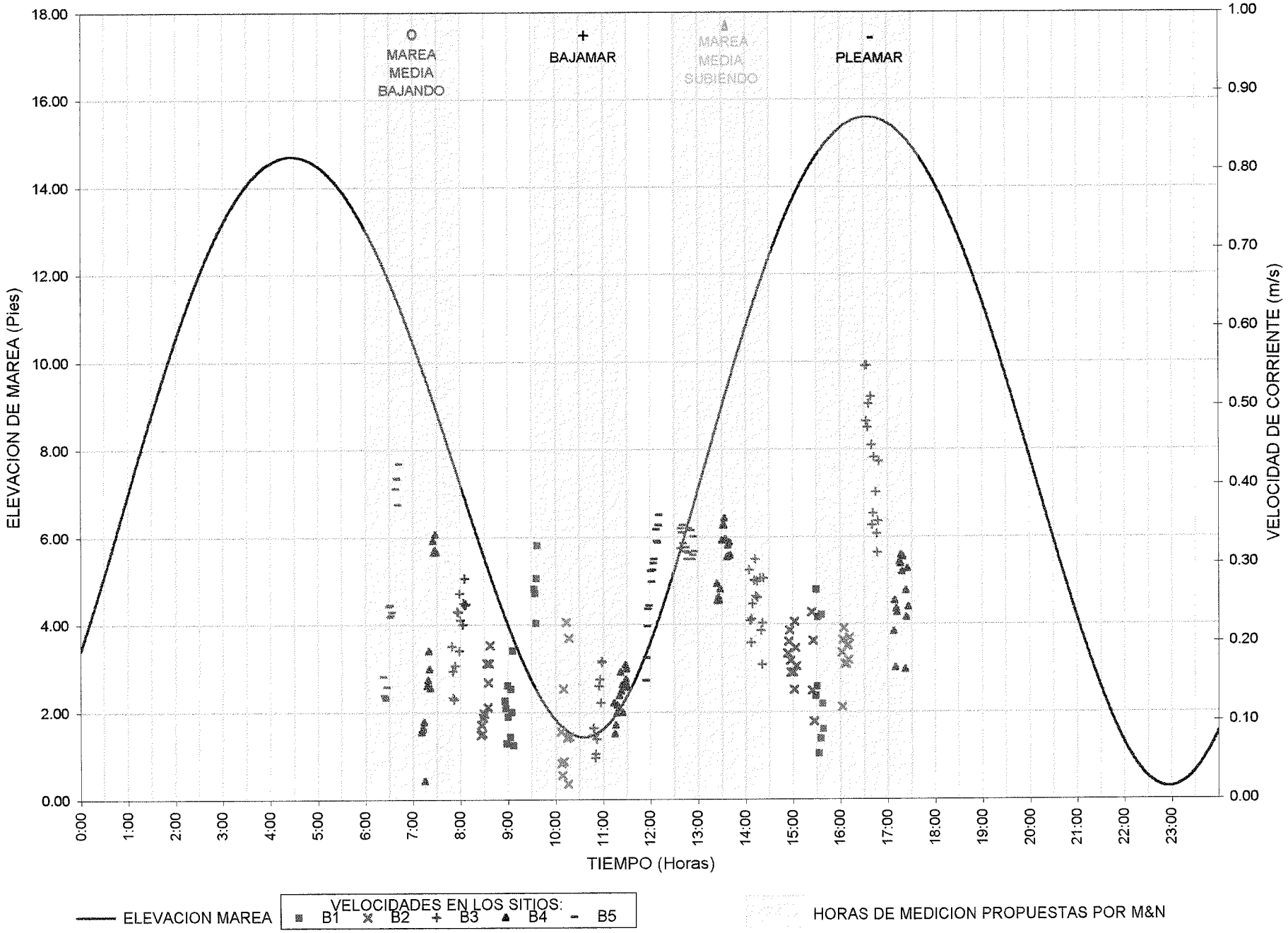
SICIGIA DE MENOR AMPLITUD (PLEAMAR)

Alineación	New Island.
Sitio	B4
Fecha	13/5/2002

Coordenadas		*Viento	
Latitud N	*978447*	**Velocidad (Kt)**	13
Longitud E	*655775*	**Dirección (º)**	315

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
50	40	15.4	17:07:27	26.61	0.21	237.60
			17:08:27	26.51	0.25	231.80
			17:09:27	26.56	0.17	236.40
			17:10:27	26.74	0.24	234.40
		15.3	17:11:27	26.85	0.24	233.10
	25	15.3	17:14:42	27.84	0.30	258.80
			17:15:42	27.77	0.30	260.50
			17:16:42	27.70	0.31	256.70
			17:17:42	27.74	0.29	257.50
		15.2	17:18:42	27.83	0.31	261.30
	10*	15.2	17:21:32	28.26	0.17	259.50
			17:22:32	28.27	0.27	238.70
			17:23:32	28.28	0.23	235.80
			17:24:32	28.28	0.29	236.30
		15.1	17:25:32	28.29	0.24	230.10

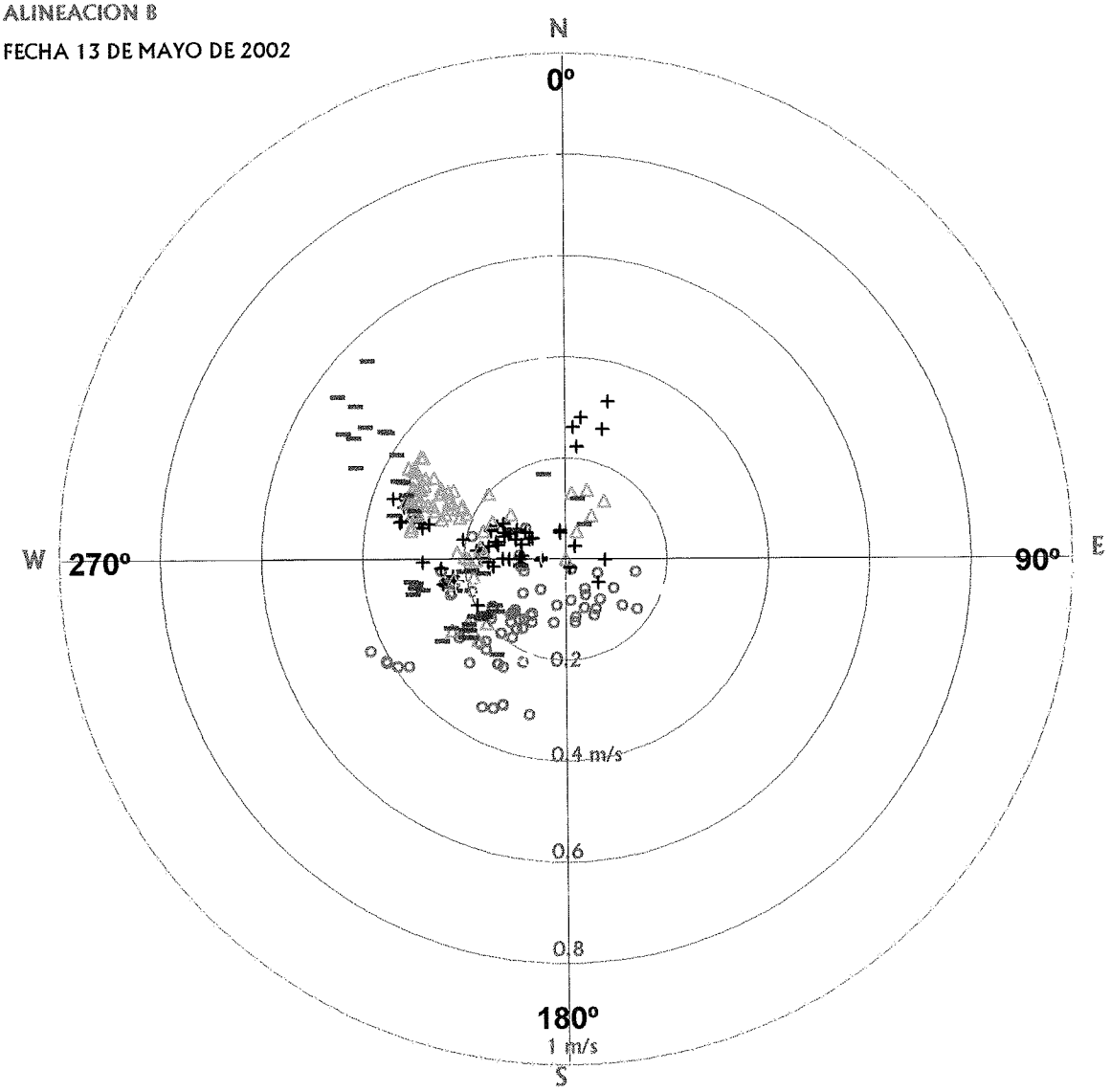
VELOCIDAD DE CORRIENTES MARINAS EN LA BAHIA DE PANAMA SEGUN HORA, CONDICION DE MAREA Y SITIOS DE MEDICION (B1, B2, B3, B4 Y B5) DE ALINEACION B (NEW ISLAND). MEDICION DE CORRIENTES #2-13 DE MAYO DE 2002



VELOCIDAD Y DIRECCION DE LAS CORRIENTES MARINAS EN LA BAHÍA DE PANAMÁ SEGÚN CONDICION DE MAREA

ALINEACION B

FECHA 13 DE MAYO DE 2002



- ○ Marea media bajando
- + Bajamar
- △ Marea media subiendo
- – Pleamar

Unidad de Operaciones-ACP

Mediciones durante Marea Media (Sicigia de menor amplitud)

Martes, 14 de mayo de 2002 - 2 día después de Luna Nueva

Toma de datos en alineación C.

Tiempo de Medición:

Marea Media Bajando: 7:00 - 9:00

Bajamar: 10:11 - 12:11

Marea Media Subiendo: 13:00 - 15:00

Pleamar: 16:11 - 18:11

TABLA 14-C1.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
SICIGIA DE MENOR AMPLITUD (MAREA MEDIA BAJANDO)

Alineación	PUNTA CHAME
Sitio	C1
Fecha	14/5/2002

Coordenadas		*Viento	
Latitud N	*954005.67*	**Velocidad (Kt)**	8
Longitud E	*648526.76*	**Dirección (º)**	350

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
80	70	9.4	8:01:34	25.15	0.82	331.90
			8:02:34	25.08	0.80	329.70
			8:03:34	24.94	0.81	332.90
			8:04:34	25.02	0.82	337.40
		9.1	8:05:34	25.03	0.85	334.70
	40	9.0	8:08:39	26.14	0.54	329.30
			8:09:39	26.09	0.55	323.80
			8:10:39	26.12	0.58	330.70
			8:11:39	26.37	0.53	333.10
		8.7	8:12:39	26.21	0.54	325.20
	10*	8.6	8:15:19	27.18	0.22	311.90
			8:16:19	27.20	0.24	305.10
			8:17:19	27.15	0.25	312.60
			8:18:19	27.22	0.24	315.40
		8.3	8:19:19	27.21	0.25	301.80

TABLA 14-C2.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
SICIGIA DE MENOR AMPLITUD (MAREA MEDIA BAJANDO)

Alineación	PUNTA CHAME
Sitio	C2
Fecha	14/5/2002

Coordenadas		*Viento	
Latitud N	*957343.09*	**Velocidad (Kt)**	7
Longitud E	*654017.28*	**Dirección (º)**	10

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
75	65	5.1	9:16:54	24.93	0.28	179.80
			9:17:54	24.93	0.27	163.30
			9:18:54	24.93	0.32	187.10
			9:19:54	24.92	0.22	179.60
		4.8	9:20:54	24.93	0.28	182.60
	37	4.7	9:23:19	26.91	0.54	184.30
			9:24:19	26.91	0.55	192.10
			9:25:19	26.90	0.55	188.80
			9:26:19	26.88	0.58	190.10
		4.5	9:27:19	26.86	0.57	188.90
	10*	4.4	9:29:59	27.82	0.78	202.80
			9:30:59	27.83	0.79	201.90
			9:31:59	27.82	0.78	203.00
		4.1	9:32:59	27.82	0.78	204.70

TABLA 14-C3.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
SICIGIA DE MENOR AMPLITUD (BAJAMAR)

Alineación	PUNTA CHAME
Sitio	C3
Fecha	14/5/2002

Coordenadas		*Viento	
Latitud N	*962880.66*	**Velocidad (Kt)**	8.5
Longitud E	*656197.52*	**Dirección (º)**	330

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
73	63	1.8	10:44:55	25.04	0.09	44.00
			10:45:55	25.03	0.06	305.40
			10:46:55	25.03	0.21	257.90
			10:47:55	25.03	0.04	288.80
		1.7	10:48:55	25.03	0.07	52.90
	36	1.6	10:52:20	25.78	0.07	236.80
			10:53:20	25.96	0.17	248.10
			10:54:20	26.23	0.14	229.10
			10:55:20	26.22	0.06	131.60
		1.6	10:56:20	26.19	0.15	243.10
	10*	1.5	10:59:50	27.13	0.12	116.50
			11:00:50	27.13	0.14	234.30
			11:01:50	27.13	0.06	197.60
			11:02:50	27.13	0.11	124.10
		1.5	11:03:50	27.21	0.15	232.60

TABLA 14-C3.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
SICIGIA DE MENOR AMPLITUD (BAJAMAR)

Alineación	PUNTA CHAME
Sitio	C3
Fecha	14/5/2002

Coordenadas		*Viento	
Latitud N	*962880.66*	**Velocidad (Kt)**	8
Longitud E	*656197.52*	**Dirección (º)**	320

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
73	63	1.5	11:11:45	25.01	0.13	287.60
			11:12:45	25.02	0.12	298.50
			11:13:45	25.01	0.16	22.10
			11:14:45	25.01	0.11	320.10
		1.5	11:15:45	25.01	0.16	294.00
	36	1.5	11:18:50	26.25	0.14	261.40
			11:19:50	26.26	0.08	26.30
			11:20:50	26.27	0.06	299.80
			11:21:50	26.27	0.15	267.10
		1.5	11:22:50	26.27	0.11	269.10
	10*	1.5	11:26:45	27.26	0.22	55.80
			11:27:45	27.49	0.11	91.80
			11:28:45	27.20	0.06	183.50
			11:29:45	27.21	0.06	84.80
		1.6	11:30:45	27.26	0.17	50.90

TABLA 14-C2.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
SICIGIA DE MENOR AMPLITUD (BAJAMAR)

Alineación	PUNTA CHAME
Sitio	C2
Fecha	14/5/2002

Coordenadas		*Viento	
Latitud N	*957343.09*	**Velocidad (Kt)**	10
Longitud E	*654017.28*	**Dirección (º)**	325

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
72	62	2.7	12:16:25	24.98	0.30	343.90
			12:17:25	24.97	0.25	347.90
			12:18:25	24.97	0.26	351.30
			12:19:25	24.96	0.31	339.30
		2.9	12:20:25	24.96	0.26	0.70
	36	3.0	12:23:00	26.92	0.12	325.70
			12:24:00	26.90	0.10	329.40
			12:25:00	26.92	0.08	349.00
			12:26:00	26.91	0.08	15.00
		3.2	12:27:00	26.93	0.11	335.20
	10*	3.4	12:32:12	28.02	0.36	264.90
			12:33:12	28.02	0.31	262.80
			12:34:12	27.90	0.34	266.30
			12:35:12	27.93	0.36	266.90
		3.6	12:36:12	28.01	0.28	260.70

TABLA 14-C1.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
SICIGIA DE MENOR AMPLITUD (MAREA MEDIA SUBIENDO)

Alineación	PUNTA CHAME
Sitio	C1
Fecha	14/5/2002

Coordenadas		*Viento	
Latitud N	*954005.67*	**Velocidad (Kt)**	10
Longitud E	*648526.76*	**Dirección (º)**	320

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
77	67	6.2	13:23:37	25.16	0.39	306.00
			13:24:37	25.15	0.32	338.40
			13:25:37	25.15	0.32	331.30
			13:26:37	25.13	0.30	333.50
		6.5	13:27:37	25.12	0.31	335.50
	38	6.7	13:30:36	27.50	0.24	266.20
			13:31:36	27.50	0.11	295.20
			13:32:36	27.51	0.29	263.60
			13:33:36	27.49	0.15	283.40
		6.9	13:34:36	27.49	0.19	266.30
	10*	7.1	13:37:17	28.52	0.22	80.80
			13:38:17	28.53	0.14	129.50
			13:39:17	28.51	0.24	88.50
			13:40:17	28.51	0.24	89.90
		7.3	13:41:17	28.50	0.09	146.70

TABLA 14-C1.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
SICIGIA DE MENOR AMPLITUD (MAREA MEDIA SUBIENDO)

Alineación	PUNTA CHAME
Sitio	C1
Fecha	14/5/2002

Coordenadas		*Viento	
Latitud N	*954005.67*	**Velocidad (Kt)**	15
Longitud E	*648526.76*	**Dirección (º)**	298

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
78	68	7.7	13:47:32	25.15	0.26	341.00
			13:48:32	25.17	0.24	340.50
			13:49:32	25.16	0.23	354.70
			13:50:32	25.41	0.24	336.00
		8.0	13:51:32	26.78	0.52	287.50
	39	8.1	13:54:47	27.35	0.32	281.30
			13:55:47	27.32	0.22	297.00
			13:56:47	27.36	0.24	289.50
			13:57:47	27.37	0.27	277.60
		8.4	13:58:47	27.35	0.29	279.90
	10*	8.6	14:01:37	28.45	0.28	81.50
			14:02:37	28.43	0.12	17.60
			14:03:37	28.41	0.44	351.50
			14:04:37	28.36	0.42	350.40
		8.9	14:05:37	28.42	0.36	331.40

TABLA 14-C2.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
SICIGIA DE MENOR AMPLITUD (MAREA MEDIA SUBIENDO)

Alineación	PUNTA CHAME
Sitio	C2
Fecha	14/5/2002

Coordenadas		*Viento	
Latitud N	*957343.09*	**Velocidad (Kt)**	14
Longitud E	*654017.28*	**Dirección (º)**	320

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
80	70	12.2	15:03:07	24.88	0.20	14.60
			15:04:07	24.89	0.20	359.20
			15:05:07	24.90	0.20	0.60
			15:06:07	24.94	0.19	350.30
		12.4	15:07:07	24.96	0.18	350.40
	35	12.5	15:10:02	27.03	0.36	284.50
			15:11:02	27.00	0.24	283.80
			15:12:02	27.10	0.31	280.40
			15:13:02	27.05	0.31	287.20
		12.7	15:14:02	27.16	0.30	287.90
	10*	12.8	15:16:52	28.70	0.43	254.70
			15:17:52	28.71	0.44	251.80
			15:18:52	28.72	0.39	248.40
			15:19:52	28.73	0.46	249.90
		13.0	15:20:52	28.72	0.43	247.50

TABLA 14-C3.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
SICIGIA DE MENOR AMPLITUD (PLEAMAR)

Alineación	PUNTA CHAME
Sitio	C3
Fecha	14/5/2002

Coordenadas		*Viento	
Latitud N	*962880.66*	**Velocidad (Kt)**	15
Longitud E	*656197.52*	**Dirección (º)**	340

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
85	75	15.0	16:18:52	24.85	0.12	134.70
			16:19:52	24.85	0.13	90.20
			16:20:52	24.85	0.07	107.20
			16:21:52	24.85	0.13	128.10
		15.1	16:22:52	24.85	0.10	124.30
	43	15.1	16:25:47	26.22	0.26	297.00
			16:26:47	26.23	0.29	271.60
			16:27:47	26.41	0.38	236.80
			16:28:47	26.41	0.39	234.60
		15.2	16:29:47	26.53	0.30	239.40
	10*	15.3	16:32:42	28.36	0.61	228.90
			16:33:42	28.38	0.65	234.80
			16:34:42	28.38	0.64	228.40
			16:35:42	28.41	0.65	233.60
		15.3	16:36:42	28.43	0.63	235.30

TABLA 14-C3.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
SICIGIA DE MENOR AMPLITUD (PLEAMAR)

Alineación	PUNTA CHAME
Sitio	C3
Fecha	14/5/2002

Coordenadas		*Viento	
Latitud N	*962880.66*	**Velocidad (Kt)**	14
Longitud E	*656197.52*	**Dirección (º)**	345

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
86	76	15.4	16:42:22	24.86	0.14	137.40
			16:43:22	24.86	0.17	137.20
			16:44:22	24.86	0.16	132.20
			16:45:22	24.86	0.13	148.10
		15.4	16:46:22	24.86	0.16	142.50
	43	15.5	16:48:32	25.64	0.28	230.90
			16:49:32	25.63	0.27	226.50
			16:50:32	25.84	0.24	212.90
			16:51:32	25.64	0.27	227.70
		15.5	16:52:32	25.63	0.31	227.40
	10*	15.5	16:56:32	28.44	0.64	231.20
			16:57:32	28.45	0.59	233.30
			16:58:32	28.44	0.61	234.40
			16:59:32	28.44	0.61	235.70
		15.6	17:00:32	28.44	0.59	230.00

TABLA 14-C2.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
SICIGIA DE MENOR AMPLITUD (PLEAMAR)

Alineación	PUNTA CHAME
Sitio	C2
Fecha	14/5/2002

Coordenadas		*Viento	
Latitud N	*957343.09*	**Velocidad (Kt)**	14
Longitud E	*654017.28*	**Dirección (º)**	295

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
84	74	15.3	17:51:07	24.91	0.27	181.20
			17:52:07	24.92	0.24	189.50
			17:53:07	24.90	0.28	181.00
			17:54:07	24.91	0.25	182.90
		15.2	17:55:07	24.91	0.25	180.00
	42	15.2	17:57:22	25.81	0.26	194.00
			17:58:22	25.81	0.33	203.10
			17:59:22	25.79	0.34	202.80
			18:00:22	25.77	0.29	195.10
		15.1	18:01:22	25.98	0.38	202.50
	10*	15.0	18:04:27	28.48	0.67	207.30
			18:05:27	28.48	0.71	208.80
			18:06:27	28.48	0.70	209.50
			18:07:27	28.48	0.70	205.90
		14.9	18:08:27	28.48	0.71	209.40

TABLA 14-C1.4

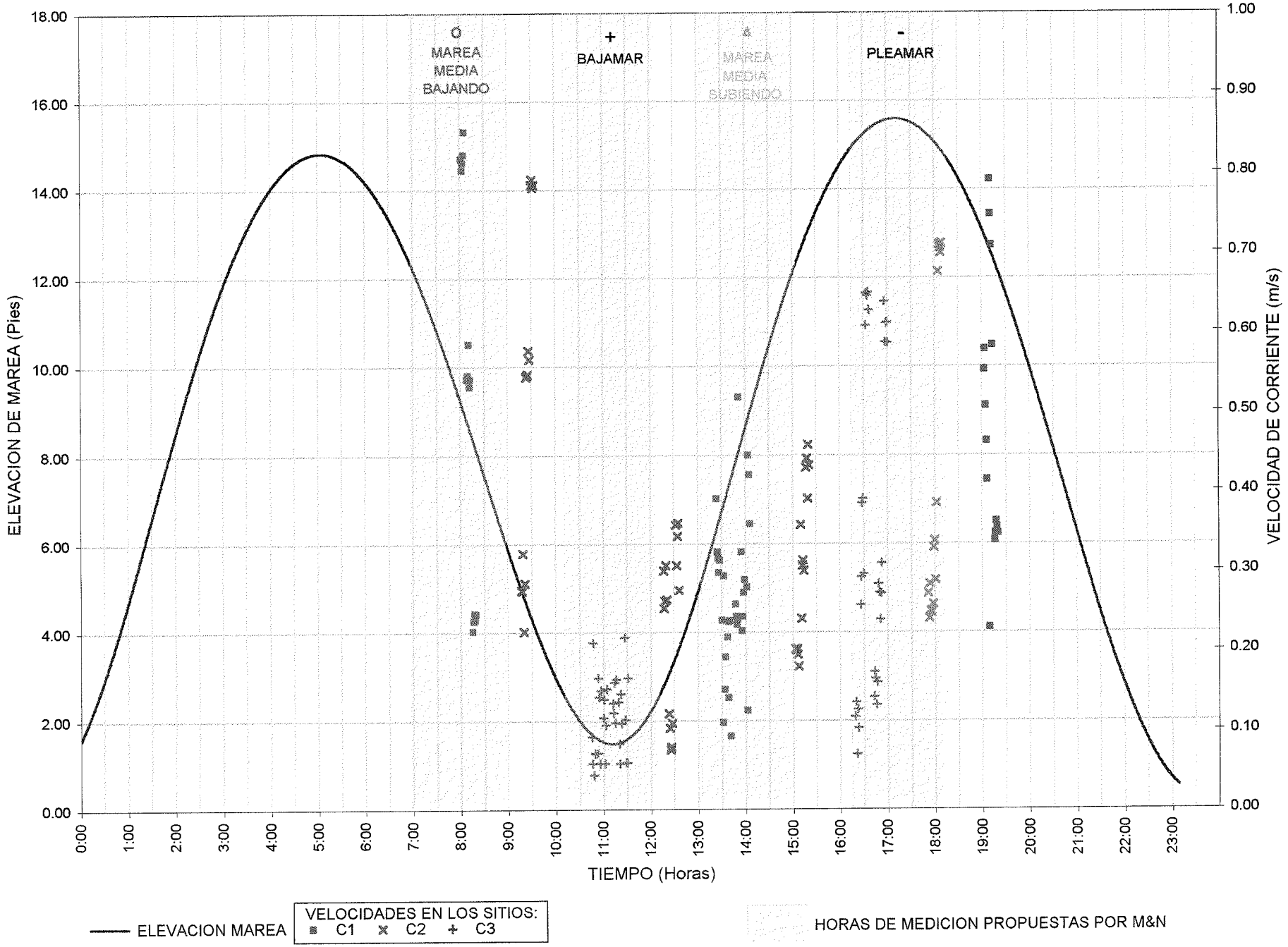
VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
SICIGIA DE MENOR AMPLITUD (MAREA MEDIA BAJANDO)

Alineación	PUNTA CHAME
Sitio	C1
Fecha	14/5/2002

Coordenadas		*Viento	
Latitud N	*954005.67*	**Velocidad (Kt)**	12
Longitud E	*648526.76*	**Dirección (º)**	240

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
82	72	13.1	19:02:27	25.51	0.55	347.50
			19:03:27	25.48	0.58	348.80
			19:04:27	25.38	0.51	342.80
			19:05:27	25.28	0.46	333.30
		12.9	19:06:27	25.26	0.41	327.80
	41	12.8	19:08:57	27.59	0.23	183.80
			19:09:57	27.70	0.79	185.20
			19:10:57	27.77	0.75	184.20
			19:11:57	27.86	0.71	184.80
		12.6	19:12:57	27.79	0.58	192.50
	10*	12.5	19:15:42	28.32	0.34	310.00
			19:16:42	28.33	0.35	313.20
			19:17:42	28.34	0.36	313.70
			19:18:42	28.34	0.35	315.70
		12.3	19:19:42	28.34	0.35	319.40

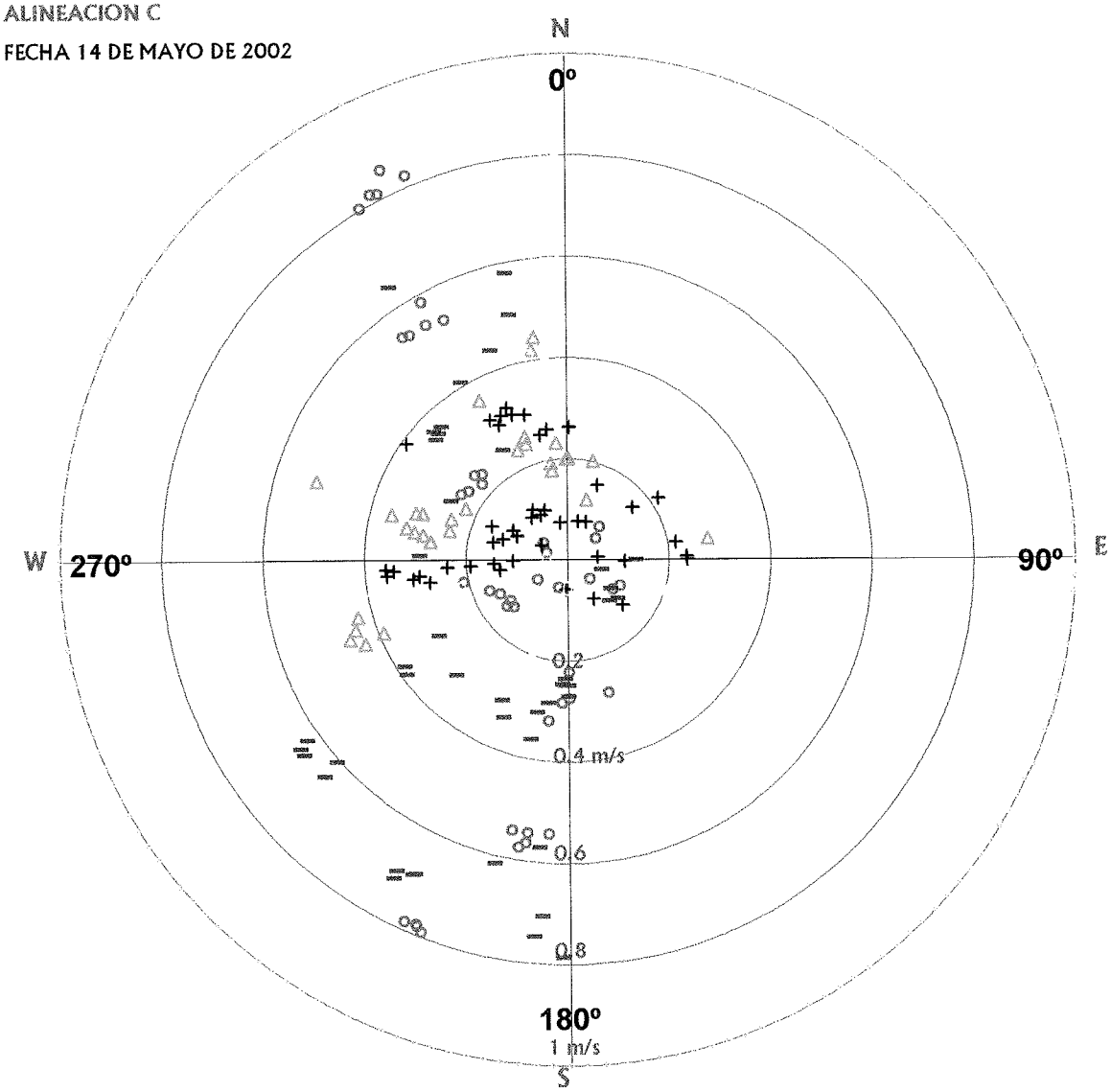
VELOCIDAD DE CORRIENTES MARINAS EN LA BAHIA DE PANAMA SEGUN HORA, CONDICION DE MAREA Y SITIOS DE MEDICION (C1, C2 Y C3) DE ALINEACION C (PUNTA CHAME). MEDICION DE CORRIENTES #3-14 DE MAYO DE 2002



VELOCIDAD Y DIRECCION DE LAS CORRIENTES MARINAS EN LA BAHÍA DE PANAMÁ SEGÚN CONDICION DE MAREA

ALINEACION C

FECHA 14 DE MAYO DE 2002



- ○ Marea media bajando
- + Bajamar
- △ Marea media subiendo
- – Pleamar

Unidad de Operaciones-ACP

Mediciones durante Marea de Cuadratura

Domingo, 19 de mayo de 2002 -Cuarto Creciente

Toma de datos en alineación A.

Tiempo de Medición:

Pleamar: 7:44 - 9:44

Marea Media Bajando: 11:00 - 13:00

Bajamar: 14:09 - 16:09

Marea Media Subiendo: 17:15 - 19:15

TABLA 19-A1.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE CUADRATURA (PLEAMAR)

Alineación	Pacora
Sitio	A1
Fecha	19/5/2002

Coordenadas		*Viento	
Latitud N	*995098*	**Velocidad (Kt)**	2.5
Longitud E	*690160*	**Dirección (º)**	299

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
13	6.5*	13.3	7:45:04	27.66	0.07	305.20
			7:46:04	27.70	0.13	15.50
			7:47:04	27.73	0.14	340.60
			7:48:04	27.81	0.18	24.50
		13.4	7:49:04	27.74	0.15	349.70

TABLA 19-A2.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE CUADRATURA (PLEAMAR)

Alineación	Pacora
Sitio	A2
Fecha	19/5/2002

Coordenadas		*Viento	
Latitud N	*989567*	**Velocidad (Kt)**	3
Longitud E	*690186*	**Dirección (º)**	270

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
58	48	13.8	8:19:39	26.76	0.12	278.90
			8:20:39	26.77	0.11	303.20
			8:21:39	26.79	0.13	300.20
			8:22:39	26.80	0.12	313.30
		13.8	8:23:39	26.82	0.09	316.10
	29	13.8	8:25:59	27.45	0.18	317.00
			8:26:59	27.45	0.18	315.80
			8:27:59	27.45	0.14	311.70
			8:28:59	27.44	0.18	313.00
		13.9	8:29:59	27.44	0.17	319.10
	10*	13.9	8:32:19	28.21	0.11	358.10
			8:33:19	28.22	0.10	3.40
			8:34:19	28.22	0.12	5.90
			8:35:19	28.22	0.10	6.90
		13.9	8:36:19	28.22	0.11	353.70

TABLA 19-A3.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE CUADRATURA (PLEAMAR)

Alineación	Pacora
Sitio	A3
Fecha	19/5/2002

Coordenadas		*Viento	
Latitud N	*985143*	Velocidad (Kt)	4
Longitud E	*690207*	Dirección (º)	305

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
90	80	13.8	9:02:59	26.02	0.14	271.90
			9:03:59	26.02	0.16	271.20
			9:04:59	26.02	0.17	284.50
			9:05:59	26.01	0.15	308.00
		13.8	9:06:59	26.00	0.13	311.70
	45	13.8	9:09:54	27.26	0.28	338.20
			9:10:54	27.30	0.24	333.90
			9:11:54	27.29	0.22	326.30
			9:12:54	27.21	0.19	315.00
		13.7	9:13:54	27.17	0.19	308.40
	10*	13.7	9:18:09	28.32	0.09	225.40
			9:19:09	28.32	0.08	307.80
			9:20:09	28.33	0.08	264.90
			9:21:09	28.32	0.09	231.20
		13.6	9:22:09	28.32	0.06	278.40

TABLA 19-A4.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE CUADRATURA (PLEAMAR)

Alineación	Pacora
Sitio	A4
Fecha	19/5/2002

Coordenadas		*Viento	
Latitud N	*979613*	Velocidad (Kt)	1
Longitud E	*690233*	Dirección (º)	105

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
117	107	12.6	10:11:18	25.03	0.10	268.60
			10:12:18	25.03	0.10	260.30
			10:13:18	25.04	0.09	258.90
			10:14:18	25.04	0.08	265.50
		12.5	10:15:18	25.06	0.09	264.10
	58.5	12.4	10:17:48	26.96	0.23	281.30
			10:18:48	26.97	0.21	277.90
		12.3	10:19:48	26.97	0.20	276.30
	10*	12.2	10:23:48	28.30	0.21	240.50
			10:24:48	28.32	0.20	241.60
			10:25:48	28.33	0.22	240.50
			10:26:48	28.34	0.22	241.40
		12.1	10:27:48	28.35	0.23	238.10

TABLA 19-A4.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE CUADRATURA (MAREA MEDIA BAJANDO)

Alineación	Pacora
Sitio	A4
Fecha	19/5/2002

Coordenadas		*Viento	
Latitud N	*979613*	**Velocidad (Kt)**	0.5
Longitud E	*690207*	**Dirección (º)**	300

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
116	106	10.9	11:01:13	25.03	0.14	207.50
			11:02:13	25.03	0.12	228.90
			11:03:13	25.03	0.12	222.80
			11:04:13	25.03	0.13	219.00
		10.8	11:05:13	25.03	0.15	226.50
	58	10.7	11:08:18	27.10	0.18	268.50
			11:09:18	27.11	0.17	264.90
			11:10:18	27.09	0.18	265.70
			11:11:18	27.09	0.17	269.30
		10.5	11:12:18	27.10	0.17	271.70
	10*	10.4	11:14:43	28.36	0.22	253.00
			11:15:43	28.35	0.25	257.90
			11:16:43	28.34	0.20	249.40
			11:17:43	28.33	0.22	248.70
		10.3	11:18:43	28.34	0.22	245.80

TABLA 19-A3.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE CUADRATURA (MAREA MEDIA BAJANDO)

Alineación	Pacora
Sitio	A3
Fecha	19/5/2002

Coordenadas		*Viento	
Latitud N	*985143*	**Velocidad (Kt)**	3
Longitud E	*690207*	**Dirección (º)**	195

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
87	77	8.8	11:54:23	26.26	0.13	226.20
			11:55:23	26.26	0.12	217.20
			11:56:23	26.25	0.11	221.70
			11:57:23	26.24	0.13	230.90
		8.6	11:58:23	26.24	0.12	235.00
	43.5	8.5	12:00:53	27.02	0.20	291.10
			12:01:53	27.02	0.19	290.30
			12:02:53	27.02	0.20	288.80
			12:03:53	27.02	0.20	289.00
		8.4	12:04:53	27.02	0.20	290.10
	10*	8.2	12:07:38	28.37	0.13	207.80
			12:08:38	28.37	0.13	203.20
			12:09:38	28.36	0.11	205.10
			12:10:38	28.37	0.13	211.60
		8.1	12:11:38	28.38	0.14	215.60

TABLA 19-A2.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE CUADRATURA (MAREA MEDIA BAJANDO)

Alineación	Pacora
Sitio	A2
Fecha	19/5/2002

Coordenadas		*Viento	
Latitud N	*989567*	**Velocidad (Kt)**	5
Longitud E	*690186*	**Dirección (º)**	155

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
51	41	7.0	12:39:08	27.39	0.14	197.00
			12:40:08	27.38	0.13	149.30
			12:41:08	27.39	0.13	137.20
			12:42:08	27.38	0.11	161.10
		6.8	12:43:08	27.38	0.09	158.40
	25.5	6.7	12:45:43	27.59	0.27	232.70
			12:46:43	27.61	0.21	239.20
			12:47:43	27.62	0.18	236.60
			12:48:43	27.61	0.17	233.50
		6.5	12:49:43	27.62	0.14	235.60
	10*	6.4	12:52:13	28.27	0.12	139.50
			12:53:13	28.26	0.13	136.70
			12:54:13	28.27	0.11	177.80
			12:55:13	28.26	0.10	183.30
		6.3	12:56:13	28.28	0.12	179.30

TABLA 19-A1.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE CUADRATURA (MAREA MEDIA BAJANDO)

Alineación	Pacora
Sitio	A1
Fecha	19/5/2002

Coordenadas		*Viento	
Latitud N	*995098*	**Velocidad (Kt)**	7
Longitud E	*690160*	**Dirección (º)**	194

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
12	5*	5.0	13:33:03	28.70	0.23	204.90
			13:34:03	28.69	0.18	193.80
			13:35:03	28.67	0.22	179.50
			13:36:03	28.71	0.23	210.60
		4.9	13:37:03	28.72	0.22	231.20

TABLA 19-A1.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE CUADRATURA (BAJAMAR)

Alineación	Pacora
Sitio	A1
Fecha	19/5/2002

Coordenadas		*Viento	
Latitud N	*995098*	**Velocidad (Kt)**	7.5
Longitud E	*690160*	**Dirección (º)**	255

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
6	5*	4.1	14:09:28	29.41	0.12	258.20
			14:10:28	29.05	0.02	307.90
			14:11:28	29.12	0.10	310.40
			14:12:28	29.03	0.14	286.80
		4.0	14:13:28	29.13	0.11	307.50

TABLA 19-A2.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE CUADRATURA (BAJAMAR)

Alineación	Pacora
Sitio	A2
Fecha	19/5/2002

Coordenadas		*Viento	
Latitud N	*989567*	**Velocidad (Kt)**	5.5
Longitud E	*690186*	**Dirección (º)**	230

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
49	40	3.5	14:47:53	27.40	0.11	347.60
			14:48:53	27.41	0.09	345.20
			14:49:53	27.42	0.14	322.20
			14:50:53	27.42	0.17	315.40
		3.5	14:51:53	27.41	0.09	334.50
	24.5	3.5	14:54:23	27.65	0.10	325.40
			14:55:23	27.66	0.17	300.90
			14:56:23	27.68	0.04	64.80
			14:57:23	27.67	0.07	127.10
		3.4	14:58:23	27.68	0.08	315.70
	10*	3.4	15:00:28	28.10	0.10	162.10
			15:01:28	28.09	0.07	162.50
			15:02:28	28.10	0.15	271.50
			15:03:28	28.11	0.05	231.00
		3.4	15:04:28	28.10	0.13	147.10

TABLA 19-A3.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE CUADRATURA (BAJAMAR)

Alineación	Pacora
Sitio	A3
Fecha	19/5/2002

Coordenadas		*Viento	
Latitud N	*985143*	**Velocidad (Kt)**	4.5
Longitud E	*690207*	**Dirección (°)**	220

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (°C)	Velocidad (m/s)	Dirección (°)
81	71	3.6	15:31:08	26.36	0.21	315.30
			15:32:08	26.35	0.18	317.40
			15:33:08	26.33	0.14	328.20
			15:34:08	26.32	0.11	334.50
		3.6	15:35:08	26.33	0.08	358.70
	40.5	3.6	15:38:03	26.79	0.22	294.60
			15:39:03	26.79	0.17	296.20
			15:40:03	26.79	0.07	284.50
			15:41:03	26.79	0.12	295.50
		3.7	15:42:03	26.79	0.20	294.10
	10*	3.7	15:45:03	28.49	0.13	283.90
			15:46:03	28.50	0.10	286.20
			15:47:03	28.50	0.08	287.60
			15:48:03	28.51	0.05	282.80
		3.8	15:49:03	28.51	0.09	283.70

TABLA 19-A4.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE CUADRATURA (BAJAMAR)

Alineación	Pacora
Sitio	A4
Fecha	19/5/2002

Coordenadas		*Viento	
Latitud N	*979613*	**Velocidad (Kt)**	3.5
Longitud E	*690207*	**Dirección (°)**	240

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (°C)	Velocidad (m/s)	Dirección (°)
107	97	4.6	16:22:08	25.23	0.16	293.60
			16:23:08	25.23	0.14	293.50
			16:24:08	25.23	0.15	297.10
			16:25:08	25.22	0.17	296.30
		4.7	16:26:08	25.23	0.19	289.60
	53.5	4.8	16:28:58	27.05	0.29	309.20
			16:29:58	27.09	0.30	308.50
			16:30:58	27.12	0.26	310.10
			16:31:58	27.05	0.30	312.40
		4.9	16:32:58	27.06	0.30	311.80
	10*	5.0	16:35:28	28.39	0.17	308.50
			16:36:28	28.41	0.16	311.90
			16:37:28	28.37	0.18	308.80
			16:38:28	28.32	0.19	309.20
		5.1	16:39:28	28.32	0.16	312.60

TABLA 19-A4.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE CUADRATURA (MAREA MEDIA SUBIENDO)

Alineación	Pacora
Sitio	A4
Fecha	19/5/2002

Coordenadas		*Viento	
Latitud N	*979613*	**Velocidad (Kt)**	3
Longitud E	*690207*	**Dirección (º)**	94

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
110	100	6.4	17:11:38	25.13	0.13	348.80
			17:12:38	25.14	0.10	351.60
			17:13:38	25.14	0.10	352.80
			17:14:38	25.14	0.10	347.90
		6.6	17:15:38	25.15	0.11	344.00
	55	6.7	17:18:23	26.99	0.22	320.00
			17:19:23	26.99	0.21	321.30
			17:20:23	26.99	0.25	316.60
			17:21:23	27.00	0.21	324.20
		6.9	17:22:23	26.99	0.18	328.70
	10*	7.0	17:26:13	28.47	0.15	333.00
			17:27:13	28.38	0.19	326.90
			17:28:13	28.37	0.16	323.10
			17:29:13	28.36	0.17	321.10
		7.2	17:30:13	28.36	0.19	331.70

TABLA 19-A3.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE CUADRATURA (MAREA MEDIA SUBIENDO)

Alineación	Pacora
Sitio	A3
Fecha	19/5/2002

Coordenadas		*Viento	
Latitud N	*985143*	**Velocidad (Kt)**	4.5
Longitud E	*690207*	**Dirección (º)**	0

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
86	76	8.7	18:02:53	26.11	0.15	21.90
			18:03:53	26.12	0.13	356.20
			18:04:53	26.12	0.14	3.60
			18:05:53	26.10	0.17	354.00
		8.9	18:06:53	26.06	0.15	10.90
	43	9.0	18:09:23	27.17	0.21	317.40
			18:10:23	26.96	0.22	311.00
			18:11:23	27.17	0.23	324.50
			18:12:23	27.15	0.22	310.30
		9.2	18:13:23	27.21	0.20	326.10
	10*	9.3	18:15:48	28.75	0.17	350.30
			18:16:48	28.74	0.11	330.70
			18:17:48	28.87	0.13	311.10
			18:18:48	28.81	0.13	316.50
		9.5	18:19:48	28.81	0.13	348.90

TABLA 19-A2.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE CUADRATURA (MAREA MEDIA SUBIENDO)

Alineación	Pacora
Sitio	A2
Fecha	19/5/2002

Coordenadas		*Viento	
Latitud N	*989567*	**Velocidad (Kt)**	0.5
Longitud E	*690186*	**Dirección (º)**	232

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
56	46	10.4	18:42:47	26.99	0.13	332.90
			18:43:47	26.99	0.15	354.00
			18:44:47	26.99	0.16	356.80
			18:45:47	26.99	0.15	354.30
		10.6	18:46:47	26.99	0.15	359.90
	28	10.7	18:49:28	27.36	0.15	341.60
			18:50:28	27.22	0.11	326.70
			18:51:28	27.33	0.13	349.00
			18:52:28	27.31	0.14	336.60
		10.9	18:53:28	27.21	0.16	316.40
	10*	11.0	18:55:38	28.05	0.07	293.10
			18:56:38	28.07	0.11	303.70
			18:57:38	28.09	0.08	306.20
			18:58:38	28.07	0.07	293.90
		11.1	18:59:38	28.02	0.08	304.80

TABLA 19-A1.4

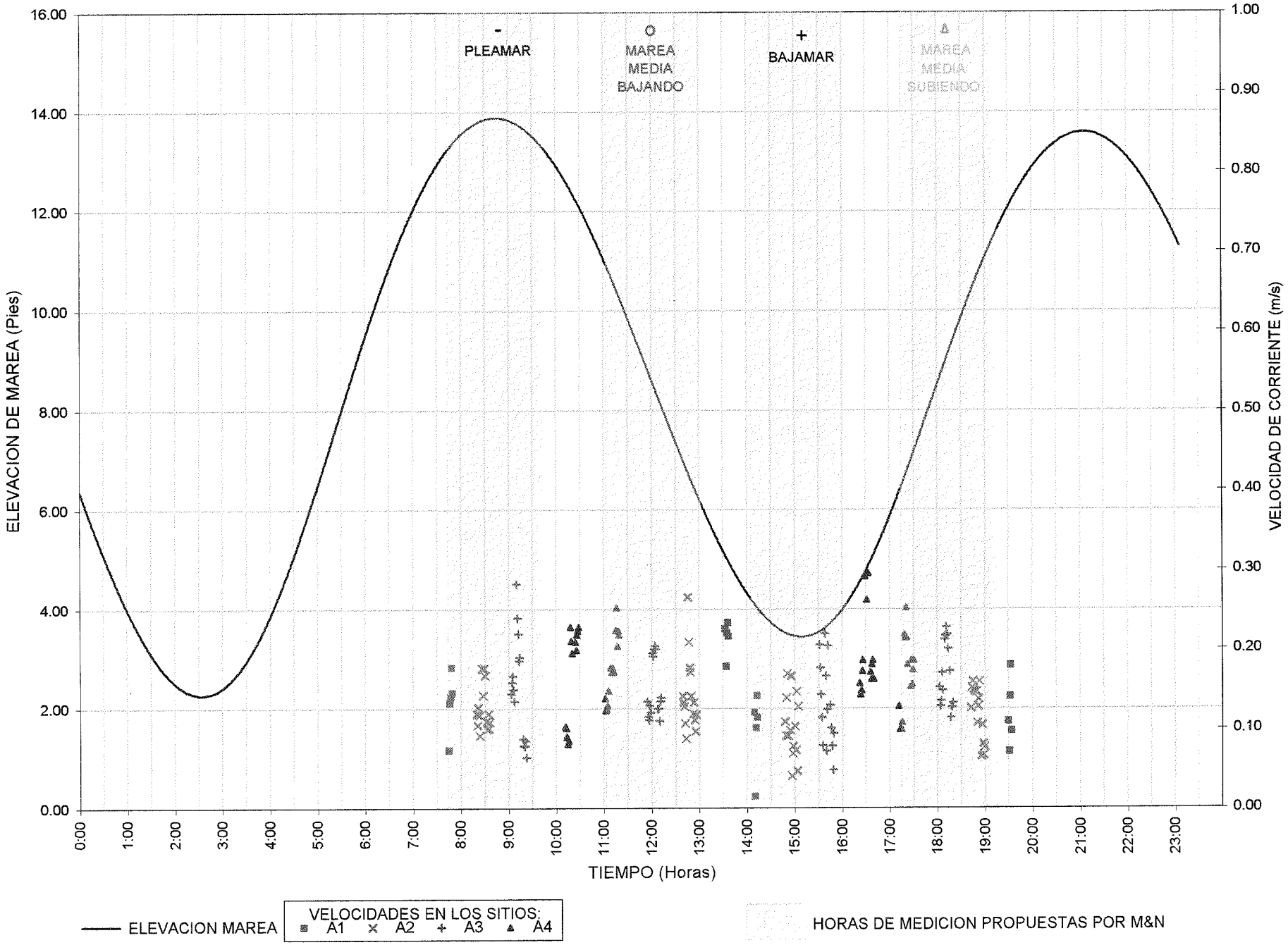
VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE CUADRATURA (MAREA MEDIA SUBIENDO)

Alineación	Pacora
Sitio	A1
Fecha	19/5/2002

Coordenadas		*Viento	
Latitud N	*995098*	**Velocidad (Kt)**	3
Longitud E	*690160*	**Dirección (º)**	226

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
12	6*	12.1	19:29:48	29.01	0.11	223.30
			19:30:48	29.05	0.07	309.00
			19:31:48	29.04	0.14	0.90
			19:32:48	29.04	0.18	36.70
		12.2	19:33:48	29.06	0.10	348.80

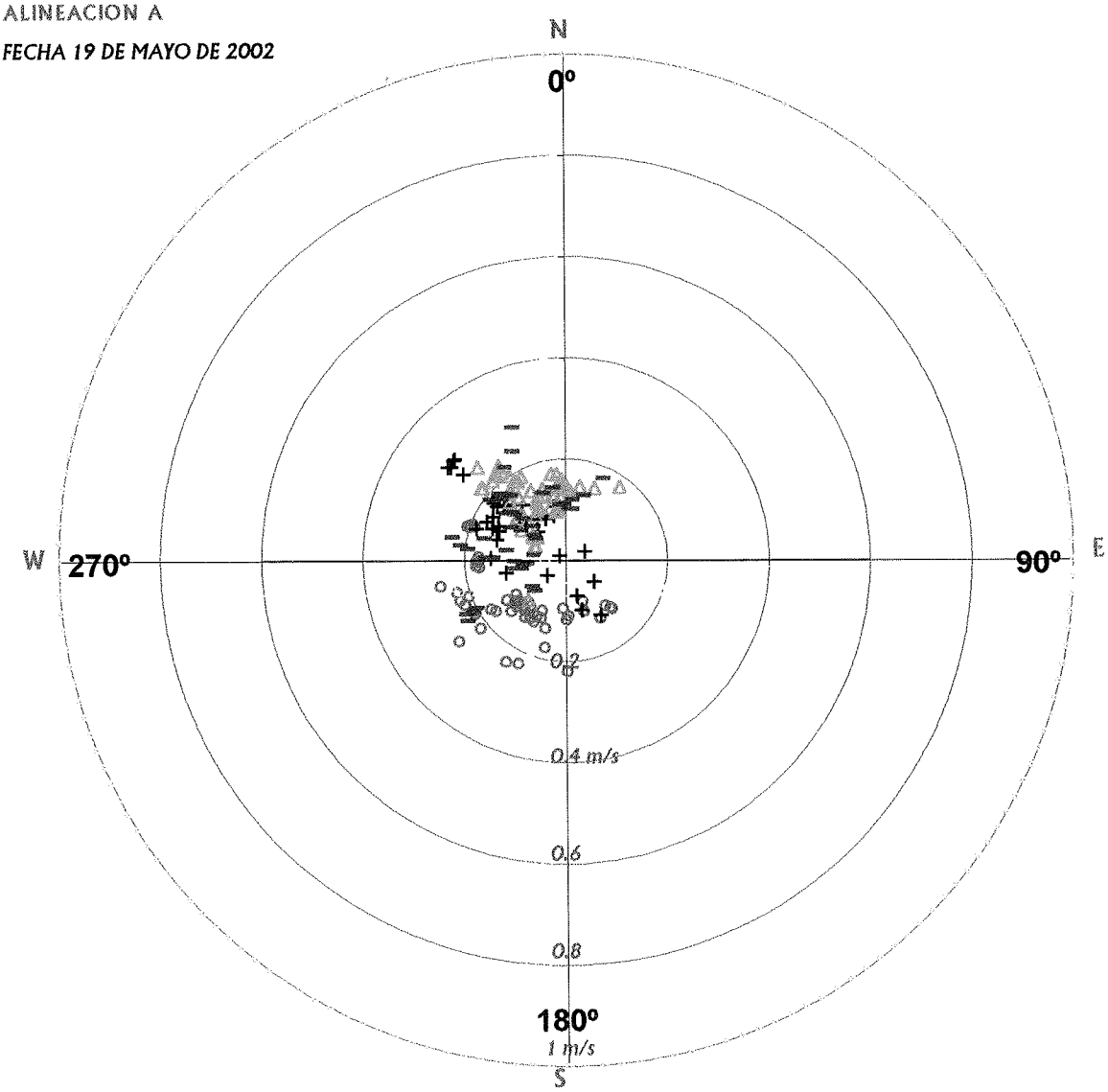
VELOCIDAD DE CORRIENTES MARINAS EN LA BAHIA DE PANAMA SEGUN HORA, CONDICION DE MAREA Y SITIOS DE MEDICION (A1,A2, A3 Y A4) DE ALINEACION A (PACORA). MEDICION DE CORRIENTES #4- 19 DE MAYO DE 2002



VELOCIDAD Y DIRECCION DE LAS CORRIENTES MARINAS EN LA BAHÍA DE PANAMÁ
SEGÚN CONDICION DE MAREA

ALINEACION A

FECHA 19 DE MAYO DE 2002



○ Marea media bajando
+ Bajamar
△ Marea media subiendo
– Pleamar

Unidad de Operaciones-ACP

Mediciones durante Marea de Cuadratura

Lunes, 20 de mayo de 2002 -1 día después de Cuarto Creciente

Toma de datos en alineación B.

Tiempo de Medición:

Marea Media Subiendo: 5:30 - 7:30

Pleamar: 8:49 - 10:49

Marea Media Bajando: 12:00 - 14:00

Bajamar: 15:15 - 17:15

TABLA 20-B1.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE CUADRATURA (MAREA MEDIA SUBIENDO)

Alineación	New Island.
Sitio	B1
Fecha	20/5/02

Coordenadas		*Viento	
Latitud N	*982350*	**Velocidad (Kt)**	
Longitud E	*654657*	**Dirección (º)**	

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
9	4*	5.4	5:30:26	28.22	0.07	334.50
			5:31:26	28.21	0.07	306.90
			5:32:26	28.22	0.08	303.50
			5:33:26	28.22	0.08	333.20
		5.5	5:34:26	28.22	0.09	304.80

TABLA 20-B2.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE CUADRATURA (MAREA MEDIA SUBIENDO)

Alineación	New Island.
Sitio	B2
Fecha	20/5/02

Coordenadas		*Viento	
Latitud N	*980877*	**Velocidad (Kt)**	1.5
Longitud E	*655029*	**Dirección (º)**	5

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
22	11*	6.2	5:47:46	28.01	0.16	327.50
			5:48:46	28.00	0.13	324.00
			5:49:46	27.97	0.13	324.50
			5:50:46	27.73	0.14	321.00
		6.3	5:51:46	27.81	0.14	320.50

TABLA 20-B3.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE CUADRATURA (MAREA MEDIA SUBIENDO)

Alineación	New Island.
Sitio	B3
Fecha	20/5/02

Coordenadas		*Viento	
Latitud N	*979742*	**Velocidad (Kt)**	4
Longitud E	*655400*	**Dirección (º)**	287

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
31	21	7.0	6:05:06	27.88	0.21	16.60
			6:06:06	27.88	0.16	54.10
			6:07:06	27.88	0.13	115.50
			6:08:06	27.89	0.10	225.80
		7.1	6:09:06	27.89	0.16	277.30
	15	7.3	6:11:46	27.96	0.17	301.20
			6:12:46	27.95	0.16	309.70
			6:13:46	27.94	0.19	315.30
			6:14:46	27.94	0.23	317.20
		7.5	6:15:46	27.94	0.21	294.80
	10*	7.5	6:17:36	27.97	0.11	210.00
			6:18:36	27.97	0.07	178.30
			6:19:36	27.97	0.09	340.90
			6:20:36	27.98	0.12	320.00
		7.7	6:21:36	27.98	0.09	319.80

TABLA 20-B4.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE CUADRATURA (MAREA MEDIA SUBIENDO)

Alineación	New Island.
Sitio	B4
Fecha	20/5/02

Coordenadas		*Viento	
Latitud N	*978361*	**Velocidad (Kt)**	5
Longitud E	*655772*	**Dirección (º)**	340

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
43	33	8.3	6:34:11	27.02	0.11	263.80
			6:35:11	27.03	0.10	276.40
			6:36:11	27.03	0.09	292.70
			6:37:11	27.04	0.15	346.00
		8.5	6:38:11	27.04	0.17	346.70
	21.5	8.6	6:40:11	27.75	0.13	346.30
			6:41:11	27.75	0.11	334.00
			6:42:11	27.75	0.11	314.00
			6:43:11	27.75	0.15	265.50
		8.8	6:44:11	27.73	0.16	263.50
	10*	8.9	6:46:21	27.76	0.08	301.70
			6:47:21	27.76	0.19	349.00
			6:48:21	27.76	0.12	348.30
			6:49:21	27.76	0.11	331.00
		9.1	6:50:21	27.76	0.08	280.90

TABLA 20-B5.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE CUADRATURA (MAREA MEDIA SUBIENDO)

Alineación	New Island.
Sitio	B5
Fecha	20/5/02

Coordenadas		*Viento	
Latitud N	*975602.77*	**Velocidad (Kt)**	5
Longitud E	*657310.57*	**Dirección (º)**	260

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
47	37	10.1	7:11:56	19.27	0.25	287.60
			7:12:56	38.06	0.24	289.00
			7:13:56	35.01	0.24	288.50
			7:14:56	33.65	0.24	290.10
		10.3	7:15:56	34.16	0.24	288.50
	23.5	10.6	7:23:51	27.81	0.23	292.90
			7:24:51	27.87	0.22	294.40
			7:25:51	27.78	0.24	294.30
		10.8	7:26:51	27.75	0.24	292.90
	10*	10.8	7:30:16	27.84	0.16	269.90
			7:31:16	27.85	0.15	278.00
			7:32:16	27.87	0.15	277.80
			7:33:16	27.87	0.14	287.40
		11.0	7:34:16	27.86	0.15	281.40

TABLA 20-B5.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE CUADRATURA (PLEAMAR)

Alineación	New Island.
Sitio	B5
Fecha	20/5/02

Coordenadas		*Viento	
Latitud N	*975602.77*	**Velocidad (Kt)**	1
Longitud E	*657310.57*	**Dirección (º)**	290

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
50	40	13.1	8:42:51	27.27	0.20	289.30
			8:43:51	27.25	0.21	294.80
			8:44:51	27.26	0.22	294.30
			8:45:51	27.23	0.20	282.30
		13.2	8:46:51	27.23	0.18	288.10
	25	13.2	8:50:01	27.71	0.15	291.40
			8:51:01	27.73	0.15	292.40
			8:52:01	27.72	0.16	296.20
			8:53:01	27.72	0.15	292.00
		13.3	8:54:01	27.76	0.16	290.20
	10*	13.4	8:57:21	27.87	0.13	248.70
			8:58:21	27.87	0.16	248.90
			8:59:21	27.88	0.13	248.10
			9:00:21	27.87	0.13	246.40
		13.4	9:01:21	27.88	0.19	252.50

TABLA 20-B4.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE CUADRATURA (PLEAMAR)

Alineación	New Island.
Sitio	B4
Fecha	20/5/02

Coordenadas		*Viento	
Latitud N	*978361*	**Velocidad (Kt)**	
Longitud E	*655772*	**Dirección (º)**	

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
48	38	13.7	9:22:50	26.93	0.04	298.00
			9:23:50	26.92	0.07	356.00
			9:24:50	26.92	0.05	315.60
			9:25:50	26.92	0.07	288.40
		13.7	9:26:50	26.92	0.09	298.60
	24	13.7	9:29:16	27.17	0.14	291.30
			9:30:16	27.18	0.14	288.30
			9:31:16	27.17	0.14	291.80
			9:32:16	27.14	0.14	287.20
		13.7	9:33:16	27.11	0.14	285.70
	10*	13.7	9:35:41	27.70	0.09	249.30
			9:36:41	27.71	0.08	249.10
			9:37:41	27.73	0.09	252.80
			9:38:41	27.73	0.09	259.20
		13.8	9:39:41	27.72	0.10	248.90

TABLA 20-B3.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE CUADRATURA (PLEAMAR)

Alineación	New Island.
Sitio	B3
Fecha	20/5/02

Coordenadas		*Viento	
Latitud N	*979742*	**Velocidad (Kt)**	
Longitud E	*655400*	**Dirección (º)**	

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
39	28	13.8	9:53:20	27.09	0.09	178.50
			9:54:20	27.06	0.08	226.50
			9:55:20	27.06	0.08	250.00
			9:56:20	27.06	0.08	257.20
		13.8	9:57:20	27.06	0.06	272.00
	19.5	13.7	10:02:06	27.49	0.09	292.90
			10:03:06	27.51	0.12	312.60
			10:04:06	27.43	0.16	315.10
			10:05:06	27.48	0.12	295.10
		13.7	10:06:06	27.55	0.09	282.00
	10*	13.7	10:09:16	27.85	0.09	216.10
			10:10:16	27.85	0.09	225.70
			10:11:16	27.85	0.08	251.60
			10:12:16	27.85	0.05	282.00
		13.7	10:13:16	27.85	0.12	214.40

TABLA 20-B2.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE CUADRATURA (PLEAMAR)

Alineación	New Island.
Sitio	B2
Fecha	20/5/02

Coordenadas		*Viento	
Latitud N	*980877*	**Velocidad (Kt)**	3
Longitud E	*655029*	**Dirección (º)**	200

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
29	19	13.5	10:29:51	27.75	0.08	222.10
			10:30:51	27.79	0.06	219.30
			10:31:51	27.79	0.10	210.80
			10:32:51	27.76	0.08	221.40
		13.4	10:33:51	27.79	0.07	212.10
	14.5	13.4	10:36:41	27.90	0.07	189.50
			10:37:41	27.89	0.06	173.20
			10:38:41	27.86	0.07	175.40
			10:39:41	27.85	0.06	158.30
		13.3	10:40:41	27.84	0.07	173.40
	10*	13.3	10:43:26	27.96	0.10	211.30
			10:44:26	27.97	0.08	201.20
			10:45:26	28.00	0.10	214.40
			10:46:26	28.02	0.10	216.60
		13.2	10:47:26	28.03	0.10	215.60

TABLA 20-B1.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE CUADRATURA (PLEAMAR)

Alineación	New Island.
Sitio	B1
Fecha	20/5/02

Coordenadas		*Viento	
Latitud N	*982350*	**Velocidad (Kt)**	
Longitud E	*654657*	**Dirección (º)**	

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
12	6*	12.9	11:03:36	28.18	0.04	177.50
			11:04:36	27.94	0.07	112.00
			11:05:36	27.92	0.06	115.40
			11:06:36	28.12	0.07	188.00
		12.8	11:07:36	28.14	0.07	217.40

TABLA 20-B1.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE CUADRATURA (MAREA MEDIA BAJANDO)

Alineación	New Island.
Sitio	B1
Fecha	20/5/02

Coordenadas		*Viento	
Latitud N	*982350*	**Velocidad (Kt)**	3
Longitud E	*654657*	**Dirección (º)**	90

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
11	5.3*	11.3	11:59:41	28.15	0.06	331.20
			12:00:41	28.16	0.08	204.50
			12:01:41	28.16	0.11	192.50
			12:02:41	28.19	0.05	181.10
		11.1	12:03:41	28.20	0.04	201.10

TABLA 20-B2.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE CUADRATURA (MAREA MEDIA BAJANDO)

Alineación	New Island.
Sitio	B2
Fecha	20/5/02

Coordenadas		*Viento	
Latitud N	*980877*	**Velocidad (Kt)**	4
Longitud E	*655029*	**Dirección (º)**	92

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
26	16	10.4	12:23:21	27.83	0.15	182.20
			12:24:21	27.83	0.14	185.30
			12:25:21	27.85	0.11	184.00
			12:26:21	27.84	0.11	185.00
		10.2	12:27:21	27.85	0.13	183.30
	10*	10.1	12:29:41	28.03	0.13	186.30
			12:30:41	28.02	0.12	187.20
			12:31:41	28.03	0.10	191.90
			12:32:41	28.03	0.12	188.70
		10.0	12:33:41	28.00	0.14	186.40

TABLA 20-B3.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE CUADRATURA (MAREA MEDIA BAJANDO)

Alineación	New Island.
Sitio	B3
Fecha	20/5/02

Coordenadas		*Viento	
Latitud N	*979742*	**Velocidad (Kt)**	3.5
Longitud E	*655400*	**Dirección (°)**	112

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (°C)	Velocidad (m/s)	Dirección (°)
34	24	9.5	12:46:46	27.23	0.12	184.40
			12:47:46	27.24	0.12	189.90
			12:48:46	27.25	0.10	192.70
			12:49:46	27.25	0.14	187.20
		9.3	12:50:46	27.25	0.13	186.40
	16	9.2	12:53:01	27.56	0.12	178.70
			12:54:01	27.48	0.10	185.90
			12:55:01	27.51	0.10	186.80
			12:56:01	27.55	0.13	175.30
		9.0	12:57:01	27.59	0.11	177.30
	10*	8.9	12:59:16	27.99	0.15	166.10
			13:00:16	27.99	0.16	164.40
			13:01:16	27.99	0.16	166.60
			13:02:16	27.99	0.13	164.60
		8.8	13:03:16	28.00	0.15	162.10

TABLA 20-B4.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE CUADRATURA (MAREA MEDIA BAJANDO)

Alineación	New Island.
Sitio	B4
Fecha	20/5/02

Coordenadas		*Viento	
Latitud N	*978361*	**Velocidad (Kt)**	3
Longitud E	*655772*	**Dirección (°)**	180

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (°C)	Velocidad (m/s)	Dirección (°)
42	32	8.0	13:22:11	27.06	0.17	173.10
			13:23:11	27.06	0.14	172.60
			13:24:11	27.07	0.14	172.90
			13:25:11	27.06	0.13	171.90
		7.8	13:26:11	27.06	0.12	171.70
	24	7.8	13:29:51	27.68	0.13	192.80
			13:30:51	27.63	0.13	199.10
		7.6	13:31:51	27.65	0.12	196.30
	10*	7.6	13:34:31	27.75	0.09	195.00
			13:35:31	27.75	0.09	193.80
			13:36:31	27.76	0.13	188.20
			13:37:31	27.75	0.11	191.80
		7.4	13:38:31	27.75	0.11	194.60

TABLA 20-B5.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE CUADRATURA (MAREA MEDIA BAJANDO)

Alineación	New Island.
Sitio	B5
Fecha	20/5/02

Coordenadas		*Viento	
Latitud N	*975602.77*	**Velocidad (Kt)**	4
Longitud E	*657310.57*	**Dirección (º)**	107

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
50	40	6.5	13:59:41	26.74	0.05	281.60
			14:00:41	26.73	0.08	248.90
			14:01:41	26.73	0.08	233.30
			14:02:41	26.73	0.07	239.40
		6.3	14:03:41	26.73	0.09	226.50
	24	6.1	14:08:01	27.02	0.15	227.90
			14:09:01	27.02	0.15	228.40
			14:10:01	27.02	0.18	222.90
			14:11:01	27.02	0.18	219.40
		6.0	14:12:01	27.02	0.18	222.40
	10*	5.9	14:15:01	28.06	0.16	203.20
			14:16:01	28.08	0.15	206.20
			14:17:01	28.07	0.15	204.50
			14:18:01	28.05	0.15	205.30
		5.7	14:19:01	28.06	0.13	204.00

TABLA 20-B5.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE CUADRATURA (BAJAMAR)

Alineación	New Island.
Sitio	B5
Fecha	20/5/02

Coordenadas		*Viento	
Latitud N	*975602*	**Velocidad (Kt)**	9
Longitud E	*657310*	**Dirección (º)**	190

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
48	38	4.1	15:14:41	26.82	0.12	222.00
			15:15:41	26.80	0.17	209.40
			15:16:41	26.80	0.15	214.70
			15:17:41	26.79	0.13	219.20
		4.0	15:18:41	26.81	0.14	219.20
	24	3.9	15:21:26	27.13	0.25	221.40
			15:22:26	27.18	0.28	219.00
			15:23:26	27.17	0.27	221.30
			15:24:26	27.12	0.26	229.50
		3.9	15:25:26	27.12	0.29	228.50
	10*	3.8	15:27:51	28.11	0.23	227.70
			15:28:51	28.02	0.22	232.40
			15:29:51	28.09	0.20	233.60
			15:30:51	28.07	0.18	236.10
		3.8	15:31:51	28.08	0.19	234.80

TABLA 20-B4.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE CUADRATURA (BAJAMAR)

Alineación	New Island.
Sitio	B4
Fecha	20/5/02

Coordenadas		*Viento	
Latitud N	*978361*	**Velocidad (Kt)**	4
Longitud E	*655772*	**Dirección (º)**	31

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
38	28	3.5	15:54:51	27.27	0.09	190.30
			15:55:51	27.27	0.10	203.10
			15:56:51	27.26	0.11	188.10
			15:57:51	27.26	0.10	183.60
		3.4	15:58:51	27.25	0.07	169.70
	16		16:01:10	27.78	0.07	158.60
			16:02:10	27.77	0.09	207.40
			16:03:10	27.79	0.08	200.30
			16:04:10	27.88	0.09	208.70
		3.4	16:05:10	27.93	0.09	182.30
	10*	3.4	16:07:21	28.16	0.09	242.50
			16:08:21	28.15	0.11	245.20
			16:09:21	28.16	0.07	217.30
			16:10:21	28.17	0.10	250.50
		3.4	16:11:21	28.16	0.12	255.70

TABLA 20-B3.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE CUADRATURA (BAJAMAR)

Alineación	New Island.
Sitio	B3
Fecha	20/5/02

Coordenadas		*Viento	
Latitud N	*979742*	**Velocidad (Kt)**	7
Longitud E	*655400*	**Dirección (º)**	210

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
28	18	3.4	16:27:11	27.30	0.12	257.40
			16:28:11	27.32	0.14	257.90
			16:29:11	27.33	0.10	254.10
			16:30:11	27.31	0.08	260.90
		3.4	16:31:11	27.31	0.11	260.20
	14	3.5	16:33:21	27.57	0.06	263.50
			16:34:21	27.47	0.10	258.10
			16:35:21	27.50	0.08	264.10
			16:36:21	27.58	0.10	261.80
		3.5	16:37:21	27.62	0.09	267.70
	10*	3.5	16:39:21	27.89	0.03	192.30
			16:40:21	27.88	0.09	245.50
			16:41:21	27.82	0.07	247.50
			16:42:21	27.74	0.06	244.50
		3.6	16:43:21	27.77	0.07	249.00

TABLA 20-B2.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE CUADRATURA (BAJAMAR)

Alineación	New Island.
Sitio	B2
Fecha	20/5/02

Coordenadas		*Viento	
Latitud N	*980877*	**Velocidad (Kt)**	4
Longitud E	*655029*	**Dirección (º)**	220

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
20	10*	3.7	16:55:21	27.81	0.09	253.60
			16:56:21	27.82	0.09	252.70
			16:57:21	27.83	0.06	242.60
			16:58:21	27.78	0.08	248.70
		3.8	16:59:21	27.79	0.08	261.90

TABLA 20-B1.4

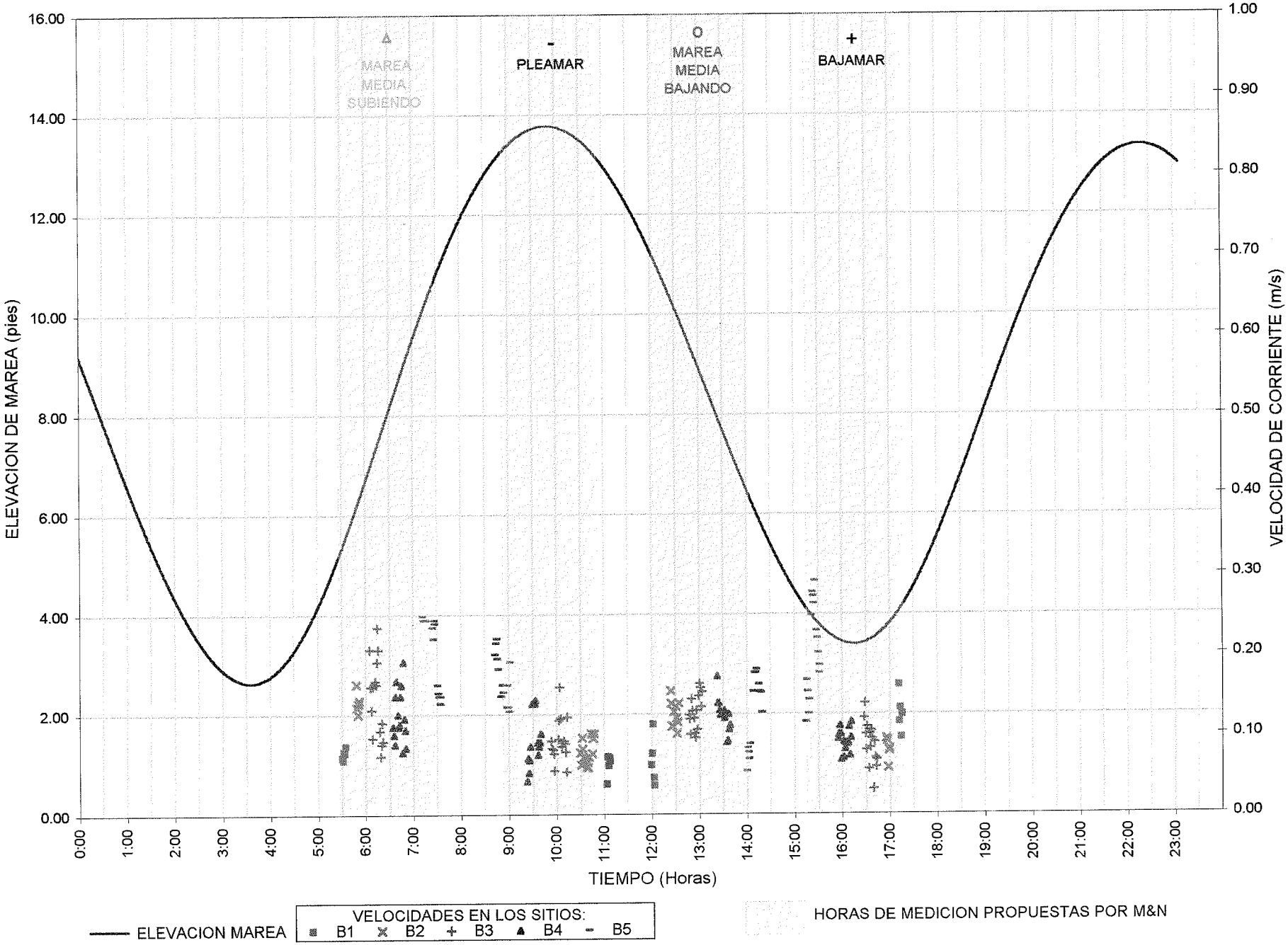
VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE CUADRATURA (BAJAMAR)

Alineación	New Island.
Sitio	B1
Fecha	20/5/02

Coordenadas		*Viento	
Latitud N	*982350*	**Velocidad (Kt)**	5
Longitud E	*654657*	**Dirección (º)**	234

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
10	5*	4.1	17:11:01	28.15	0.16	292.50
			17:12:01	28.13	0.12	316.30
			17:13:01	28.06	0.13	330.80
			17:14:01	28.07	0.10	0.00
		4.2	17:15:01	28.09	0.12	331.20

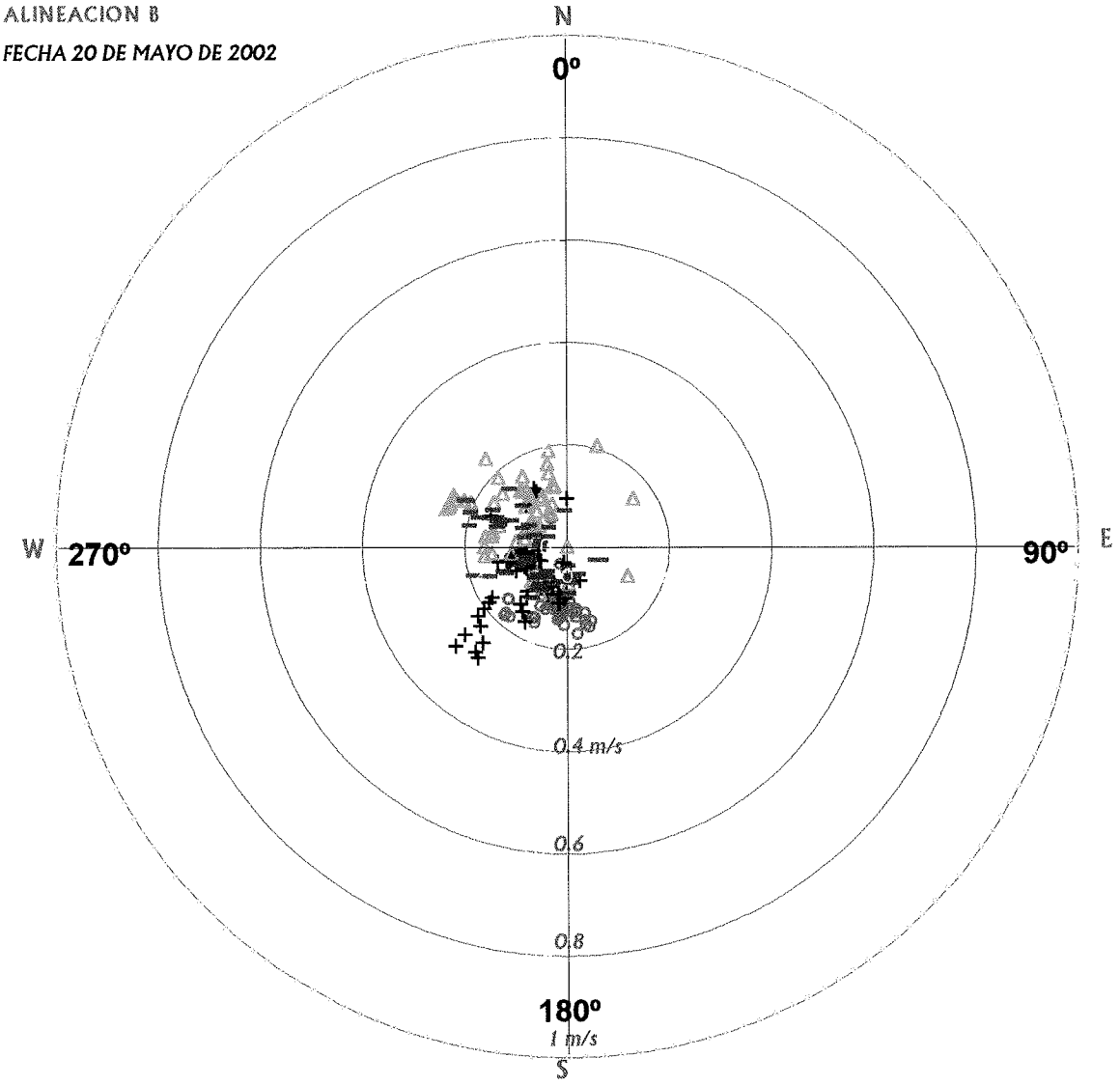
VELOCIDAD DE CORRIENTES MARINAS EN LA BAHIA DE PANAMA SEGUN HORA, CONDICION DE MAREA Y SITIOS DE MEDICION (B1, B2, B3, B4 Y B5) DE ALINEACION B (NEW ISLAND). MEDICION DE CORRIENTES #5- 20 DE MAYO DE 2002



VELOCIDAD Y DIRECCION DE LAS CORRIENTES MARINAS EN LA BAHÍA DE PANAMÁ SEGÚN CONDICION DE MAREA

ALINEACION B

FECHA 20 DE MAYO DE 2002



- ○ Marea media bajando
- + Bajamar
- △ Marea media subiendo
- – Pleamar

Unidad de Operaciones -ACP

Mediciones durante Marea de Cuadratura

Martes, 21 de mayo de 2002 - 2 día después de Cuarto Creciente

Toma de datos en alineación C.

Tiempo de Medición:

Marea Media Subiendo: 6:30 - 8:30

Pleamar: 10:01 - 12:01

Marea Media Bajando: 13:00 - 15:00

Bajamar: 16:22 - 18:22

TABLA 21-C1.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE CUADRATURA (MAREA MEDIA SUBIENDO)

Alineación	PUNTA CHAME
Sitio	C1
Fecha	21/5/2002

Coordenadas		*Viento	
Latitud N	*954005.67*	Velocidad (Kt)	
Longitud E	*648526.76*	Dirección (º)	

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
77	67	5.3	6:31:23	26.46	0.28	351.00
			6:32:23	26.47	0.30	354.00
			6:33:23	26.46	0.28	352.20
			6:34:23	26.46	0.28	354.80
		5.5	6:35:23	26.47	0.28	350.70
	33.5	5.6	6:39:23	28.08	0.16	342.00
			6:40:23	28.13	0.16	346.80
			6:41:23	28.04	0.19	345.60
			6:42:23	28.15	0.17	349.00
		5.8	6:43:23	28.17	0.19	344.50
	10*	5.9	6:46:38	28.17	0.18	348.90
			6:47:38	28.17	0.18	353.70
			6:48:38	28.17	0.19	350.90
			6:49:38	28.17	0.17	344.30
		6.1	6:50:38	28.16	0.19	351.90

TABLA 21-C2.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE CUADRATURA (MAREA MEDIA SUBIENDO)

Alineación	PUNTA CHAME
Sitio	C2
Fecha	21/5/2002

Coordenadas		*Viento	
Latitud N	*957343.09*	Velocidad (Kt)	3
Longitud E	*654017.28*	Dirección (º)	70

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
77	67	7.8	7:27:28	26.33	0.21	350.60
			7:28:28	26.34	0.22	349.70
			7:29:28	26.34	0.21	346.70
			7:30:28	26.34	0.22	341.30
		8.0	7:31:28	26.33	0.21	342.00

TABLA 21-C3.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE CUADRATURA (PLEAMAR)

Alineación	PUNTA CHAME
Sitio	C3
Fecha	21/5/2002

Coordenadas		*Viento	
Latitud N	*962880.66*	**Velocidad (Kt)**	
Longitud E	*656197.52*	**Dirección (°)**	

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (°C)	Velocidad (m/s)	Dirección (°)
84	74	13.9	10:42:19		0.09	92.27
			10:43:19		0.06	145.70
			10:44:19		0.09	180.77
			10:45:19		0.10	184.46
		13.9	10:46:19		0.09	190.25
	42	13.9	10:32:45		0.11	186.17
			10:33:45		0.12	188.52
			10:34:45		0.10	164.33
			10:35:45		0.16	198.73
		13.9	10:36:45		0.14	204.37
	10*	13.9	10:26:19		0.19	299.93
			10:27:19		0.18	306.52
			10:28:19		0.17	311.91
			10:29:19		0.17	295.80
		13.9	10:30:19		0.16	324.34

TABLA 21-C2.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE CUADRATURA (PLEAMAR)

Alineación	PUNTA CHAME
Sitio	C2
Fecha	21/5/2002

Coordenadas		*Viento	
Latitud N	*957343.09*	**Velocidad (Kt)**	2
Longitud E	*654017.28*	**Dirección (°)**	190

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (°C)	Velocidad (m/s)	Dirección (°)
83	73	14.0	11:24:31	26.31	0.15	175.08
			11:25:31	26.30	0.16	162.53
			11:26:31	26.30	0.16	162.80
			11:27:31	26.30	0.16	157.40
		13.9	11:28:31	26.30	0.17	148.70
	41.5	13.9	11:31:36	27.97	0.16	176.00
			11:32:36	27.97	0.18	177.40
			11:33:36	27.97	0.18	176.70
			11:34:36	27.97	0.17	160.60
		13.8	11:35:36	27.97	0.16	163.86
	10*	13.8	11:39:16	28.53	0.19	263.90
			11:40:16	28.52	0.18	263.40
			11:41:16	28.57	0.19	265.70
			11:42:16	28.57	0.18	265.80
		13.8	11:43:16	28.59	0.19	265.80

TABLA 21-C1.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE CUADRATURA (PLEAMAR)

Alineación	PUNTA CHAME
Sitio	C1
Fecha	21/5/2002

Coordenadas		*Viento	
Latitud N	*954005.67*	**Velocidad (Kt)**	7
Longitud E	*648526.76*	**Dirección (º)**	205

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
84	74	13.0	12:19:36	27.89	0.34	187.10
			12:20:36	26.38	0.26	204.10
			12:21:36	26.38	0.21	206.30
			12:22:36	26.37	0.24	214.70
		12.9	12:23:36	26.36	0.26	213.40
	42	12.8	12:26:21	27.84	0.26	173.50
			12:27:21	27.79	0.25	173.90
			12:28:21	27.70	0.26	178.70
			12:29:21	27.70	0.27	176.50
		12.7	12:30:21	27.72	0.30	177.50
	10*	12.6	12:33:21	28.25	0.28	177.10
			12:34:21	28.26	0.28	172.70
			12:35:21	28.25	0.31	176.60
			12:36:21	28.24	0.31	176.20
		12.5	12:37:21	28.28	0.32	170.30

TABLA 21-C1.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE CUADRATURA (MAREA MEDIA BAJANDO)

Alineación	PUNTA CHAME
Sitio	C1
Fecha	21/5/2002

Coordenadas		*Viento	
Latitud N	*954005.67*	**Velocidad (Kt)**	3
Longitud E	*648526.76*	**Dirección (º)**	160

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
83	73	11.8	13:01:13	26.37	0.29	191.60
			13:02:13	26.37	0.29	190.70
			13:03:13	26.38	0.31	191.40
			13:04:13	26.37	0.33	186.60
		11.6	13:05:13	26.38	0.30	187.30
	41.5	11.5	13:09:03	27.54	0.40	164.30
			13:10:03	27.53	0.41	166.10
			13:11:03	27.56	0.41	168.00
			13:12:03	27.56	0.43	166.60
		11.3	13:13:03	27.56	0.41	168.40
	10*	11.2	13:15:48	28.38	0.44	178.90
			13:16:48	28.40	0.40	173.00
			13:17:48	28.39	0.40	168.10
			13:18:48	28.39	0.42	177.00
		11.1	13:19:48	28.39	0.41	174.60

TABLA 21-C2.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE CUADRATURA (MAREA MEDIA BAJANDO)

Alineación	PUNTA CHAME
Sitio	C2
Fecha	21/5/2002

Coordenadas		*Viento	
Latitud N	*957343.09*	**Velocidad (Kt)**	7
Longitud E	*654017.28*	**Dirección (º)**	185

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
79	69	9.4	13:57:42	26.41	0.32	176.90
			13:58:42	26.40	0.35	189.60
			13:59:42	26.40	0.38	185.80
			14:00:42	26.41	0.40	175.50
		9.3	14:01:42	26.41	0.38	174.00
	39.5	8.6	14:16:02	28.02	0.43	177.10
			14:17:02	28.01	0.42	180.20
			14:18:02	28.00	0.42	177.60
			14:19:02	28.00	0.44	175.90
		8.5	14:20:02	27.99	0.43	170.50
	10*	8.4	14:22:32	28.72	0.21	207.80
			14:23:32	28.72	0.16	170.60
			14:24:32	28.68	0.21	141.10
			14:25:32	28.74	0.16	170.80
		8.2	14:26:32	28.72	0.21	209.10

TABLA 21-C3.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE CUADRATURA (MAREA MEDIA BAJANDO)

Alineación	PUNTA CHAME
Sitio	C3
Fecha	21/5/2002

Coordenadas		*Viento	
Latitud N	*962880.66*	**Velocidad (Kt)**	8
Longitud E	*656197.52*	**Dirección (º)**	163

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
80	70	6.8	14:58:02	26.38	0.21	158.90
			14:59:02	26.37	0.19	157.90
			15:00:02	26.38	0.23	163.20
			15:01:02	26.38	0.20	161.20
		6.6	15:02:02	26.38	0.22	163.00
	35	6.5	15:04:52	27.50	0.31	166.00
			15:05:52	27.50	0.30	165.10
			15:06:52	27.51	0.31	168.00
			15:07:52	27.53	0.30	166.10
		6.3	15:08:52	27.54	0.31	171.80
	10*	6.2	15:11:37	29.03	0.23	220.40
			15:12:37	28.97	0.25	216.20
			15:13:37	29.00	0.23	220.50
			15:14:37	29.01	0.22	205.50
		6.0	15:15:37	29.01	0.24	216.70

TABLA 21-C3.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE CUADRATURA (BAJAMAR)

Alineación	PUNTA CHAME
Sitio	C3
Fecha	21/5/2002

Coordenadas		*Viento	
Latitud N	*962880.66*	Velocidad (Kt)	6
Longitud E	*656197.52*	Dirección (°)	185

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (°C)	Velocidad (m/s)	Dirección (°)
76	66	4.0	16:12:47	26.54	0.17	177.70
			16:13:47	26.54	0.17	166.30
			16:14:47	26.54	0.17	176.10
			16:15:47	26.55	0.17	152.10
		3.9	16:16:47	26.55	0.18	172.70
	38	3.8	16:19:42	27.69	0.27	162.30
			16:20:42	27.73	0.25	153.70
			16:21:42	27.73	0.25	161.40
			16:22:42	27.68	0.25	160.40
		3.7	16:23:42	27.68	0.27	175.20
	10*	3.6	16:26:47	29.12	0.17	256.00
			16:27:47	29.05	0.21	245.00
			16:28:47	29.11	0.15	260.30
			16:29:47	29.08	0.20	253.40
		3.5	16:30:47	29.10	0.17	250.00

TABLA 21-C2.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE CUADRATURA (BAJAMAR)

Alineación	PUNTA CHAME
Sitio	C2
Fecha	21/5/2002

Coordenadas		*Viento	
Latitud N	*957343.09*	Velocidad (Kt)	4
Longitud E	*654017.28*	Dirección (°)	295

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (°C)	Velocidad (m/s)	Dirección (°)
73	63	3.0	17:09:07	26.62	0.11	237.50
			17:10:07	26.62	0.09	244.80
			17:11:07	26.62	0.09	210.40
			17:12:07	26.63	0.08	181.70
		3.0	17:13:07	26.62	0.10	251.80
	36.5	3.0	17:17:07	27.26	0.19	174.30
			17:18:07	27.29	0.19	176.50
			17:19:07	27.30	0.19	155.70
			17:20:07	27.29	0.18	180.80
		3.0	17:21:07	27.28	0.19	162.70
	10*	3.0	17:23:42	28.58	0.17	315.40
			17:24:42	28.58	0.12	357.00
			17:25:42	28.56	0.17	298.40
			17:26:42	28.60	0.16	311.10
		3.0	17:27:42	28.62	0.17	321.60

TABLA 21-C1.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA

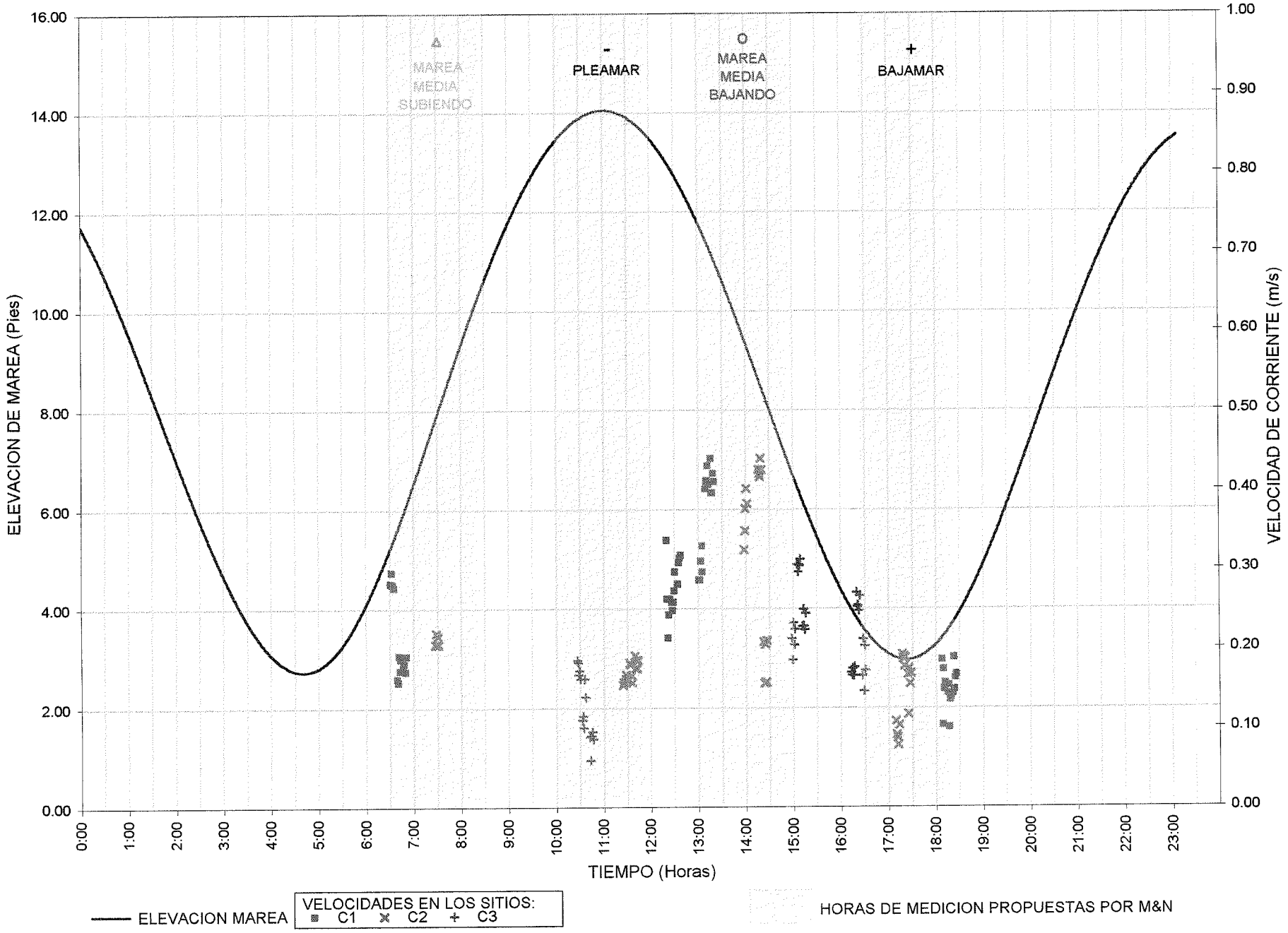
MAREA DE CUADRATURA (BAJAMAR)

Alineación	PUNTA CHAME
Sitio	C1
Fecha	21/5/2002

Coordenadas		***Viento**	
Latitud N	*954005.67*	**Velocidad (Kt)**	9
Longitud E	*648526.76*	**Dirección (°)**	265

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (°C)	Velocidad (m/s)	Dirección (°)
76	66	3.4	18:07:22	27.11	0.19	332.50
			18:08:22	27.11	0.10	15.00
			18:09:22	27.11	0.17	339.90
			18:10:22	27.11	0.15	356.20
		3.5	18:11:22	27.10	0.16	339.10
	38	3.6	18:14:47	27.87	0.14	193.00
			18:15:47	27.85	0.15	172.90
			18:16:47	27.83	0.10	261.00
			18:17:47	27.82	0.14	237.80
		3.7	18:18:47	27.85	0.14	194.50
	10*	3.7	18:21:02	28.68	0.14	53.30
			18:22:02	28.68	0.19	70.70
			18:23:02	28.68	0.15	36.50
			18:24:02	28.67	0.16	16.20
		3.8	18:25:02	28.67	0.17	66.70

VELOCIDAD DE CORRIENTES MARINAS EN LA BAHIA DE PANAMA SEGUN HORA, CONDICION DE MAREA Y SITIOS DE MEDICION (C1, C2 Y C3) DE ALINEACION C (PUNTA CHAME). MEDICION DE CORRIENTES #6- 21 DE MAYO DE 2002



ELEVACION MAREA

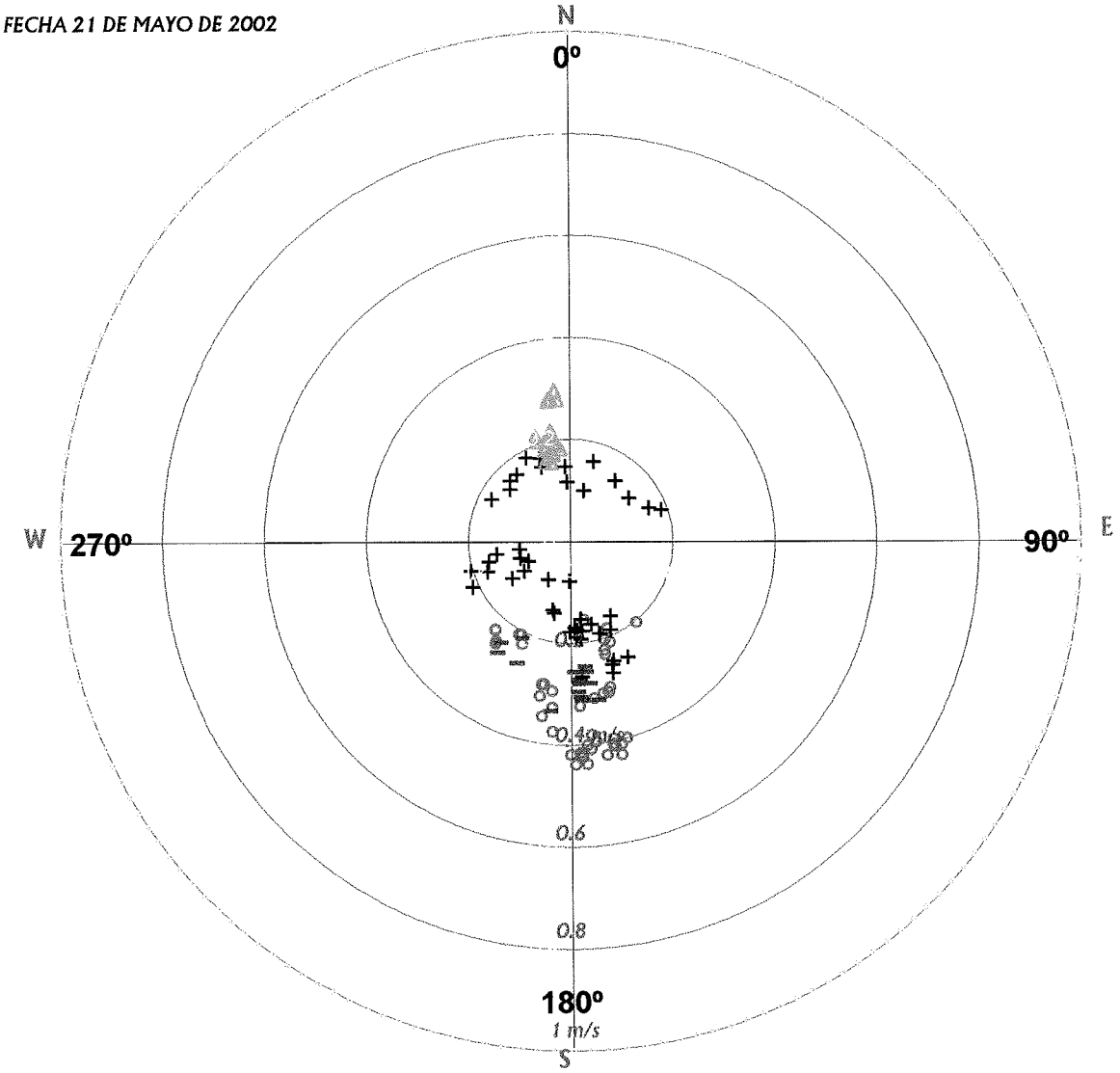
VELOCIDADES EN LOS SITIOS: C1 C2 C3

HORAS DE MEDICION PROPUESTAS POR M&N

VELOCIDAD Y DIRECCION DE LAS CORRIENTES MARINAS EN LA BAHÍA DE PANAMÁ SEGÚN CONDICION DE MAREA

ALINEACION C

FECHA 21 DE MAYO DE 2002



- ○ Marea media bajando
- + Bajamar
- △ Marea media subiendo
- ▬ Pleamar

Unidad de Operaciones-ACP

Mediciones durante Marea de Sicigia

Lunes, 27 de mayo de 2002 - 1 día después de Luna Llena

Toma de datos en alineación B.

Tiempo de Medición:

Marea Media Bajando: 6:00 - 8:00

Bajamar: 9:18 - 11:18

Marea Media Subiendo: 12:30 - 14:30

Pleamar: 15:27 - 17:27

TABLA 27-B1.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (MAREA MEDIA BAJANDO)

Alineación	New Island.
Sitio	B1
Fecha	27/5/02

Coordenadas		*Viento	
Latitud N	*982350*	Velocidad (Kt)	3
Longitud E	*654657*	Dirección (º)	310

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
15.4	7.5*	13.2	6:12:53	28.77	0.06	194.20
			6:13:53	28.76	0.09	186.70
			6:14:53	28.74	0.09	261.30
			6:15:53	28.75	0.17	279.60
		13.0	6:16:53	28.74	0.09	217.00

TABLA 27-B2.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (MAREA MEDIA BAJANDO)

Alineación	New Island.
Sitio	B2
Fecha	27/5/02

Coordenadas		*Viento	
Latitud N	*980877*	Velocidad (Kt)	3.5
Longitud E	*655029*	Dirección (º)	140

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
28	18	12.2	6:31:13	28.90	0.15	190.80
			6:32:13	28.90	0.13	199.80
			6:33:13	28.90	0.14	179.80
			6:34:13	28.91	0.14	193.80
		11.9	6:35:13	28.90	0.10	220.40
	14	11.8	6:37:23	28.89	0.11	224.00
			6:38:23	28.91	0.15	184.00
			6:39:23	28.91	0.12	215.30
			6:40:23	28.91	0.12	203.90
		11.6	6:41:23	28.91	0.11	204.20
	7*	11.4	6:43:18	28.80	0.15	206.90
			6:44:18	28.76	0.16	208.70
			6:45:18	28.76	0.20	204.80
			6:46:18	28.75	0.16	217.90
		11.2	6:47:18	28.73	0.17	211.30

TABLA 27-B3.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (MAREA MEDIA BAJANDO)

Alineación	New Island.
Sitio	B3
Fecha	27/5/02

Coordenadas		*Viento	
Latitud N	*979742*	**Velocidad (Kt)**	7
Longitud E	*655400*	**Dirección (º)**	260

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
35	25	10.2	7:02:28	28.91	0.32	166.00
			7:03:28	28.91	0.26	158.30
			7:04:28	28.91	0.23	155.20
			7:05:28	28.91	0.24	153.30
		9.9	7:06:28	28.91	0.24	148.90
	17.5	9.8	7:08:23	28.90	0.20	222.60
			7:09:23	28.90	0.19	215.50
			7:10:23	28.90	0.19	216.90
			7:11:23	28.89	0.16	194.70
		9.5	7:12:23	28.89	0.22	168.80
	10*	9.4	7:14:33	28.88	0.20	157.40
			7:15:33	28.87	0.20	213.80
			7:16:33	28.87	0.16	207.80
			7:17:33	28.87	0.16	213.50
		9.1	7:18:33	28.87	0.19	224.40

TABLA 27-B4.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (MAREA MEDIA BAJANDO)

Alineación	New Island.
Sitio	B4
Fecha	27/5/02

Coordenadas		*Viento	
Latitud N	*978361*	**Velocidad (Kt)**	8
Longitud E	*655772*	**Dirección (º)**	180

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
42	32	8.1	7:31:43	28.95	0.30	186.20
			7:32:43	28.95	0.35	190.00
			7:33:43	28.95	0.37	175.20
			7:34:43	28.95	0.32	168.00
		7.8	7:35:43	28.95	0.33	163.80
	21	7.7	7:38:03	28.81	0.26	160.20
			7:39:03	28.83	0.22	161.40
			7:40:03	28.83	0.21	174.60
			7:41:03	28.84	0.24	166.50
		7.4	7:42:03	28.82	0.17	184.20
	10*	7.3	7:44:23	28.81	0.22	162.40
			7:45:23	28.82	0.22	166.40
			7:46:23	28.82	0.22	162.20
			7:47:23	28.82	0.17	176.80
		7.0	7:48:23	28.82	0.20	218.60

TABLA 27-B5.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (MAREA MEDIA BAJANDO)

Alineación	New Island.
Sitio	B5
Fecha	27/5/02

Coordenadas		*Viento	
Latitud N	*975602.77*	**Velocidad (Kt)**	11
Longitud E	*657310.57*	**Dirección (º)**	190

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
49	39	5.4	8:10:53	28.50	0.22	223.00
			8:11:53	28.50	0.22	218.60
			8:12:53	28.51	0.15	211.30
			8:13:53	28.50	0.18	205.40
		5.5	8:14:53	28.50	0.21	204.80
	24.5	4.9	8:17:23	28.63	0.29	209.50
			8:18:23	28.65	0.29	207.90
			8:19:23	28.64	0.28	206.90
			8:20:23	28.64	0.24	208.40
		4.7	8:21:23	28.64	0.26	198.00
	10*	4.5	8:24:13	28.66	0.32	196.90
			8:25:13	28.66	0.32	205.60
			8:26:13	28.67	0.31	209.70
			8:27:13	28.67	0.37	200.60
		4.2	8:28:13	28.68	0.33	191.10

TABLA 27-B5.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (BAJAMAR)

Alineación	New Island.
Sitio	B5
Fecha	27/5/02

Coordenadas		*Viento	
Latitud N	*975602.77*	**Velocidad (Kt)**	11
Longitud E	*657310.57*	**Dirección (º)**	195

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
47	37	4.6	9:21:58	28.52	0.22	261.70
			9:22:58	28.53	0.09	280.20
			9:23:58	28.52	0.14	125.30
			9:24:58	28.51	0.15	270.70
		4.4	9:25:58	28.51	0.07	185.90
	23.5	4.2	9:28:23	28.70	0.14	207.80
			9:29:23	28.66	0.20	147.30
			9:30:23	28.66	0.17	234.40
			9:31:23	28.66	0.15	225.60
		4.0	9:32:23	28.67	0.16	247.20
	10*	0.8	9:34:13	28.72	0.18	233.80
			9:35:13	28.72	0.14	217.90
			9:36:13	28.72	0.16	224.70
			9:37:13	28.72	0.20	163.30
		0.7	9:38:13	28.73	0.17	220.30

TABLA 27-B4.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (BAJAMAR)

Alineación	New Island.
Sitio	B4
Fecha	27/5/02

Coordenadas		*Viento	
Latitud N	*978361*	Velocidad (Kt)	10
Longitud E	*655772*	Dirección (º)	200

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
30	20	0.1	10:06:58	28.77	0.13	183.30
			10:07:58	28.77	0.14	164.90
			10:08:58	28.77	0.13	207.40
			10:09:58	28.78	0.13	191.10
		0.0	10:10:58	28.78	0.17	158.90
	15	0.0	10:13:58	28.79	0.19	234.10
			10:14:58	28.79	0.15	180.90
			10:15:58	28.79	0.10	166.70
			10:16:58	28.79	0.13	228.70
		0.0	10:17:58	28.79	0.13	214.10
	10*	0.0	10:20:13	28.83	0.15	207.50
			10:21:13	28.84	0.17	239.10
			10:22:13	28.84	0.11	170.60
			10:23:13	28.83	0.15	220.50
		0.0	10:24:13	28.84	0.15	244.50

TABLA 27-B3.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (BAJAMAR)

Alineación	New Island.
Sitio	B3
Fecha	27/5/02

Coordenadas		*Viento	
Latitud N	*979742*	Velocidad (Kt)	13.5
Longitud E	*655400*	Dirección (º)	225

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
25	15	2.0	11:38:23	28.81	0.11	284.20
			11:39:23	28.84	0.10	304.80
			11:40:23	28.83	0.15	292.90
			11:41:23	28.80	0.10	307.20
		2.2	11:42:23	28.78	0.04	102.40
	10*	2.4	11:44:18	28.88	0.23	318.80
			11:45:18	28.90	0.25	317.00
			11:46:18	28.88	0.25	300.00
			11:47:18	28.86	0.14	340.90
		2.6	11:48:18	28.89	0.13	341.70

TABLA 27-B2.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (MAREA MEDIA SUBIENDO)

Alineación	New Island.
Sitio	B2
Fecha	27/5/02

Coordenadas		*Viento	
Latitud N	*980877*	**Velocidad (Kt)**	13
Longitud E	*655029*	**Dirección (°)**	205

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (°C)	Velocidad (m/s)	Dirección (°)
20	10*	5.6	12:34:18	29.26	0.15	344.20
			12:35:18	29.09	0.18	346.10
			12:36:18	29.08	0.20	333.30
			12:37:18	29.07	0.10	344.20
		5.9	12:38:18	29.09	0.21	212.50

TABLA 27-B2.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (MAREA MEDIA SUBIENDO)

Alineación	New Island.
Sitio	B2
Fecha	27/5/02

Coordenadas		*Viento	
Latitud N	*980877*	**Velocidad (Kt)**	14
Longitud E	*655029*	**Dirección (°)**	185

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (°C)	Velocidad (m/s)	Dirección (°)
20	10*	6.1	12:42:28	29.13	0.42	187.00
			12:43:28	29.13	0.40	183.50
			12:44:28	29.14	0.39	177.10
			12:45:28	29.15	0.42	173.00
		6.4	12:46:28	29.14	0.40	190.30

TABLA 27-B3.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (MAREA MEDIA SUBIENDO)

Alineación	New Island.
Sitio	B3
Fecha	27/5/02

Coordenadas		*Viento	
Latitud N	*979742*	**Velocidad (Kt)**	11.5
Longitud E	*655400*	**Dirección (º)**	155

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
30	20	8.5	13:14:33	28.79	0.02	257.70
			13:15:33	28.79	0.04	200.10
			13:16:33	28.79	0.07	235.70
			13:17:33	28.79	0.13	259.30
		8.8	13:18:33	28.79	0.06	183.80
	15	9.1	13:21:38	28.89	0.05	280.30
			13:22:38	28.89	0.14	317.50
			13:23:38	28.89	0.19	302.60
			13:24:38	28.94	0.08	307.00
		9.3	13:25:38	28.93	0.13	343.60
	10*	9.5	13:27:28	29.08	0.19	330.90
			13:28:28	29.07	0.19	337.60
			13:29:28	29.05	0.20	343.80
			13:30:28	29.02	0.18	343.80
		9.7	13:31:28	29.10	0.22	351.80

TABLA 27-B4.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (MAREA MEDIA SUBIENDO)

Alineación	New Island.
Sitio	B4
Fecha	27/5/02

Coordenadas		*Viento	
Latitud N	*978361*	**Velocidad (Kt)**	13
Longitud E	*655772*	**Dirección (º)**	145

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
40	30	11.6	13:58:13	28.92	0.09	330.90
			13:59:13	28.92	0.12	356.40
			14:00:13	28.92	0.09	331.60
			14:01:13	28.92	0.06	300.30
		11.9	14:02:13	28.92	0.10	262.80
	20	12.0	14:04:18	28.94	0.12	339.70
			14:05:18	28.95	0.12	325.30
			14:06:18	28.93	0.15	318.00
			14:07:18	28.93	0.14	332.00
		12.3	14:08:18	28.93	0.25	289.30
	10*	12.7	14:10:18	29.20	0.20	348.90
			14:11:18	29.22	0.21	347.00
			14:12:18	29.18	0.21	325.00
			14:13:18	29.20	0.21	331.00
		13.0	14:14:18	29.20	0.19	359.90

TABLA 27-B5.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (MAREA MEDIA SUBIENDO)

Alineación	New Island.
Sitio	B5
Fecha	27/5/02

Coordenadas		*Viento	
Latitud N	*975602.77*	Velocidad (Kt)	20
Longitud E	*657310.57*	Dirección (º)	150

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
60	50	15.0	14:55:58	28.50	0.08	322.70
			14:56:58	28.49	0.19	264.60
			14:57:58	28.49	0.20	266.50
			14:58:58	28.49	0.17	270.10
		15.1	14:59:58	28.49	0.13	270.30
	30	15.2	15:02:13	28.72	0.14	224.10
			15:03:13	28.71	0.15	242.80
			15:04:13	28.76	0.25	230.30
			15:05:13	28.74	0.13	211.20
		15.4	15:06:13	28.74	0.18	249.50
	10*	15.5	15:08:13	28.95	0.19	285.70
			15:09:13	28.93	0.09	352.40
			15:10:13	28.92	0.09	309.00
			15:11:13	28.96	0.22	288.60
		15.7	15:12:13	28.96	0.19	290.00

TABLA 27-B5.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (PLEAMAR)

Alineación	New Island.
Sitio	B5
Fecha	27/5/02

Coordenadas		*Viento	
Latitud N	*975602*	Velocidad (Kt)	12
Longitud E	*657310*	Dirección (º)	145

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
62	52	16.4	15:35:48	28.49	0.15	185.60
			15:36:48	28.49	0.13	154.90
			15:37:48	28.49	0.21	220.50
			15:38:48	28.49	0.18	209.30
		16.6	15:39:48	28.49	0.14	181.30
	31	16.6	15:41:48	28.65	0.21	233.50
			15:42:48	28.65	0.20	226.50
			15:43:48	28.65	0.21	224.00
			15:44:48	28.65	0.20	197.50
		16.7	15:45:48	28.65	0.22	229.10
	10*	16.8	15:47:48	28.99	0.10	145.20
			15:48:48	29.01	0.02	126.60
			15:49:48	28.98	0.21	251.50
			15:50:48	28.99	0.15	265.70
		16.8	15:51:48	28.98	0.17	264.50

TABLA 27-B4.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA

MAREA DE SICIGIA (PLEAMAR)

Alineación	New Island.
Sitio	B4
Fecha	27/5/02

Coordenadas		*Viento	
Latitud N	*978361*	**Velocidad (Kt)**	7.5
Longitud E	*655772*	**Dirección (º)**	21

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
46	36	17.3	16:30:13	28.66	0.11	232.20
			16:31:13	28.65	0.16	247.10
			16:32:13	28.65	0.05	205.00
			16:33:13	28.66	0.16	232.20
		17.3	16:34:13	28.66	0.11	198.50
	23	17.3	16:36:13	28.76	0.15	216.20
			16:37:13	28.74	0.12	158.70
			16:38:13	28.73	0.15	210.50
			16:39:13	28.74	0.15	215.40
		17.3	16:40:13	28.75	0.13	177.30
	10*	17.2	16:42:13	29.28	0.11	337.90
			16:43:13	29.28	0.12	339.30
			16:44:13	29.28	0.14	305.50
			16:45:13	29.27	0.14	304.90
		17.2	16:46:13	29.27	0.11	343.50

TABLA 27-B3.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA

MAREA DE SICIGIA (PLEAMAR)

Alineación	New Island.
Sitio	B3
Fecha	27/5/02

Coordenadas		*Viento	
Latitud N	*979742*	**Velocidad (Kt)**	8
Longitud E	*655400*	**Dirección (º)**	175

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
42	32	17.0	17:03:48	29.09	0.15	224.10
			17:04:48	29.08	0.11	149.80
			17:05:48	29.09	0.15	107.60
			17:06:48	29.08	0.07	155.80
		16.9	17:07:48	29.09	0.16	232.70
	21	16.9	17:10:23	29.10	0.11	229.20
			17:11:23	29.09	0.11	230.40
			17:12:23	29.08	0.10	226.30
			17:13:23	29.08	0.11	182.50
		16.8	17:14:23	29.09	0.14	197.30
	10*	16.7	17:16:28	29.09	0.16	228.80
			17:17:28	29.09	0.16	128.20
			17:18:28	29.10	0.12	213.80
			17:19:28	29.10	0.07	195.30
		16.6	17:20:28	29.11	0.14	118.30

TABLA 27-B2.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (PLEAMAR)

Alineación	New Island.
Sitio	B2
Fecha	27/5/02

Coordenadas		*Viento	
Latitud N	*980877*	**Velocidad (Kt)**	6.5
Longitud E	*655029*	**Dirección (º)**	130

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
33	23	16.1	17:37:13	29.13	0.11	128.50
			17:38:13	29.12	0.13	161.60
			17:39:13	29.12	0.16	206.00
			17:40:13	29.12	0.14	205.40
		16.0	17:41:13	29.13	0.10	168.90
	16.5	15.9	17:43:13	29.18	0.17	196.00
			17:44:13	29.18	0.15	136.70
			17:45:13	29.18	0.16	173.80
			17:46:13	29.20	0.16	201.60
		15.8	17:47:13	29.19	0.12	127.90
	10*	15.7	17:49:13	29.18	0.14	163.30
			17:50:13	29.18	0.17	153.50
			17:51:13	29.18	0.15	176.50
			17:52:13	29.24	0.17	184.20
		15.5	17:53:13	29.29	0.14	183.00

TABLA 27-B1.4

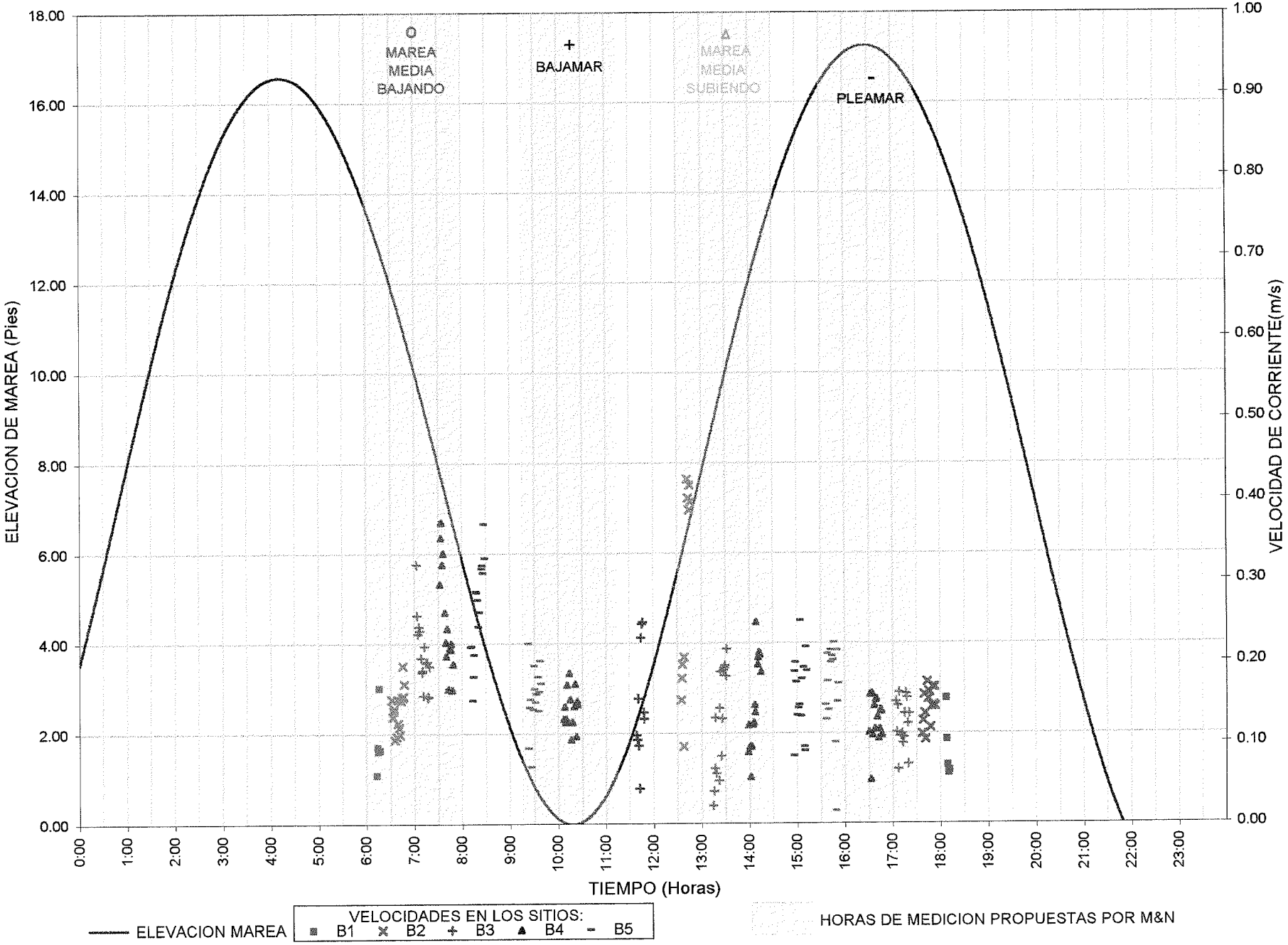
VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (PLEAMAR)

Alineación	New Island.
Sitio	B1
Fecha	27/5/02

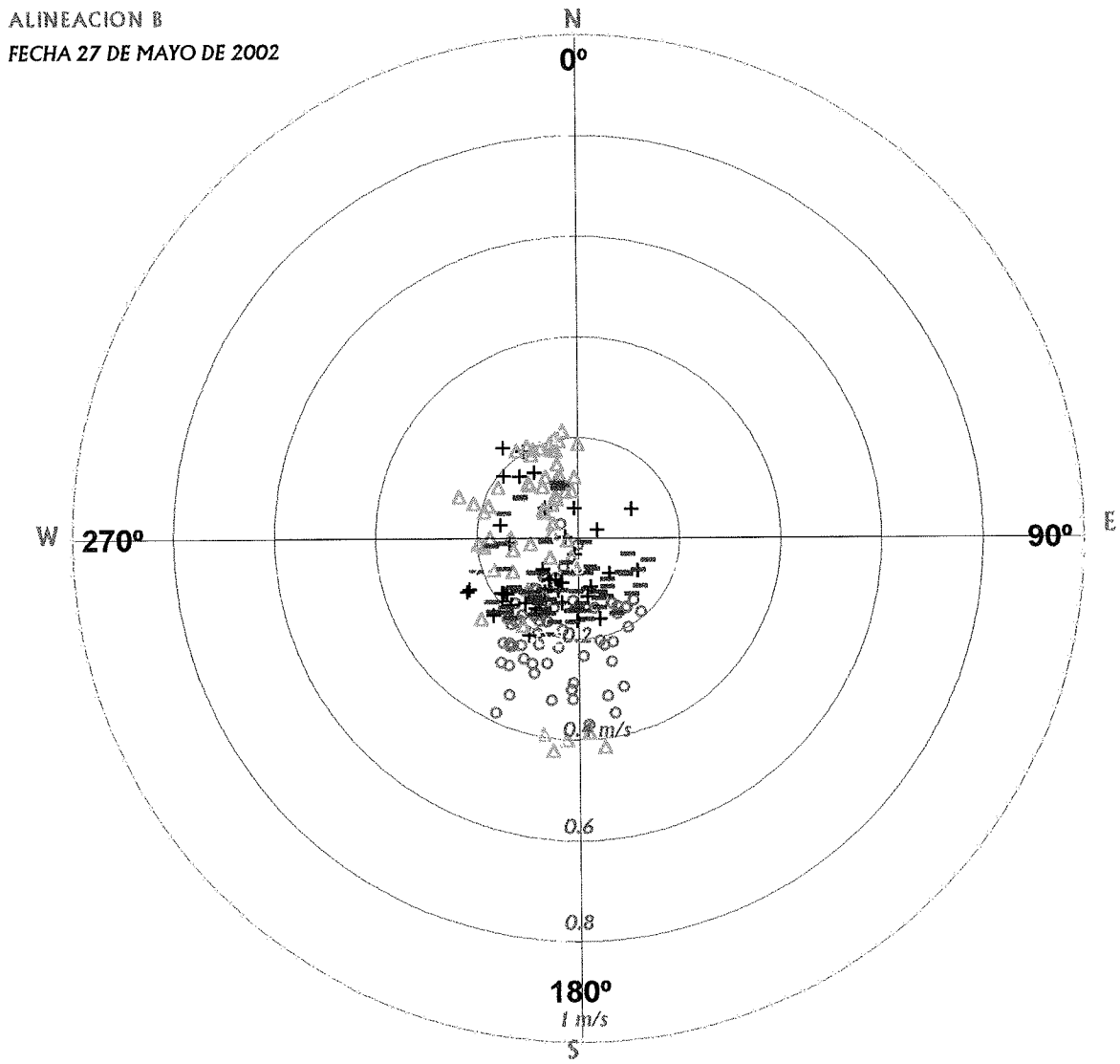
Coordenadas		*Viento	
Latitud N	*982350*	**Velocidad (Kt)**	9
Longitud E	*654657*	**Dirección (º)**	145

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
15	10*	14.9	18:07:03	29.46	0.15	288.10
			18:08:03	29.46	0.10	107.90
			18:09:03	29.47	0.07	168.70
			18:10:03	29.47	0.06	159.00
		14.7	18:11:03	29.47	0.07	262.50

VELOCIDAD DE CORRIENTES MARINAS EN LA BAHIA DE PANAMA SEGUN HORA, CONDICION DE MAREA Y SITIOS DE MEDICION (B1, B2, B3, B4 Y B5) DE ALINEACION B (NEW ISLAND). MEDICION DE CORRIENTES #7- 27 DE MAYO DE 2002



VELOCIDAD Y DIRECCION DE LAS CORRIENTES MARINAS EN LA BAHÍA DE PANAMÁ SEGÚN CONDICION DE MAREA



- ○ Marea media bajando
- + Bajamar
- △ Marea media subiendo
- ▬ Pleamar

ANEXO Nº2

TABLAS

TABLA 1.

POSICIÓN DE LOS SITIOS DE MEDICION DE CORRIENTES EN LA BAHÍA DE PANAMA POR ALINEACIÓN, COORDENADAS GEOGRAFICAS Y UTM

PUNTO DE MEDICIÓN	COORDENADAS									
	GEOGRÁFICAS								UTM (METROS)	
		°	'	"		°	'	"	LAT N	LONG E
ALINEACIÓN A (PACORA)										
A1	N	9	0	0	W	79	16	12	995098.0	690160.9
A2	N	8	57	0	W	79	16	12	989567.8	690186.9
A3	N	8	54	36	W	79	16	12	985143.6	690207.7
A4	N	8	51	36	W	79	16	12	979613.3	690233.5
ALINEACIÓN B (NEW ISLAND)										
B1	N	8	53	10	W	79	35	36	982350.9	654657.3
B2	N	8	52	22	W	79	35	24	980877.9	655029.5.
B3	N	8	51	45	W	79	35	12	979742.6	655400.4
B4	N	8	51	0	W	79	35	0	978361.7	655772.3
B5	N	8	49	30	W	79	34	10	975602.8	657310.6
ALINEACIÓN C (CHAME)										
C1	N	8	37	48	W	79	39	0	954005.7	648526.8
C2	N	8	39	36	W	79	35	60	957343.1	654017.3
C3	N	8	42	36	W	79	34	48	962880.7	656197.5

TABLA 2
PROGRAMACIÓN DE LA CAMPAÑA 1 DE MEDICION DE MAREA EN LA BAHIA DE PANAMA, POR ALINEACIÓN, ESTADO DE LA MAREA, SEGÚN LA FECHA Y LA HORA DE LA MEDICION

FECHA	ALINEACIÓN	FASE DE LA LUNA	HORA DE MEDICIÓN	ESTADO DE LA MAREA
DOMINGO 12 DE MAYO DEL 2002	A RÍO PACORA	LUNA NUEVA	05:30 – 7:30	MEDIA BAJANDO
DOMINGO 12 DE MAYO DEL 2002	A RÍO PACORA	LUNA NUEVA	09:00 – 11:00	BAJAMAR
DOMINGO 12 DE MAYO DEL 2002	A RÍO PACORA	LUNA NUEVA	12:00 – 14:00	MEDIA SUBIENDO
DOMINGO 12 DE MAYO DEL 2002	A RÍO PACORA	LUNA NUEVA	14:58 – 16:58	PLEAMAR
LUNES 13 DE MAYO DEL 2002	B NEW ISLAND	UN DÍA DESPUÉS DE LUNA NUEVA	06:00 – 8:00	MEDIA BAJANDO
LUNES 13 DE MAYO DEL 2002	B NEW ISLAND	UN DÍA DESPUÉS DE LUNA NUEVA	9:35 – 11:35	BAJAMAR
LUNES 13 DE MAYO DEL 2002	B NEW ISLAND	UN DÍA DESPUÉS DE LUNA NUEVA	12:30 – 14:30	MEDIA SUBIENDO
LUNES 13 DE MAYO DEL 2002	B NEW ISLAND	UN DÍA DESPUÉS DE LUNA NUEVA	15:34 – 17:34	PLEAMAR
MATES 14 DE MAYO DEL 2002	C PUNTA CHAME	DOS DÍAS DESPUÉS DE LUNA NUEVA	07:00 – 9:00	MEDIA BAJANDO
MATES 14 DE MAYO DEL 2002	C PUNTA CHAME	DOS DÍAS DESPUÉS DE LUNA NUEVA	10:11 – 12:11	BAJAMAR
MATES 14 DE MAYO DEL 2002	C PUNTA CHAME	DOS DÍAS DESPUÉS DE LUNA NUEVA	13:00 – 15:00	MEDIA SUBIENDO
MATES 14 DE MAYO DEL 2002	C PUNTA CHAME	DOS DÍAS DESPUÉS DE LUNA NUEVA	16:11 – 18:11	PLEAMAR

TABLA 3
PROGRAMACIÓN DE LA CAMPAÑA 2 DE MEDICION DE MAREA EN LA BAHIA DE PANAMA, POR ALINEACIÓN, ESTADO DE LA MAREA, SEGÚN LA FECHA Y LA HORA DE LA MEDICION

FECHA	ALINEACIÓN	FASE DE LA LUNA	HORA DE MEDICIÓN	ESTADO DE LA MAREA
DOMINGO 19 DE MAYO DEL 2002	A RÍO PACORA	CUARTO CRECIENTE	07:44 – 09:44	PLEAMAR
DOMINGO 19 DE MAYO DEL 2002	A RÍO PACORA	CUARTO CRECIENTE	11:00 – 13:00	MEDIA BAJANDO
DOMINGO 19 DE MAYO DEL 2002	A RÍO PACORA	CUARTO CRECIENTE	14:09 – 16:09	BAJAMAR
DOMINGO 19 DE MAYO DEL 2002	A RÍO PACORA	CUARTO CRECIENTE	17:15 – 19:15	MEDIA SUBIENDO
LUNES 20 DE MAYO DEL 2002	B NEW ISLAND	UN DÍA DESPUÉS DE CUARTO CRECIENTE	05:30 – 7:30	MEDIA SUBIENDO
LUNES 20 DE MAYO DEL 2002	B NEW ISLAND	UN DÍA DESPUÉS DE CUARTO CRECIENTE	8:49 – 10:49	PLEAMAR
LUNES 20 DE MAYO DEL 2002	B NEW ISLAND	UN DÍA DESPUÉS DE CUARTO CRECIENTE	12:00 – 14:00	MEDIA BAJANDO
LUNES 20 DE MAYO DEL 2002	B NEW ISLAND	UN DÍA DESPUÉS DE CUARTO CRECIENTE	15:15 – 17:15	BAJAMAR
MATES 21 DE MAYO DEL 2002	C PUNTA CHAME	DOS DÍAS DESPUÉS DE CUARTO CRECIENTE	06:30 – 08:30	MEDIA SUBIENDO
MATES 21 DE MAYO DEL 2002	C PUNTA CHAME	DOS DÍAS DESPUÉS DE CUARTO CRECIENTE	10:01 – 12:01	PLEAMAR
MATES 21 DE MAYO DEL 2002	C PUNTA CHAME	DOS DÍAS DESPUÉS DE CUARTO CRECIENTE	13:00 – 15:00	MEDIA BAJANDO
MATES 21 DE MAYO DEL 2002	C PUNTA CHAME	DOS DÍAS DESPUÉS DE CUARTO CRECIENTE	16:22 – 18:22	BAJAMAR

TABLA 4
PROGRAMACIÓN DE LA CAMPAÑA 3 DE MEDICION DE MAREA EN LA BAHIA DE PANAMA, POR ALINEACIÓN, ESTADO DE LA MAREA, SEGÚN LA FECHA Y LA HORA DE LA MEDICION

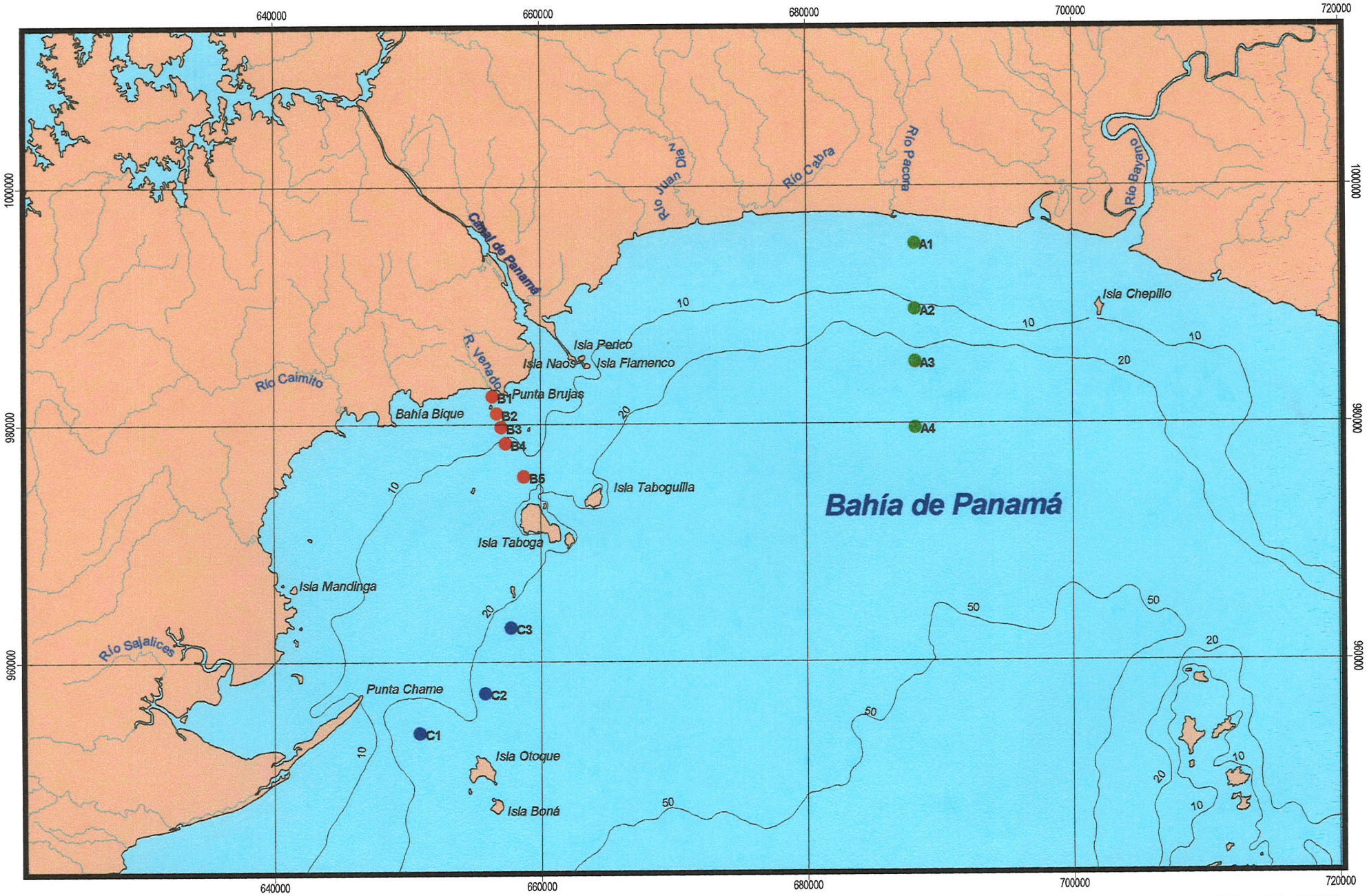
FECHA	ALINEACIÓN	FASE DE LA LUNA	HORA DE MEDICIÓN	ESTADO DE LA MAREA
DOMINGO 26 DE MAYO DEL 2002	A RÍO PACORA	LUNA LLENA	05:30 – 07:30	MEDIA BAJANDO
DOMINGO 26 DE MAYO DEL 2002	A RÍO PACORA	LUNA LLENA	08:32 – 10:32	BAJAMAR
DOMINGO 26 DE MAYO DEL 2002	A RÍO PACORA	LUNA LLENA	11:30 – 13:30	MEDIA SUBIENDO
DOMINGO 26 DE MAYO DEL 2002	A RÍO PACORA	LUNA LLENA	14:38 – 16:38	PLEAMAR
LUNES 27 DE MAYO DEL 2002	B NEW ISLAND	UN DÍA DESPUÉS DE LUNA LLENA	06:00 – 08:00	MEDIA BAJANDO
LUNES 27 DE MAYO DEL 2002	B NEW ISLAND	UN DÍA DESPUÉS DE LUNA LLENA	09:18 – 11:18	BAJAMAR
LUNES 27 DE MAYO DEL 2002	B NEW ISLAND	UN DÍA DESPUÉS DE LUNA LLENA	12:30 – 14:30	MEDIA SUBIENDO
LUNES 27 DE MAYO DEL 2002	B NEW ISLAND	UN DÍA DESPUÉS DE LUNA LLENA	15:27 – 17:27	PLEAMAR
MATES 28 DE MAYO DEL 2002	C PUNTA CHAME	DOS DÍAS DESPUÉS DE LUNA LLENA	07:00 – 09:00	MEDIA BAJANDO
MATES 28 DE MAYO DEL 2002	C PUNTA CHAME	DOS DÍAS DESPUÉS DE LUNA LLENA	10:03 – 12:03	BAJAMAR
MATES 28 DE MAYO DEL 2002	C PUNTA CHAME	DOS DÍAS DESPUÉS DE LUNA LLENA	13:00 – 15:00	MEDIA SUBIENDO
MATES 28 DE MAYO DEL 2002	C PUNTA CHAME	DOS DÍAS DESPUÉS DE LUNA LLENA	16:15 – 18:15	PLEAMAR

TABLA 5
PERSONAL QUE PARTICIPO EN LAS MEDICIONES DE CORRIENTES MARINAS EN LA BAHIA DE PANAMA Y OBSERVACIONES DE LOS RESULTADOS SEGÚN FECHA Y CAMPAÑA

FECHA	TAREA	PERSONAL	ALINEACIÓN	OBSERVACIONES
MAYO 12 DEL 2002	CAMPAÑA 1	OSCAR BALOYES	A	PROBLEMAS DE TIEMPO DE ANCLAJE. RESULTADOS REGULARES.
		EDUARDO MEDRANO	A	
MAYO 13 DEL 2002		OSCAR BALOYES	B	BUENOS RESULTADOS
		EDUARDO MEDRANO	B	
		GERARDO MELO	B	
MAYO 14 DEL 2002		OSCAR BALOYES	C	
		EDUARDO MEDRANO	C	
		GERARDO MELO	C	
MAYO 19 DEL 2002	CAMPAÑA 2	OSCAR BALOYES	A	
		EDUARDO MEDRANO	A	
		AJAX MURILLO	A	
MAYO 20 DEL 2002		OSCAR BALOYES	B	
		EDUARDO MEDRANO	B	
		JAIME MASSOT	B	
MAYO 21 DEL 2002		OSCAR BALOYES	C	
		NELSON GUERRA	C	
MAYO 26 DEL 2002	CAMPAÑA 3	OSCAR BALOYES	A	
		CLÍMACO ABADÍA	A	SUSPENDIDO POR MAL TIEMPO
MAYO 27 DEL 2002		EDUARDO MEDRANO	B	PERDIDA DE ALETA DE COLA. BUENOS RESULTADOS.
		AJAX MURILLO	B	
MAYO 28 DEL 2002		OSCAR BALOYES	C	SUSPENDIDO POR MAL TIEMPO
		NELSON GUERRA	C	

ANEXO Nº3

MAPAS



División de Administración Ambiental
Sección de Manejo de Cuenca
Unidad de Operaciones
Medición de Corrientes Marinas
Bahía de Panamá

Mayo 2002

MAPA 1

N

Escala

12 0 12 Km

LEYENDA

Rios

Línea Batimétrica (m)

Alineación Pacora

Alineación New Island

Alineación Punta Chame

ANEXO Nº4

DOCUMENTOS Y FORMULARIOS

AUTORIDAD DEL CANAL DE PANAMA

UNIDAD DE OPERACIONES AMBIENTALES

FORMULARIO Nº1 CONTROL DE MEDICION DE CORRIENTES MARINAS

FECHA: Nombre del Sitio: Lancha:

No. Punto	Circuito	Hora Inicio	Profundidad Total	Profundidad Observacion	Elevacion Marea		Viento		Posición		Nombre Archivo (.CAL)	Técnico
					Inicio	Final	Vel. (Nudos)	Dir. (Grados)	Latitud	Longitud		

Comentarios:

New York, 9 de Mayo de 2002

Descripción de la campaña de mediciones de campo de corrientes para la modelacion hidrodinámica.

Rafael Cañizares
Santiago Alfageme.

Introducción

La campaña de mediciones presentada en este documento esta diseñada unicamente para recopilar la que es considerada mínima cantidad de datos para calibrar el modelo hidrodinámico de la Bahía de Panama. Si el Departamento de Ingenieria de la Autoridad del Canal de Panama dispone del tiempo y los recursos necesarios, seria util la recopilación de un mayor número de datos de corrientes que los indicados en el presente documento. Si este fuera el caso, Moffatt and Nichol Engineers asistiría con la Autoridad en el diseño de esa campaña adicional de mediciones de campo.

Campaña de Mediciones de campo de corrientes para Mayo 2002

En cada uno de los tres alineamientos A, B y C cuyos puntos estan situados en las coordenadas presentadas en la Tabla 1, se tomaran mediciones correspondientes a marea de sicigia (marea viva), marea media y marea de cuadratura (marea muerta). Para cada una de estos estados de marea las mediciones han de tomarse durante bajamar, pleamar y dos mareas medias cada día Cada una de estas mediciones debe efectuarse en un periodo de aproximadamente dos horas, comenzando una hora antes del tiempo marcado como bajamar, pleamar y marea media. El tiempo en el que se presenta bajamar y pleamar ha sido tomado de la Tabla de Mareas del 2002 confeccionada por el Departamento de Ingeniería Proyectos, División de Ingeniería, Sección de Meteorología e Hidrología, para la estación de Balboa en el Pacífico. Los datos en estas tablas están en hora local de la República de Panama.

Tabla 1: Geo Coordinates for Current Data Measurement Points

Point Number	Latitude				Longitude			
		°	'	"		°	'	"
Transect A. Rio Pacora								
A1	N	9	0	0	W	79	16	12
A2	N	8	57	0	W	79	16	12
A3	N	8	54	36	W	79	16	12
A4	N	8	51	36	W	79	16	12
Transect B. New Island								
B1	N	8	53	10	W	79	35	36
B2	N	8	52	22	W	79	35	24
B3	N	8	51	45	W	79	35	12
B4	N	8	51	0	W	79	35	0
B5	N	8	49	30	W	79	34	10
Transect C. Punta Chame								
C1	N	8	37	48	W	79	39	0
C2	N	8	39	36	W	79	35	60
C3	N	8	42	36	W	79	34	48

Mediciones durante Marea Media (Sicigia de menor ampliltud)

Domingo, 12 de Mayo del 2002 –Luna Nueva
Toma de datos en alineación A.
Tiempo de Medición:

Marea Media bajando: 5:30 – 7:30
Bajamar : 9:00 – 11:00
Marea Media subiendo: 12:00 – 14:00
Pleamar: 14:58 – 16:58

Lunes, 13 de Mayo del 2002 –1 dia despues de Luna Nueva
Toma de datos en alineación B.
Tiempo de Medición:

Marea Media bajando: 6:00 – 8:00
Bajamar : 9:35 – 11:35
Marea Media subiendo: 12:30 – 14:30
Pleamar: 15:34 – 17:34

Martes, 14 de Mayo del 2002 –2 dias despues de Luna Nueva
Toma de datos en alineación C.
Tiempo de Medición:

Marea Media bajando: 7:00 – 9:00
Bajamar : 10:11 – 12:11
Marea Media subiendo: 13:00 – 15:00
Pleamar: 16:11 – 18:11

Mediciones durante Marea de Cuadratura

Domingo, 19 de Mayo del 2002 – Cuarto Creciente
Toma de datos en alineación A.
Tiempo de Medición:

Pleamar: 7:44 – 9:44
Marea Media bajando: 11:00 – 13:00
Bajamar : 14:09 – 16:09
Marea Media subiendo: 17:15 – 19:15

Lunes, 20 de Mayo del 2002 –
Toma de datos en alineación B.
Tiempo de Medición:

Marea Media subiendo: 5:30 – 7:30
Pleamar: 8:49 – 10:49
Marea Media bajando: 12:00 – 14:00
Bajamar : 15:15 – 17:15

Martes, 21 de Mayo del 2002 –
Toma de datos en alineación C.
Tiempo de Medición:

Marea Media subiendo: 6:30 – 8:30
Pleamar::10:01– 12:01
Marea Media bajando: 13:00 – 15:00
Bajamar : 16:22 – 18:22

Mediciones durante Marea de Sicigia

Domingo, 26 de Mayo del 2002 –Luna Llena
Toma de datos en alineación A.
Tiempo de Medición:

Marea Media bajando: 5:30 – 7:30
Bajamar : 8:32 – 10:32
Marea Media subiendo: 11:30 – 13:30
Pleamar: 14:38 – 16:38

Lunes, 27 de Mayo del 2002 –1 dia despues de Luna Llena
Toma de datos en alineación B.
Tiempo de Medición:

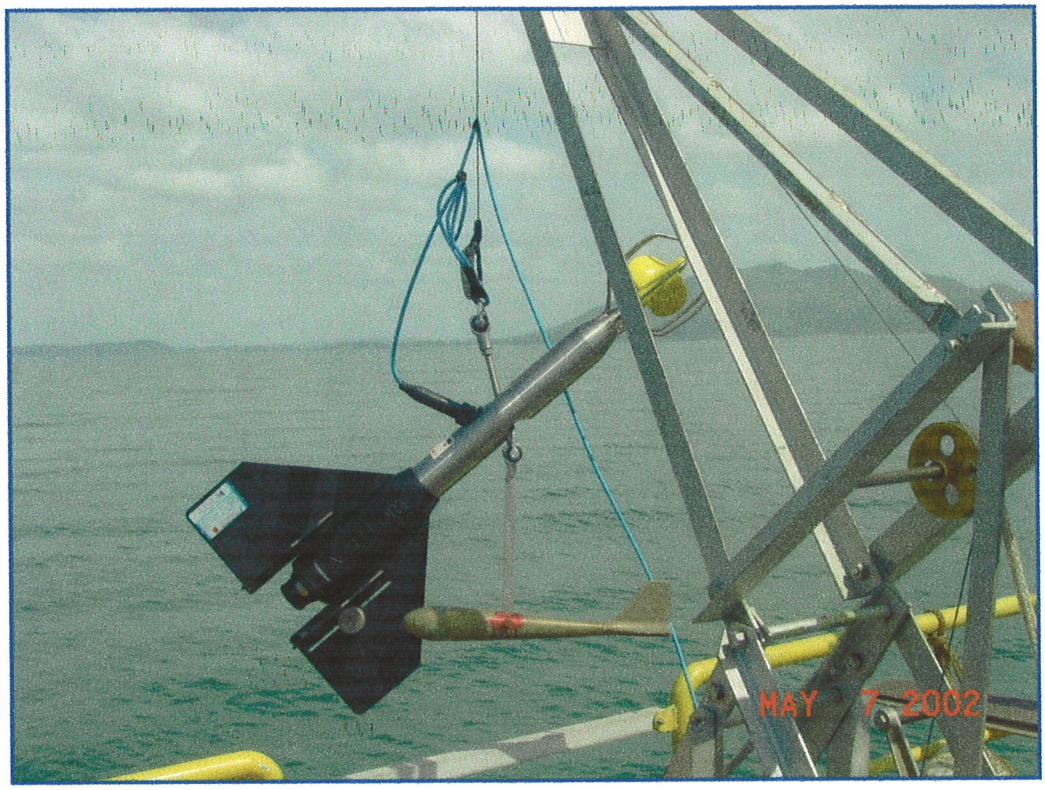
Marea Media bajando: 6:00 – 8:00
Bajamar : 9:18 – 11:18
Marea Media subiendo: 12:30 – 14:30
Pleamar: 15:27 – 17:27

Martes, 28 de Mayo del 2002 –2 dias despues de Luna Llena
Toma de datos en alineación C.
Tiempo de Medición:

Marea Media bajando: 7:00 – 9:00
Bajamar : 10:03 – 12:03
Marea Media subiendo: 13:00 – 15:00
Pleamar: 16:15 – 18:15

ANEXO Nº5

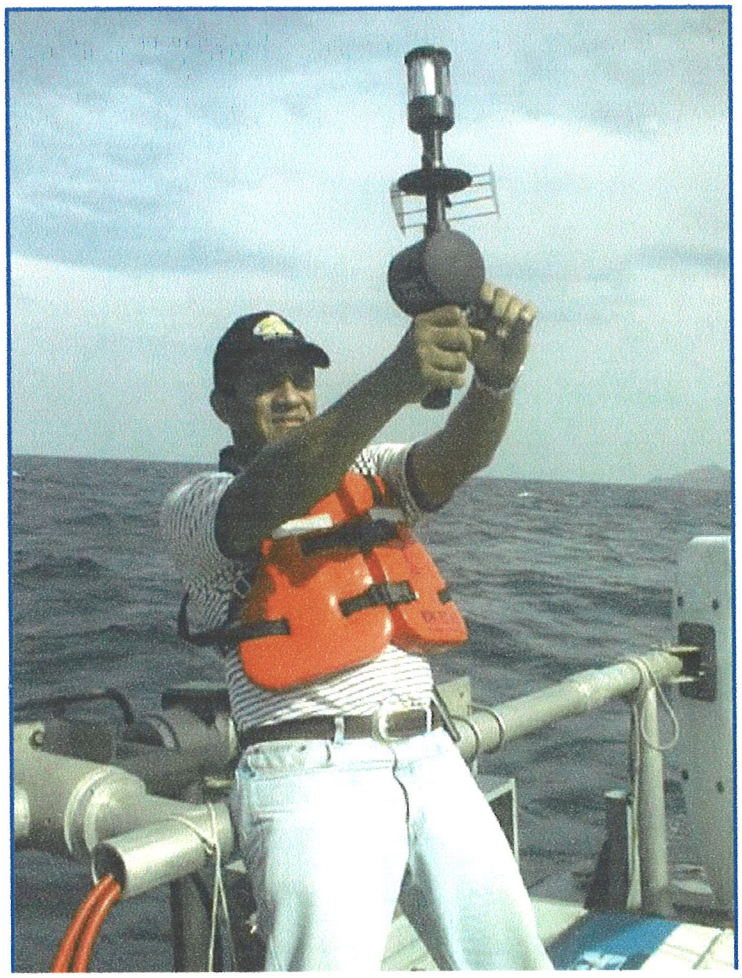
FOTOGRAFIAS



Correntímetro Valeport 308 utilizado en las campañas en la Bahía de Panamá.

Proceso de medición de las corrientes marinas.

Computadoras y accesorios para el registro delas mediciones.



Medición de la velocidad y dirección del viento

AUTORIDAD DEL CANAL DE PANAMA
DIVISIÓN DE ADMINISTRACIÓN AMBIENTAL
SECCIÓN DE MANEJO DE CUENCA
Unidad de Operaciones

MEDICION DE CORRIENTES MARINAS EN LA BAHÍA DE PANAMA

(COMPLEMENTO DEL INFORME DE JUNIO DE 2002)

DATOS DE LAS CAMPAÑAS 4 y 5

Por

Oscar Baloyes

Gerardo Leis R.

Tomás García

Supervisor Hidrólogo
Ing. Jaime Massot

Pedro Miguel, Panamá
Julio de 2002

Para información adicional sobre este informe:

Ing. Jaime Massot
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Unidad de Operaciones
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INTRODUCCIÓN

La División de Capacidad del Canal (IPC) solicitó la medición de corrientes marinas en la Bahía de Panamá como parte de los estudios que se están realizando para el proyecto denominado "Canales de Navegación". Estas mediciones son necesarias para calibrar el modelo hidrodinámico de corrientes marinas que utilizará la empresa Moffatt & Nichol.

En este documento se presentan los datos de las campañas 4 y 5, que complementan las campañas de mediciones anteriores efectuadas en el mes de mayo de 2002, presentadas en el informe: "MEDICION DE CORRIENTES MARINAS EN LA BAHÍA DE PANAMA, CAMPAÑAS 1, 2 Y 3." (Junio de 2002).

La campañas 4 y 5, programadas por Moffatt & Nichol, fueron efectuadas los días 3, 4,7, 23, 24 y 25 de junio de 2002.(anexo 2 – Documento)

La medición, planificada originalmente para el día 5 de junio, se pospuso para el 7 de junio por causa de los fuertes oleajes presentados ese día. El resto de las mediciones se cumplieron en los días programados sin que se presentaran complicaciones.

ANEXO Nº1

DATOS Y GRAFICAS DE MEDICION DE CORRIENTES

Mediciones durante Marea de Cuadratura

Lunes, 3 de junio de 2002 -Cuarto Creciente

Toma de datos en alineación A.

Tiempo de Medición:

Marea Media Subiendo: 6:00 - 8:00

Pleamar: 8:57 - 10:57

Marea Media Bajando: 12:00 - 14:00

Bajamar: 15:09 - 17:09

TABLA 3-A1.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LA CORRIENTES EN LA BAHIA DE PANAMA
MAREA DE CUADRATURA (MAREA MEDIA SUBIENDO)

Alineación	Pacora
Sitio	A1
Fecha	3/6/02

Coordenadas		*Viento	
Latitud N	*995098*	Velocidad (Kt)	3
Longitud E	*690160*	Dirección (º)	60

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
10	10*	8.9	6:50:36	28.74	0.05	30.20
			6:51:36	28.73	0.14	42.00
			6:52:36	28.75	0.18	39.50
			6:53:36	28.76	0.17	26.60
			6:54:36	28.70	0.20	3.80

TABLA 3-A2.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LA CORRIENTES EN LA BAHIA DE PANAMA
MAREA DE CUADRATURA (MAREA MEDIA SUBIENDO)

Alineación	Pacora
Sitio	A2
Fecha	3/6/02

Coordenadas		*Viento	
Latitud N	*989567*	Velocidad (Kt)	3
Longitud E	*690186*	Dirección (º)	60

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
56	46	10.3	7:27:17	27.91	0.09	30.70
			7:28:17	27.93	0.12	334.60
			7:29:17	27.91	0.12	335.70
			7:30:17	27.92	0.09	353.10
		10.4	7:31:17	27.91	0.10	50.20
	28	10.6	7:35:17	28.40	0.20	66.30
			7:36:17	28.41	0.17	61.60
			7:37:17	28.41	0.18	68.20
			7:38:17	28.41	0.17	60.90
		10.7	7:39:17	28.41	0.17	63.40
	10*	10.8	7:42:32	28.68	0.20	72.50
			7:43:32	28.68	0.17	67.40
			7:44:32	28.68	0.21	75.60
			7:45:32	28.69	0.18	65.30
		10.9	7:46:32	28.69	0.19	69.40

TABLA 3-A3.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LA CORRIENTES EN LA BAHIA DE PANAMA
MAREA DE CUADRATURA (MAREA MEDIA SUBIENDO)

Alineación	Pacora
Sitio	A3
Fecha	3/6/02

Coordenadas		*Viento	
Latitud N	*985143*	Velocidad (Kt)	4
Longitud E	*979613*	Dirección (º)	310

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
90	80	12.0	8:25:32	26.17	0.08	335.30
			8:26:32	26.17	0.07	354.70
			8:27:32	26.16	0.05	357.20
			8:28:32	26.16	0.06	5.50
		12.1	8:29:32	26.16	0.10	305.30
	45	12.2	8:32:22	28.19	0.16	55.70
			8:33:22	28.23	0.14	54.30
			8:34:22	28.22	0.21	61.30
			8:35:22	28.24	0.15	55.50
		12.2	8:36:22	28.23	0.18	58.70
	10*	12.3	8:39:02	28.89	0.12	106.60
			8:40:02	28.89	0.09	121.10
			8:41:02	28.89	0.11	102.90
			8:42:02	28.89	0.12	103.30
		12.4	8:43:02	28.88	0.11	105.20

TABLA 3-A4.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LA CORRIENTES EN LA BAHIA DE PANAMA
MAREA DE CUADRATURA (PLEAMAR)

Alineación	Pacora
Sitio	A4
Fecha	3/6/02

Coordenadas		*Viento	
Latitud N	*979613*	Velocidad (Kt)	2
Longitud E	*690233*	Dirección (º)	270

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
116	106	12.9	9:15:07	25.27	0.12	243.00
			9:16:07	25.27	0.09	245.60
			9:17:07	25.27	0.07	254.40
			9:18:07	25.27	0.09	264.80
		12.9	9:19:07	25.27	0.06	269.30
	58	13.0	9:22:02	28.44	0.14	53.50
			9:23:02	28.44	0.14	46.60
			9:24:02	28.40	0.16	49.00
			9:25:02	28.42	0.15	50.30
		13.0	9:26:02	28.44	0.14	53.20
	10*	13.1	9:28:47	28.94	0.20	174.90
			9:29:47	28.95	0.18	166.30
			9:30:47	28.95	0.18	176.80
			9:31:47	28.95	0.18	168.40
		13.1	9:32:47	28.93	0.20	175.60

TABLA 3-A3.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LA CORRIENTES EN LA BAHIA DE PANAMA
MAREA DE CUADRATURA (PLEAMAR)

Alineación	Pacora
Sitio	A3
Fecha	3/6/02

Coordenadas		*Viento	
Latitud N	*985143*	Velocidad (Kt)	4
Longitud E	*690207*	Dirección (°)	230

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (°C)	Velocidad (m/s)	Dirección (°)
90	80*	13.1	10:06:23	26.18	0.10	218.30
			10:07:23	26.17	0.06	204.40
			10:08:23	26.17	0.07	193.00
			10:09:23	26.17	0.08	199.60
		13.1	10:10:23	26.17	0.06	219.90
	45	13.1	10:12:43	28.30	0.13	77.50
			10:13:43	28.30	0.13	80.20
			10:14:43	28.31	0.13	82.00
		13.1	10:15:43	28.31	0.14	82.00
	10*	13.1	10:19:38	29.00	0.11	147.50
			10:20:38	29.00	0.11	136.40
			10:21:38	29.01	0.11	127.30
			10:22:38	28.99	0.11	150.90
			10:23:38	29.00	0.12	145.90

TABLA 3-A2.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LA CORRIENTES EN LA BAHIA DE PANAMA
MAREA DE CUADRATURA (PLEAMAR)

Alineación	Pacora
Sitio	A2
Fecha	3/6/02

Coordenadas		*Viento	
Latitud N	*989567*	Velocidad (Kt)	5
Longitud E	*690186*	Dirección (°)	192

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (°C)	Velocidad (m/s)	Dirección (°)
56	46	12.7	10:50:03	27.97	0.20	193.40
			10:51:03	27.97	0.17	182.70
			10:52:03	27.97	0.13	182.20
			10:53:03	27.97	0.13	178.60
		12.7	10:54:03	27.98	0.12	177.30
	28	12.7	10:56:18	28.34	0.13	131.00
			10:57:18	28.35	0.12	125.50
			10:58:18	28.34	0.10	122.40
			10:59:18	28.34	0.13	128.10
		12.7	11:00:18	28.34	0.15	131.90
	10*	12.6	11:02:28	28.74	0.20	110.50
			11:03:28	28.74	0.16	104.20
			11:04:28	28.72	0.17	95.60
			11:05:28	28.74	0.21	117.50
		12.5	11:06:28	28.74	0.18	109.70

TABLA 3-A1.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LA CORRIENTES EN LA BAHIA DE PANAMA
MAREA DE CUADRATURA (MAREA MEDIA BAJANDO)

Alineación	Pacora
Sitio	A1
Fecha	3/6/02

Coordenadas		*Viento	
Latitud N	*995098*	Velocidad (Kt)	S/D
Longitud E	*690160*	Dirección (º)	S/D

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
12	6*	11.9	11:35:58	29.00	0.18	143.40
			11:36:58	28.93	0.09	143.20
			11:37:58	28.93	0.17	142.60
			11:38:58	28.99	0.09	134.60
		11.8	11:39:58	28.92	0.16	148.70

TABLA 3-A1.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LA CORRIENTES EN LA BAHIA DE PANAMA
MAREA DE CUADRATURA (MAREA MEDIA BAJANDO)

Alineación	Pacora
Sitio	A1
Fecha	3/6/02

Coordenadas		*Viento	
Latitud N	*995098*	Velocidad (Kt)	7
Longitud E	*690160*	Dirección (º)	195

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
12	6*	11.4	11:52:13	29.02	0.24	129.10
			11:53:13	29.06	0.07	173.80
			11:54:13	29.00	0.19	131.30
			11:55:13	29.14	0.12	130.10
		11.3	11:56:13	29.02	0.16	128.00

TABLA 3-A2.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LA CORRIENTES EN LA BAHIA DE PANAMA
MAREA DE CUADRATURA (MAREA MEDIA BAJANDO)

Alineación	Pacora
Sitio	A2
Fecha	3/6/02

Coordenadas		*Viento	
Latitud N	*989567*	Velocidad (Kt)	7
Longitud E	*690186*	Dirección (º)	185

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
55	45	10.4	12:25:38	28.04	0.28	218.00
			12:26:38	28.03	0.34	259.00
			12:27:38	28.03	0.37	281.10
			12:28:38	28.02	0.12	290.20
		10.3	12:29:38	28.02	0.09	167.10
	27.5	10.2	12:31:58	28.22	0.10	163.80
			12:32:58	28.22	0.11	167.40
			12:33:58	28.21	0.10	175.40
			12:34:58	28.22	0.12	160.50
		10.1	12:35:58	28.21	0.11	169.80
	10*	10.0	12:38:13	28.75	0.19	129.80
			12:39:13	28.74	0.10	137.30
			12:40:13	28.72	0.17	129.90
			12:41:13	28.73	0.22	128.30
		9.8	12:42:13	28.75	0.17	131.60

TABLA 3-A3.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LA CORRIENTES EN LA BAHIA DE PANAMA
MAREA DE CUADRATURA (MAREA MEDIA BAJANDO)

Alineación	Pacora
Sitio	A3
Fecha	3/6/02

Coordenadas		*Viento	
Latitud N	*985143*	Velocidad (Kt)	3
Longitud E	*690207*	Dirección (º)	210

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
86	76	8.8	13:10:33	26.38	0.15	209.30
			13:11:33	26.39	0.12	218.30
			13:12:33	26.39	0.13	196.40
			13:13:33	26.39	0.14	195.80
		8.7	13:14:33	26.38	0.13	203.50
	43	8.6	13:17:33	28.46	0.11	106.20
			13:18:33	28.45	0.07	100.20
			13:19:33	28.46	0.06	24.10
			13:20:33	28.46	0.12	95.00
		8.5	13:21:33	28.46	0.14	112.40
	10*	8.3	13:24:43	28.94	0.14	121.70
			13:25:43	28.95	0.17	125.80
			13:26:43	28.97	0.13	116.20
			13:27:43	28.95	0.12	111.30
		8.2	13:28:43	28.96	0.15	124.40

TABLA 3-A4.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LA CORRIENTES EN LA BAHIA DE PANAMA
MAREA DE CUADRATURA (MAREA MEDIA BAJANDO)

Alineación	Pacora
Sitio	A4
Fecha	3/6/02

Coordenadas		*Viento	
Latitud N	*979613*	Velocidad (Kt)	2
Longitud E	*690233*	Dirección (º)	220

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
111	101	7.0	14:01:08	25.41	0.08	244.10
			14:02:08	25.41	0.05	257.30
			14:03:08	25.40	0.05	275.70
			14:04:08	25.41	0.08	232.50
		6.9	14:05:08	25.41	0.08	228.10
	55	6.8	14:07:48	28.07	0.19	97.80
			14:08:48	28.01	0.20	93.20
			14:09:48	27.62	0.18	86.80
			14:10:48	27.82	0.16	99.70
		6.7	14:11:48	28.16	0.17	100.10
	10*	6.6	14:15:13	29.05	0.16	156.00
			14:16:13	29.05	0.17	158.90
			14:17:13	29.02	0.15	150.50
			14:18:13	28.96	0.17	131.90
		6.5	14:19:13	28.92	0.15	136.70

TABLA 3-A4.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LA CORRIENTES EN LA BAHIA DE PANAMA
MAREA DE CUADRATURA (BAJAMAR)

Alineación	Pacora
Sitio	A4
Fecha	3/6/02

Coordenadas		*Viento	
Latitud N	*979613*	Velocidad (Kt)	3
Longitud E	*690233*	Dirección (º)	235

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
110	100	5.4	14:57:13	25.42	0.08	240.20
			14:58:13	25.41	0.09	261.20
			14:59:13	25.41	0.08	260.50
			15:00:13	25.41	0.07	279.40
		5.3	15:01:13	25.41	0.09	260.30
	55	5.3	15:03:43	27.83	0.13	104.80
			15:04:43	27.68	0.15	105.30
			15:05:43	27.74	0.15	102.80
			15:06:43	27.78	0.16	98.40
		5.2	15:07:43	27.69	0.13	109.10
	10*	5.1	15:10:28	29.07	0.14	148.60
			15:11:28	29.07	0.14	152.30
			15:12:28	29.06	0.15	152.60
			15:13:28	29.02	0.14	140.80
		5.0	15:14:28	29.00	0.14	147.80

TABLA 3-A3.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LA CORRIENTES EN LA BAHIA DE PANAMA
MAREA DE CUADRATURA (BAJAMAR)

Alineación	Pacora
Sitio	A3
Fecha	3/6/02

Coordenadas		*Viento	
Latitud N	*985143*	Velocidad (Kt)	8
Longitud E	*690207*	Dirección (°)	300

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (°C)	Velocidad (m/s)	Dirección (°)
82	72	4.6	15:48:48	26.71	0.10	292.60
			15:49:48	26.71	0.13	314.40
			15:50:48	26.69	0.16	340.40
			15:51:48	26.68	0.13	350.20
		4.6	15:52:48	26.63	0.06	338.10
	41	4.5	15:55:08	28.47	0.14	87.90
			15:56:08	28.48	0.15	69.30
			15:57:08	28.48	0.12	128.80
			15:58:08	28.48	0.14	81.30
		4.5	15:59:08	28.48	0.18	68.60
	10*	4.5	16:01:18	28.90	0.17	148.00
			16:02:18	28.93	0.15	97.10
			16:03:18	28.94	0.18	67.20
			16:04:18	28.96	0.23	55.60
		4.5	16:05:18	28.94	0.16	133.90

TABLA 3-A2.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LA CORRIENTES EN LA BAHIA DE PANAMA
MAREA DE CUADRATURA (BAJAMAR)

Alineación	Pacora
Sitio	A2
Fecha	3/6/02

Coordenadas		*Viento	
Latitud N	*989567*	Velocidad (Kt)	5
Longitud E	*690186*	Dirección (°)	300

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (°C)	Velocidad (m/s)	Dirección (°)
49	39	4.7	16:37:48	28.10	0.20	15.90
			16:38:48	28.11	0.10	19.80
			16:39:48	28.09	0.13	19.00
			16:40:48	28.09	0.18	18.40
		4.7	16:41:48	28.09	0.08	24.50
	24.5	4.7	16:44:23	28.38	0.13	157.50
			16:45:23	28.39	0.07	70.90
			16:46:23	28.38	0.07	117.60
			16:47:23	28.38	0.06	106.50
		4.8	16:48:23	28.38	0.08	146.70
	10*	4.8	16:50:28	28.96	0.14	112.80
			16:51:28	28.90	0.15	80.20
			16:52:28	28.96	0.18	140.00
			16:53:28	28.92	0.14	73.50
		4.9	16:54:28	28.89	0.17	131.10

TABLA 3-A1.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LA CORRIENTES EN LA BAHIA DE PANAMA

MAREA DE CUADRATURA (BAJAMAR)

Alineación	Pacora
Sitio	A1
Fecha	3/6/02

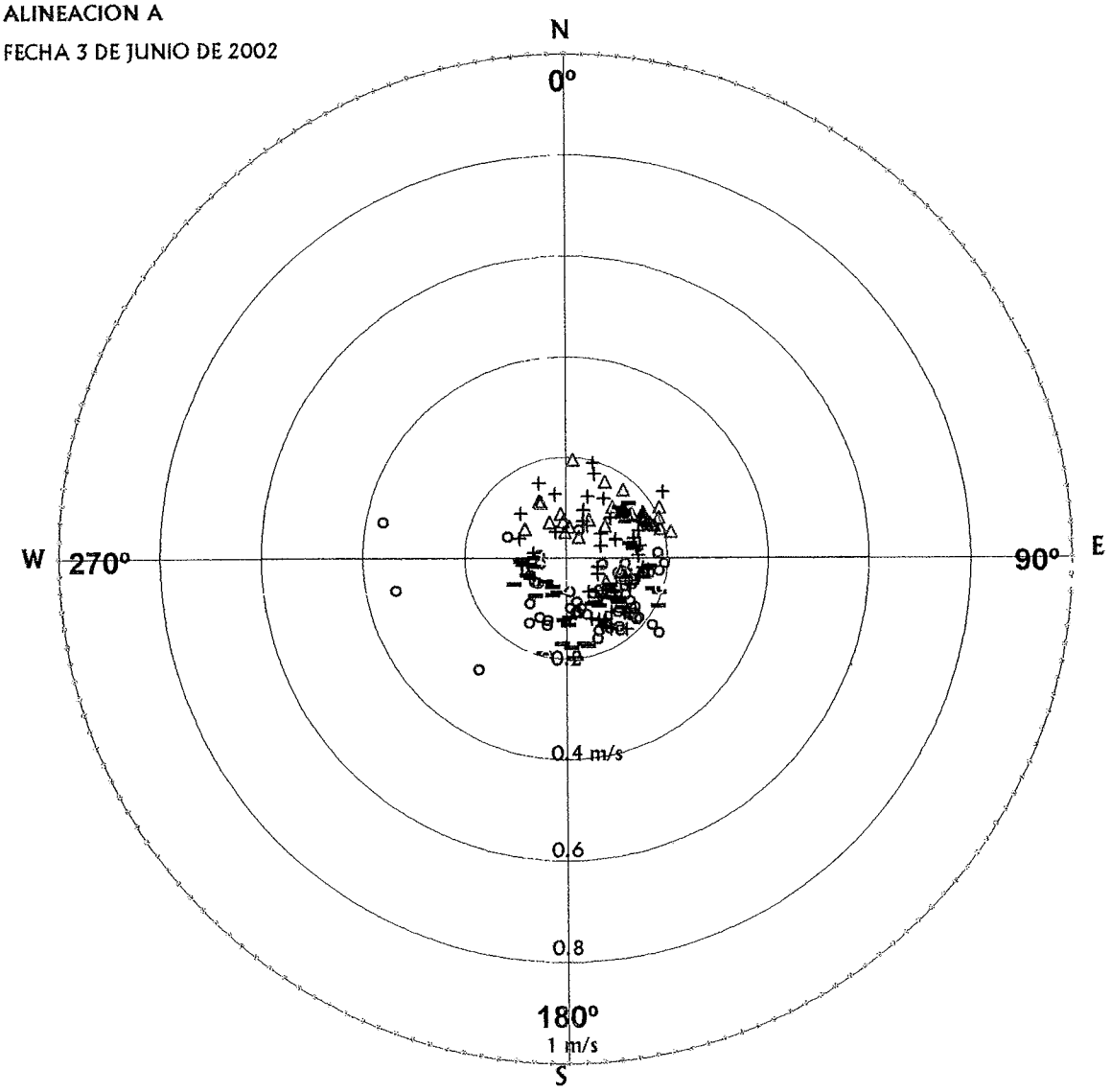
Coordenadas		*Viento	
Latitud N	*995098*	Velocidad (Kt)	3
Longitud E	*690160*	Dirección (º)	240

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
9.5	5*	5.4	17:22:23	29.44	0.12	47.70
			17:23:23	29.32	0.14	32.10
			17:24:23	29.25	0.10	69.10
			17:25:23	29.02	0.08	32.50
		5.5	17:26:23	28.92	0.08	54.70

VELOCIDAD Y DIRECCION DE LAS CORRIENTES MARINAS EN LA BAHÍA DE PANAMÁ SEGÚN CONDICION DE MAREA

ALINEACION A

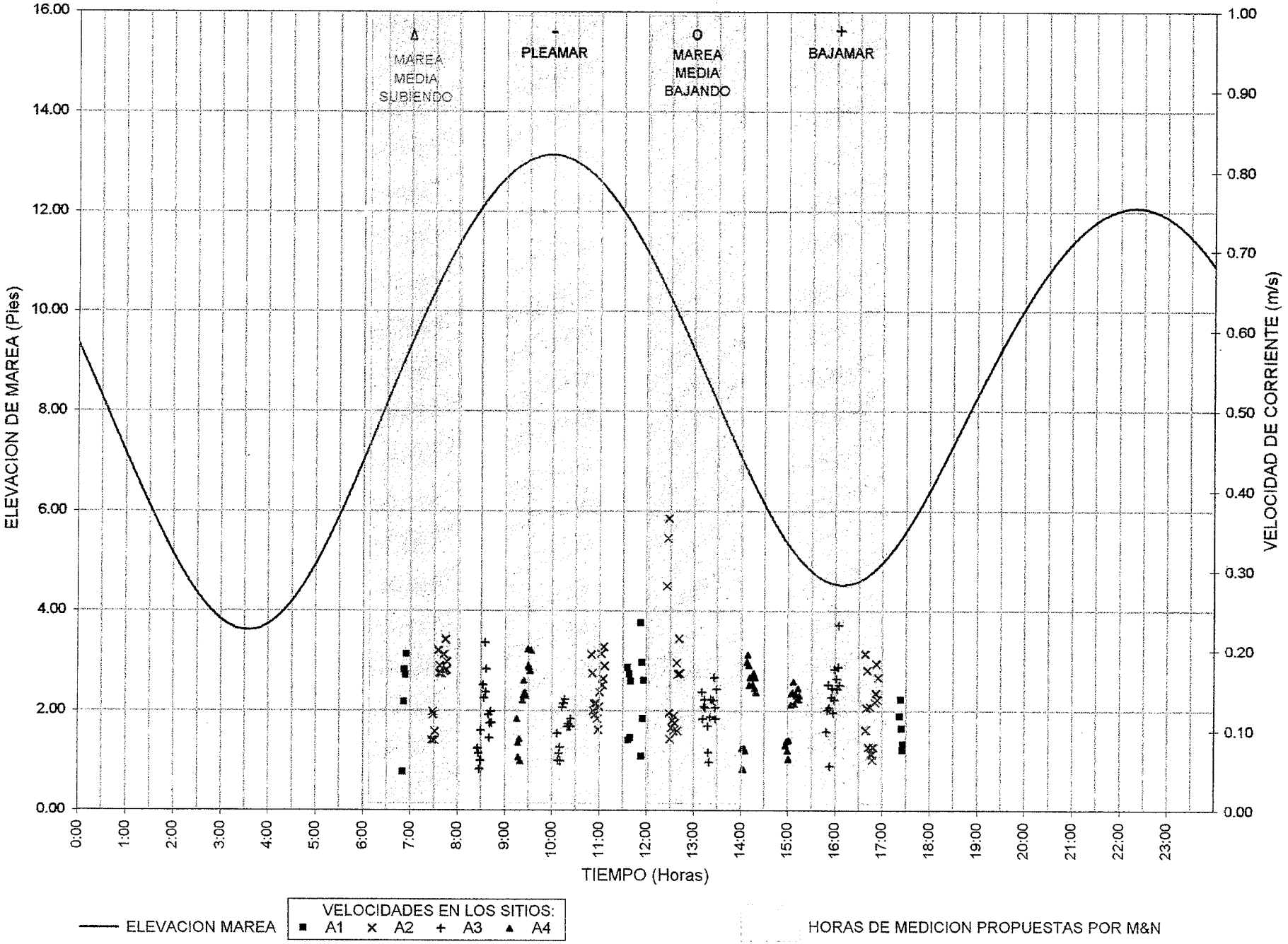
FECHA 3 DE JUNIO DE 2002



- ○ Marea media bajando
- + Bajamar
- △ Marea media subiendo
- – Pleamar

Unidad de Operaciones-ACP

VELOCIDAD DE CORRIENTES MARINAS EN LA BAHIA DE PANAMA SEGUN HORA, CONDICION DE MAREA Y SITIOS DE MEDICION (A1,A2, A3 Y A4) DE ALINEACION A (PACORA). MEDICION DE CORRIENTES #8-3 DE JUNIO DE 2002



Mediciones durante Marea de Cuadratura

Martes, 4 de junio de 2002 - 1 día después de Cuarto Creciente
Toma de datos en alineación B.
Tiempo de Medición:
Marea Media Subiendo: 7:00 - 9:00
Pleamar: 9:57 - 11:57
Marea Media Bajando: 13:00 - 14:00
Bajamar: 16:07 - 18:07

TABLA 4-B1.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LA CORRIENTES EN LA BAHIA DE PANAMA
MAREA DE CUADRATURA (MAREA MEDIA SUBIENDO)

Alineación	New Island
Sitio	B1
Fecha	4/6/02

Coordenadas		*Viento	
Latitud N	*982350*	Velocidad (Kt)	3
Longitud E	*654657*	Dirección (º)	350

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
7	5*	6.9	6:49:28	29.23	0.11	293.60
			6:50:28	29.23	0.08	276.20
			6:51:28	29.22	0.08	283.50
			6:52:28	29.22	0.08	328.60
		7.2	6:53:28	29.21	0.09	348.80

TABLA 4-B2.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LA CORRIENTES EN LA BAHIA DE PANAMA
MAREA DE CUADRATURA (MAREA MEDIA SUBIENDO)

Alineación	New Island
Sitio	B2
Fecha	3/6/02

Coordenadas		*Viento	
Latitud N	*980877*	Velocidad (Kt)	4
Longitud E	*655029*	Dirección (º)	15

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
24	14	8.0	7:16:09	29.00	0.12	346.20
			7:17:09	29.00	0.14	344.70
			7:18:09	28.99	0.12	336.90
			7:19:09	28.98	0.14	342.60
		8.1	7:20:09	28.98	0.15	343.60
	10*	8.3	7:26:29	29.03	0.15	337.20
			7:27:29	29.03	0.13	336.80
			7:28:29	29.04	0.15	337.00
			7:29:29	29.04	0.12	336.80
		8.5	7:30:29	29.07	0.10	343.70

TABLA 4-B3.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LA CORRIENTES EN LA BAHIA DE PANAMA
MAREA DE CUADRATURA (MAREA MEDIA SUBIENDO)

Alineación	New Island
Sitio	B3
Fecha	4/6/02

Coordenadas		*Viento	
Latitud N	*979742*	Velocidad (Kt)	4.5
Longitud E	*655400*	Dirección (º)	40

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
33	23	9.0	7:45:44	28.75	0.26	341.80
			7:46:44	28.75	0.20	341.30
			7:47:44	28.77	0.11	344.60
			7:48:44	28.76	0.10	90.40
		9.1	7:49:44	28.76	0.13	355.90
	11.5*	9.2	7:52:44	28.87	0.13	342.20
			7:53:44	28.87	0.06	35.50
			7:54:44	28.87	0.06	11.10
			7:55:44	28.87	0.22	346.80
		9.4	7:56:44	28.87	0.12	343.00

TABLA 4-B4.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LA CORRIENTES EN LA BAHIA DE PANAMA
MAREA DE CUADRATURA (MAREA MEDIA SUBIENDO)

Alineación	New Island
Sitio	B4
Fecha	4/6/02

Coordenadas		*Viento	
Latitud N	*978361*	Velocidad (Kt)	5.5
Longitud E	*655772*	Dirección (º)	15

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
44	34	9.8	8:10:39	28.59	0.16	357.10
			8:11:39	28.59	0.17	357.70
			8:12:39	28.60	0.15	358.50
			8:13:39	28.64	0.12	14.00
		10.0	8:14:39	28.70	0.09	62.90
	22	10.1	8:17:04	28.78	0.10	70.00
			8:18:04	28.73	0.09	4.20
			8:19:04	28.77	0.23	357.20
			8:20:04	28.78	0.09	34.80
		10.2	8:21:04	28.80	0.09	50.00
	10*	10.2	8:23:39	28.90	0.24	337.70
			8:24:39	28.90	0.12	326.80
			8:25:39	28.89	0.07	246.10
			8:26:39	28.88	0.13	285.90
		10.4	8:27:39	28.90	0.10	313.60

TABLA 4-B5.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LA CORRIENTES EN LA BAHIA DE PANAMA
MAREA DE CUADRATURA (MAREA MEDIA SUBIENDO)

Alineación	New Island
Sitio	B5
Fecha	4/6/02

Coordenadas		*Viento	
Latitud N	*975602*	Velocidad (Kt)	3
Longitud E	*657310*	Dirección (°)	50

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (°C)	Velocidad (m/s)	Dirección (°)
52	42	11.0	8:48:19	28.46	0.17	100.70
			8:49:19	28.43	0.13	104.80
			8:50:19	28.44	0.12	99.60
			8:51:19	28.43	0.09	101.70
		11.1	8:52:19	28.43	0.13	5.20
	26	11.1	8:54:44	28.77	0.17	27.40
			8:55:44	28.79	0.14	35.40
			8:56:44	28.78	0.14	42.50
			8:57:44	28.77	0.12	51.80
		11.2	8:58:44	28.76	0.15	32.40
	10*	11.3	9:01:09	28.94	0.05	45.60
			9:02:09	28.95	0.10	143.80
			9:03:09	28.94	0.05	202.20
			9:04:09	28.95	0.08	326.90
		11.4	9:05:09	28.94	0.12	333.30

TABLA 4-B5.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LA CORRIENTES EN LA BAHIA DE PANAMA
MAREA DE CUADRATURA (PLEAMAR)

Alineación	New Island
Sitio	B5
Fecha	4/6/02

Coordenadas		*Viento	
Latitud N	*975602*	Velocidad (Kt)	5.5
Longitud E	*657310*	Dirección (°)	15

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (°C)	Velocidad (m/s)	Dirección (°)
54	44	12.4	9:52:08	28.39	0.13	117.80
			9:53:08	28.37	0.08	15.60
			9:54:08	28.40	0.09	3.00
			9:55:08	28.38	0.07	18.40
		12.5	9:56:08	28.39	0.08	80.20
	27	12.5	9:58:34	28.72	0.20	23.30
			9:59:34	28.69	0.23	20.60
			10:00:34	28.72	0.18	35.10
			10:01:34	28.74	0.17	49.60
		12.6	10:02:34	28.74	0.17	49.70
	10*	12.6	10:04:49	28.99	0.08	284.40
			10:05:49	28.99	0.09	185.30
			10:06:49	28.99	0.12	157.70
			10:07:49	28.99	0.07	261.60
		12.6	10:08:49	28.99	0.06	264.10

TABLA 4-B4.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LA CORRIENTES EN LA BAHIA DE PANAMA
MAREA DE CUADRATURA (PLEAMAR)

Alineación	New Island
Sitio	B4
Fecha	4/6/02

Coordenadas		*Viento	
Latitud N	*978361*	Velocidad (Kt)	4.5
Longitud E	*655772*	Dirección (º)	95

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
46	36	12.8	10:30:09	28.60	0.17	8.40
			10:31:09	28.61	0.18	3.50
			10:32:09	28.59	0.09	15.50
			10:33:09	28.59	0.09	71.20
		12.9	10:34:09	28.58	0.10	5.60
	23	12.9	10:36:44	28.73	0.13	18.30
			10:37:44	28.73	0.12	120.50
			10:38:44	28.72	0.08	85.20
			10:39:44	28.71	0.10	105.10
		12.9	10:40:44	28.70	0.10	33.40
	10*	12.9	10:42:54	28.99	0.09	214.00
			10:43:54	28.98	0.09	317.60
			10:44:54	29.01	0.16	332.40
			10:45:54	29.01	0.05	282.60
		12.9	10:46:54	28.98	0.07	319.50

TABLA 4-B3.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LA CORRIENTES EN LA BAHIA DE PANAMA
MAREA DE CUADRATURA (PLEAMAR)

Alineación	New Island
Sitio	B3
Fecha	4/6/02

Coordenadas		*Viento	
Latitud N	*979742*	Velocidad (Kt)	5
Longitud E	*655400*	Dirección (º)	110

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
36	26	12.9	11:03:24	28.66	0.11	149.00
			11:04:24	28.63	0.06	30.70
			11:05:24	28.63	0.02	58.60
			11:06:24	28.70	0.07	119.00
		12.9	11:07:24	28.69	0.12	352.40
	18	12.9	11:09:48	28.84	0.07	265.20
			11:10:48	28.83	0.09	209.70
			11:11:48	28.84	0.06	197.60
			11:12:48	28.84	0.08	320.90
		12.9	11:13:48	28.84	0.04	254.70
	10*	12.9	11:15:58	29.03	0.08	329.40
			11:16:58	28.95	0.07	289.30
			11:17:58	28.97	0.10	210.50
			11:18:58	29.03	0.06	272.50
		12.9	11:19:58	29.01	0.08	236.10

TABLA 4-B2.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LA CORRIENTES EN LA BAHIA DE PANAMA
MAREA DE CUADRATURA (PLEAMAR)

Alineación	New Island
Sitio	B2
Fecha	4/6/02

Coordenadas		*Viento	
Latitud N	*980877*	Velocidad (Kt)	5.5
Longitud E	*655029*	Dirección (º)	135

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
28	18	12.8	11:32:28	28.99	0.05	25.00
			11:33:28	29.00	0.07	32.40
			11:34:28	29.01	0.05	49.00
			11:35:28	29.01	0.06	35.10
		12.7	11:36:28	29.01	0.09	42.40
	14	12.7	11:38:44	29.02	0.06	77.70
			11:39:44	29.03	0.06	77.00
			11:40:44	29.02	0.07	48.40
			11:41:44	29.02	0.07	19.40
		12.7	11:42:44	29.01	0.06	42.60
	10*	12.7	11:44:44	29.25	0.06	214.70
			11:45:44	29.34	0.08	228.40
			11:46:44	29.18	0.05	280.00
			11:47:44	29.28	0.09	213.90
		12.6	11:48:44	29.33	0.09	230.70

TABLA 4-B1.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LA CORRIENTES EN LA BAHIA DE PANAMA
MAREA DE CUADRATURA (PLEAMAR)

Alineación	New Island
Sitio	B1
Fecha	4/6/02

Coordenadas		*Viento	
Latitud N	*982350*	Velocidad (Kt)	4
Longitud E	*654657*	Dirección (º)	125

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
12	6*	12.4	12:02:14	29.56	0.07	248.50
			12:03:14	29.52	0.11	230.90
			12:04:14	29.52	0.05	347.40
			12:05:14	29.50	0.05	333.90
		12.3	12:06:14	29.52	0.10	230.40

TABLA 4-B1.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LA CORRIENTES EN LA BAHIA DE PANAMA
MAREA DE CUADRATURA (MAREA MEDIA BAJANDO)

Alineación	New Island
Sitio	B1
Fecha	4/6/02

Coordenadas		*Viento	
Latitud N	*982350*	Velocidad (Kt)	7
Longitud E	*654657*	Dirección (º)	180

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
11.7	6*	11.3	12:51:54	29.62	0.08	238.50
			12:52:54	29.64	0.13	261.70
			12:53:54	29.67	0.03	184.20
			12:54:54	29.61	0.15	98.40
		11.2	12:55:54	29.70	0.12	269.20

TABLA 4-B2.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LA CORRIENTES EN LA BAHIA DE PANAMA
MAREA DE CUADRATURA (MAREA MEDIA BAJANDO)

Alineación	New Island
Sitio	B2
Fecha	4/6/02

Coordenadas		*Viento	
Latitud N	*980877*	Velocidad (Kt)	12
Longitud E	*655029*	Dirección (º)	235

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
26	16	10.8	13:09:24	29.06	0.06	187.30
			13:10:24	29.06	0.11	133.90
			13:11:24	29.05	0.09	106.20
			13:12:24	29.06	0.09	217.80
		10.7	13:13:24	29.05	0.06	159.50
	13	10.6	13:15:34	29.10	0.11	245.60
			13:16:34	29.09	0.18	100.30
			13:17:34	29.09	0.09	224.20
			13:18:34	29.11	0.07	150.60
		10.5	13:19:34	29.11	0.08	224.60
	10*	10.5	13:21:44	29.28	0.10	241.10
			13:22:44	29.48	0.09	220.90
			13:23:44	29.29	0.08	136.00
			13:24:44	29.27	0.09	217.50
		10.3	13:25:44	29.22	0.25	102.60

TABLA 4-B3.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LA CORRIENTES EN LA BAHIA DE PANAMA
MAREA DE CUADRATURA (MAREA MEDIA BAJANDO)

Alineación	New Island
Sitio	B3
Fecha	4/6/02

Coordenadas		*Viento	
Latitud N	*979742*	Velocidad (Kt)	14.5
Longitud E	*655400*	Dirección (º)	220

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
34	24	9.9	13:40:03	28.95	0.14	123.30
			13:41:03	28.95	0.11	189.00
			13:42:03	28.95	0.15	129.80
			13:43:03	28.96	0.09	185.90
		9.7	13:44:03	28.96	0.14	138.90
	17	9.7	13:46:04	29.07	0.17	114.60
			13:47:04	29.08	0.11	182.10
			13:48:04	29.06	0.10	157.60
			13:49:04	29.09	0.22	118.20
		9.5	13:50:04	29.11	0.11	213.20
	10*	9.4	13:52:39	29.31	0.12	163.50
			13:53:39	29.22	0.09	163.90
			13:54:39	29.22	0.06	219.10
			13:55:39	29.28	0.14	247.50
		9.3	13:56:39	29.26	0.13	147.30

TABLA 4-B4.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LA CORRIENTES EN LA BAHIA DE PANAMA
MAREA DE CUADRATURA (MAREA MEDIA BAJANDO)

Alineación	New Island
Sitio	B4
Fecha	4/6/02

Coordenadas		*Viento	
Latitud N	*978361*	Velocidad (Kt)	14
Longitud E	*655772*	Dirección (º)	210

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
44	34	8.3	14:23:54	28.65	0.11	159.30
			14:24:54	28.64	0.15	173.00
			14:25:54	28.66	0.11	157.80
			14:26:54	28.64	0.18	126.20
		8.2	14:27:54	28.63	0.10	170.10
	22	8.1	14:30:24	28.89	0.19	122.60
			14:31:24	28.93	0.15	219.70
			14:32:24	28.92	0.20	133.80
			14:33:24	28.91	0.16	158.50
		8.0	14:34:24	28.89	0.10	184.40
	10*	7.8	14:38:04	29.41	0.15	311.70
			14:39:04	29.48	0.11	311.80
			14:40:04	29.44	0.12	63.00
			14:41:04	29.49	0.17	303.80
		7.7	14:42:04	29.48	0.10	16.40

TABLA 4-B5.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LA CORRIENTES EN LA BAHIA DE PANAMA
MAREA DE CUADRATURA (MAREA MEDIA BAJANDO)

Alineación	New Island
Sitio	B5
Fecha	4/6/02

Coordenadas		*Viento	
Latitud N	*975602*	Velocidad (Kt)	12
Longitud E	*657310*	Dirección (°)	240

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (°C)	Velocidad (m/s)	Dirección (°)
52	42	6.9	15:06:14	28.38	0.23	121.80
			15:07:14	28.38	0.13	202.60
			15:08:14	28.38	0.10	165.50
			15:09:14	28.38	0.16	137.90
		6.7	15:10:14	28.38	0.25	120.00
	26	6.7	15:12:34	28.79	0.10	146.70
			15:13:34	28.80	0.19	120.60
			15:14:34	28.79	0.11	155.50
			15:15:34	28.79	0.19	120.20
		6.5	15:16:34	28.79	0.09	173.80
	10*	6.5	15:19:09	29.35	0.16	51.90
			15:20:09	29.33	0.13	339.00
			15:21:09	29.27	0.12	43.50
			15:22:09	29.32	0.16	348.70
		6.3	15:23:09	29.28	0.15	42.40

TABLA 4-B5.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LA CORRIENTES EN LA BAHIA DE PANAMA
MAREA DE CUADRATURA (BAJAMAR)

Alineación	New Island
Sitio	B5
Fecha	4/6/02

Coordenadas		*Viento	
Latitud N	*975602*	Velocidad (Kt)	10.5
Longitud E	*657310*	Dirección (°)	165

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (°C)	Velocidad (m/s)	Dirección (°)
50	40	5.4	15:59:34	28.49	0.24	126.40
			16:00:34	28.49	0.18	145.40
			16:01:34	28.50	0.09	176.10
			16:02:34	28.49	0.12	136.30
		5.3	16:03:34	28.49	0.18	109.20
	25	5.2	16:05:49	28.76	0.18	141.90
			16:06:49	28.76	0.17	129.60
			16:07:49	28.77	0.20	136.10
			16:08:49	28.78	0.13	163.80
		5.2	16:09:49	28.78	0.11	154.40
	10*	5.1	16:12:39	29.30	0.17	15.10
			16:13:39	29.28	0.20	20.90
			16:14:39	29.26	0.19	38.70
			16:15:39	29.25	0.22	52.30
		5.0	16:16:39	29.27	0.17	21.70

TABLA 4-B4.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LA CORRIENTES EN LA BAHIA DE PANAMA
MAREA DE CUADRATURA (BAJAMAR)

Alineación	New Island
Sitio	B4
Fecha	4/6/02

Coordenadas		*Viento	
Latitud N	*978361*	Velocidad (Kt)	14.5
Longitud E	*655772*	Dirección (°)	210

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (°C)	Velocidad (m/s)	Dirección (°)
38	28	4.7	16:40:43	28.87	0.16	142.50
			16:41:43	28.87	0.19	219.70
			16:42:43	28.88	0.12	152.70
			16:43:43	28.87	0.10	177.60
		4.7	16:44:43	28.87	0.10	141.80
	19	4.7	16:46:49	29.20	0.03	77.20
			16:47:49	29.22	0.21	111.70
			16:48:49	29.21	0.02	123.60
			16:49:49	29.22	0.04	324.40
		4.6	16:50:49	29.21	0.10	108.10
	10*	4.6	16:53:04	29.31	0.18	58.10
			16:54:04	29.31	0.21	53.70
			16:55:04	29.31	0.18	353.10
			16:56:04	29.32	0.25	54.80
		4.6	16:57:04	29.32	0.23	30.50

TABLA 4-B3.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LA CORRIENTES EN LA BAHIA DE PANAMA
MAREA DE CUADRATURA (BAJAMAR)

Alineación	New Island
Sitio	B3
Fecha	4/6/02

Coordenadas		*Viento	
Latitud N	*979742*	Velocidad (Kt)	14
Longitud E	*655400*	Dirección (°)	180

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (°C)	Velocidad (m/s)	Dirección (°)
30	20	4.6	17:11:54	29.40	0.08	13.70
			17:12:54	29.40	0.10	337.60
			17:13:54	29.40	0.18	65.70
			17:14:54	29.41	0.09	22.70
		4.6	17:15:54	29.39	0.16	72.70
	15	4.6	17:17:49	29.43	0.16	69.30
			17:18:49	29.43	0.12	55.90
			17:19:49	29.43	0.14	350.40
			17:20:49	29.44	0.12	53.60
		4.6	17:21:49	29.48	0.15	69.00
	10*	4.6	17:24:49	29.49	0.15	74.30
			17:25:49	29.50	0.15	111.90
			17:26:49	29.50	0.14	100.40
			17:27:49	29.50	0.13	77.80
		4.6	17:28:49	29.48	0.12	73.90

TABLA 4-B2.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LA CORRIENTES EN LA BAHIA DE PANAMA
MAREA DE CUADRATURA (BAJAMAR)

Alineación	New Island
Sitio	B2
Fecha	4/6/02

Coordenadas		*Viento	
Latitud N	*980877*	Velocidad (Kt)	13.5
Longitud E	*655029*	Dirección (º)	180

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
20	10*	4.9	17:50:59	29.66	0.18	49.90
			17:51:59	29.66	0.17	0.60
			17:52:59	29.67	0.22	82.00
			17:53:59	29.66	0.22	53.40
		4.9	17:54:59	29.65	0.22	69.70

TABLA 4-B1.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LA CORRIENTES EN LA BAHIA DE PANAMA
MAREA DE CUADRATURA (BAJAMAR)

Alineación	New Island
Sitio	B1
Fecha	4/6/02

Coordenadas		*Viento	
Latitud N	*982350*	Velocidad (Kt)	12
Longitud E	*654657*	Dirección (º)	210

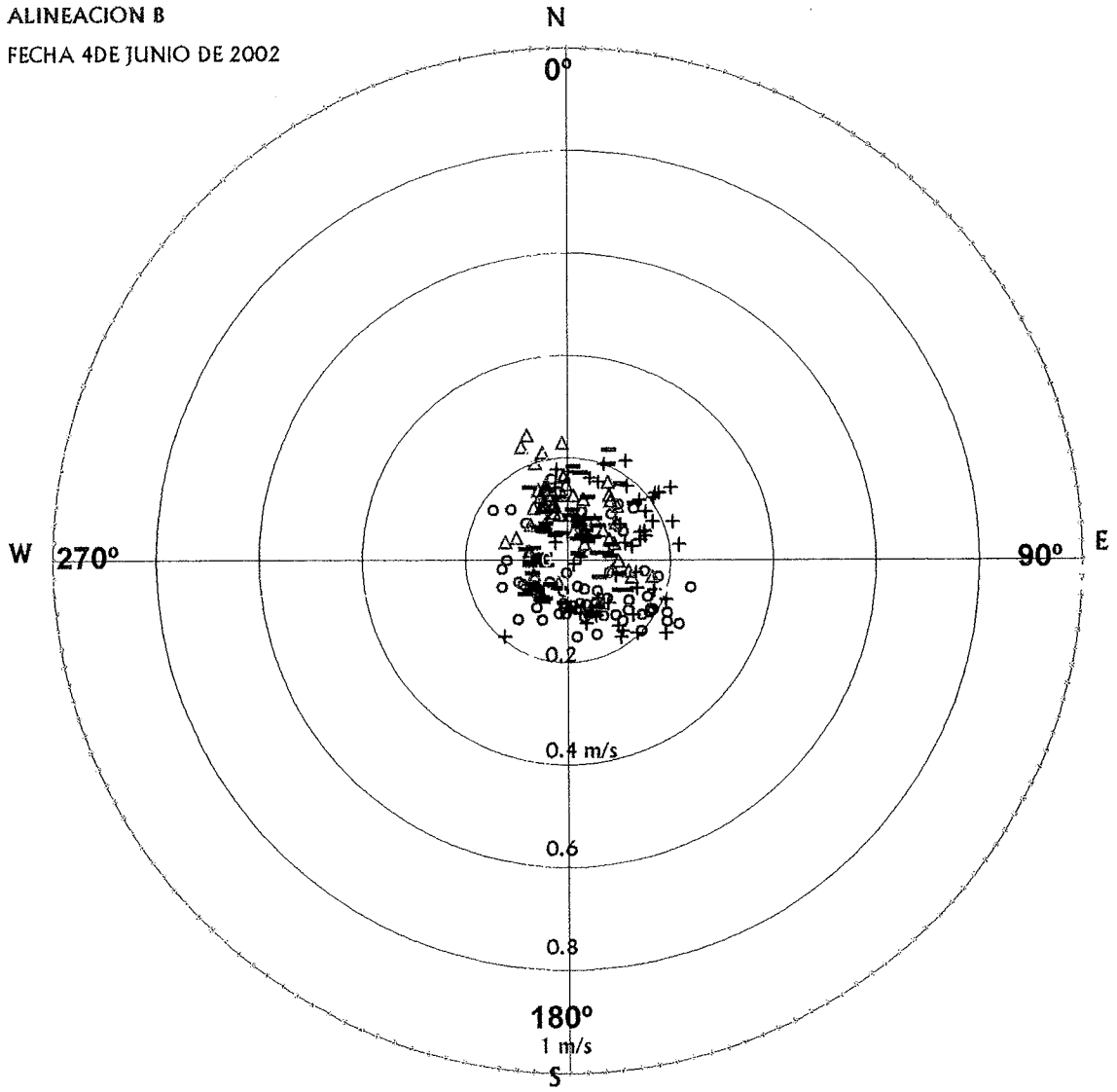
Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
8.8	5*	5.2	18:09:24	29.66	0.14	20.70
			18:10:24	29.66	0.18	357.60
			18:11:24	29.66	0.11	58.40
			18:12:24	29.66	0.12	340.40
		5.3	18:13:24	29.66	0.10	354.00

** Medición realizada aproximadamente 1000 pies de coordenadas de B1(en B1 no había profundidad de calado).

VELOCIDAD Y DIRECCION DE LAS CORRIENTES MARINAS EN LA BAHÍA DE PANAMÁ SEGÚN CONDICION DE MAREA

ALINEACION B

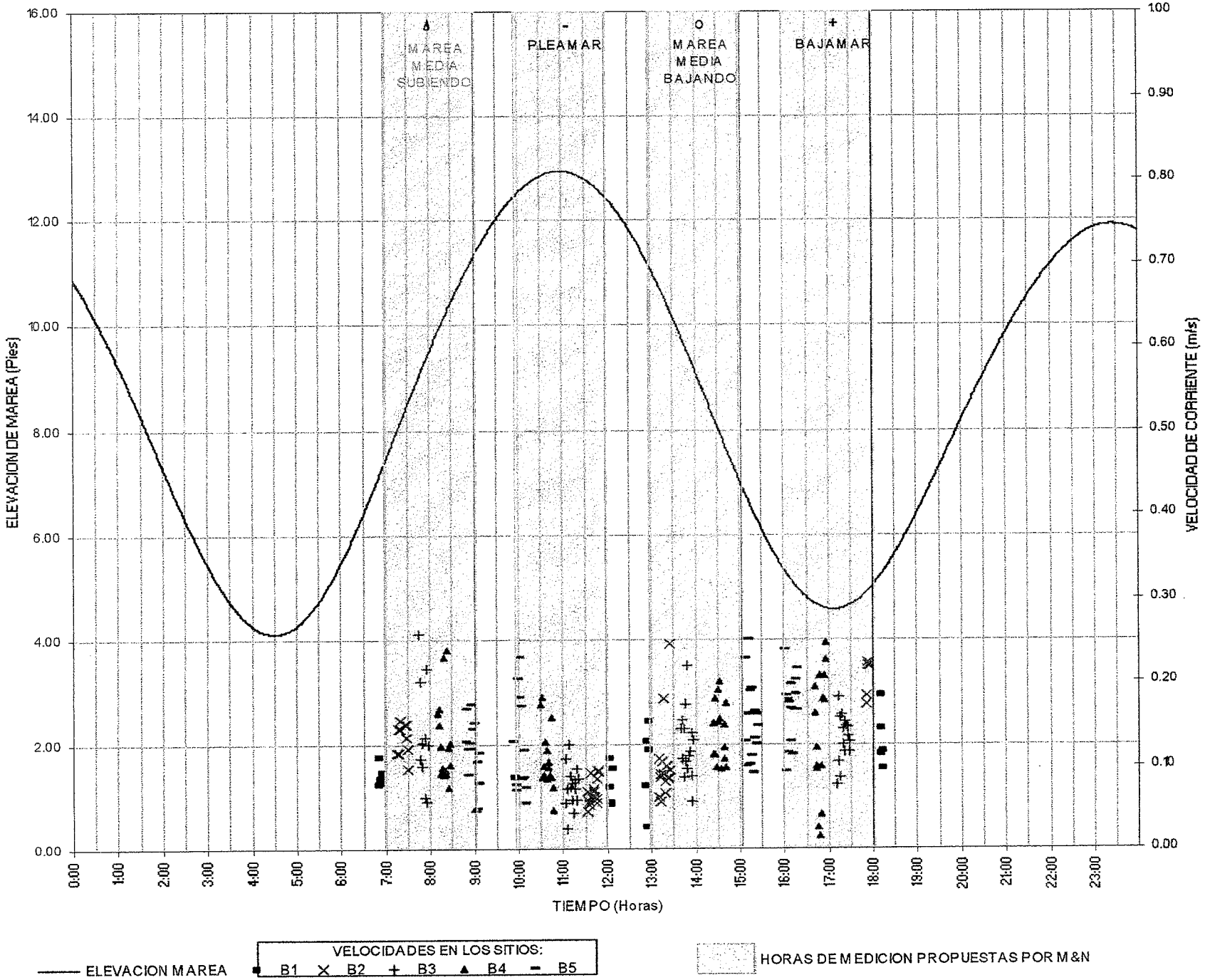
FECHA 4DE JUNIO DE 2002



- ○ Marea media bajando
- + Bajamar
- △ Marea media subiendo
- – Pleamar

Unidad de Operaciones-ACP

VELOCIDAD DE CORRIENTES MARINAS EN LA BAHIA DE PANAMA SEGUN HORA, CONDICION DE MAREA Y SITIOS DE MEDICION (B1, B2, B3, B4 Y B5) DE ALINEACION B (NEWISLAND). MEDICION DE CORRIENTES #9-4 DE JUNIO DE 2002



Mediciones durante Marea de Cuadratura

Viernes, 7 de junio de 2002 -

Toma de datos en alineación C.
Tiempo de Medición:
Bajamar: 6:15 - 8:15
Marea Media Subiendo: 9:15 - 11:15
Pleamar: 12:26 - 14:26
Marea Media Bajando: 15:30 - 17:30

TABLA 7-C3.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LA CORRIENTES EN LA BAHIA DE PANAMA
MAREA DE CUADRATURA (BAJAMAR)

Alineación	Punta Chame
Sitio	C3
Fecha	7/6/02

Coordenadas		*Viento	
Latitud N	*962880*	Velocidad (Kt)	4
Longitud E	*656197*	Dirección (º)	30

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
75	65	4.0	7:11:24	27.01	0.10	90.10
			7:12:24	27.11	0.10	139.70
			7:13:24	27.06	0.09	140.10
			7:14:24	26.97	0.07	100.20
		4.0	7:15:24	26.94	0.10	81.10
	37.5	4.0	7:18:48	28.13	0.08	209.70
			7:19:48	28.14	0.07	225.30
			7:20:48	28.13	0.08	197.60
			7:21:48	28.13	0.11	249.40
		4.0	7:22:48	28.14	0.09	259.40
	10*	4.0	7:26:44	28.17	0.10	186.40
			7:27:44	28.17	0.08	195.20
			7:28:44	28.17	0.09	220.70
			7:29:44	28.17	0.09	217.40
		4.0	7:30:44	28.16	0.10	214.90

TABLA 7-C2.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LA CORRIENTES EN LA BAHIA DE PANAMA
MAREA DE CUADRATURA (BAJAMAR)

Alineación	Punta Chame
Sitio	C2
Fecha	7/6/02

Coordenadas		*Viento	
Latitud N	*957343*	Velocidad (Kt)	5
Longitud E	*654017*	Dirección (º)	35

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
73	63	4.4	8:04:49	26.92	0.19	27.70
			8:05:49	26.93	0.18	28.30
			8:06:49	26.94	0.14	32.70
			8:07:49	26.96	0.16	32.40
		4.5	8:08:49	26.96	0.16	32.80
	36.5	4.5	8:12:14	28.11	0.10	317.80
			8:13:14	28.11	0.09	328.10
			8:14:14	28.11	0.09	324.70
			8:15:14	28.11	0.11	339.40
		4.6	8:16:14	28.11	0.11	337.40
	10*	4.7	8:19:19	28.17	0.11	346.00
			8:20:19	28.18	0.14	10.30
			8:21:19	28.18	0.14	354.20
			8:22:19	28.18	0.13	351.10
		4.8	8:23:19	28.18	0.08	351.50

TABLA 7-C1.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LA CORRIENTES EN LA BAHIA DE PANAMA
MAREA DE CUADRATURA (MAREA MEDIA SUBIENDO)

Alineación	Punta Chame
Sitio	C1
Fecha	7/6/02

Coordenadas		*Viento	
Latitud N	*954005*	Velocidad (Kt)	4
Longitud E	*648526*	Dirección (º)	5

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
77	67	6.3	9:14:34	26.79	0.27	11.00
			9:15:34	26.79	0.23	14.50
			9:16:34	26.82	0.23	14.90
			9:17:34	26.85	0.29	13.80
		6.5	9:18:34	26.81	0.23	14.10
	38.5	6.6	9:21:04	27.98	0.28	330.20
			9:22:04	28.00	0.29	325.20
			9:23:04	28.00	0.21	322.80
			9:24:04	28.01	0.26	335.80
		6.8	9:25:04	28.03	0.25	327.80
	10*	6.8	9:27:34	28.09	0.14	321.00
			9:28:34	28.09	0.13	311.70
			9:29:34	28.09	0.15	329.30
			9:30:34	28.09	0.10	312.00
		7.0	9:31:34	28.09	0.13	315.00

TABLA 7-C2.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LA CORRIENTES EN LA BAHIA DE PANAMA
MAREA DE CUADRATURA (MAREA MEDIA SUBIENDO)

Alineación	Punta Chame
Sitio	C2
Fecha	7/6/02

Coordenadas		*Viento	
Latitud N	*957343*	Velocidad (Kt)	2
Longitud E	*654017*	Dirección (º)	175

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
77	67	8.5	10:09:49	27.57	0.12	145.20
			10:10:49	27.60	0.10	187.70
			10:11:49	27.63	0.11	274.20
			10:12:49	27.63	0.11	299.60
		8.7	10:13:49	27.64	0.12	310.20
	38.5	8.8	10:16:54	28.19	0.19	353.50
			10:17:54	28.18	0.20	354.20
			10:18:54	28.18	0.21	358.60
			10:19:54	28.18	0.20	348.50
		9.0	10:20:54	28.18	0.21	349.00
	10*	9.2	10:23:34	28.20	0.27	340.90
			10:24:34	28.20	0.27	345.50
			10:25:34	28.19	0.28	346.40
			10:26:34	28.18	0.28	347.70
		9.3	10:27:34	28.17	0.27	351.10

TABLA 7-C3.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LA CORRIENTES EN LA BAHIA DE PANAMA
MAREA DE CUADRATURA (MAREA MEDIA SUBIENDO)

Alineación	Punta Chame
Sitio	C3
Fecha	7/6/02

Coordenadas		*Viento	
Latitud N	*962880*	Velocidad (Kt)	7
Longitud E	*656197*	Dirección (º)	160

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
80	70	10.7	11:03:04	26.77	0.27	105.80
			11:04:04	26.77	0.26	107.60
			11:05:04	26.78	0.21	127.70
			11:06:04	26.78	0.06	283.10
		10.8	11:07:04	26.78	0.10	354.60
	40	11.0	11:10:14	28.15	0.13	317.80
			11:11:14	28.15	0.14	5.90
			11:12:14	28.15	0.14	349.60
			11:13:14	28.15	0.12	323.10
		11.1	11:14:14	28.15	0.15	353.10
	10*	11.3	11:17:04	28.30	0.15	326.30
			11:18:04	28.30	0.13	346.40
			11:19:04	28.28	0.16	8.50
			11:20:04	28.27	0.12	326.90
		11.4	11:21:04	28.27	0.12	344.40

TABLA 7-C3.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LA CORRIENTES EN LA BAHIA DE PANAMA
MAREA DE CUADRATURA (PLEAMAR)

Alineación	Punta Chame
Sitio	C3
Fecha	7/6/02

Coordenadas		*Viento	
Latitud N	*962880*	Velocidad (Kt)	8
Longitud E	*656197*	Dirección (º)	183

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
83	73	12.9	12:08:29	27.06	0.21	56.80
			12:09:29	27.05	0.11	37.60
			12:10:29	27.08	0.11	29.00
			12:11:29	27.05	0.10	38.70
		12.9	12:12:29	27.09	0.09	26.50
	41.5	13.1	12:15:54	28.18	0.12	351.30
			12:16:54	28.18	0.11	20.60
			12:17:54	28.18	0.11	347.80
			12:18:54	28.18	0.17	48.50
		13.1	12:19:54	28.18	0.15	291.20
	10*	13.2	12:22:49	28.65	0.07	299.90
			12:23:49	28.61	0.06	36.70
			12:24:49	28.62	0.18	262.50
			12:25:49	28.75	0.07	289.00
		13.3	12:26:49	28.61	0.06	274.40

TABLA 7-C2.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LA CORRIENTES EN LA BAHIA DE PANAMA
MAREA DE CUADRATURA (PLEAMAR)

Alineación	Punta Chame
Sitio	C2
Fecha	7/6/02

Coordenadas		*Viento	
Latitud N	*957343*	Velocidad (Kt)	7
Longitud E	*654017*	Dirección (º)	182

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
82	72	13.8	13:02:48	27.54	0.09	286.50
			13:03:48	27.52	0.10	280.00
			13:04:48	27.52	0.05	328.90
			13:05:48	27.50	0.05	346.60
		13.9	13:06:48	27.52	0.09	308.70
	41	13.9	13:10:09	28.06	0.11	242.80
			13:11:09	28.06	0.14	122.30
			13:12:09	28.06	0.06	241.20
			13:13:09	28.06	0.10	261.90
		13.9	13:14:09	28.07	0.09	252.10
	10*	14.0	13:16:59	28.23	0.13	277.80
			13:17:59	28.24	0.08	272.10
			13:18:59	28.24	0.11	265.40
			13:19:59	28.25	0.06	241.60
		14.0	13:20:59	28.25	0.09	257.60

TABLA 7-C1.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LA CORRIENTES EN LA BAHIA DE PANAMA
MAREA DE CUADRATURA (PLEAMAR)

Alineación	Punta Chame
Sitio	C1
Fecha	7/6/02

Coordenadas		*Viento	
Latitud N	*954005*	Velocidad (Kt)	6
Longitud E	*648526*	Dirección (º)	210

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
84	74	13.8	13:56:44	26.74	0.21	190.40
			13:57:44	26.74	0.22	184.70
			13:58:44	26.74	0.25	171.70
			13:59:44	26.74	0.25	188.70
		13.8	14:00:44	26.74	0.23	197.00
	42	13.8	14:03:39	28.14	0.09	239.60
			14:04:39	28.14	0.12	240.80
			14:05:39	28.14	0.11	204.90
			14:06:39	28.14	0.12	169.30
		13.7	14:07:39	28.14	0.13	172.10
	10*	13.7	14:10:39	28.54	0.15	220.90
			14:11:39	28.54	0.13	185.20
			14:12:39	28.55	0.13	195.80
			14:13:39	28.57	0.16	224.30
		13.6	14:14:39	28.59	0.16	217.70

TABLA 7-C1.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LA CORRIENTES EN LA BAHIA DE PANAMA
MAREA DE CUADRATURA (MAREA MEDIA BAJANDO)

Alineación	Punta Chame
Sitio	C1
Fecha	7/6/02

Coordenadas		*Viento	
Latitud N	*954005*	Velocidad (Kt)	3.5
Longitud E	*648526*	Dirección (º)	245

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
82	72	12.1	15:14:44	26.85	0.21	177.20
			15:15:44	26.84	0.25	175.50
			15:16:44	26.83	0.25	173.40
			15:17:44	26.85	0.28	171.20
		12.0	15:18:44	26.88	0.28	166.30
	41	11.9	15:21:49	27.97	0.25	161.80
			15:22:49	27.95	0.29	167.10
			15:23:49	27.93	0.31	167.20
			15:24:49	27.93	0.31	170.20
		11.8	15:25:49	27.95	0.32	167.10
	10*	11.7	15:28:39	28.39	0.32	178.30
			15:29:39	28.36	0.32	172.10
			15:30:39	28.39	0.33	175.50
			15:31:39	28.39	0.32	181.80
		11.6	15:32:39	28.37	0.34	182.50

TABLA 7-C2.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LA CORRIENTES EN LA BAHIA DE PANAMA
MAREA DE CUADRATURA (MAREA MEDIA BAJANDO)

Alineación	Punta Chame
Sitio	C2
Fecha	7/6/02

Coordenadas		*Viento	
Latitud N	*957343*	Velocidad (Kt)	1
Longitud E	*962880*	Dirección (º)	169

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
79	69	10.0	16:11:09	27.27	0.12	159.30
			16:12:09	27.27	0.13	151.20
			16:13:09	27.26	0.15	146.20
			16:14:09	27.27	0.14	147.90
		9.9	16:15:09	27.24	0.13	143.10
	39.5	9.7	16:18:19	28.16	0.20	178.80
			16:19:19	28.16	0.17	174.60
			16:20:19	28.16	0.15	185.10
			16:21:19	28.16	0.24	187.80
		9.6	16:22:19	28.16	0.29	183.70
	10*	9.5	16:24:59	28.43	0.26	194.00
			16:25:59	28.30	0.24	195.10
			16:26:59	28.28	0.24	194.50
			16:27:59	28.29	0.24	193.90
		9.3	16:28:59	28.29	0.22	187.80

TABLA 7-C3.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LA CORRIENTES EN LA BAHIA DE PANAMA

MAREA DE CUADRATURA (MAREA MEDIA BAJANDO)

Alineación	Punta Chame
Sitio	C3
Fecha	7/6/02

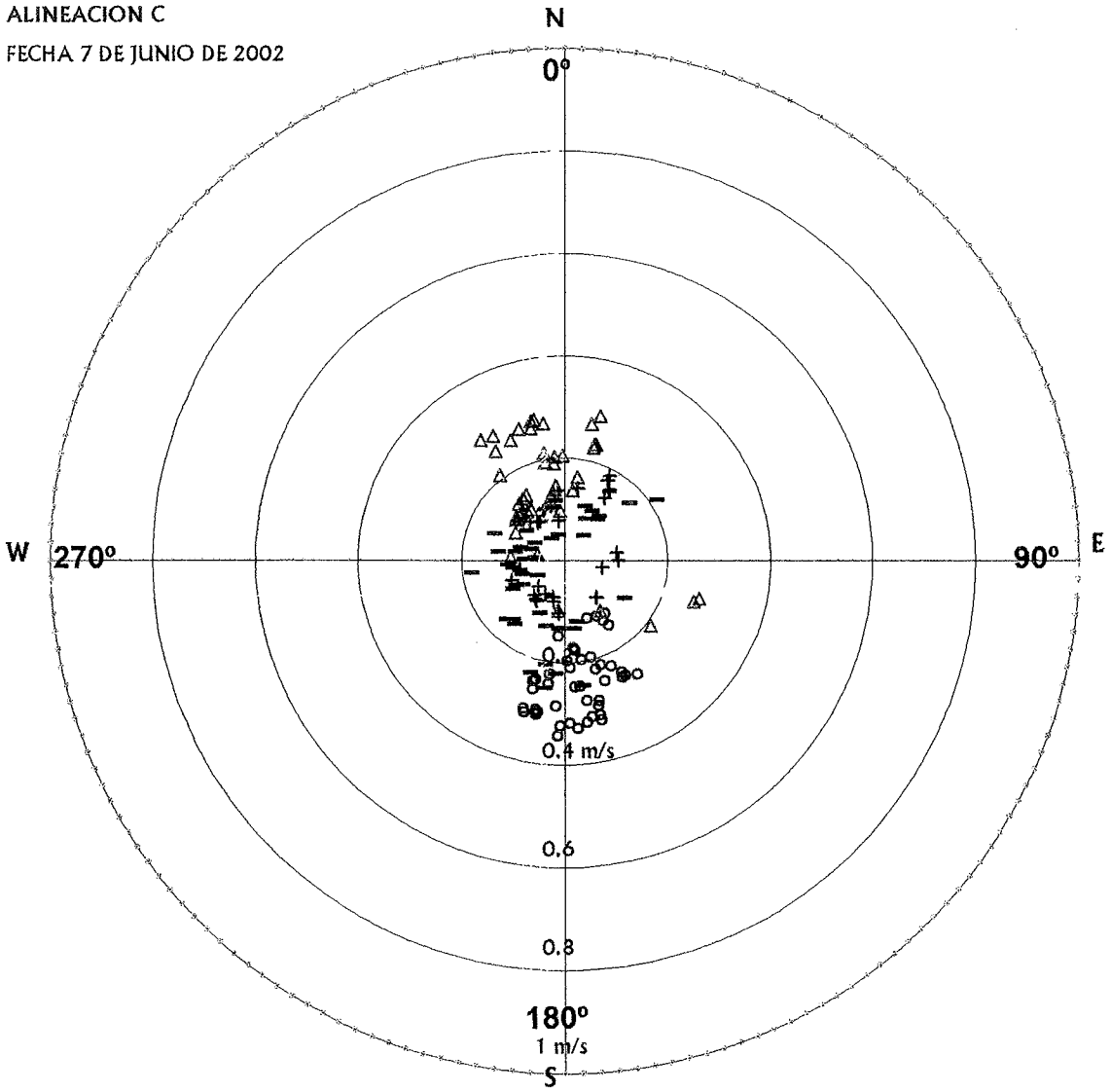
Coordenadas		*Viento	
Latitud N	*962880*	Velocidad (Kt)	2
Longitud E	*656197*	Dirección (º)	140

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
78	68	7.7	17:05:39	27.57	0.26	147.60
			17:06:39	27.57	0.24	153.30
			17:07:39	27.57	0.25	152.40
			17:08:39	27.56	0.25	154.00
		7.5	17:09:39	27.53	0.23	156.40
	39	7.4	17:12:29	28.13	0.22	161.20
			17:13:29	28.14	0.20	165.20
			17:14:29	28.13	0.22	164.30
			17:15:29	28.14	0.20	170.90
		7.2	17:16:29	28.16	0.18	173.60
	10*	7.1	17:19:14	28.84	0.30	195.70
			17:20:14	28.84	0.31	195.10
			17:21:14	28.85	0.31	190.60
			17:22:14	28.83	0.30	191.10
		6.9	17:23:14	28.84	0.30	190.20

VELOCIDAD Y DIRECCION DE LAS CORRIENTES MARINAS EN LA BAHÍA DE PANAMÁ SEGÚN CONDICION DE MAREA

ALINEACION C

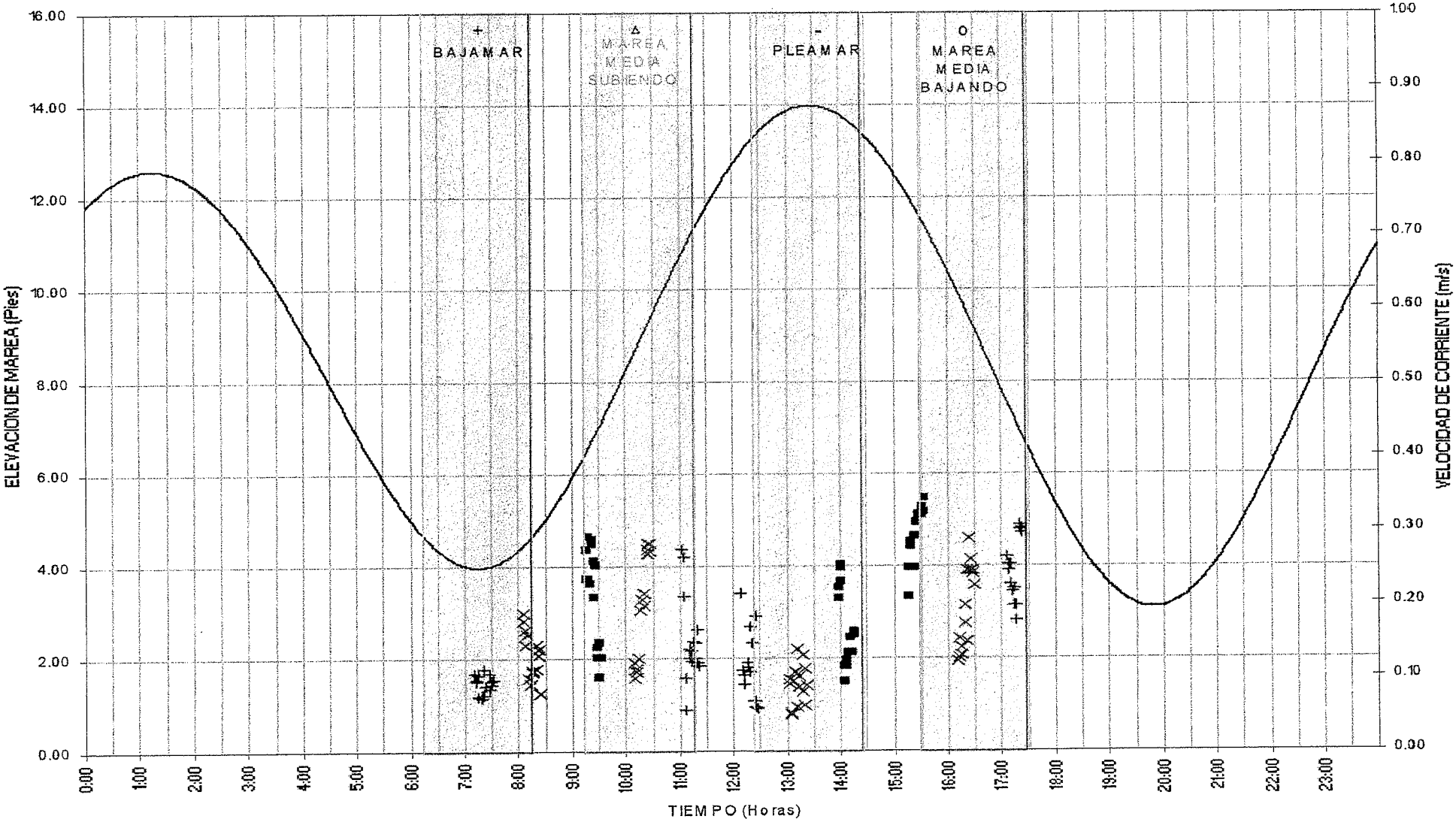
FECHA 7 DE JUNIO DE 2002



- ○ Marea media bajando
- + Bajamar
- △ Marea media subiendo
- – Pleamar

Unidad de Operaciones-ACP

VELOCIDAD DE CORRIENTES MARINAS EN LA BAHIA DE PANAMA SEGUN HORA, CONDICION DE MAREA Y SITIOS DE MEDICION (C1, C2 Y C3) DE ALINEACION C (PUNTA CHAME). MEDICION DE CORRIENTES # 10-7 DE JUNIO DE 2002



ELEVACION MAREA

VELOCIDADES EN LOS SITIOS: C1 × C2 + C3

HORAS DE MEDICION PROPUESTAS POR M&N

Mediciones durante Marea de Sicigia

Domingo, 23 de junio de 2002 -1 día antes de Luna Llena

Toma de datos en alineación A.

Tiempo de Medición:

Bajamar: 7:22 - 9:22

Marea Media Subiendo: 10:30 - 12:30

Pleamar: 13:30 - 15:30

Marea Media Bajando: 16:30 - 18:30

TABLA 23-A2.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (BAJAMAR)

Alineación	Pacora
Sitio	A2
Fecha	23/6/2002

Coordenadas		*Viento	
Latitud N	*989567*	Velocidad (Kt)	4
Longitud E	*690186*	Dirección (º)	50

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
47	37	1.9	8:03:34	29.08	0.09	283.80
			8:04:34	29.09	0.13	294.10
			8:05:34	29.09	0.09	281.10
			8:06:34	29.08	0.05	233.90
		1.9	8:07:34	29.09	0.12	305.40
	23.5	1.9	8:09:39	29.35	0.11	202.20
			8:10:39	29.34	0.11	221.80
			8:11:39	29.34	0.17	297.70
			8:12:39	29.34	0.14	275.30
		1.8	8:13:39	29.34	0.11	225.10
	10*	1.8	8:16:19	29.25	0.19	300.80
			8:17:19	29.26	0.10	250.30
			8:18:19	29.26	0.10	217.40
			8:19:19	29.25	0.10	243.40
		1.8	8:20:19	29.25	0.12	292.70

TABLA 23-A3.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (BAJAMAR)

Alineación	Pacora
Sitio	A3
Fecha	23/6/2002

Coordenadas		*Viento	
Latitud N	*985143*	Velocidad (Kt)	5
Longitud E	*690207*	Dirección (º)	7

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
80	70	2.0	8:48:28	28.52	0.07	240.90
			8:49:28	28.53	0.08	248.80
			8:50:28	28.53	0.06	240.30
			8:51:28	28.52	0.06	251.90
		2.1	8:52:28	28.53	0.07	249.20
	40	2.1	8:54:39	28.93	0.27	293.30
			8:55:39	28.93	0.29	295.50
			8:56:39	28.93	0.30	300.20
			8:57:39	28.93	0.28	296.70
		2.2	8:58:39	28.93	0.29	303.20
	10*	2.2	9:00:49	29.33	0.31	301.20
			9:01:49	29.34	0.33	304.40
			9:02:49	29.34	0.31	305.40
			9:03:49	29.35	0.32	305.70
		2.3	9:04:49	29.34	0.33	309.50

TABLA 23-A4.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (BAJAMAR)

Alineación	Pacora
Sitio	A4
Fecha	23/6/2002

Coordenadas		*Viento	
Latitud N	*979613*	Velocidad (Kt)	1
Longitud E	*690233*	Dirección (°)	335

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (°C)	Velocidad (m/s)	Dirección (°)
108	98	3.4	9:39:02	26.82	0.09	312.60
			9:40:02	26.83	0.08	316.50
			9:41:02	26.84	0.07	313.40
			9:42:02	26.84	0.09	316.90
		3.6	9:43:02	26.80	0.06	312.20
	54	3.7	9:45:42	28.38	0.24	310.90
			9:46:42	28.40	0.22	305.30
			9:47:42	28.43	0.23	309.20
			9:48:42	28.54	0.25	313.90
		3.8	9:49:42	28.53	0.26	313.20
	10*	4.0	9:52:02	29.39	0.35	299.80
			9:53:02	29.40	0.36	296.50
			9:54:02	29.40	0.37	303.30
			9:55:02	29.40	0.37	298.90
		4.2	9:56:02	29.40	0.37	301.00

TABLA 23-A4.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (MAREA MEDIA SUBIENDO)

Alineación	Pacora
Sitio	A4
Fecha	23/6/2002

Coordenadas		*Viento	
Latitud N	*979613*	Velocidad (Kt)	4
Longitud E	*690233*	Dirección (°)	10

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (°C)	Velocidad (m/s)	Dirección (°)
109	100	4.4	10:01:22	26.66	0.11	350.50
			10:02:22	26.67	0.12	351.60
			10:03:22	26.67	0.11	352.70
			10:04:22	26.68	0.13	350.10
		4.6	10:05:22	26.66	0.11	348.80
	54.5	4.8	10:08:07	28.44	0.29	313.40
			10:09:07	28.41	0.28	313.50
			10:10:07	28.37	0.28	311.70
			10:11:07	28.32	0.28	314.20
		5.0	10:12:07	28.47	0.30	314.80
	10*	5.1	10:15:12	29.39	0.44	295.00
			10:16:12	29.39	0.45	297.70
			10:17:12	29.39	0.45	301.50
			10:18:12	29.38	0.46	298.00
		5.3	10:19:12	29.39	0.45	300.70

TABLA 23-A3.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (MAREA MEDIA SUBIENDO)

Alineación	Pacora
Sitio	A3
Fecha	23/6/2002

Coordenadas		*Viento	
Latitud N	*985143*	Velocidad (Kt)	3
Longitud E	*690207*	Dirección (º)	30

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
85	75	7.1	10:49:12	27.79	0.30	100.20
			10:50:12	27.79	0.13	120.50
			10:51:12	27.79	0.07	96.80
			10:52:12	27.79	0.05	54.00
		7.3	10:53:12	27.79	0.10	21.90
	42.5	7.4	10:55:42	28.75	0.36	306.10
			10:56:42	28.75	0.35	306.70
			10:57:42	28.76	0.34	307.40
			10:58:42	28.76	0.36	309.70
		7.7	10:59:42	28.77	0.36	310.80
	10*	7.8	11:02:07	29.38	0.29	305.40
			11:03:07	29.38	0.30	310.50
			11:04:07	29.38	0.29	307.80
			11:05:07	29.39	0.28	306.90
		8.1	11:06:07	29.38	0.29	310.70

TABLA 23-A2.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (MAREA MEDIA SUBIENDO)

Alineación	Pacora
Sitio	A2
Fecha	23/6/2002

Coordenadas		*Viento	
Latitud N	*989567*	Velocidad (Kt)	0
Longitud E	*690186*	Dirección (º)	0

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
54	44	9.6	11:31:51	28.93	0.02	301.10
			11:32:51	28.92	0.09	301.00
			11:33:51	28.90	0.12	317.80
			11:34:51	28.90	0.13	317.30
		9.9	11:35:51	28.90	0.14	322.10
	27	10.1	11:38:12	29.16	0.29	326.00
			11:39:12	29.15	0.28	323.60
			11:40:12	29.14	0.24	315.50
			11:41:12	29.15	0.27	319.50
		10.3	11:42:12	29.15	0.26	323.90
	10*	10.4	11:44:17	29.31	0.23	317.80
			11:45:17	29.31	0.22	315.90
			11:46:17	29.33	0.21	311.30
			11:47:17	29.33	0.20	309.80
		10.7	11:48:17	29.32	0.21	316.20

TABLA 23-A1.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (MAREA MEDIA SUBIENDO)

Alineación	Pacora
Sitio	A1
Fecha	23/6/2002

Coordenadas		*Viento	
Latitud N	*995098*	Velocidad (Kt)	4
Longitud E	*690160*	Dirección (º)	39

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
13	6.5	12.2	12:15:52	29.71	0.15	22.60
			12:16:52	29.73	0.16	19.80
			12:17:52	29.74	0.19	25.80
			12:18:52	29.75	0.15	23.40
		12.4	12:19:52	29.75	0.17	25.90

TABLA 23-A1.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (MAREA MEDIA SUBIENDO)

Alineación	Pacora
Sitio	A1
Fecha	23/6/2002

Coordenadas		*Viento	
Latitud N	*995098*	Velocidad (Kt)	0
Longitud E	*690160*	Dirección (º)	0

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
13	6.5	12.7	12:24:27	29.75	0.13	37.60
			12:25:27	29.73	0.18	48.20
			12:26:27	29.69	0.21	34.10
			12:27:27	29.70	0.17	24.40
		12.9	12:28:27	29.70	0.16	24.80

TABLA 23-A2.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (MAREA MEDIA SUBIENDO)

Alineación	Pacora
Sitio	A2
Fecha	23/6/2002

Coordenadas		*Viento	
Latitud N	*989567*	Velocidad (Kt)	0
Longitud E	*690186*	Dirección (º)	0

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
59	49	14.4	13:00:52	28.93	0.19	308.30
			13:01:52	28.92	0.19	311.30
			13:02:52	28.92	0.11	299.20
			13:03:52	28.92	0.16	301.90
		14.5	13:04:52	28.92	0.18	305.80
	29.5	14.7	13:08:02	29.29	0.26	323.20
			13:09:02	29.29	0.23	323.50
			13:10:02	29.28	0.22	322.90
			13:11:02	29.29	0.21	320.80
		14.8	13:12:02	29.28	0.23	323.00
	10	14.9	13:14:02	29.36	0.17	304.20
			13:15:02	29.36	0.15	302.20
			13:16:02	29.36	0.16	304.20
			13:17:02	29.36	0.18	304.80
		15.0	13:18:02	29.36	0.17	304.70

TABLA 23-A3.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (PLEAMAR)

Alineación	Pacora
Sitio	A3
Fecha	23/6/2002

Coordenadas		*Viento	
Latitud N	*985143*	Velocidad (Kt)	1
Longitud E	*690207*	Dirección (º)	255

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
94	84	15.8	13:45:32	27.57	0.15	164.40
			13:46:32	27.57	0.16	170.30
			13:47:32	27.58	0.14	176.10
			13:48:32	27.60	0.12	206.40
		15.9	13:49:32	27.60	0.12	203.20
	47	15.9	13:53:12	28.60	0.20	271.00
			13:54:12	28.60	0.20	270.50
			13:55:12	28.61	0.19	275.60
			13:56:12	28.62	0.18	272.00
		16.0	13:57:12	28.61	0.19	265.40
	10*	16.1	14:00:27	29.66	0.22	274.60
			14:01:27	29.65	0.21	278.90
			14:02:27	29.65	0.21	269.80
			14:03:27	29.66	0.21	270.30
		16.1	14:04:27	29.66	0.20	274.60

TABLA 23-A4.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (PLEAMAR)

Alineación	Pacora
Sitio	A4
Fecha	23/6/2002

Coordenadas		*Viento	
Latitud N	*979613*	Velocidad (Kt)	5
Longitud E	*690233*	Dirección (º)	208

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
120	110	16.3	14:41:47	26.33	0.13	180.40
			14:42:47	26.32	0.11	184.10
			14:43:47	26.32	0.14	186.50
			14:44:47	26.32	0.13	185.60
		16.2	14:45:47	26.33	0.13	188.20
	60	16.2	14:49:12	28.33	0.17	259.10
			14:50:12	28.33	0.17	254.10
			14:51:12	28.33	0.18	251.50
			14:52:12	28.33	0.17	254.10
		16.2	14:53:12	28.33	0.17	253.60
	10*	16.1	14:55:37	29.32	0.52	283.40
			14:56:37	29.32	0.52	284.50
			14:57:37	29.33	0.52	279.70
			14:58:37	29.33	0.53	281.20
		16.1	14:59:37	29.33	0.52	286.40

TABLA 23-A4.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (PLEAMAR)

Alineación	Pacora
Sitio	A4
Fecha	23/6/2002

Coordenadas		*Viento	
Latitud N	*979613*	Velocidad (Kt)	7
Longitud E	*690233*	Dirección (º)	230

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
120	110	15.8	15:17:37	26.43	0.14	194.30
			15:18:37	26.43	0.14	198.00
			15:19:37	26.43	0.15	199.30
			15:20:37	26.43	0.13	201.10
		15.7	15:21:37	26.43	0.13	200.80
	60	15.6	15:24:12	28.28	0.18	246.80
			15:25:12	28.28	0.17	242.30
			15:26:12	28.28	0.19	244.00
			15:27:12	28.28	0.17	248.00
		15.5	15:28:12	28.28	0.16	246.30
	10*	15.4	15:30:57	29.42	0.52	277.40
			15:31:57	29.45	0.52	278.30
			15:32:57	29.44	0.50	276.40
			15:33:57	29.44	0.52	274.20
		15.3	15:34:57	29.44	0.51	274.00

TABLA 23-A3.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (MAREA MEDIA BAJANDO)

Alineación	Pacora
Sitio	A3
Fecha	23/6/2002

Coordenadas		*Viento	
Latitud N	*985143*	Velocidad (Kt)	13
Longitud E	*690207*	Dirección (º)	265

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
91	81	14.2	16:07:02	27.73	0.35	218.30
			16:08:02	27.70	0.36	212.90
			16:09:02	27.74	0.38	215.10
			16:10:02	27.80	0.44	219.70
		14.0	16:11:02	27.79	0.43	216.40
	45.5	13.9	16:14:37	28.98	0.42	239.10
			16:15:37	28.98	0.39	236.10
			16:16:37	28.99	0.43	238.60
			16:17:37	28.98	0.42	240.70
		13.7	16:18:37	28.99	0.42	241.70
	10*	13.5	16:21:37	29.69	0.50	249.90
			16:22:37	29.68	0.55	251.70
			16:23:37	29.68	0.52	250.30
			16:24:37	29.64	0.49	250.00
		13.3	16:25:37	29.65	0.49	250.50

TABLA 23-A2.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (MAREA MEDIA BAJANDO)

Alineación	Pacora
Sitio	A2
Fecha	23/6/2002

Coordenadas		*Viento	
Latitud N	*989567*	Velocidad (Kt)	11.5
Longitud E	*690186*	Dirección (º)	276

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
56	46	12.1	16:49:57	28.87	0.11	272.40
			16:50:57	28.88	0.18	257.90
			16:51:57	28.88	0.27	241.10
			16:52:57	28.88	0.19	247.50
		11.9	16:53:57	28.88	0.12	266.50
	28	11.7	16:56:42	28.95	0.11	265.90
			16:57:42	28.94	0.18	244.40
			16:58:42	28.94	0.18	248.70
			16:59:42	28.93	0.26	237.00
		11.5	17:00:42	28.94	0.20	244.50
	10*	11.4	17:02:47	29.49	0.32	220.40
			17:03:47	29.52	0.14	204.90
			17:04:47	29.49	0.16	210.30
			17:05:47	29.51	0.19	215.00
		11.2	17:06:47	29.45	0.23	214.50

TABLA 23-A1.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (MAREA MEDIA BAJANDO)

Alineación	Pacora
Sitio	A1
Fecha	23/6/2002

Coordenadas		*Viento	
Latitud N	*995098*	Velocidad (Kt)	S/D
Longitud E	*690160*	Dirección (°)	S/D

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (°C)	Velocidad (m/s)	Dirección (°)
10	5	9.4	17:36:07	30.08	0.20	147.20
			17:37:07	30.08	0.20	189.30
			17:38:07	30.08	0.20	166.30
			17:39:07	30.09	0.22	172.70
		9.1	17:40:07	30.10	0.20	142.60

TABLA 23-A1.5

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (MAREA MEDIA BAJANDO)

Alineación	Pacora
Sitio	A1
Fecha	23/6/2002

Coordenadas		*Viento	
Latitud N	*995098*	Velocidad (Kt)	S/D
Longitud E	*690160*	Dirección (°)	S/D

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (°C)	Velocidad (m/s)	Dirección (°)
9	4.5	8.7	17:46:32	30.11	0.12	185.60
			17:47:32	30.21	0.19	155.80
			17:48:32	30.18	0.20	169.30
			17:49:32	30.20	0.21	173.30
		8.5	17:50:32	30.26	0.19	162.00

TABLA 23-A2.5

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (MAREA MEDIA BAJANDO)

Alineación	Pacora
Sitio	A2
Fecha	23/6/2002

Coordenadas		*Viento	
Latitud N	*989567*	Velocidad (Kt)	12
Longitud E	*690186*	Dirección (º)	270

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
51	41	6.3	18:24:42	28.90	0.13	237.60
			18:25:42	28.89	0.10	261.90
			18:26:42	28.89	0.11	243.20
			18:27:42	28.89	0.11	259.60
		6.1	18:28:42	28.89	0.13	242.50
	25.5	5.9	18:30:02	29.09	0.18	217.50
			18:31:02	29.10	0.19	211.80
			18:32:02	29.10	0.21	216.60
			18:33:02	29.10	0.17	209.70
		5.7	18:34:02	29.10	0.22	213.20
	10*	5.5	18:37:32	29.49	0.21	187.90
			18:38:32	29.48	0.21	194.10
			18:39:32	29.50	0.22	176.20
			18:40:32	29.49	0.25	189.80
		5.3	18:41:32	29.48	0.25	189.60

TABLA 23-A3.5

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (MAREA MEDIA BAJANDO)

Alineación	Pacora
Sitio	A3
Fecha	23/6/2002

Coordenadas		*Viento	
Latitud N	*985143*	Velocidad (Kt)	10
Longitud E	*690207*	Dirección (º)	264

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
81	71	3.7	19:07:42	28.30	0.19	345.40
			19:08:42	28.31	0.17	222.40
			19:09:42	28.36	0.29	222.90
			19:10:42	28.32	0.23	220.30
		3.5	19:11:42	28.38	0.28	222.80
	40.5	3.4	19:14:17	29.06	0.26	265.70
			19:15:17	29.06	0.28	264.60
			19:16:17	29.07	0.30	267.90
			19:17:17	29.06	0.23	267.90
		3.2	19:18:17	29.06	0.32	256.20
	10*	3.0	19:21:37	29.39	0.21	257.70
			19:22:37	29.39	0.23	247.70
			19:23:37	29.39	0.15	271.80
			19:24:37	29.39	0.20	259.50
		2.8	19:25:37	29.38	0.24	252.20

TABLA 23-A4.5

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA

MAREA DE SICIGIA (BAJAMAR)

Alineación	Pacora
Sitio	A4
Fecha	23/6/2002

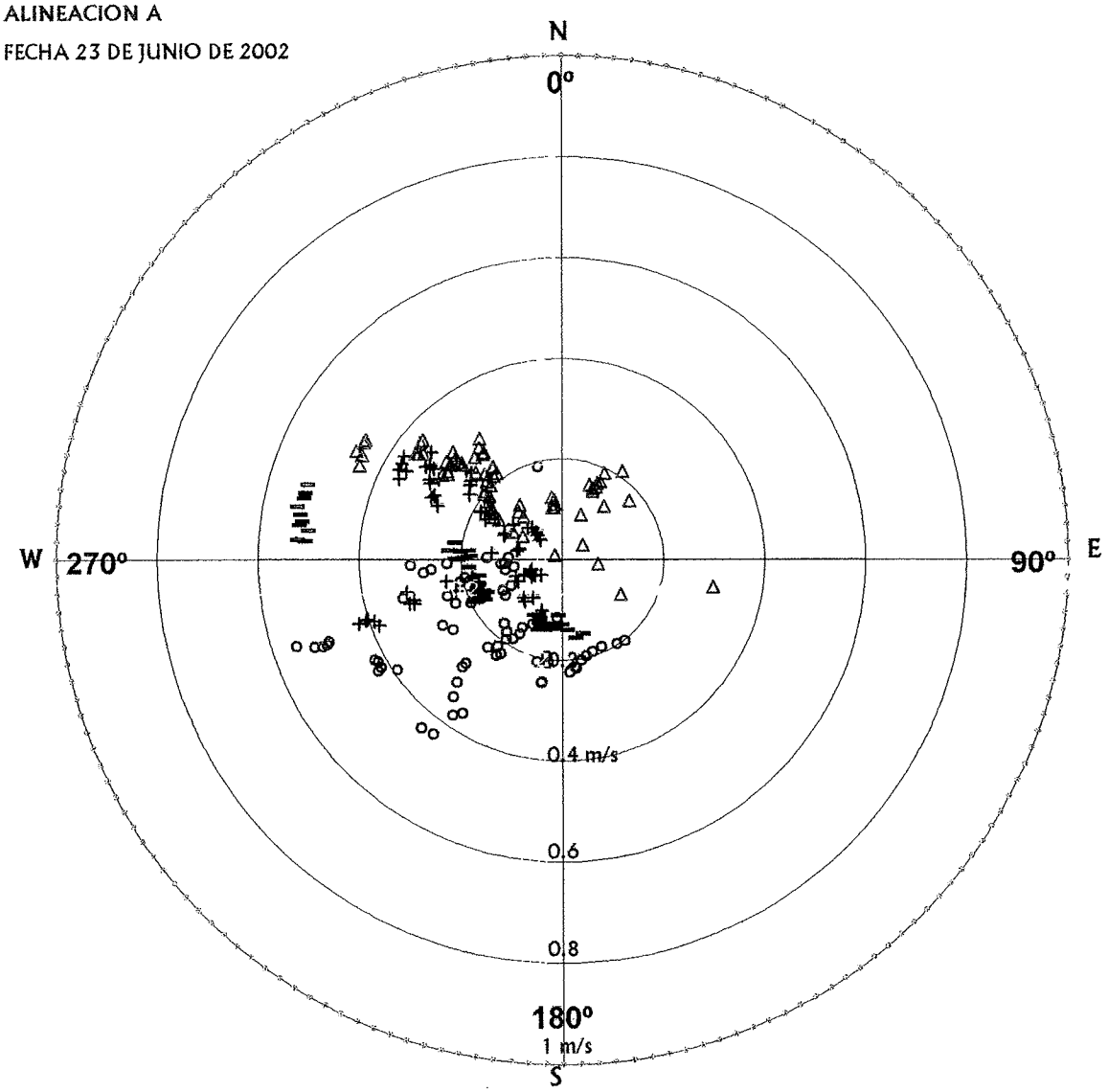
Coordenadas		*Viento	
Latitud N	*979613*	Velocidad (Kt)	13
Longitud E	*690233*	Dirección (º)	280

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
106	96	1.4	19:58:12	27.16	0.23	259.20
			19:59:12	27.14	0.22	253.40
			20:00:12	27.11	0.19	250.50
			20:01:12	27.13	0.18	245.60
		1.3	20:02:12	27.14	0.17	245.20
	53	1.2	20:05:02	28.67	0.40	252.70
			20:06:02	28.68	0.41	252.70
			20:07:02	28.68	0.39	251.60
			20:08:02	28.68	0.38	250.00
		1.1	20:09:02	28.69	0.42	252.20
	10*	1.0	20:12:37	29.40	0.18	258.60
			20:13:37	29.40	0.31	258.10
			20:14:37	29.40	0.31	253.60
			20:15:37	29.40	0.30	253.30
		0.9	20:16:37	29.39	0.30	254.50

VELOCIDAD Y DIRECCION DE LAS CORRIENTES MARINAS EN LA BAHÍA DE PANAMÁ SEGÚN CONDICION DE MAREA

ALINEACION A

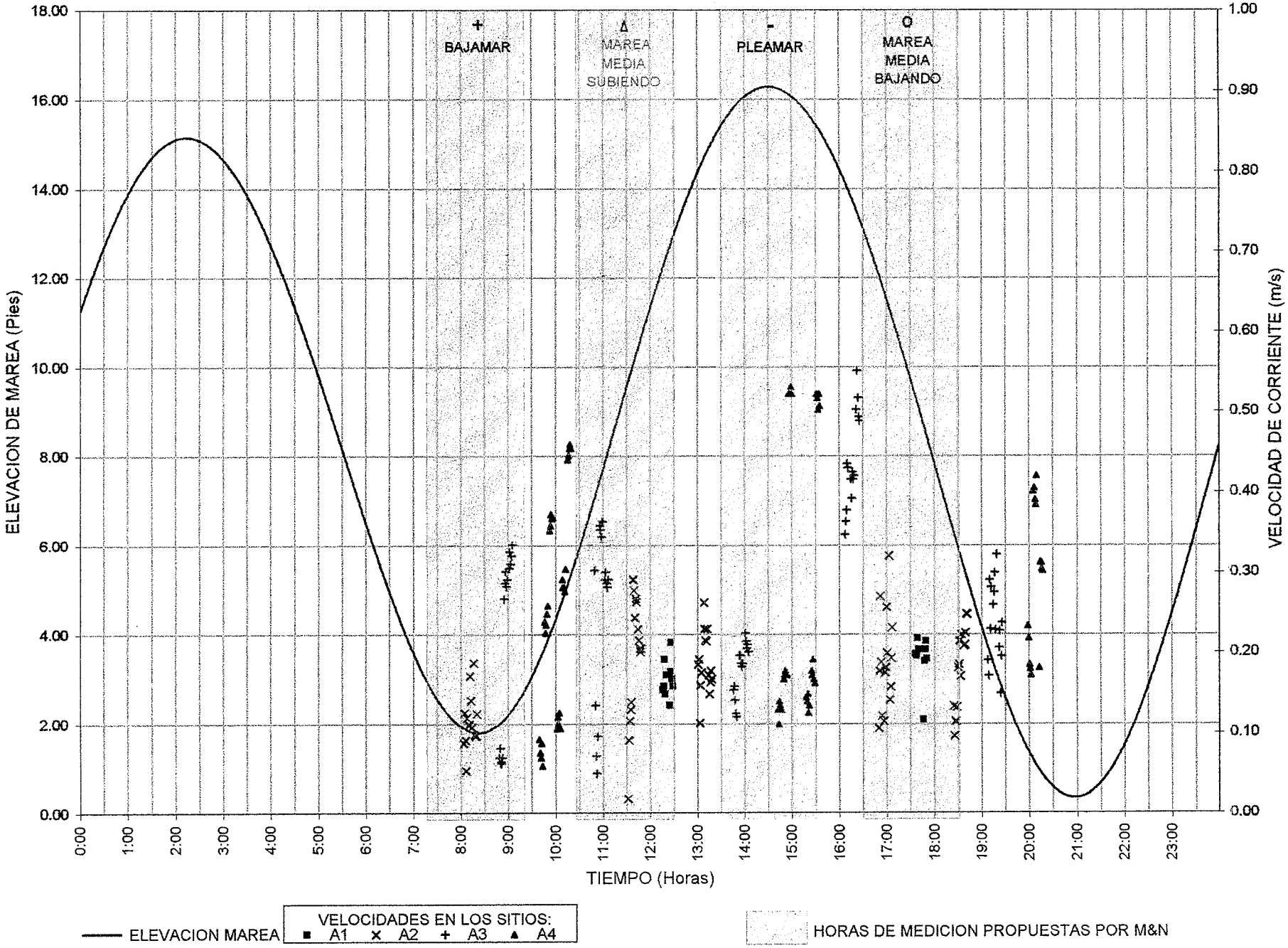
FECHA 23 DE JUNIO DE 2002



- ∘ Marea media bajando
- + Bajamar
- △ Marea media subiendo
- ▬ Pleamar

Unidad de Operaciones-ACP

VELOCIDAD DE CORRIENTES MARINAS EN LA BAHIA DE PANAMA SEGUN HORA, CONDICION DE MAREA Y SITIOS DE MEDICION (A1,A2, A3 Y A4) DE ALINEACION A (PACORA). MEDICION DE CORRIENTES #11-23 DE JUNIO DE 2002



Mediciones durante Marea de Sicigia

Lunes, 24 de junio de 2002 -Luna Llena

Toma de datos en alineación B.
Tiempo de Medición:
Marea Media Bajando: 5:30 - 7:30
Bajamar: 8:14 - 10:14
Marea Media Subiendo: 11:30 - 13:30
Pleamar: 14:20 - 16:20

TABLA 24-B1.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (MAREA MEDIA BAJANDO)

Alineación	New Island
Sitio	B1
Fecha	24/6/2002

Coordenadas		*Viento	
Latitud N	*982350*	Velocidad (Kt)	5
Longitud E	*654657*	Dirección (º)	332

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
10	5*	9.6	5:52:33	28.80	0.06	262.90
			5:53:33	28.82	0.09	269.40
			5:54:33	28.83	0.13	66.20
			5:55:33	28.82	0.09	76.50
		9.6	5:56:33	28.81	0.03	321.70

TABLA 24-B2.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (MAREA MEDIA BAJANDO)

Alineación	New Island
Sitio	B2
Fecha	24/06/2002

Coordenadas		*Viento	
Latitud N	*980877*	Velocidad (Kt)	5
Longitud E	*655029*	Dirección (º)	300

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
25	15	8.6	6:16:13	29.20	0.17	222.70
			6:17:13	29.20	0.18	226.30
			6:18:13	29.20	0.17	227.90
			6:19:13	29.21	0.17	233.90
		8.4	6:20:13	29.20	0.16	233.00
	10*	8.3	6:24:53	29.17	0.23	226.30
			6:25:53	29.17	0.24	232.10
			6:26:53	29.17	0.24	235.90
			6:27:53	29.17	0.25	233.60
		8.0	6:28:53	29.16	0.23	225.00

TABLA 24-B3.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (MAREA MEDIA BAJANDO)

Alineación	New Island
Sitio	B3
Fecha	24/6/2002

Coordenadas		*Viento	
Latitud N	*979742*	Velocidad (Kt)	3.5
Longitud E	*655400*	Dirección (º)	307

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
32	22	7.0	6:43:33	29.31	0.18	207.20
			6:44:33	29.31	0.18	199.40
			6:45:33	29.32	0.18	216.50
			6:46:33	29.31	0.16	215.00
		6.9	6:47:33	29.31	0.18	204.30
	16	6.8	6:47:43	29.35	0.23	224.30
			6:48:43	29.35	0.22	218.10
			6:49:43	29.35	0.23	229.50
			6:50:43	29.34	0.22	217.00
		6.6	6:51:43	29.34	0.22	224.20
	10*	6.4	6:55:43	29.36	0.31	228.40
			6:56:43	29.35	0.31	227.00
			6:57:43	29.35	0.29	224.90
			6:58:43	29.35	0.32	231.60
		6.1	6:59:43	29.35	0.28	222.90

TABLA 24-B4.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (MAREA MEDIA BAJANDO)

Alineación	New Island
Sitio	B4
Fecha	24/06/2001

Coordenadas		*Viento	
Latitud N	*978361*	Velocidad (Kt)	4
Longitud E	*655772*	Dirección (º)	308

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
40	30	5.2	7:16:03	29.17	0.14	193.40
			7:17:03	29.17	0.13	204.20
			7:18:03	29.15	0.12	207.10
			7:19:03	29.16	0.13	214.80
		4.9	7:20:03	29.16	0.12	220.00
	20	4.8	7:22:18	29.32	0.24	207.70
			7:23:18	29.31	0.23	208.60
			7:24:18	29.31	0.24	210.60
			7:25:18	29.31	0.24	207.60
		4.7	7:26:18	29.31	0.23	211.90
	10*	4.5	7:28:28	29.39	0.34	222.60
			7:29:28	29.40	0.34	224.70
			7:30:28	29.39	0.34	216.00
			7:31:28	29.39	0.33	220.80
		4.3	7:32:28	29.40	0.34	223.30

TABLA 24-B5.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (BAJAMAR)

Alineación	New Island
Sitio	B5
Fecha	24/6/2002

Coordenadas		*Viento	
Latitud N	*975602*	Velocidad (Kt)	8
Longitud E	*657310*	Dirección (°)	297

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (°C)	Velocidad (m/s)	Dirección (°)
44	34	3.2	7:54:33	28.89	0.30	231.50
			7:55:33	28.89	0.33	238.40
			7:56:33	28.89	0.30	233.20
			7:57:33	28.89	0.30	229.90
		3.1	7:58:33	28.89	0.30	230.30
	22	3.0	8:01:28	29.08	0.43	241.30
			8:02:28	29.06	0.42	239.80
			8:03:28	29.05	0.43	241.40
			8:04:28	29.13	0.47	249.50
		3.0	8:05:28	29.21	0.38	239.10
	10*	2.8	8:06:18	29.22	0.43	237.50
			8:07:18	29.23	0.46	243.20
			8:08:18	29.21	0.44	241.30
			8:09:18	29.22	0.42	240.20
		2.6	8:10:18	29.20	0.40	234.60

TABLA 24-B5.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (BAJAMAR)

Alineación	New Island
Sitio	B5
Fecha	24/6/2002

Coordenadas		*Viento	
Latitud N	*975602*	Velocidad (Kt)	8
Longitud E	*657310*	Dirección (°)	320

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (°C)	Velocidad (m/s)	Dirección (°)
44	34	2.2	8:22:53	28.92	0.28	237.20
			8:23:53	28.92	0.31	242.90
			8:24:53	28.93	0.29	240.30
			8:25:53	28.92	0.31	244.90
		2.2	8:26:53	28.90	0.31	248.40
	22	2.1	8:28:43	29.13	0.44	255.40
			8:29:43	29.10	0.41	253.10
			8:30:43	29.08	0.43	255.90
			8:31:43	29.08	0.41	252.70
		2.0	8:32:43	29.22	0.39	246.60
	10*	1.9	8:33:33	29.14	0.42	231.20
			8:34:33	29.14	0.44	235.60
			8:35:33	29.14	0.46	239.60
			8:36:33	29.15	0.43	235.40
		1.9	8:37:33	29.16	0.42	235.60

TABLA 24-B4.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (BAJAMAR)

Alineación	New Island
Sitio	B4
Fecha	24/6/2002

Coordenadas		*Viento	
Latitud N	*978361*	Velocidad (Kt)	7.5
Longitud E	*655772*	Dirección (º)	329

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
38	28	1.5	8:59:43	29.13	0.05	286.20
			9:00:43	29.12	0.07	282.90
			9:01:43	29.13	0.10	274.50
			9:02:43	29.15	0.09	271.80
		1.7	9:03:43	29.16	0.10	269.20
	19	1.4	9:05:33	29.27	0.15	236.60
			9:06:33	29.27	0.17	237.40
			9:07:33	29.27	0.18	241.60
			9:08:33	29.26	0.19	239.70
		1.4	9:09:33	29.26	0.13	230.90
	10*	1.4	9:10:28	29.21	0.28	237.90
			9:11:28	29.21	0.21	224.00
			9:12:28	29.21	0.25	230.60
			9:13:28	29.21	0.17	207.10
		1.5	9:14:28	29.21	0.29	238.90

TABLA 24-B3.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (BAJAMAR)

Alineación	New Island
Sitio	B3
Fecha	24/6/2002

Coordenadas		*Viento	
Latitud N	*979742*	Velocidad (Kt)	5
Longitud E	*655400*	Dirección (º)	270

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
26	16	1.6	9:38:38	29.30	0.13	288.00
			9:39:38	29.29	0.11	289.70
			9:40:38	29.30	0.08	305.40
			9:41:38	29.30	0.10	293.20
		1.6	9:42:38	29.31	0.09	300.40
	13	1.7	9:45:58	29.25	0.12	273.90
			9:46:58	29.26	0.11	280.20
			9:47:58	29.28	0.08	286.90
			9:48:58	29.28	0.11	279.30
		1.7	9:49:58	29.28	0.09	285.00
	10*	1.8	9:51:48	29.21	0.15	266.40
			9:52:48	29.22	0.15	263.70
			9:53:48	29.22	0.21	263.50
			9:54:48	29.21	0.28	257.40
		2.0	9:55:48	29.21	0.20	252.80

TABLA 24-B2.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (BAJAMAR)

Alineación	New Island
Sitio	B2
Fecha	24/6/2002

Coordenadas		*Viento	
Latitud N	*980877*	Velocidad (Kt)	3
Longitud E	*655029*	Dirección (º)	90

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
18	10*	2.3	10:09:33	28.97	0.20	315.90
			10:10:33	28.98	0.25	328.50
			10:11:33	29.00	0.14	303.70
			10:12:33	28.98	0.16	242.00
		2.5	10:13:33	28.98	0.11	264.90

TABLA 24-B1.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (BAJAMAR)

Alineación	New Island
Sitio	B1**
Fecha	24/6/2002

Coordenadas		*Viento	
Latitud N	*980871*	Velocidad (Kt)	S/D
Longitud E	*655025*	Dirección (º)	S/D

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
10	5*	2.9	10:25:48	28.88	0.26	297.50
			10:26:48	28.90	0.15	264.40
			10:27:48	28.87	0.11	259.20
			10:28:48	28.89	0.19	350.50
			10:29:48	28.92	0.15	355.30

** Medición realizada entre B2 y B1(en B1 no había profundidad de calado).

TABLA 24-B1.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (MAREA MEDIA SUBIENDO)

Alineación	New Island
Sitio	B1
Fecha	24/6/2002

Coordenadas		*Viento	
Latitud N	*982350*	Velocidad (Kt)	6
Longitud E	*654657*	Dirección (°)	325

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (°C)	Velocidad (m/s)	Dirección (°)
7.5	4*	7.6	11:50:02	29.04	0.18	31.50
			11:51:02	29.05	0.09	319.50
			11:52:02	29.05	0.20	290.90
			11:53:02	29.03	0.14	281.20
		7.9	11:54:02	29.03	0.15	2.70

TABLA 24-B2.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (MAREA MEDIA SUBIENDO)

Alineación	New Island
Sitio	B2
Fecha	24/6/2002

Coordenadas		*Viento	
Latitud N	*980877*	Velocidad (Kt)	3
Longitud E	*655029*	Dirección (°)	33

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (°C)	Velocidad (m/s)	Dirección (°)
25	15	8.6	12:06:27	29.31	0.16	285.80
			12:07:27	29.31	0.19	297.40
			12:08:27	29.31	0.17	290.80
			12:09:27	29.31	0.17	293.80
		8.9	12:10:27	29.32	0.19	291.40
	12	9.1	12:12:37	29.31	0.13	313.50
			12:13:37	29.31	0.16	318.10
			12:14:37	29.30	0.17	307.60
		9.3	12:15:37	29.31	0.13	320.30
	10*	9.5	12:18:32	29.31	0.16	307.50
			12:19:32	29.31	0.12	312.70
			12:20:32	29.31	0.13	298.30
			12:21:32	29.30	0.18	299.50
		9.7	12:22:32	29.30	0.17	305.50

TABLA 24-B3.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (MAREA MEDIA SUBIENDO)

Alineación	New Island
Sitio	B3
Fecha	24/6/2002

Coordenadas		*Viento	
Latitud N	*979742*	**Velocidad (Kt)**	6
Longitud E	*655400*	**Dirección (°)**	342

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (°C)	Velocidad (m/s)	Dirección (°)
35	25	10.5	12:35:12	29.01	0.27	318.10
			12:36:12	29.01	0.26	320.20
			12:37:12	29.01	0.36	324.40
			12:38:12	29.01	0.34	330.30
		10.8	12:39:12	29.02	0.32	333.30
	17	10.9	12:41:12	29.20	0.25	316.00
			12:42:12	29.22	0.32	277.90
			12:43:12	29.22	0.22	288.00
			12:44:12	29.20	0.31	327.60
		11.2	12:45:12	29.21	0.28	327.60
	10*	11.3	12:47:47	29.26	0.14	276.10
			12:48:47	29.27	0.16	276.30
			12:49:47	29.27	0.24	312.10
			12:50:47	29.27	0.25	325.50
		11.6	12:51:47	29.28	0.19	329.10

TABLA 24-B4.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (MAREA MEDIA SUBIENDO)

Alineación	New Island
Sitio	B4
Fecha	24/6/2002

Coordenadas		*Viento	
Latitud N	*978361*	**Velocidad (Kt)**	8.5
Longitud E	*655772*	**Dirección (°)**	300

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (°C)	Velocidad (m/s)	Dirección (°)
47	37	12.3	13:05:07	28.98	0.21	278.00
			13:06:07	28.98	0.22	280.00
			13:07:07	28.98	0.20	296.30
			13:08:07	28.98	0.23	289.50
		12.5	13:09:07	28.98	0.24	279.60
	24	12.6	13:11:07	29.18	0.33	272.70
			13:12:07	29.12	0.30	285.90
			13:13:07	29.15	0.32	282.60
			13:14:07	29.17	0.38	274.40
		12.9	13:15:07	29.16	0.39	276.20
	10*	13.0	13:17:12	29.26	0.29	273.90
			13:18:12	29.30	0.27	276.30
			13:19:12	29.31	0.31	276.60
			13:20:12	29.31	0.31	267.80
		13.2	13:21:12	29.31	0.32	273.20

TABLA 24-B5.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (MAREA MEDIA SUBIENDO)

Alineación	New Island
Sitio	B5
Fecha	24/6/2002

Coordenadas		*Viento	
Latitud N	*975602*	Velocidad (Kt)	8.5
Longitud E	*657310*	Dirección (º)	305

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
57	47	14.3	13:44:02	28.60	0.26	311.00
			13:45:02	28.59	0.25	304.30
			13:46:02	28.59	0.27	300.40
			13:47:02	28.58	0.27	300.00
		14.4	13:48:02	28.56	0.29	303.20
	29	14.6	13:51:02	28.54	0.33	292.70
			13:52:02	28.54	0.36	300.20
			13:53:02	28.55	0.38	293.20
			13:54:02	28.54	0.29	297.60
		14.7	13:55:02	28.53	0.35	304.50
	10*	14.8	13:57:22	29.39	0.32	237.00
			13:58:22	29.38	0.31	247.20
			13:59:22	29.39	0.31	247.50
			14:00:22	29.40	0.27	254.70
		14.9	14:01:22	29.40	0.31	251.30

TABLA 24-B5.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (PLEAMAR)

Alineación	New Island
Sitio	B5
Fecha	24/6/2002

Coordenadas		*Viento	
Latitud N	*975602*	Velocidad (Kt)	7
Longitud E	*657310*	Dirección (º)	315

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
50	40	15.5	14:17:17	28.44	0.25	284.60
			14:18:17	28.44	0.31	286.70
			14:19:17	28.43	0.34	288.80
		15.6	14:20:17	28.43	0.32	288.20
	25	15.6	14:22:17	28.61	0.29	298.80
			14:23:17	28.71	0.40	292.10
			14:24:17	28.59	0.33	295.00
			14:25:17	28.73	0.38	295.50
		15.7	14:26:17	28.58	0.38	294.80
	10*	15.8	14:28:27	29.35	0.37	249.00
			14:29:27	29.38	0.34	250.20
			14:30:27	29.36	0.32	246.70
		15.8	14:31:27	29.36	0.33	242.60

TABLA 24-B4.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (PLEAMAR)

Alineación	New Island
Sitio	B4
Fecha	24/6/2002

Coordenadas		*Viento	
Latitud N	*978361*	Velocidad (Kt)	5.5
Longitud E	*655772*	Dirección (º)	303

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
50	40	16.2	14:52:22	28.96	0.08	270.10
			14:53:22	28.98	0.14	269.30
			14:54:22	28.98	0.19	276.50
			14:55:22	28.97	0.15	266.90
		16.3	14:56:22	28.97	0.19	276.00
	25	16.3	14:59:12	29.09	0.35	264.80
			15:00:12	29.10	0.36	263.40
			15:01:12	29.11	0.37	267.00
			15:02:12	29.12	0.38	265.10
		16.4	15:03:12	29.13	0.36	265.00
	10*	16.4	15:05:22	29.31	0.43	239.20
			15:06:22	29.31	0.44	243.40
			15:07:22	29.31	0.45	242.10
			15:08:22	29.33	0.44	240.60
		16.4	15:09:22	29.30	0.35	253.00

TABLA 24-B3.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (PLEAMAR)

Alineación	New Island
Sitio	B3
Fecha	24/6/2002

Coordenadas		*Viento	
Latitud N	*979742*	Velocidad (Kt)	6.5
Longitud E	*655400*	Dirección (º)	328

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
41	31	16.4	15:22:37	29.04	0.11	282.90
			15:23:37	29.04	0.13	279.00
			15:24:37	29.03	0.10	274.40
			15:25:37	29.03	0.09	279.30
		16.4	15:26:37	29.03	0.12	273.90
	20	16.4	15:28:47	29.26	0.14	237.20
			15:29:47	29.26	0.17	249.90
			15:30:47	29.24	0.21	257.90
			15:31:47	29.24	0.20	266.90
		16.4	15:32:47	29.24	0.23	272.50
	10*	16.4	15:35:32	29.28	0.14	219.10
			15:36:32	29.28	0.21	238.20
			15:37:32	29.28	0.22	238.00
			15:38:32	29.28	0.23	236.70
		16.3	15:39:32	29.28	0.21	225.00

TABLA 24-B2.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (PLEAMAR)

Alineación	New Island
Sitio	B2
Fecha	24/6/2002

Coordenadas		*Viento	
Latitud N	*980877*	Velocidad (Kt)	5.5
Longitud E	*655029*	Dirección (º)	392

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
31	21	16.2	15:51:27	29.25	0.21	259.80
			15:52:27	29.24	0.16	249.00
			15:53:27	29.25	0.14	246.70
			15:54:27	29.25	0.13	243.50
		16.1	15:55:27	29.23	0.16	245.80
	15	16.1	15:57:07	29.24	0.17	248.10
			15:58:07	29.26	0.16	245.00
			15:59:07	29.27	0.17	242.50
			16:00:07	29.27	0.15	245.00
		16.0	16:01:07	29.26	0.19	244.90
	10*	16.0	16:02:47	29.30	0.21	223.40
			16:03:47	29.29	0.19	223.60
			16:04:47	29.29	0.19	219.10
			16:05:47	29.31	0.14	204.80
		15.9	16:06:47	29.31	0.17	217.70

TABLA 24-B1.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (PLEAMAR)

Alineación	New Island
Sitio	B1
Fecha	24/6/2002

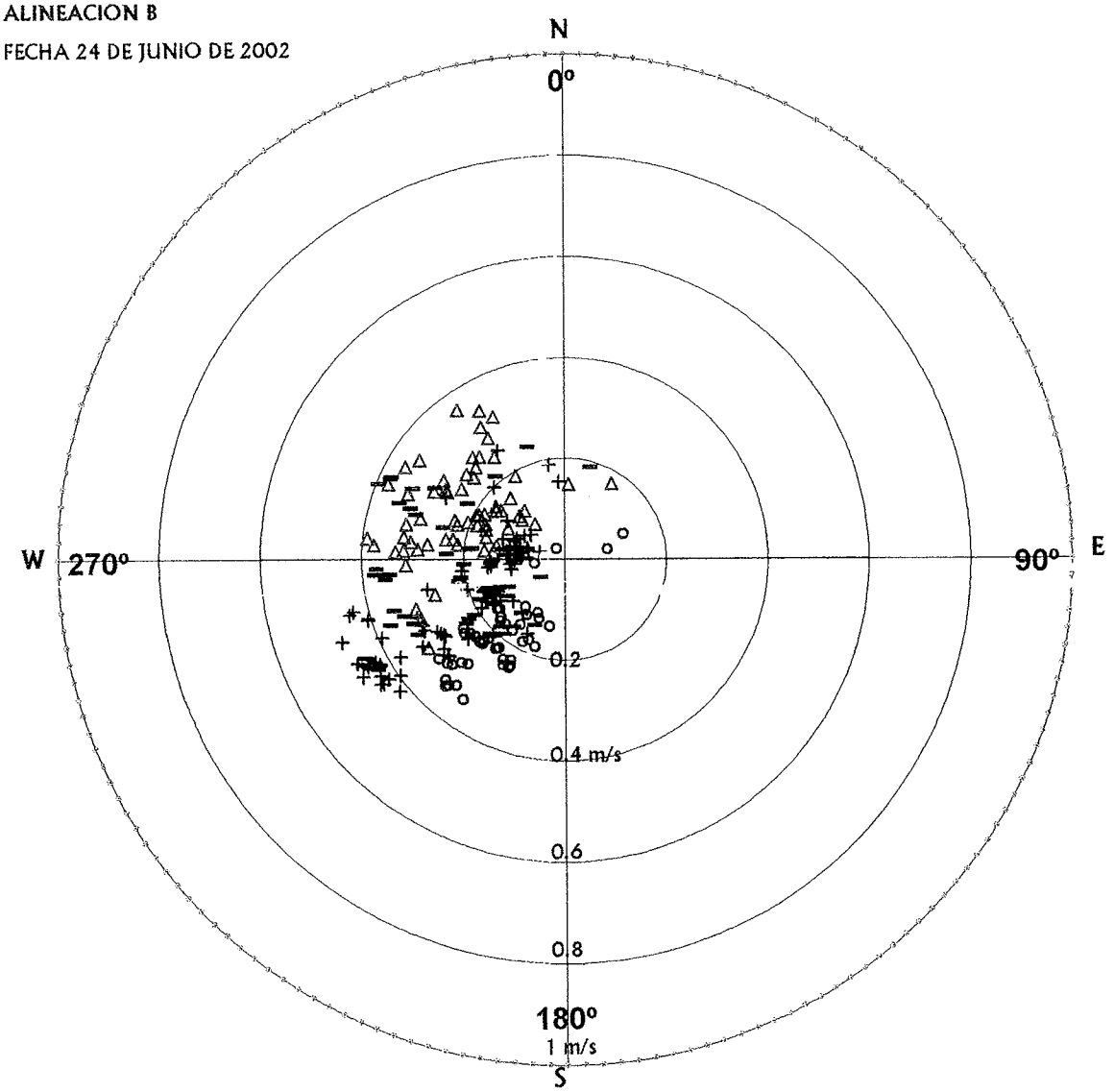
Coordenadas		*Viento	
Latitud N	*982350*	Velocidad (Kt)	6
Longitud E	*654657*	Dirección (º)	157

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
20	10*	15.7	16:18:17	29.19	0.22	299.90
			16:19:17	29.26	0.21	320.20
			16:20:17	29.32	0.23	341.40
			16:21:17	29.31	0.19	15.70
		15.5	16:22:17	29.29	0.06	233.20

VELOCIDAD Y DIRECCION DE LAS CORRIENTES MARINAS EN LA BAHÍA DE PANAMÁ SEGÚN CONDICION DE MAREA

ALINEACION B

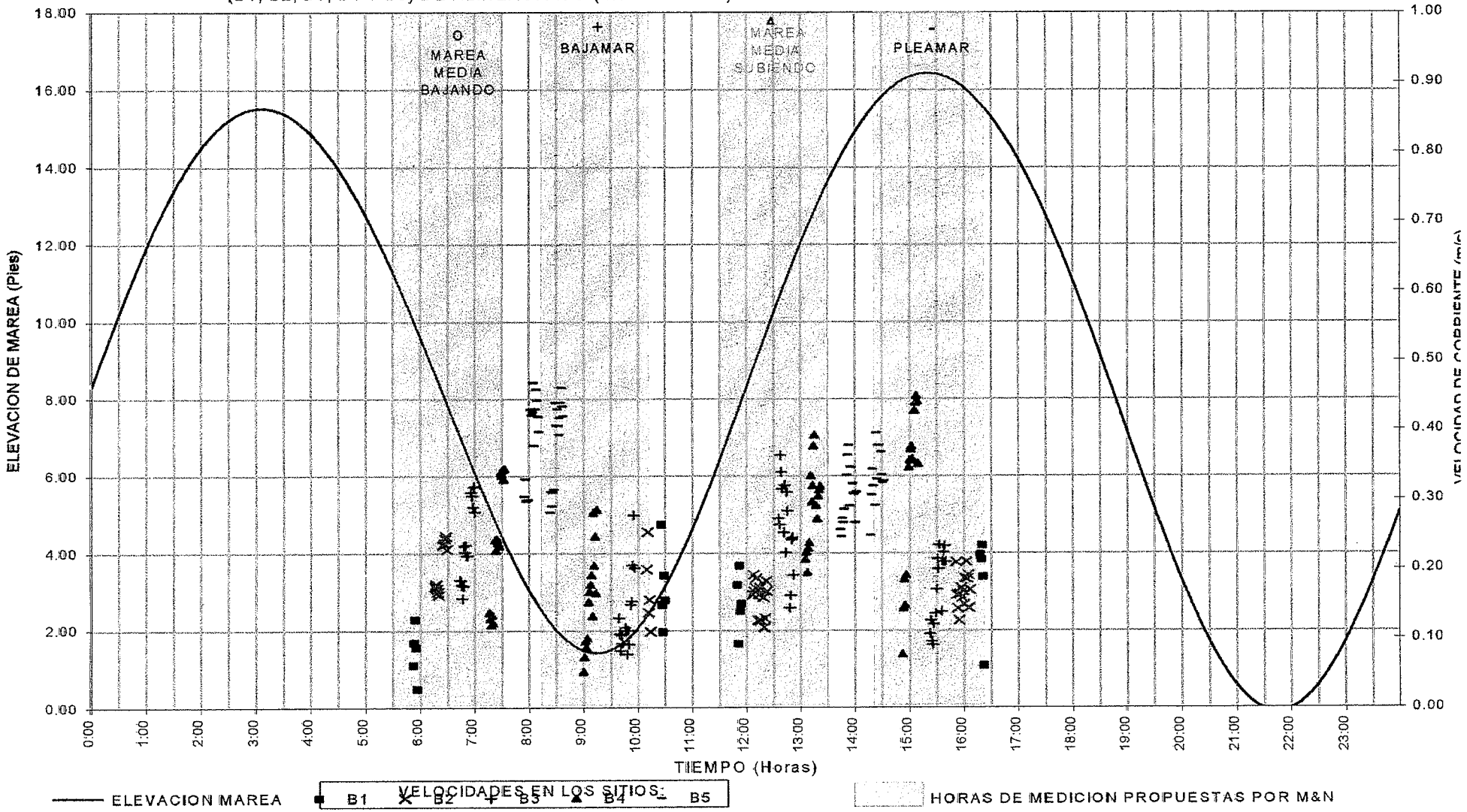
FECHA 24 DE JUNIO DE 2002



- ∘ Marea media bajando
- + Bajamar
- △ Marea media subiendo
- – Pleamar

Unidad de Operaciones-ACP

VELOCIDAD DE CORRIENTES MARINAS EN LA BAHIA DE PANAMA SEGUN HORA, CONDICION DE MAREA Y SITIOS DE MEDICION (B1, B2, B3, B4 Y B5) DE ALINEACION B (NEW ISLAND). MEDICION DE CORRIENTES #12-24 DE JUNIO DE 2002



Mediciones durante Marea de Sicigia

Martes, 25 de junio de 2002 - 2 día después de Luna Llena

Toma de datos en alineación C.

Tiempo de Medición:

Marea Media Bajando: 6:00 - 8:00

Bajamar: 9:02 - 11:02

Marea Media Subiendo: 12:00 - 14:00

Pleamar: 15:10 - 17:10

TABLA 25-C1.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (MAREA MEDIA BAJANDO)

Alineación	Punta Chame
Sitio	C1
Fecha	25/6/2002

Coordenadas		*Viento	
Latitud N	*954005*	Velocidad (Kt)	7
Longitud E	*648526*	Dirección (°)	335

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (°C)	Velocidad (m/s)	Dirección (°)
82	72	11.0	6:26:38	28.28	0.20	318.90
			6:27:38	28.29	0.23	317.60
			6:28:38	28.29	0.21	312.30
			6:29:38	28.29	0.22	319.10
		10.7	6:30:38	28.29	0.19	309.30
	41	10.6	6:33:18	28.76	0.28	244.80
			6:34:18	28.76	0.48	203.50
			6:35:18	28.76	0.71	189.50
			6:36:18	28.76	0.69	188.90
		10.3	6:37:18	28.75	0.70	182.90
	10*	10.2	6:39:38	28.70	0.39	196.10
			6:40:38	28.70	0.20	309.10
			6:41:38	28.70	0.72	187.70
			6:42:38	28.70	0.80	183.10
		10	6:43:38	28.70	0.82	183.60

TABLA 25-C2.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (MAREA MEDIA BAJANDO)

Alineación	Punta Chame
Sitio	C2
Fecha	25/6/2002

Coordenadas		*Viento	
Latitud N	*957343*	Velocidad (Kt)	8.5
Longitud E	*654017*	Dirección (°)	315

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (°C)	Velocidad (m/s)	Dirección (°)
76	66	7.4	7:25:58	28.39	0.33	161.30
			7:26:58	28.40	0.36	168.40
			7:27:58	28.39	0.37	170.50
			7:28:58	28.39	0.35	171.50
		7.1	7:29:58	28.41	0.35	168.00
	38	6.9	7:32:28	28.71	0.54	179.20
			7:33:28	28.70	0.52	176.00
			7:34:28	28.70	0.51	177.60
			7:35:28	28.70	0.52	177.80
		6.7	7:36:28	28.70	0.53	178.40
	10*	6.6	7:38:43	28.77	0.64	186.00
			7:39:43	28.77	0.64	187.00
			7:40:43	28.77	0.63	182.90
			7:41:43	28.77	0.65	187.90
		6.3	7:42:43	28.77	0.61	184.50

TABLA 25-C3.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (MAREA MEDIA BAJANDO)

Alineación	Punta Chame
Sitio	C3
Fecha	25/6/2002

Coordenadas		*Viento	
Latitud N	*962880*	Velocidad (Kt)	10
Longitud E	*656197*	Dirección (º)	333

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
76	66	4.1	8:20:08	28.23	0.13	283.80
			8:21:08	28.23	0.15	292.60
			8:22:08	28.24	0.43	312.60
			8:23:08	28.21	0.15	187.60
		3.9	8:24:08	28.22	0.17	149.40
	38	3.8	8:26:33	28.55	0.24	172.80
			8:27:33	28.54	0.26	172.70
			8:28:33	28.54	0.24	172.80
			8:29:33	28.54	0.24	163.90
		3.6	8:30:33	28.54	0.26	164.30
	10*	3.5	8:32:58	28.68	0.28	165.10
			8:33:58	28.64	0.30	168.50
			8:34:58	28.64	0.29	171.00
			8:35:58	28.64	0.27	165.70
		3.3	8:36:58	28.63	0.27	179.70

TABLA 25-C3.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (BAJAMAR)

Alineación	Punta Chame
Sitio	C3
Fecha	25/6/2002

Coordenadas		*Viento	
Latitud N	*962880*	Velocidad (Kt)	7.5
Longitud E	*656197*	Dirección (º)	325

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
76	66	2.1	9:05:23	28.23	0.13	174.40
			9:06:23	28.23	0.17	179.20
			9:07:23	28.23	0.12	107.00
			9:08:23	28.25	0.13	159.10
		2.0	9:09:23	28.25	0.14	127.40
	38	1.9	9:11:58	28.61	0.20	148.50
			9:12:58	28.61	0.19	158.00
			9:13:58	28.62	0.24	157.20
			9:14:58	28.61	0.21	163.50
		1.8	9:15:58	28.60	0.20	152.90
	10*	1.7	9:18:28	28.67	0.34	175.60
			9:19:28	28.69	0.29	169.80
			9:20:28	28.68	0.34	179.30
			9:21:28	28.68	0.29	168.20
		1.6	9:22:28	28.67	0.29	173.10

TABLA 25-C2.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (BAJAMAR)

Alineación	Punta Chame
Sitio	C2
Fecha	25/6/2002

Coordenadas		*Viento	
Latitud N	*957343*	Velocidad (Kt)	11
Longitud E	*654017*	Dirección (º)	5

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
70	60	1.2	10:08:48	28.32	0.07	13.10
			10:09:48	28.31	0.08	10.30
			10:10:48	28.31	0.08	337.90
			10:11:48	28.32	0.05	12.20
		1.2	10:12:48	28.31	0.12	8.30
	35	1.3	10:15:08	28.63	0.16	194.70
			10:16:08	28.64	0.21	203.90
			10:17:08	28.64	0.15	161.60
			10:18:08	28.64	0.18	197.30
		1.3	10:19:08	28.64	0.17	181.10
	10*	1.3	10:21:28	28.71	0.14	223.20
			10:22:28	28.72	0.33	309.40
			10:23:28	28.72	0.35	315.00
			10:24:28	28.74	0.35	312.00
		1.4	10:25:28	28.74	0.34	311.90

TABLA 25-C1.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (MAREA MEDIA SUBIENDO)

Alineación	Punta Chame
Sitio	C1
Fecha	25/6/2002

Coordenadas		*Viento	
Latitud N	*954005*	Velocidad (Kt)	6
Longitud E	*648526*	Dirección (º)	35

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
75	65	2.4	10:59:28	28.57	0.22	305.10
			11:00:28	28.57	0.21	310.90
			11:01:28	28.58	0.17	331.50
			11:02:28	28.58	0.20	316.50
		2.5	11:03:28	28.59	0.15	347.00
	37.5	2.6	11:05:48	28.80	0.17	218.90
			11:06:48	28.80	0.16	237.80
			11:07:48	28.80	0.08	188.80
			11:08:48	28.80	0.17	239.00
		2.7	11:09:48	28.80	0.07	190.30
	10*	2.8	11:12:03	28.94	0.19	211.20
			11:13:03	28.93	0.15	169.10
			11:14:03	28.93	0.18	172.40
			11:15:03	28.94	0.15	187.30
		3.0	11:16:03	28.93	0.18	188.20

TABLA 25-C1.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA

MAREA DE SICIGIA (MAREA MEDIA SUBIENDO)

Alineación	Punta Chame
Sitio	C1
Fecha	25/6/2002

Coordenadas		*Viento	
Latitud N	*954005*	Velocidad (Kt)	8
Longitud E	*648526*	Dirección (º)	356

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
76	66	5.7	12:04:23	28.55	0.34	338.80
			12:05:23	28.55	0.36	326.60
			12:06:23	28.56	0.38	355.40
			12:07:23	28.56	0.32	343.90
		5.9	12:08:23	28.56	0.38	329.40
	38	6.0	12:10:53	28.79	0.14	2.10
			12:11:53	28.79	0.25	313.70
			12:12:53	28.80	0.23	308.60
			12:13:53	28.80	0.20	324.50
		6.3	12:14:53	28.80	0.25	316.80
	10*	6.5	12:17:18	28.98	0.09	94.30
			12:18:18	28.98	0.16	274.40
			12:19:18	28.97	0.15	271.00
			12:20:18	28.97	0.06	0.30
		6.7	12:21:18	28.97	0.19	273.10

TABLA 25-C2.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA

MAREA DE SICIGIA (MAREA MEDIA SUBIENDO)

Alineación	Punta Chame
Sitio	C2
Fecha	25/6/2002

Coordenadas		*Viento	
Latitud N	*957343*	Velocidad (Kt)	11.5
Longitud E	*654017*	Dirección (º)	325

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
78	68	9.0	12:57:08	28.44	0.27	338.70
			12:58:08	28.45	0.32	336.40
			12:59:08	28.45	0.30	334.80
			13:00:08	28.45	0.33	333.50
		9.2	13:01:08	28.45	0.29	333.50
	39	9.4	13:03:48	28.67	0.24	345.60
			13:04:48	28.68	0.28	347.00
			13:05:48	28.67	0.26	351.10
			13:06:48	28.68	0.27	337.20
		9.7	13:07:48	28.69	0.22	348.80
	10*	9.8	13:09:58	29.04	0.25	283.40
			13:10:58	29.04	0.25	285.30
			13:11:58	29.02	0.28	283.70
			13:12:58	29.03	0.27	284.80
		10.1	13:13:58	29.05	0.25	279.30

TABLA 25-C3.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (MAREA MEDIA SUBIENDO)

Alineación	Punta Chame
Sitio	C3
Fecha	25/6/2002

Coordenadas		*Viento	
Latitud N	*962880*	Velocidad (Kt)	9
Longitud E	*656197*	Dirección (°)	300

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (°C)	Velocidad (m/s)	Dirección (°)
82	72	12.5	13:55:58	28.25	0.41	342.50
			13:56:58	28.24	0.36	345.70
			13:57:58	28.24	0.47	344.00
			13:58:58	28.24	0.44	338.20
		12.8	13:59:58	28.25	0.41	340.50
	41	12.9	14:02:28	28.57	0.31	324.10
			14:03:28	28.57	0.32	325.00
			14:04:28	28.56	0.30	322.50
			14:05:28	28.56	0.33	328.40
		13.1	14:06:28	28.55	0.28	327.00
	10*	13.2	14:08:48	29.05	0.25	293.90
			14:09:48	29.04	0.25	292.10
			14:10:48	29.05	0.26	292.80
			14:11:48	29.06	0.18	276.60
		13.4	14:12:48	29.01	0.21	296.60

TABLA 25-C3.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (PLEAMAR)

Alineación	Punta Chame
Sitio	C3
Fecha	25/6/2002

Coordenadas		*Viento	
Latitud N	*962880*	Velocidad (Kt)	8.5
Longitud E	*656197*	Dirección (°)	285

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (°C)	Velocidad (m/s)	Dirección (°)
90	80	15.6	15:12:47	28.22	0.14	337.10
			15:13:47	28.22	0.13	344.40
			15:14:47	28.22	0.13	336.10
			15:15:47	28.22	0.12	325.70
		15.7	15:16:47	28.22	0.10	336.20
	45	15.7	15:19:08	28.64	0.25	245.90
			15:20:08	28.63	0.23	247.40
			15:21:08	28.65	0.21	240.50
			15:22:08	28.63	0.23	243.00
		15.8	15:23:08	28.59	0.21	246.10
	10*	15.9	15:25:28	29.20	0.41	212.00
			15:26:28	29.16	0.41	214.10
			15:27:28	29.20	0.41	211.50
			15:28:28	29.15	0.41	214.60
		15.9	15:29:28	29.14	0.41	215.20

TABLA 25-C2.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (PLEAMAR)

Alineación	Punta Chame
Sitio	C2
Fecha	25/6/2002

Coordenadas		*Viento	
Latitud N	*957343*	Velocidad (Kt)	10.5
Longitud E	*654017*	Dirección (º)	300

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
85	75	16.3	15:56:58	27.62	0.12	318.30
			15:57:58	27.60	0.09	341.50
			15:58:58	27.56	0.09	356.90
			15:59:58	27.58	0.09	332.50
		16.3	16:00:58	27.60	0.10	340.30
	42.5	16.3	16:03:23	28.45	0.15	239.80
			16:04:23	28.43	0.13	244.30
			16:05:23	28.45	0.11	233.80
			16:06:23	28.45	0.11	222.20
		16.3	16:07:23	28.48	0.11	239.50
	10*	16.3	16:09:58	29.15	0.43	206.50
			16:10:58	29.15	0.44	205.60
			16:11:58	29.14	0.41	206.10
			16:12:58	29.07	0.38	205.20
		16.3	16:13:58	29.14	0.40	203.40

TABLA 25-C1.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LAS BAHIA DE PANAMA
MAREA DE SICIGIA (PLEAMAR)

Alineación	Punta Chame
Sitio	C1
Fecha	25/6/2002

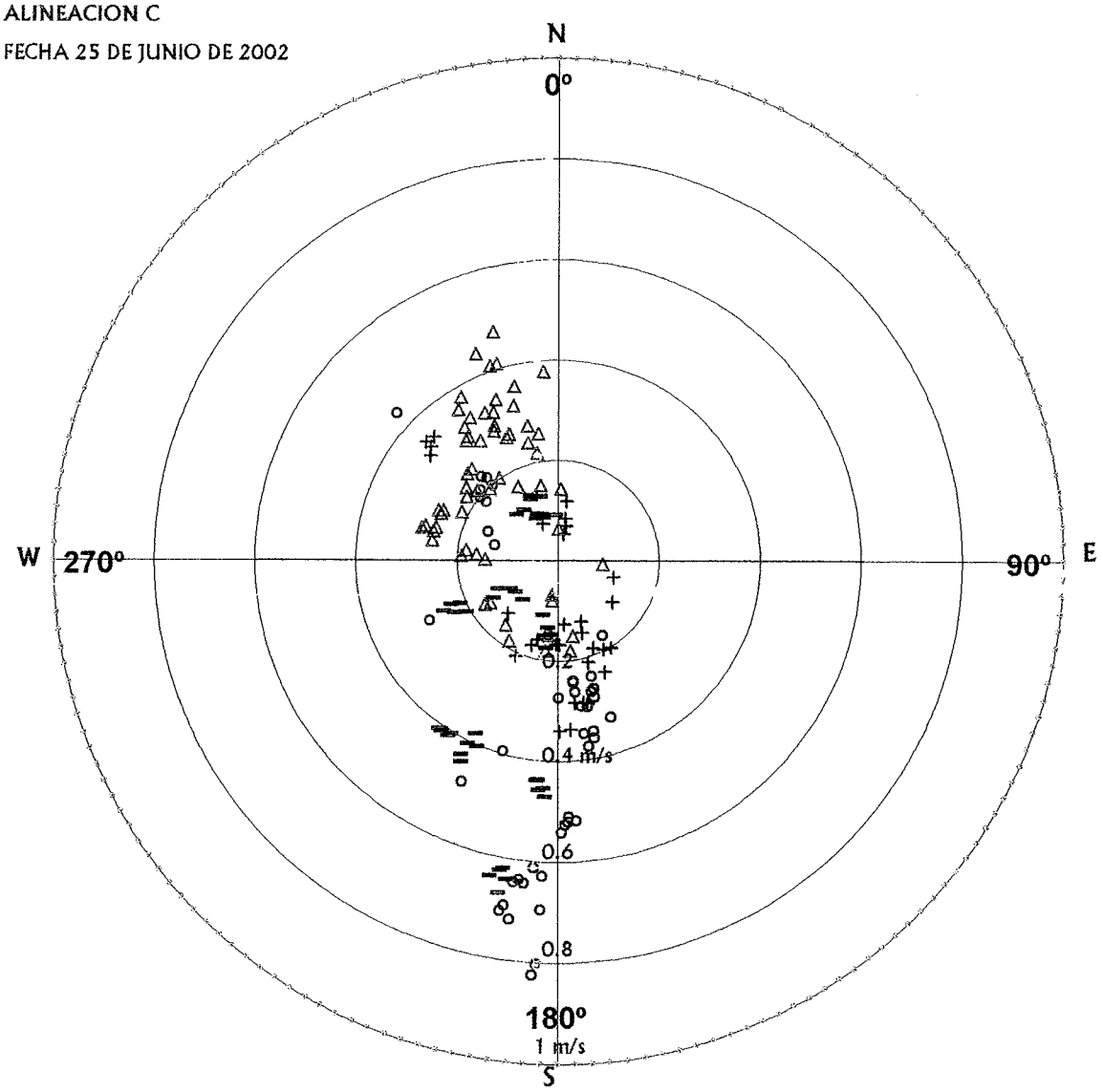
Coordenadas		*Viento	
Latitud N	*954005*	Velocidad (Kt)	10
Longitud E	*648526*	Dirección (º)	305

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
87	77	15.9	16:47:43	28.25	0.11	195.70
			16:48:43	28.25	0.15	189.70
			16:49:43	28.23	0.14	188.90
			16:50:43	28.26	0.15	185.30
		15.9	16:51:43	28.26	0.18	187.90
	43.5	15.8	16:54:08	28.86	0.44	185.20
			16:55:08	28.85	0.46	184.80
			16:56:08	28.84	0.44	185.70
			16:57:08	28.85	0.45	183.70
		15.7	16:58:08	28.86	0.47	183.20
	10*	15.7	17:00:53	29.07	0.63	190.60
			17:01:53	29.07	0.62	190.10
			17:02:53	29.06	0.64	189.20
			17:03:53	29.08	0.67	190.20
		15.6	17:04:53	29.06	0.64	192.20

VELOCIDAD Y DIRECCION DE LAS CORRIENTES MARINAS EN LA BAHÍA DE PANAMÁ SEGÚN CONDICION DE MAREA

ALINEACION C

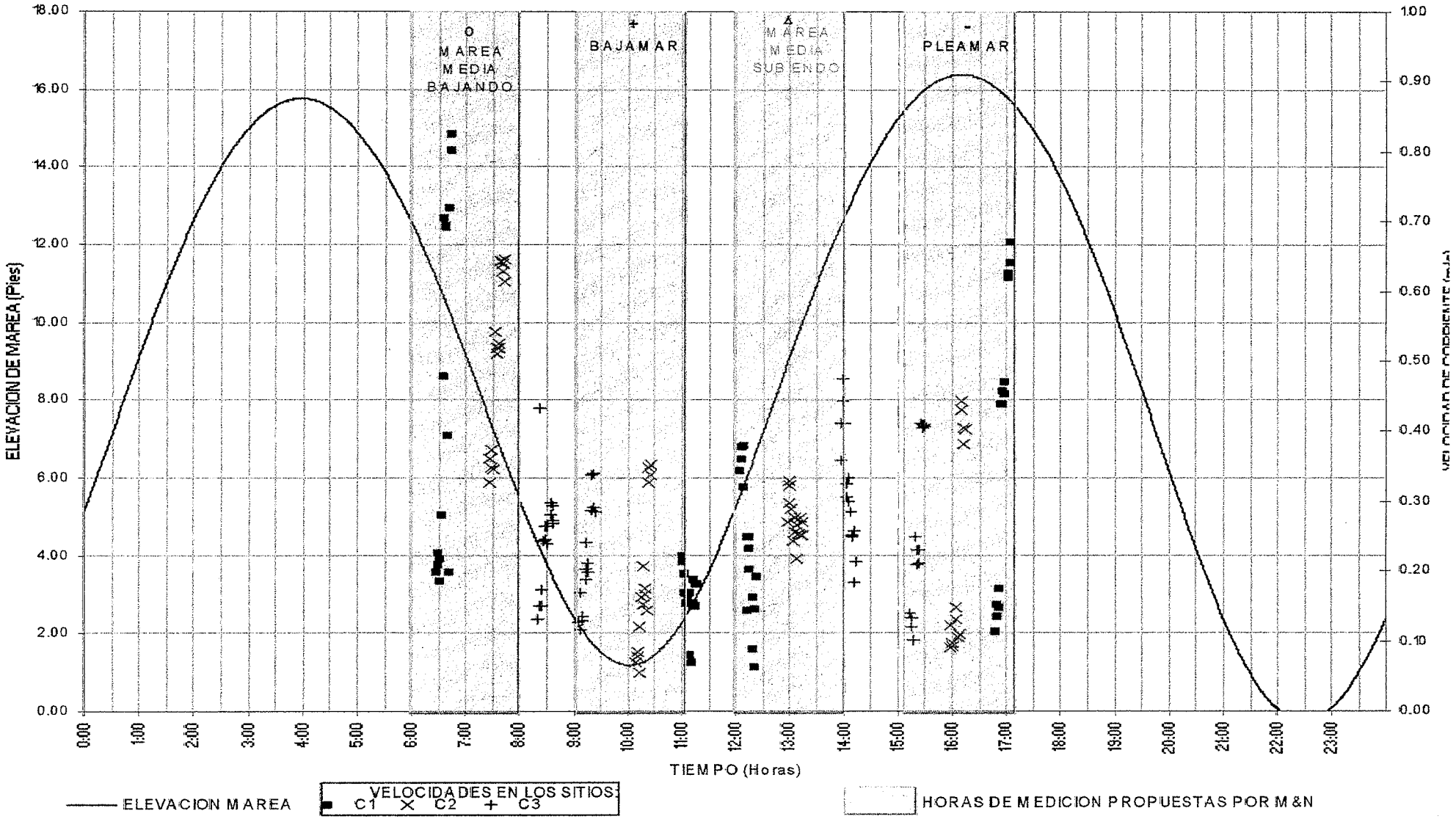
FECHA 25 DE JUNIO DE 2002



- ○ Marea media bajando Mid-tide ebb.
- + Bajamar Low tide
- △ Marea media subiendo Mid-tide flood
- – Pleamar High tide.

Unidad de Operaciones-ACP

VELOCIDAD DE CORRIENTES MARINAS EN LA BAHIA DE PANAMA SEGUN HORA, CONDICION DE MAREA Y SITIOS DE MEDICION
(C1, C2 Y C3) DE ALINEACION C (PUNTA CHAME). MEDICION DE CORRIENTES #13-25 DE JUNIO DE 2002



ANEXO Nº2

DOCUMENTOS

New York, 28 de Mayo de 2002

Descripción de la campaña de mediciones de campo de corrientes para la modelacion hidrodinámica (II).

Rafael Cañizares
Santiago Alfageme.

Introducción

La campaña de mediciones presentada en este documento esta diseñada unicamente para complementar la anterior campaña de mediciones del 9 de Mayo del 2002 que consisitía en un total de 9 dias de toma de mediciones durante tres situaciones diferentes de la marea en Balboa, Panama. Debido a un número de problemas tanto meteorológicos como técnicos ocurridos durante los últimos tres dias de la campaña de mediciones, las corrientes durante la marea de sicigia no pudieron ser correctamente observadas. Por lo tanto sugerimos a la ACP que proceda a la realización de unas nuevas mediciones de la corriente durante los dias indicados en este documento. Además de las mediciones durante la marea de sicigia (del 23 al 25 de Junio) si esta dentro de las posiblidades del ACP, sugerimos tambien la toma de mediciones de corriente durante la marea de cuadratura del 3 al 5 de Junio.

Campaña de Mediciones de campo de corrientes para Junio 2002

En cada uno de los tres alineamientos A, B y C cuyos puntos estan situados en las coordenadas presentadas en la Tabla 1, se tomaran mediciones correspondientes a marea de sicigia (marea viva), marea media y marea de cuadratura (marea muerta). Para cada una de estos estados de marea las mediciones han de tomarse durante bajamar, pleamar y dos mareas medias cada día Cada una de estas mediciones debe efectuarse en un periodo de aproximadamente dos horas, comenzando una hora antes del tiempo marcado como bajamar, pleamar y marea media. El tiempo en el que se presenta bajamar y pleamar ha sido tomado de la Tabla de Mareas del 2002 confeccionada por el Departamento de Ingeniería Proyectos, División de Ingeniería, Sección de Meteorología e Hidrología, para la estación de Balboa en el Pacífico. Los datos en estas tablas están en hora local de la República de Panama.

Tabla 1: Geo Coordinates for Current Data Measurement Points

Point Number	Latitude				Longitude			
		°	'	"		°	'	"
Transect A. Rio Pacora								
A1	N	9	0	0	W	79	16	12
A2	N	8	57	0	W	79	16	12
A3	N	8	54	36	W	79	16	12
A4	N	8	51	36	W	79	16	12
Transect B. New Island								
B1	N	8	53	10	W	79	35	36
B2	N	8	52	22	W	79	35	24
B3	N	8	51	45	W	79	35	12
B4	N	8	51	0	W	79	35	0
B5	N	8	49	30	W	79	34	10
Transect C. Punta Chame								
C1	N	8	37	48	W	79	39	0
C2	N	8	39	36	W	79	35	60
C3	N	8	42	36	W	79	34	48

Mediciones durante Marea de Cuadratura

Lunes, 3 de Junio del 2002 – Cuarto Creciente
Toma de datos en alineación A.
Tiempo de Medición:

Marea Media subiendo: 6:00 – 8:00
Pleamar: 8:57 – 10:57
Marea Media bajando: 12:00 – 14:00
Bajamar : 15:09 – 17:09

Martes, 4 deJunio del 2002 –
Toma de datos en alineación B.
Tiempo de Medición:

Marea Media subiendo: 7:00 – 9:00
Pleamar: 9: 57– 11:57
Marea Media bajando: 13:00 – 14:00
Bajamar : 16:07 – 18:07

Miercoles, 5 de Junio del 2002 –
Toma de datos en alineación C.
Tiempo de Medición:

Marea Media subiendo: 8:00 – 10:00
Pleamar::10:55– 12:55
Marea Media bajando: 14:00 – 16:00
Bajamar : 17:05 – 19:05

Mediciones durante Marea de Sicigia

Domingo, 23 de Junio del 2002 1 dia antes de Luna Llena
Toma de datos en alineación A.
Tiempo de Medición:

Bajamar : 7:22 – 9:22
Marea Media subiendo: 10:30 – 12:30
Pleamar : 13:30 – 15:30
Marea Media bajando: 16:30 – 18:30

Lunes, 24 de Junio del 2002 –Luna Llena
Toma de datos en alineación B.
Tiempo de Medición:

Marea Media bajando: 5:30 – 7:30
Bajamar : 8:14 – 10:14
Marea Media subiendo: 11:30 – 13:30
Pleamar: 14:20 – 16:20

Martes, 25 de Junio *del 2002 –2 dias despues de Luna Llena*
Toma de datos en alineación C.
Tiempo de Medición:

Marea Media bajando: 6:00 – 8:00
Bajamar : 9:02 – 11:02
Marea Media subiendo: 12:00 – 14:00
Pleamar: 15:10 – 17:10

AUTORIDAD DEL CANAL DE PANAMA
DIVISIÓN DE ADMINISTRACIÓN AMBIENTAL
SECCIÓN DE MANEJO DE CUENCA
Unidad de Operaciones

MEDICION DE CORRIENTES MARINAS EN LA ENTRADA SUR DEL CANAL DE PANAMA

Por

Oscar Baloyes

Gerardo Leis R.

Tomás García

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Ing. Jaime Massot

Pedro Miguel, Panamá
Diciembre de 2002

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PERSONAL QUE PARTICIPO EN LA MEDICION DE CORRIENTES MARINAS EN LA ENTRADA SUR DEL CANAL DE PANAMA

Oscar Baloyes
Coordinador del Proyecto

Medición de corrientes
Gerardo Leis
Oscar Baloyes

Gerardo Melo

Preparación del informe

Oscar Baloyes,
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Tomás García
Jaime Massot

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I INTRODUCCIÓN

A. Propósito

La Autoridad del Canal de Panamá (ACP) está conduciendo un estudio de factibilidad para evaluar la posibilidad de construir una isla artificial, en la entrada del Pacífico del Canal, utilizando el material de dragado que se extraería de los proyectos de expansión del Canal de Panamá.

Los estudios incluyen las mediciones de corrientes marinas para calibrar el modelo hidrodinámico de corrientes marinas que aplicará la empresa consultora Moffatt & Nichol (M & N).

La campaña de mediciones, registradas en este documento, complementa las efectuadas en el mes de mayo de 2002.

B. Objetivo

Recolectar información sobre las características dinámicas de las corrientes marinas (velocidad y dirección), del viento (velocidad y dirección) y temperatura en dos alineaciones en la entrada sur del Canal de Panamá, es decir entre Punta Guinea – Causeway y en la zona del puente de las Américas.

C. Definición de términos

1. *Bajamar o marea baja:* Estado de la marea existente cuando el nivel del agua es mínimo para un ciclo de mareas dado. Mínimo nivel alcanzado por un curso de agua o un lago (estiaje)

2. *Campaña de mediciones de corrientes:* Se refiere a un conjunto de mediciones en ciertas condiciones de las mareas (sicigia de menor o mayor amplitud, de cuadratura, etc.)

3. *Correntímetro*: Instrumento para medir dirección y velocidad de las corrientes de agua, algunos están equipados con otros sensores que miden, temperatura, presión, etc.

4. *Corriente:* Movimiento horizontal del agua. Puede clasificarse en corrientes de marea y corrientes marinas.

5. Corrientes de marea: Se aplica casi exclusivamente a las corrientes periódicas producidas por las mareas. Por lo general, son débiles en alta mar pero pueden adquirir cerca de la costa velocidades suficientes para arrastrar las materias del fondo removidas por las olas. Estas corrientes cambian, teóricamente, de sentido en el momento que el mar alcanza su nivel medio. Cuando el mar está por encima de ese nivel, hay corrientes de flujo, cuando está por debajo, hay corrientes de reflujo cuyo sentido es opuesto al primero.

6. *Corrientes marinas:* Corrientes propiamente dichas, constituyen los movimientos de un sistema circulatorio general

7. *Cuadratura de la luna:* Posición de la Luna cuando su longitud difiere 90° de la longitud del Sol.

8. *Ecosonda:* Aparato electrónico, transmisor y receptor de sonidos de alta frecuencia, que permite medir las profundidades de las bahías, mares y océanos.

9. *Escala de marea:* Dispositivo para medir la altura de la marea.

10. *Marea muerta:* Marea de pequeña amplitud que se produce dos veces al mes cuando la luna esta en cuadratura de fase.

11. *Marea de sicigia:* Marea de gran amplitud en los periodos de luna llena y luna nueva

12. *Marea:* Elevación y descenso periódicos del agua en los mares o en grandes lagos debidos a la atracción gravitatoria de la luna y el sol

13. *Mareógrafo*: Instrumento que registra automáticamente el ascenso

14. *Marea media:* Es el nivel medio del agua, relativo al punto de referencia (nivel de referencia)

15. *Marea media bajando o subiendo:* Período entre el nivel de marea media hacia bajamar o pleamar respectivamente.

16. *Medición de corriente:* Procedimiento mediante el cual se mide la corriente del agua con el uso de un correntímetro.

17. *Oleaje:* Oscilación vertical de agua durante un período relativamente corto y de gran velocidad relativa.

18. *Pleamar o Marea Alta:* Nivel máximo alcanzado por una marea creciente. Este nivel puede ser efecto exclusivo de mareas periódicas, o pueden sumarse a éstas los efectos de las condiciones meteorológicas prevalecientes.

19. *Tabla de mareas:* Folleto que dan las predicciones diarias de las alturas y tiempo de ascenso y descenso de las mareas.

D. Delimitaciones:

Las mediciones se realizaron únicamente en las dos alineaciones establecidas por M & N en la Bahía de Panamá (apéndice 1). En cada alineación se especificaron varios sitios de medición y en cada sitio tres profundidades (a diez pies del fondo, a media profundidad y a diez pies de la superficie)

Las alineaciones y los sitios establecidos fueron (apéndice 2 – tabla 1, apéndice 3 - mapa):

1. Alineación A: "Puente de las Américas", compuesta de tres sitios (A1, A2, A3)

2. Alineación B: "Punta Guinea-Causeway", compuesta por cinco sitios (B1, B2, B3, B4 y B5)

E. Limitaciones:

1. Debido a que el trabajo requería de mediciones en las orillas y el centro del Canal y la ACP no permite el anclaje en el centro, por razones de seguridad, se mantuvieron las posiciones con el GPS y el motor en neutral para realizar las correcciones cuando fuere necesario.

2. El tráfico de lanchas y buques causaban oleajes y forzaban a desplazarse a un área segura cuando se realizaban las mediciones en el centro del Canal.

3. El día 6 de noviembre el cable del correntímetro fue cortado por la propela de la lancha. Esto aplazó las mediciones hasta el día 8 de noviembre para la reparación del cable. Las mediciones que no se llevaron a cabo el 6 de noviembre se completaron el 8 en condiciones similares de marea.

II METODOLOGÍA

A. Instrumentación y equipo:

Los equipos utilizados en las campañas fueron:

1. Correntímetro Valeport® 308
2. software Datalog®
3. Anemómetro y veleta Belfort®
4. Ecosonda Odom®
5. Torno de aforo
6. Sistema de posicionamiento global (GPS)
7. Fuente externa de 12 voltios
8. Computadora portátil.

Antes de iniciar la campaña de mediciones, se evaluaron las propiedades y el funcionamiento del correntímetro Valeport® 308 y el programa de manejo Datalog®

B. Mediciones:

1. La empresa M & N proporcionó dos alineaciones(A y B) en la entrada sur del Canal de Panamá con 8 sitios de medición, las fechas y horas de las diferentes campañas (anexo) en función de las fases lunares y las condiciones de las mareas.

2. Los sitios de medición fueron ubicados por georreferenciación con el GPS, de alta precisión de la lancha "Cazón" de la Unidad de Hidrografía.

3. El anclaje de la nave se realizó con una ancla en la proa y la otra en la popa para los puntos B1 y B5 el tiempo de este proceso duraba entre 5 a 10 minutos en función del oleaje y de la consistencia del material del lecho marino.

4. En los puntos en las orillas del Canal. A1, A3, B2 y B4 se ató la lancha a las boyas 17, 20, 13 y 14 respectivamente.

5. En el centro del Canal se sostuvo la posición de la lancha con el GPS y las correcciones con el motor encendido. Se cotejó la validez de este procedimiento con algunas pruebas midiendo: a)las corrientes sujetando la lancha a las boyas y b) luego sin sujetar a la lancha aplicando el procedimiento descrito.

6. La inmovilidad lateral de la nave se verificó constantemente con el GPS.

7. Las profundidades totales se midieron con el ecosonda de la nave

8. Se armó el correntímetro Valeport, se conectaron los cables a la computadora y se activo el sistema.

9. El correntímetro se enganchó al cable del torno de aforo montado en una grúa especial de la Unidad de Operaciones fijada en la nave.

10. Con el torno de aforo se medía el nivel cero, correspondiente a la superficie del agua y se determinaba las profundidades para cada medición en los sitios.

11. En cada sitio se midieron los datos de temperatura, velocidad y dirección de las corrientes a tres profundidades: diez pies desde el fondo, media profundidad y diez pies de la superficie.

12. Se registraron las velocidades y direcciones del viento, aproximadamente a cuatro metros de la superficie del agua sobre la proa de la nave, para

referencia de la profundidad de las corrientes a diez pies de la superficie del agua.

13. Las informaciones anteriores y las observaciones fueron registradas en un formulario de control de medición de corrientes (apéndice 4 – formulario 1)

D. Procesamiento de la información:

Las mediciones de velocidad y dirección de las corrientes marinas se verificaban en tiempo real con la computadora portátil, para validar la consistencia, mientras se registraba en el sistema del correntímetro.

Al finalizar el período de medición, estas se registraban en el disco duro de la computadora y se hacía una copia de seguridad en disco flexible. Toda la información fue verificada posteriormente en la Unidad de Operaciones.

III PRESENTACIÓN Y ANÁLISIS DE LOS RESULTADOS

Para una mejor comprensión de los resultados, estos fueron agrupados en tablas y analizados por medio de gráficos. A continuación una explicación de cada sección:

A. Tablas:

Los datos de las mediciones (apéndice 1 – datos y gráficas) están ordenados cronológicamente según la programación de M&N (anexo)

Se asignó una nomenclatura a cada tabla que se define según el día, la alineación, el sitio y la condición de la marea según la programación. Así la Tabla 06-B1.1 corresponde al día 6, la alineación B, sitio B1 (Punta Ginea), y la condición de marea es, por ejemplo, "marea media bajando".

Las elevaciones de las mareas corresponden a la ecuación armónica calculada para Balboa (Diablo), utilizada en la tabla de mareas de la Sección de Meteorología e Hidrología de la Autoridad del Canal de Panamá.

Las tablas de datos y gráficas muestran las unidades de medida tales como se registraron en cada equipo utilizado.

La medición del viento se realizó a cuatro metros de la superficie del agua en la cubierta de la nave. El viento esta definido según la dirección de procedencia.

B. Gráficas

Las gráficas presentadas en este reporte pretenden sintetizar el volumen de información obtenida y verificar la consistencia de los datos. Se confeccionaron dos tipos de gráficas que se complementan mutuamente:

1. Gráficas lineales que presentan la velocidad de las corrientes según los sitios de medición en la alineación correspondiente, las horas y las condiciones de las mareas. La finalidad de estas gráficas es presentar las mediciones realizadas dentro de la programación planeada por M & N y verificar la consistencia de los datos.

2. Las gráficas polares muestran la dirección y velocidad de las corrientes según las condiciones de las mareas en los conjuntos de mediciones de cada alineación, mostrando el agrupamiento o dispersión de los datos (lo que permite evaluar la consistencia).

Las direcciones de los sitios medidos en el primer tipo de gráfica se pueden relacionar con el segundo tipo de gráfica por las condiciones de las mareas.

IV CONCLUSIONES Y RECOMENDACIONES.

1. Las campañas de medición de las corrientes marinas en la entrada Sur del Canal de Panamá, de acuerdo al plan de M & N, se cumplieron en un 95%.

2. Los controles y verificaciones que se aplicaron para evitar los desplazamientos de la nave, al momento de las mediciones, fueron eficaces en las campañas realizadas.

3. Para evitar el desplazamiento de la nave en el momento de la medición se recomienda la colocación de dos anclas (una en la proa y la otra en la popa), o fijar la nave a una boya, además es necesaria la verificación continua de la posición con un GPS de alta precisión.

4. Se debe instalar una estructura en la lancha que proteja el correntímetro Valeport contra golpes sobre la estructura de la nave o el lecho marino.

5. Es necesario mantener el control continuo de los datos generados en tiempo real mediante la computadora y los formularios de campo.

APÉNDICE Nº1
DATOS Y GRAFICAS DE CORRIENTES

TABLA 06-B1.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)
MAREA DE SICIGIA (MAREA MEDIA BAJANDO)

Alineación	Punta Guinea
Sitio	B1
Fecha	6/11/2002

Coordenadas		*Viento	
Latitud N	*986530.73*	**Velocidad (Kt)**	8.5
Longitud E	*658872.60*	**Dirección (º)**	290

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
13.8	7*	11.7	7:00:25	28.11	0.49	152.80
			7:01:25	28.11	0.48	158.70
			7:02:25	28.10	0.54	159.80
			7:03:25	28.10	0.57	166.30
		11.6	7:04:25	28.10	0.59	160.30

TABLA 06-B2.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)
MAREA DE SICIGIA (MAREA MEDIA BAJANDO)

Alineación	Punta Guinea
Sitio	B2
Fecha	6/11/2002

Coordenadas		*Viento	
Latitud N	*986716.80*	**Velocidad (Kt)**	6.0
Longitud E	*659194.08*	**Dirección (º)**	300

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
56	46	10.2	7:16:20	28.06	0.14	139.40
			7:17:20	28.06	0.14	145.90
			7:18:20	28.06	0.09	168.90
			7:19:20	28.06	0.16	155.30
		9.8	7:20:20	28.06	0.23	150.70
	28	9.7	7:23:10	28.13	0.20	147.80
			7:24:10	28.13	0.21	151.10
			7:25:10	28.12	0.18	153.50
			7:26:10	28.10	0.18	153.20
		9.2	7:27:10	28.10	0.17	151.00
	10*	9.1	7:30:00	28.13	0.34	144.60
			7:31:00	28.13	0.34	143.30
			7:32:00	28.13	0.32	145.30
			7:33:00	28.12	0.43	143.80
		8.7	7:34:00	28.14	0.41	142.00

TABLA 06-B3.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)
MAREA DE SICIGIA (MAREA MEDIA BAJANDO)

Alineación	Punta Guinea
Sitio	B3
Fecha	6/11/2002

Coordenadas		*Viento	
Latitud N	*986788.69*	**Velocidad (Kt)**	2.0
Longitud E	*659318.33*	**Dirección (º)**	295

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
55	45	8.0	7:43:40	28.07	0.15	139.30
			7:44:40	28.07	0.13	144.40
			7:45:40	28.07	0.12	161.40
			7:46:40	28.07	0.13	153.50
		7.6	7:47:40	28.07	0.13	167.90
	28	7.5	7:49:45	28.12	0.21	172.10
			7:50:45	28.11	0.21	170.10
			7:51:45	28.11	0.21	167.60
			7:52:45	28.11	0.21	161.70
		6.8				
	10*	6.9	7:57:25	28.12	0.38	136.00
			7:58:25	28.11	0.39	136.60
			7:59:25	28.11	0.39	136.10
			8:00:25	28.11	0.42	137.30
		6.4	8:01:25	28.11	0.52	136.00

TABLA 06-B4.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)
MAREA DE SICIGIA (MAREA MEDIA BAJANDO)

Alineación	Punta Guinea
Sitio	B4
Fecha	6/11/2002

Coordenadas		*Viento	
Latitud N	*986881.93*	**Velocidad (Kt)**	8.0
Longitud E	*659331.47*	**Dirección (º)**	320

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
52	42	5.9	8:09:10	28.08	0.22	149.20
			8:10:10	28.09	0.24	151.70
			8:11:10	28.09	0.22	151.80
			8:12:10	28.09	0.21	152.60
		5.4	8:13:10	28.09	0.20	143.90
	26	5.3	8:16:10	28.12	0.24	152.80
			8:17:10	28.13	0.24	148.30
			8:18:10	28.13	0.26	156.00
			8:19:10	28.13	0.27	152.00
		4.8	8:20:10	28.13	0.26	148.30
	10*	4.8	8:22:25	28.11	0.52	139.70
			8:23:25	28.11	0.53	140.00
			8:24:25	28.11	0.54	150.20
			8:25:25	28.11	0.54	137.10
		4.2	8:26:25	28.11	0.52	140.40

TABLA 06-B5.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)
MAREA DE SICIGIA (MAREA MEDIA BAJANDO)

Alineación	Punta Guinea
Sitio	B5
Fecha	6/11/2002

Coordenadas		*Viento	
Latitud N	*986869.70*	**Velocidad (Kt)**	5.0
Longitud E	*659755.99*	**Dirección (º)**	325

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
14	7*	3.6	8:37:20	28.14	0.23	139.20
			8:38:20	28.15	0.23	130.90
			8:39:20	28.14	0.22	134.70
			8:40:20	28.14	0.24	139.10
		3.2	8:41:20	28.14	0.24	144.60

TABLA 06-B5.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)
MAREA DE SICIGIA (BAJAMAR)

Alineación	Punta Guinea
Sitio	B5
Fecha	6/11/2002

Coordenadas		*Viento	
Latitud N	*986869.70*	**Velocidad (Kt)**	4.5
Longitud E	*659755.99*	**Dirección (º)**	65

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
9	4.5*	-1.1	9:57:15	28.35	0.18	126.90
			9:58:15	28.37	0.11	151.90
			9:59:15	28.37	0.04	255.40
			10:00:15	28.34	0.07	142.10
		-1.3	10:01:15	28.38	0.06	141.50

TABLA 06-B4.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)

MAREA DE SICIGIA (BAJAMAR)

Alineación	Punta Guinea
Sitio	B4
Fecha	6/11/2002

Coordenadas		*Viento	
Latitud N	*986881.93*	**Velocidad (Kt)**	6.0
Longitud E	*659331.47*	**Dirección (º)**	85

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
45	35	-1.4	10:07:34	28.14	0.04	93.10
			10:08:34	28.15	0.04	103.90
			10:09:34	28.15	0.02	135.40
			10:10:34	28.14	0.04	268.50
		-1.5	10:11:34	28.13	0.10	193.80
	22	-1.6	10:13:40	28.16	0.13	153.00
			10:14:40	28.16	0.13	161.40
			10:15:40	28.16	0.13	166.00
			10:16:40	28.16	0.13	164.60
		-1.7	10:17:40	28.16	0.13	154.60
	10*	-1.7	10:19:35	28.16	0.32	125.00
			10:20:35	28.16	0.33	125.60
			10:21:35	28.15	0.34	129.00
			10:22:35	28.16	0.39	125.60
		-1.7	10:23:35	28.16	0.38	131.90

TABLA 06-B3.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)

MAREA DE SICIGIA (BAJAMAR)

Alineación	Punta Guinea
Sitio	B3
Fecha	6/11/2002

Coordenadas		*Viento	
Latitud N	*986788.69*	**Velocidad (Kt)**	5.5
Longitud E	*659318.33*	**Dirección (º)**	100

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
46	36	-1.8	10:28:15	28.14	0.10	223.80
			10:29:15	28.12	0.13	278.10
			10:30:15	28.10	0.15	287.70
			10:31:15	28.09	0.19	294.30
		-1.9	10:32:15	28.09	0.19	300.00
	23	-1.9	10:34:20	28.16	0.10	231.90
			10:35:20	28.16	0.10	250.00
			10:36:20	28.15	0.10	251.30
			10:37:20	28.16	0.13	232.10
		-1.9	10:38:20	28.16	0.13	226.10
	10*	-1.9	10:40:05	28.17	0.19	201.50
			10:41:05	28.17	0.16	191.40
			10:42:05	28.17	0.16	187.90
			10:43:05	28.17	0.14	186.60
		-1.9	10:44:05	28.16	0.15	183.50

TABLA 06-B2.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)

MAREA DE SICIGIA (BAJAMAR)

Alineación	Punta Guinea
Sitio	B2
Fecha	6/11/2002

Coordenadas		*Viento	
Latitud N	*986716.80*	**Velocidad (Kt)**	6.5
Longitud E	*659194.08*	**Dirección (º)**	120

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
43	33	-1.9	10:49:35	28.12	0.13	333.40
			10:50:35	28.12	0.16	330.90
			10:51:35	28.13	0.14	330.50
			10:52:35	28.12	0.13	325.60
		-1.8	10:53:35	28.14	0.12	317.10
	21	-1.8	10:55:15	28.16	0.10	296.10
			10:56:15	28.16	0.14	333.10
			10:57:15	28.15	0.15	330.40
			10:58:15	28.15	0.17	331.00
		-1.7	10:59:15	28.15	0.16	332.50
	10*	-1.7	11:00:55	28.21	0.10	320.30
			11:01:55	28.19	0.09	308.90
			11:02:55	28.17	0.09	310.00
			11:03:55	28.21	0.07	314.00
		-1.6	11:04:55	28.23	0.06	310.60

TABLA 06-B1.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)

MAREA DE SICIGIA (MAREA MEDIA SUBIENDO)

Alineación	Punta Guinea
Sitio	B1
Fecha	6/11/2002

Coordenadas		*Viento	
Latitud N	*986530.73*	**Velocidad (Kt)**	7.5
Longitud E	*658872.60*	**Dirección (º)**	160

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
8	4*	5.9	13:10:50	30.04	0.08	265.50
			13:11:50	30.02	0.05	343.60
			13:12:50	30.01	0.09	327.10
			13:13:50	29.94	0.08	246.00
		67.0	13:14:50	29.89	0.06	284.30

TABLA 06-B2.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)
MAREA DE SICIGIA (MAREA MEDIA SUBIENDO)

Alineación	Punta Guinea
Sitio	B2
Fecha	6/11/2002

Coordenadas		*Viento	
Latitud N	*986716.80*	**Velocidad (Kt)**	3.0
Longitud E	*659194.08*	**Dirección (º)**	150

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
53	43	7.1	13:23:25	28.02	0.50	328.10
			13:24:25	28.01	0.52	328.50
			13:25:25	28.00	0.50	329.90
			13:26:25	28.00	0.49	328.70
		7.4	13:27:25	27.99	0.49	325.60
	26	7.6	13:29:00	28.10	0.56	326.30
			13:30:00	28.10	0.52	326.80
			13:31:00	28.12	0.54	323.70
			13:32:00	28.12	0.57	324.80
		7.9	13:33:00	28.12	0.56	327.50
	10*	8.0	13:34:55	29.22	0.31	341.70
			13:35:55	29.15	0.32	339.40
			13:36:55	29.15	0.32	339.50
			13:37:55	29.24	0.31	341.10
		8.3	13:38:55	29.15	0.28	335.30

TABLA 06-B3.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)
MAREA DE SICIGIA (MAREA MEDIA SUBIENDO)

Alineación	Punta Guinea
Sitio	B3
Fecha	6/11/2002

Coordenadas		*Viento	
Latitud N	*986788.69*	**Velocidad (Kt)**	S/D
Longitud E	*659318.33*	**Dirección (º)**	S/D

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
56	46	S/D				
		S/D				
	28	11.8	14:21:25	28.03	0.45	312.50
			14:22:25	28.06	0.42	315.60
			14:23:25	28.08	0.39	320.40
	10*	S/D				
		S/D				

TABLA 06-B4.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)

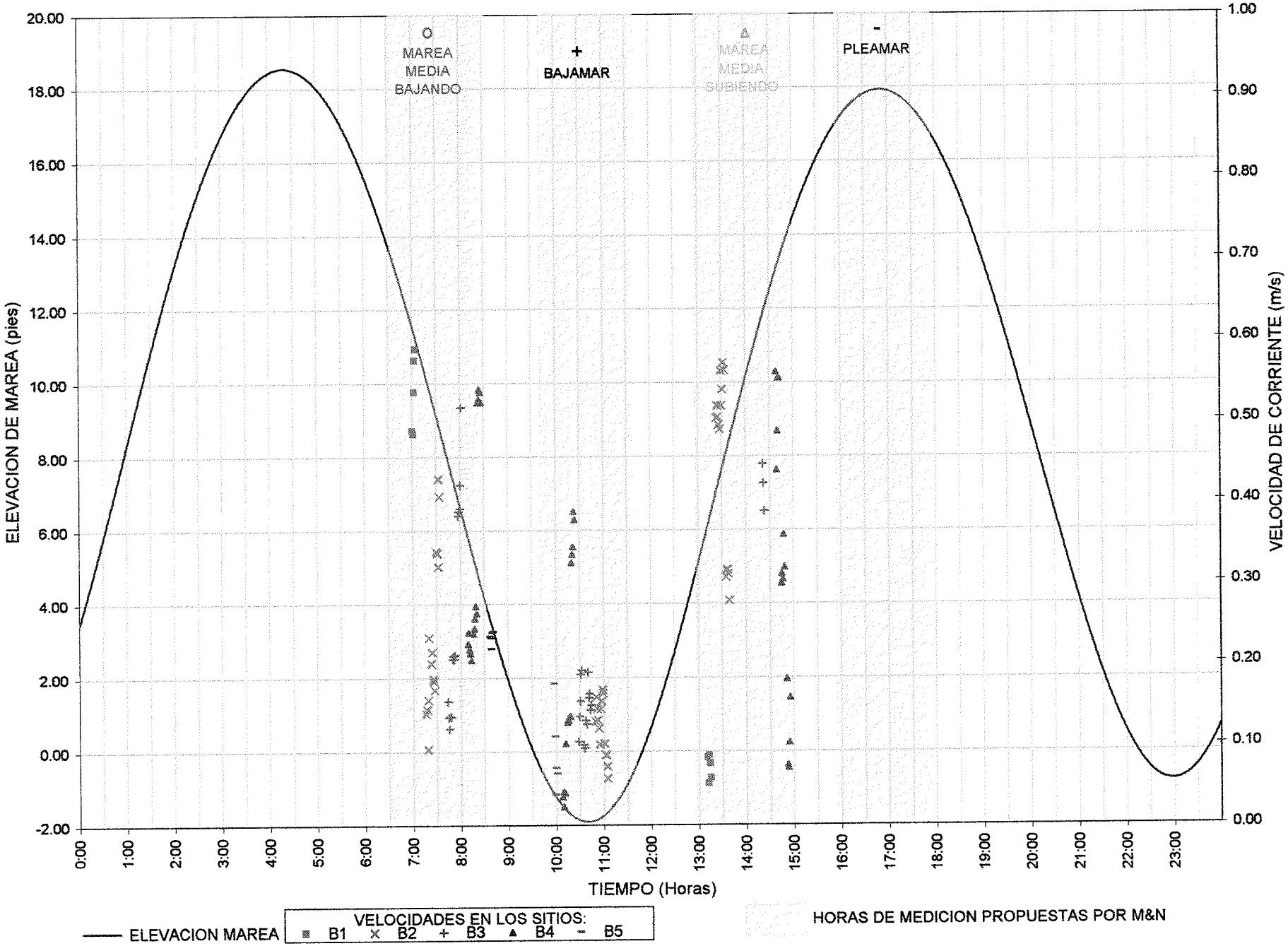
MAREA DE SICIGIA (MAREA MEDIA SUBIENDO)

Alineación	Punta Guinea
Sitio	B4
Fecha	6/11/2002

Coordenadas		*Viento	
Latitud N	*986881.93*	**Velocidad (Kt)**	6.7
Longitud E	*659331.47*	**Dirección (º)**	296

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
58	48	13.0	14:38:05	28.01	0.56	342.50
			14:39:05	28.03	0.44	313.90
			14:40:05	28.02	0.49	340.40
			14:41:05	28.01	0.55	348.40
		13.3	14:42:05	28.02	0.55	344.10
	29	13.4	14:44:15	28.28	0.30	301.80
			14:45:15	28.29	0.31	294.80
			14:46:15	28.28	0.30	314.50
			14:47:15	28.28	0.36	317.80
		13.7	14:48:15	28.28	0.32	303.60
	10*	13.8	14:50:40	29.05	0.18	356.10
			14:51:40	29.02	0.07	294.20
			14:52:40	28.98	0.07	344.80
			14:53:40	28.99	0.10	358.90
		14.2	14:54:40	29.01	0.16	8.80

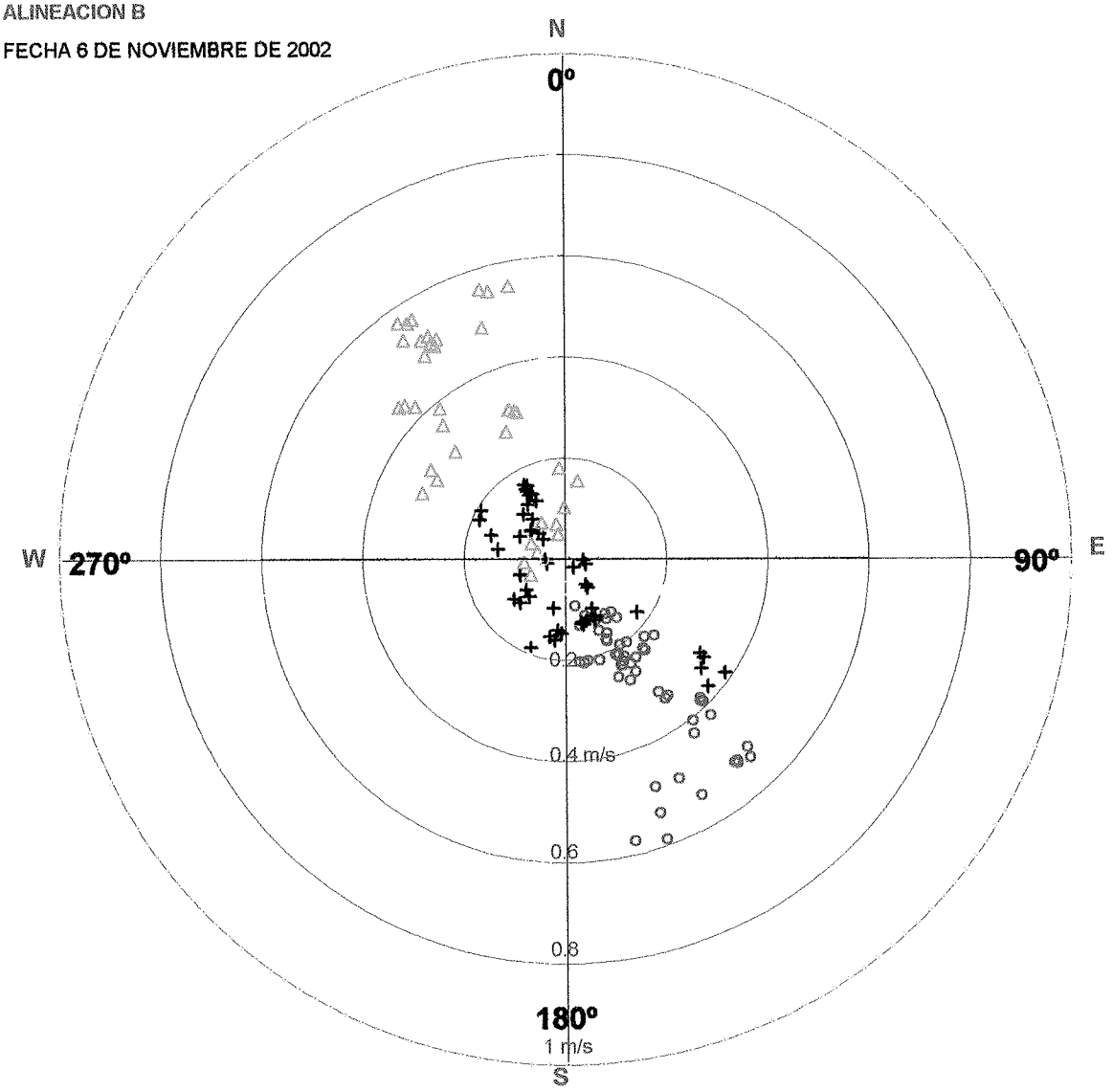
VELOCIDAD DE CORRIENTES MARINAS EN LA ENTRADA SUR DEL CANAL SEGUN HORA, CONDICION DE MAREA Y SITIOS DE MEDICION (B1, B2, B3, B4 Y B5) DE ALINEACION B (PUNTA GUINEA). 6 DE NOVIEMBRE DE 2002.



VELOCIDAD Y DIRECCION DE LAS CORRIENTES MARINAS EN LA ENTRADA SUR DEL CANAL DE PANAMÁ SEGÚN CONDICION DE MAREA

ALINEACION B

FECHA 6 DE NOVIEMBRE DE 2002



○ Marea media bajando

+ Bajamar

△ Marea media subiendo

Unidad de Operaciones-ACP

TABLA 08-A1.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)
MAREA DE SICIGIA (MAREA MEDIA BAJANDO)

Alineación	P. de las Americas
Sitio	A1
Fecha	8/11/2002

Coordenadas		*Viento	
Latitud N	*988683.76*	**Velocidad (Kt)**	0
Longitud E	*657637.26*	**Dirección (º)**	0

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
57	47	10.6	8:45:26	28.25	0.36	155.40
			8:46:26	28.23	0.45	151.60
			8:47:26	28.23	0.48	146.90
			8:48:26	28.22	0.48	147.00
		10.1	8:49:26	28.22	0.44	143.90
	28	9.8	8:54:46	28.21	0.51	141.90
			8:55:46	28.21	0.48	143.70
			8:56:46	28.23	0.49	144.80
			8:57:46	28.21	0.50	145.50
		9.4	8:58:46	28.22	0.52	147.70
	10*	9.1	9:02:36	28.08	0.34	121.60
			9:03:36	28.07	0.35	128.00
			9:04:36	28.05	0.31	136.90
			9:05:36	28.05	0.33	129.60
		8.8	9:06:36	28.08	0.32	123.40

TABLA 08-A2.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)
MAREA DE SICIGIA (MAREA MEDIA BAJANDO)

Alineación	P. de las Americas
Sitio	A2
Fecha	8/11/2002

Coordenadas		*Viento	
Latitud N	*988751.56*	**Velocidad (Kt)**	0.0
Longitud E	*657714.48*	**Dirección (º)**	0

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
55	45	7.4	9:23:36	28.18	0.66	155.90
			9:24:36	28.18	0.21	153.10
			9:25:36	28.18	0.27	141.90
			9:26:36	28.18	0.79	132.50
		7.1	9:27:36	28.18	0.27	112.50
	27	7.0	9:29:11	28.21	0.19	134.00
			9:30:11	28.20	0.20	149.50
			9:31:11	28.20	0.21	133.30
			9:32:11	28.20	0.16	131.00
		6.6				
	10*	6.0	9:43:11	28.14	0.61	131.30
			9:44:11	28.15	0.42	122.10
			9:45:11	28.15	0.19	84.40
			9:46:11	28.14	0.17	113.40
		5.4	9:47:11	28.15	1.10	141.30

TABLA 08-A3.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)
MAREA DE SICIGIA (MAREA MEDIA BAJANDO)

Alineación	P. de las Americas
Sitio	A3
Fecha	8/11/2002

Coordenadas		*Viento	
Latitud N	*988886.56*	**Velocidad (Kt)**	2.5
Longitud E	*657739.72*	**Dirección (º)**	307

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
44	34	4.7	9:53:46	28.19	0.17	133.80
			9:54:46	28.19	0.30	154.70
			9:55:46	28.19	0.31	142.60
			9:56:46	28.19	0.29	149.70
		4.6	9:57:46	28.19	0.27	144.30
	22	4.6	10:00:36	28.15	0.12	163.60
			10:01:36	28.16	0.09	125.00
			10:02:36	28.16	0.16	95.50
			10:03:36	28.16	0.14	129.30
		4.3	10:04:36	28.16	0.13	138.30
	10*	4.2	10:06:16	28.16	0.04	81.40
			10:07:16	28.16	0.09	40.30
			10:08:16	28.17	0.12	97.90
			10:09:16	28.15	0.04	76.50
		3.8	10:10:16	28.16	0.07	83.70

TABLA 08-A3.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)
MAREA DE SICIGIA (BAJAMAR)

Alineación	P. de las Americas
Sitio	A3
Fecha	8/11/2002

Coordenadas		*Viento	
Latitud N	*988886.56*	**Velocidad (Kt)**	2.0
Longitud E	*657739.72*	**Dirección (º)**	101

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
40	30	-0.1	11:29:11	28.16	0.06	182.70
			11:30:11	28.17	0.08	80.40
			11:31:11	28.17	0.03	55.30
			11:32:11	28.17	0.05	327.80
		-0.3	11:33:11	28.18	0.12	277.30
	20	-0.4	11:34:45	28.19	0.04	234.00
			11:35:45	28.19	0.01	333.90
			11:36:45	28.19	0.05	61.50
			11:37:45	28.20	0.04	73.20
		-0.5	11:38:45	28.19	0.07	122.90
	10*	-0.5	11:40:26	28.16	0.09	245.70
			11:41:26	28.16	0.08	182.40
			11:42:26	28.16	0.10	148.00
			11:43:26	28.16	0.11	149.40
		-0.6	11:44:26	28.17	0.11	199.00

TABLA 08-A1.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)

MAREA DE SICIGIA (BAJAMAR)

Alineación	P. de las Americas
Sitio	A1
Fecha	8/11/2002

Coordenadas		*Viento	
Latitud N	*988683.76*	**Velocidad (Kt)**	1.5
Longitud E	*657637.26*	**Dirección (º)**	83

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
46	36	-0.7	11:50:35	28.24	0.14	313.90
			11:51:35	28.24	0.09	285.40
			11:52:35	28.25	0.06	292.90
			11:53:35	28.25	0.07	296.60
		-0.7	11:54:35	28.25	0.07	313.00
	23	-0.7	11:56:11	28.25	0.06	321.80
			11:57:11	28.25	0.11	335.20
			11:58:11	28.25	0.09	286.90
			11:59:11	28.25	0.08	282.30
		-0.8	12:00:11	28.26	0.10	328.20
	10*	-0.8	12:01:51	28.17	0.15	172.70
			12:02:51	28.17	0.16	171.90
			12:03:51	28.17	0.11	161.70
			12:04:51	28.17	0.15	156.00
		-0.9	12:05:51	28.18	0.16	179.90

TABLA 08-A2.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)

MAREA DE SICIGIA (BAJAMAR)

Alineación	P. de las Americas
Sitio	A2
Fecha	8/11/2002

Coordenadas		*Viento	
Latitud N	*988751.56*	**Velocidad (Kt)**	0.0
Longitud E	*657714.48*	**Dirección (º)**	0

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
44	34	-0.8	12:09:36	28.18	0.22	323.20
			12:10:36	28.19	0.33	335.90
			12:11:36	28.19	0.32	328.10
			12:12:36	28.19	0.20	322.20
		-0.8	12:13:36	28.19	0.19	309.30
	22	-0.8	12:15:11	28.22	0.26	305.10
			12:16:11	28.22	0.16	317.50
			12:17:11	28.22	0.21	334.20
			12:18:11	28.22	0.23	314.40
		-0.8	12:19:11	28.22	0.26	312.40
	10*	-0.8	12:20:46	28.20	0.06	300.80
			12:21:46	28.19	0.07	303.50
			12:22:46	28.19	0.03	303.60
			12:23:46	28.19	0.06	301.40
		-0.8	12:24:46	28.19	0.05	296.90

TABLA 08-A1.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)
MAREA DE SICIGIA (MAREA MEDIA SUBIENDO)

Alineación	P. de las Americas
Sitio	A1
Fecha	8/11/2002

Coordenadas		*Viento	
Latitud N	*988683.76*	**Velocidad (Kt)**	0.0
Longitud E	*657637.26*	**Dirección (º)**	0

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
49	39	3.4	14:03:46	28.27	0.34	325.90
			14:04:46	28.27	0.31	331.80
			14:05:46	28.27	0.29	326.00
			14:06:46	28.27	0.30	324.20
		3.6	14:07:46	28.27	0.30	326.30
	25	3.7	14:09:31	28.24	0.33	331.30
			14:10:31	28.25	0.34	332.20
			14:11:31	28.25	0.35	330.30
			14:12:31	28.25	0.36	327.00
		4.0	14:13:31	28.26	0.36	331.00
	10*	4.2	14:15:01	28.17	0.09	334.30
			14:16:01	28.17	0.10	326.20
			14:17:01	28.17	0.12	342.70
			14:18:01	28.18	0.11	331.40
		4.5				

TABLA 08-A2.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)
MAREA DE SICIGIA (MAREA MEDIA SUBIENDO)

Alineación	P. de las Americas
Sitio	A2
Fecha	8/11/2002

Coordenadas		*Viento	
Latitud N	*988751.56*	**Velocidad (Kt)**	0.0
Longitud E	*657714.48*	**Dirección (º)**	0

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
50	40	5.7	14:35:06	27.79	0.49	332.50
			14:36:06	28.27	0.86	336.40
			14:37:06	28.27	0.46	343.00
			14:38:06	28.28	0.37	339.80
		5.9				
	25	6.0	14:41:26	28.24	0.46	327.60
			14:42:26	28.24	0.45	324.10
			14:43:26	28.24	0.46	333.00
		6.3				
	10*	6.7	14:51:16	28.28	0.63	339.00
			14:52:16	28.26	0.32	347.20
			14:53:16	28.26	0.17	318.90
			14:54:16	28.26	0.12	303.80
		7.1	14:55:16	28.28	0.14	290.80

TABLA 08-B3.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)
MAREA DE SICIGIA (MAREA MEDIA SUBIENDO)

Alineación	Punta Guinea
Sitio	B3
Fecha	8/11/2002

Coordenadas		*Viento	
Latitud N	*986788.69*	**Velocidad (Kt)**	0.0
Longitud E	*659318.33*	**Dirección (º)**	0

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
		8.0	15:09:11	28.34	0.32	346.90
			15:10:11	28.32	0.37	355.90
	45		15:11:11	28.31	0.28	16.70
			15:12:11	28.30	0.14	37.00
		8.3				
		8.3	15:13:41	28.39	0.13	35.00
			15:14:41	28.41	0.17	49.10
55	22		15:15:41	28.43	0.18	56.30
		8.6				
		8.6	15:17:46	28.44	0.13	58.00
			15:18:46	28.44	0.12	64.00
	10*		15:19:46	28.45	0.13	27.20
			15:20:46	28.47	0.10	7.10
		8.8				

TABLA 08-A3.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)
MAREA DE SICIGIA (MAREA MEDIA SUBIENDO)

Alineación	P. de las Americas
Sitio	A3
Fecha	8/11/2002

Coordenadas		*Viento	
Latitud N	*988886.56*	**Velocidad (Kt)**	2.2
Longitud E	*657739.72*	**Dirección (º)**	180

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
		9.7	15:32:51	28.30	0.30	321.40
			15:33:51	28.31	0.35	321.70
	38		15:34:51	28.29	0.34	316.90
			15:35:51	28.28	0.23	302.40
		10.0	15:36:51	28.26	0.11	268.90
		10.1	15:38:31	28.23	0.07	262.10
			15:39:31	28.24	0.15	341.70
48	24		15:40:31	28.24	0.27	327.30
			15:41:31	28.24	0.03	258.20
		10.4	15:42:31	28.24	0.02	215.50
		10.5	15:44:11	28.21	0.04	12.80
			15:45:11	28.22	0.07	322.40
	10*		15:46:11	28.22	0.09	324.60
			15:47:11	28.24	0.09	327.50
		10.8	15:48:11	28.24	0.07	340.80

TABLA 08-B4.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)
MAREA DE SICIGIA (MAREA MEDIA SUBIENDO)

Alineación	Punta Guinea
Sitio	B4
Fecha	8/11/2002

Coordenadas		*Viento	
Latitud N	*986881.93*	**Velocidad (Kt)**	0.0
Longitud E	*659331.47*	**Dirección (º)**	0

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
57	47	12.1	16:08:41	28.39	0.27	322.80
			16:09:41	28.39	0.30	318.30
			16:10:41	28.38	0.28	324.20
			16:11:41	28.38	0.31	329.40
		12.3	16:12:41	28.39	0.27	320.90
	24	12.4	16:14:21	28.40	0.29	326.00
			16:15:21	28.42	0.30	331.30
			16:16:21	28.42	0.35	335.70
			16:17:21	28.41	0.23	304.30
		12.7	16:18:21	28.41	0.25	299.80
	10*	12.8	16:20:21	28.51	0.20	353.10
			16:21:21	28.51	0.21	354.70
			16:22:21	28.51	0.19	337.70
			16:23:21	28.52	0.17	333.10
		13.0	16:24:21	28.51	0.16	344.60

TABLA 08-B5.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)
MAREA DE SICIGIA (MAREA MEDIA SUBIENDO)

Alineación	Punta Guinea
Sitio	B5
Fecha	8/11/2002

Coordenadas		*Viento	
Latitud N	*986869.70*	**Velocidad (Kt)**	0.0
Longitud E	*659755.99*	**Dirección (º)**	0

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
23	11*	13.4	16:31:06	28.48	0.05	129.80
			16:32:06	28.48	0.13	38.50
			16:33:06	28.48	0.18	359.90
			16:34:06	28.48	0.18	333.50
		13.6	16:35:06	28.49	0.20	315.90

TABLA 08-A3.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)

MAREA DE SICIGIA (PLEAMAR)

Alineación	P. de las Americas
Sitio	A3
Fecha	8/11/2002

Coordenadas		*Viento	
Latitud N	*988886.56*	**Velocidad (Kt)**	0.0
Longitud E	*657739.72*	**Dirección (º)**	0

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
50	40	16.5	17:46:26	28.32	0.07	208.50
			17:47:26	28.32	0.08	298.90
			17:48:26	28.32	0.06	256.60
			17:49:26	28.32	0.04	300.30
		16.5	17:50:26	28.32	0.05	280.00
	20	16.5	17:52:01	28.37	0.06	153.00
			17:53:01	28.37	0.12	142.30
			17:54:01	28.35	0.09	133.60
			17:55:01	28.36	0.13	135.50
		16.6	17:56:01	28.35	0.14	131.90
	10*	16.6	17:57:51	28.33	0.10	119.10
			17:58:51	28.34	0.07	113.40
			17:59:51	28.35	0.05	115.10
			18:00:51	28.35	0.08	121.20
		16.7	18:01:51	28.35	0.11	110.40

TABLA 08-B5.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)

MAREA DE SICIGIA (PLEAMAR)

Alineación	Punta Guinea
Sitio	B5
Fecha	8/11/2002

Coordenadas		*Viento	
Latitud N	*986869.70*	**Velocidad (Kt)**	0.0
Longitud E	*659755.99*	**Dirección (º)**	0

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
25	12*	16.9	18:17:46	28.43	0.16	357.20
			18:18:46	28.42	0.14	22.30
			18:19:46	28.42	0.10	32.60
			18:20:46	28.43	0.13	350.90
		16.9	18:21:46	28.43	0.13	344.00

TABLA 08-B4.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)

MAREA DE SICIGIA (PLEAMAR)

Alineación	Punta Guinea
Sitio	B4
Fecha	8/11/2002

Coordenadas		*Viento	
Latitud N	*986881.93*	**Velocidad (Kt)**	0.0
Longitud E	*659331.47*	**Dirección (º)**	0

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
61	51	16.9	18:28:51	28.34	0.21	326.30
			18:29:51	28.34	0.15	325.70
			18:30:51	28.34	0.13	336.80
			18:31:51	28.35	0.12	342.70
		16.9	18:32:51	28.33	0.14	350.20
	30	16.9	18:34:46	28.45	0.09	295.30
			18:35:46	28.45	0.09	283.80
			18:36:46	28.45	0.09	260.20
			18:37:46	28.45	0.10	234.90
		16.9	18:38:46	28.46	0.06	291.10
	10*	16.9	18:40:56	28.46	0.13	32.40
			18:41:56	28.46	0.08	49.40
			18:42:56	28.45	0.08	94.20
			18:43:56	28.46	0.10	73.20
		16.9	18:44:56	28.46	0.11	87.30

TABLA 08-B3.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)

MAREA DE SICIGIA (PLEAMAR)

Alineación	Punta Guinea
Sitio	B3
Fecha	8/11/2002

Coordenadas		*Viento	
Latitud N	*986788.69*	**Velocidad (Kt)**	0.0
Longitud E	*659318.33*	**Dirección (º)**	0

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
62	52	16.8	18:49:26	28.35	0.29	303.40
			18:50:26	28.35	0.32	304.90
			18:51:26	28.33	0.29	312.10
		16.8				
	31	16.7	18:53:21	28.44	0.32	85.80
			18:54:21	28.43	0.20	288.80
			18:55:21	28.44	0.24	302.10
		16.7				
	10*	16.7	18:56:51	28.39	0.26	298.10
			18:57:51	28.40	0.32	309.30
			18:58:51	28.39	0.29	313.90
		16.7				

TABLA 08-B2.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)
MAREA DE SICIGIA (PLEAMAR)

Alineación	Punta Guinea
Sitio	B2
Fecha	8/11/2002

Coordenadas		*Viento	
Latitud N	*986716.80*	**Velocidad (Kt)**	4.5
Longitud E	*659194.08*	**Dirección (º)**	280

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
62	52	16.6	19:06:10	28.38	0.14	28.00
			19:07:10	28.38	0.06	263.80
			19:08:10	28.38	0.11	32.60
			19:09:10	28.39	0.04	214.30
		16.5	19:10:10	28.40	0.06	331.50
	31	16.4	19:11:46	28.41	0.07	266.30
			19:12:46	28.41	0.07	345.20
			19:13:46	28.41	0.07	271.70
			19:14:46	28.42	0.06	298.30
		16.4	19:15:46	28.42	0.09	323.80
	10*	16.2	19:17:15	28.50	0.04	274.80
			19:18:15	28.50	0.08	144.00
			19:19:15	28.50	0.06	98.20
			19:20:15	28.50	0.04	167.10
		16.2	19:21:15	28.50	0.06	178.60

TABLA 08-B1.4

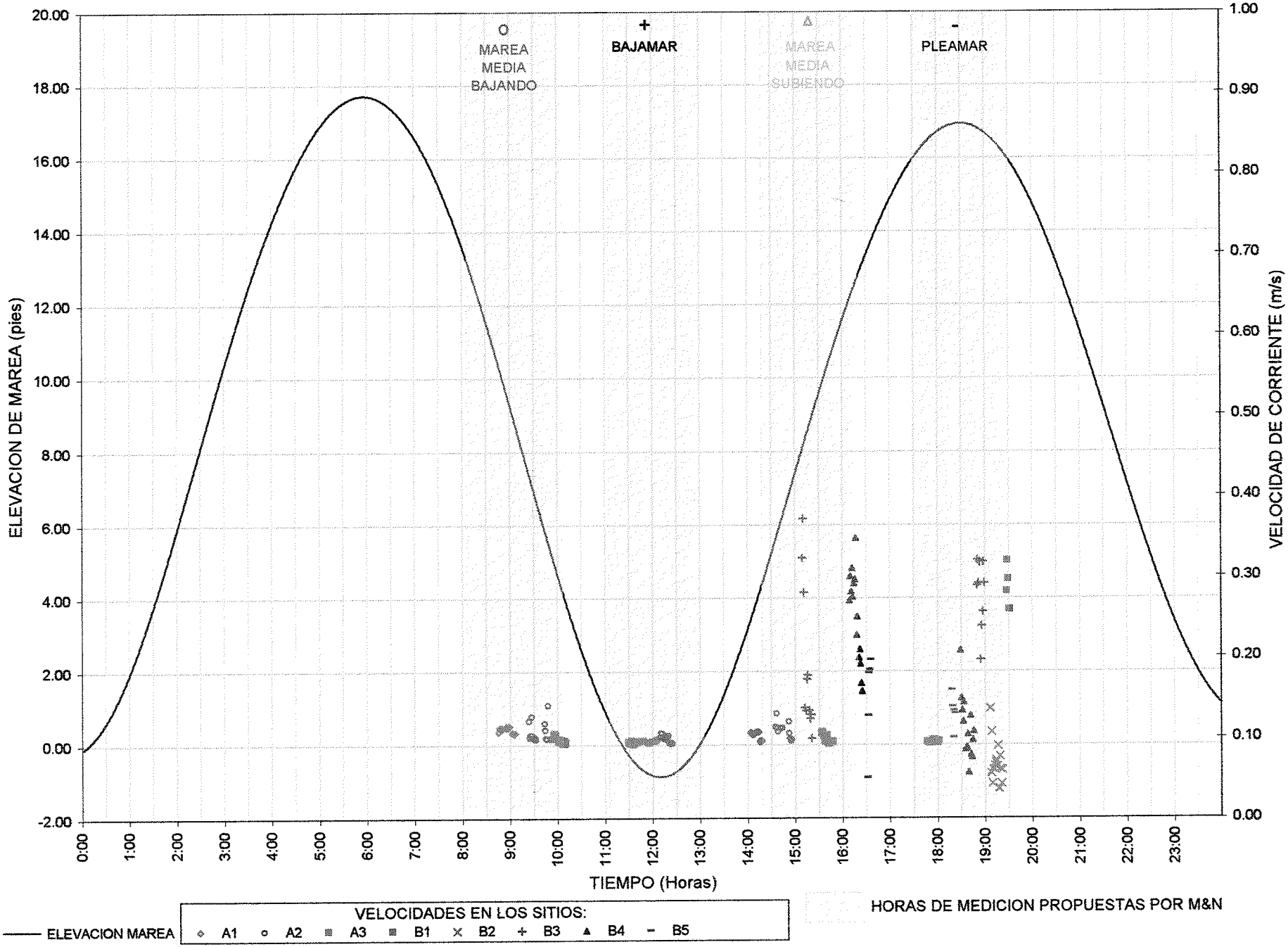
VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)
MAREA DE SICIGIA (PLEAMAR)

Alineación	Punta Guinea
Sitio	B1
Fecha	8/11/2002

Coordenadas		*Viento	
Latitud N	*986530.73*	**Velocidad (Kt)**	3.0
Longitud E	*658872.60*	**Dirección (º)**	310

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
16	8*	16.1	19:27:06	28.54	0.28	332.70
			19:28:06	28.53	0.32	302.00
			19:29:06	28.53	0.30	302.50
			19:30:06	28.52	0.26	302.30
		15.9	19:31:06	28.51	0.26	300.30

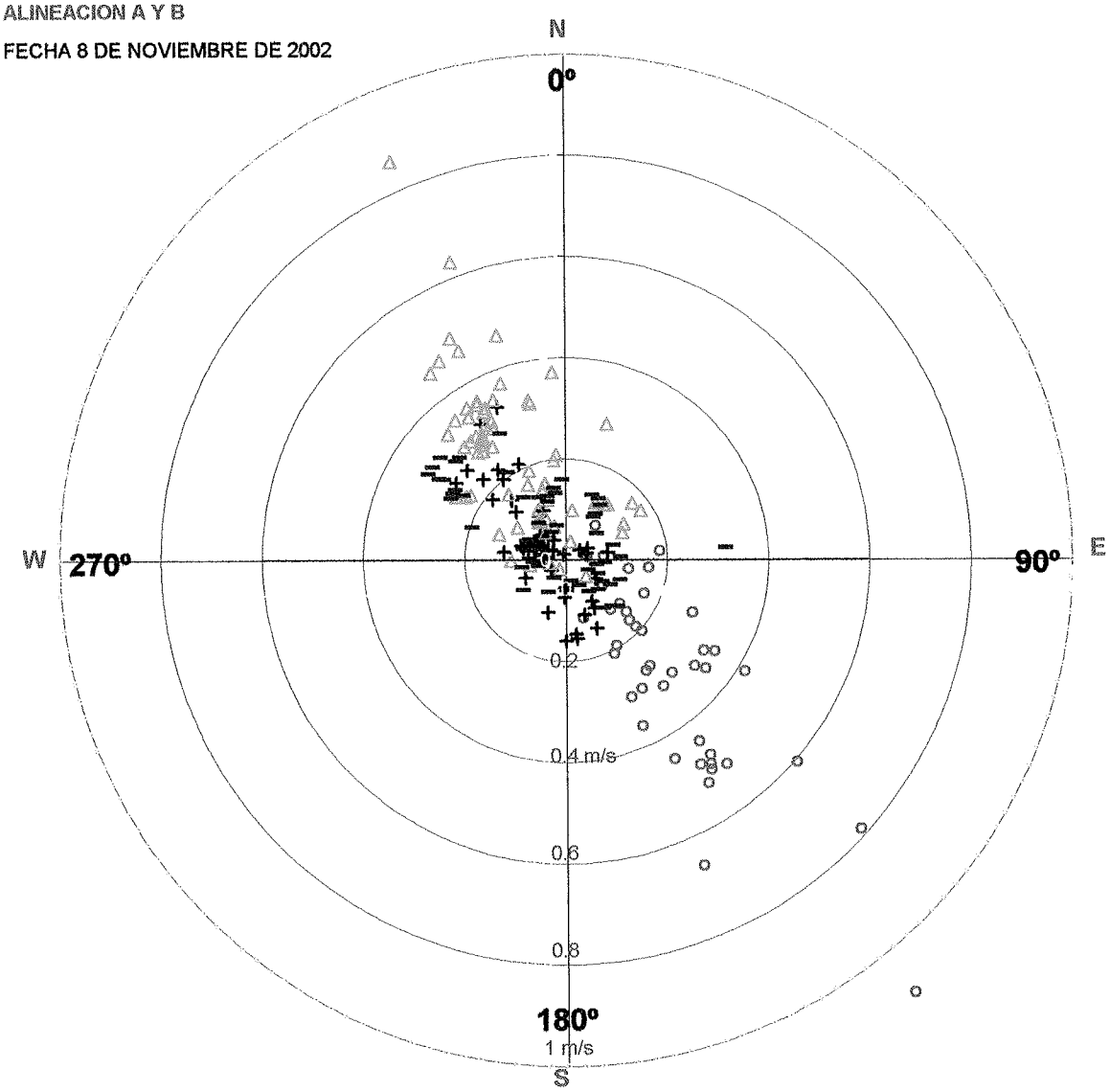
VELOCIDAD DE CORRIENTES MARINAS EN LA ENTRADA SUR DEL CANAL SEGUN HORA, CONDICION DE MAREA Y SITIOS DE MEDICION DE ALINEACION A (P. DE LAS AMERICAS) Y B (PUNTA GUINEA). 8 DE NOVIEMBRE DE 2002.



VELOCIDAD Y DIRECCION DE LAS CORRIENTES MARINAS EN LA ENTRADA SUR DEL CANAL DE PANAMÁ SEGÚN CONDICION DE MAREA

ALINEACION A Y B

FECHA 8 DE NOVIEMBRE DE 2002



- ○ Marea media bajando
- + Bajamar
- △ Marea media subiendo
- – Pleamar

Unidad de Operaciones-ACP

TABLA 13-B1.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)

MAREA MUERTA (MAREA MEDIA SUBIENDO)

Alineación	Punta Guinea
Sitio	B1
Fecha	13/11/2002

Coordenadas		*Viento	
Latitud N	*986530.73*	**Velocidad (Kt)**	3.0
Longitud E	*658872.60*	**Dirección (º)**	352

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
10	5*	7.8	7:03:00	28.09	0.18	251.60
			7:04:00	28.06	0.18	292.90
			7:05:00	28.08	0.11	320.50
			7:06:00	28.09	0.14	62.50
		7.9	7:07:00	28.07	0.06	341.00

TABLA 13-B2.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)

MAREA MUERTA (MAREA MEDIA SUBIENDO)

Alineación	Punta Guinea
Sitio	B2
Fecha	13/11/2002

Coordenadas		*Viento	
Latitud N	*986716.80*	**Velocidad (Kt)**	0.0
Longitud E	*659194.08*	**Dirección (º)**	0

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
55	45	8.3	7:17:40	28.15	0.27	344.40
			7:18:40	28.14	0.31	356.10
			7:19:40	28.13	0.30	322.80
			7:20:40	28.14	0.32	303.80
		8.4	7:21:40	28.14	0.29	324.90
	27.5	8.4	7:23:50	28.16	0.21	308.30
			7:24:50	28.16	0.24	320.60
			7:25:50	28.16	0.23	320.50
			7:26:50	28.16	0.31	339.90
		8.6	7:27:50	28.17	0.25	339.30
	10*	8.6	7:29:55	28.16	0.09	311.90
			7:30:55	28.17	0.10	306.20
			7:31:55	28.19	0.13	336.90
			7:32:55	28.18	0.11	321.70
		8.7	7:33:55	28.17	0.11	306.20

TABLA 13-B3.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)
MAREA MUERTA (MAREA MEDIA SUBIENDO)

Alineación	Punta Guinea
Sitio	B3
Fecha	13/11/2002

Coordenadas		*Viento	
Latitud N	*986788.69*	**Velocidad (Kt)**	4
Longitud E	*659318.33*	**Dirección (º)**	344

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
57	47	9.0	7:40:55	28.13	0.13	338.50
			7:41:55	28.13	0.24	13.20
			7:42:55	28.13	0.24	73.80
			7:43:55	28.13	0.16	339.30
		9.1	7:44:55	28.13	0.21	340.10
	28.5	9.1	7:46:55	28.15	0.37	338.90
			7:47:55	28.14	0.38	333.00
			7:48:55	28.14	0.38	332.50
			7:49:55	28.14	0.39	334.10
		9.3	7:50:55	28.14	0.39	332.60
	10*	9.3	7:52:55	28.10	0.10	312.50
			7:53:55	28.10	0.17	335.90
			7:54:55	28.11	0.33	312.40
			7:55:55	28.10	0.39	291.00
		9.4	7:56:55	28.13	0.28	317.00

TABLA 13-B4.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)
MAREA MUERTA (MAREA MEDIA SUBIENDO)

Alineación	Punta Guinea
Sitio	B4
Fecha	13/11/2002

Coordenadas		*Viento	
Latitud N	*986881.93*	**Velocidad (Kt)**	4.0
Longitud E	*659331.47*	**Dirección (º)**	294

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
56	46	10.0	8:10:35	28.15	0.17	334.50
			8:11:35	28.15	0.16	324.70
			8:12:35	28.15	0.14	322.60
			8:13:35	28.15	0.15	317.40
		10.1	8:14:35	28.15	0.15	303.50
	28	10.1	8:17:20	28.15	0.15	341.30
			8:18:20	28.15	0.16	324.70
			8:19:20	28.15	0.16	310.90
			8:20:20	28.16	0.15	316.60
		10.2	8:21:20	28.15	0.17	312.40
	10*	10.2	8:23:45	28.10	0.06	4.10
			8:24:45	28.10	0.10	348.00
			8:25:45	28.10	0.12	316.80
			8:26:45	28.10	0.11	326.70
		10.4	8:27:45	28.10	0.09	346.80

TABLA 13-B5.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)

MAREA MUERTA (MAREA MEDIA SUBIENDO)

Alineación	Punta Guinea
Sitio	B5
Fecha	13/11/2002

Coordenadas		*Viento	
Latitud N	*986869.70*	**Velocidad (Kt)**	2.0
Longitud E	*659755.99*	**Dirección (º)**	327

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
20	10*	11.0	8:50:35	28.20	0.20	350.90
			8:51:35	28.19	0.17	348.80
			8:52:35	28.19	0.13	317.50
			8:53:35	28.19	0.13	323.20
		11.0	8:54:35	28.19	0.13	292.70

TABLA 13-B5.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)

MAREA MUERTA (PLEAMAR)

Alineación	Punta Guinea
Sitio	B5
Fecha	13/11/2002

Coordenadas		*Viento	
Latitud N	*986869.70*	**Velocidad (Kt)**	0.0
Longitud E	*659755.99*	**Dirección (º)**	0

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
10	5*	12.1	9:51:45	28.29	0.07	252.20
			9:52:45	28.28	0.04	269.60
			9:53:45	28.29	0.05	292.30
			9:54:45	28.30	0.04	316.20
		12.2	9:55:45	28.29	0.07	302.70

TABLA 13-B4.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)

MAREA MUERTA (PLEAMAR)

Alineación	Punta Guinea
Sitio	B4
Fecha	13/11/2002

Coordenadas		*Viento	
Latitud N	*986881.93*	**Velocidad (Kt)**	0.0
Longitud E	*659331.47*	**Dirección (º)**	0

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
58	48	12.3	10:05:30	28.13	0.14	0.10
			10:06:30	28.13	0.14	356.40
			10:07:30	28.13	0.10	326.20
			10:08:30	28.13	0.09	296.70
		12.3	10:09:30	28.13	0.09	336.10
	29	12.3	10:11:25	28.16	0.10	344.20
			10:12:25	28.16	0.10	312.10
			10:13:25	28.16	0.11	292.40
			10:14:25	28.16	0.10	272.20
		12.4	10:15:25	28.16	0.08	295.80
	10*	12.4	10:17:35	28.20	0.07	155.50
			10:18:35	28.20	0.07	230.00
			10:19:35	28.19	0.06	176.90
			10:20:35	28.19	0.04	149.20
		12.4	10:21:35	28.19	0.06	78.20

TABLA 13-B3.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)

MAREA MUERTA (PLEAMAR)

Alineación	Punta Guinea
Sitio	B3
Fecha	13/11/2002

Coordenadas		*Viento	
Latitud N	*986788.69*	**Velocidad (Kt)**	1.0
Longitud E	*659318.33*	**Dirección (º)**	225

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
58	48	12.4	10:25:55	28.13	0.14	325.70
			10:26:55	28.13	0.10	314.90
			10:27:55	28.13	0.10	333.80
			10:28:55	28.12	0.11	335.30
		12.5	10:29:55	28.12	0.12	337.90
	29	12.5	11:08:22	28.16	0.08	152.40
			11:09:22	28.16	0.05	183.80
			11:10:22	28.16	0.04	155.10
			11:11:22	28.16	0.06	266.00
		12.5	11:12:22	28.16	0.08	264.70
	10*	12.4	11:14:52	28.25	0.05	279.10
			11:15:52	28.25	0.08	270.00
			11:16:52	28.25	0.06	266.80
			11:17:52	28.25	0.05	302.70
		12.4	11:18:52	28.24	0.04	319.80

TABLA 13-B2.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)

MAREA MUERTA (PLEAMAR)

Alineación	Punta Guinea
Sitio	B2
Fecha	13/11/2002

Coordenadas		*Viento	
Latitud N	*986716.80*	**Velocidad (Kt)**	3.0
Longitud E	*659194.08*	**Dirección (º)**	146

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
55	45	12.4	11:23:17	28.15	0.10	319.70
			11:24:17	28.15	0.12	337.00
			11:25:17	28.15	0.12	333.10
			11:26:17	28.15	0.12	327.30
		12.4	11:27:17	28.15	0.14	326.10
	27.5	12.3	11:29:32	28.16	0.06	281.90
			11:30:32	28.15	0.05	270.10
			11:31:32	28.15	0.10	321.40
			11:32:32	28.15	0.09	330.70
		12.3	11:33:32	28.15	0.11	325.40
	10*	12.3	11:35:37	28.24	0.05	268.40
			11:36:37	28.26	0.05	256.80
			11:37:37	28.25	0.09	256.70
			11:38:37	28.23	0.09	240.40
		12.2	11:39:37	28.22	0.05	221.80

TABLA 13-B1.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)

MAREA MUERTA (PLEAMAR)

Alineación	Punta Guinea
Sitio	B1
Fecha	13/11/2002

Coordenadas		*Viento	
Latitud N	*986530.73*	**Velocidad (Kt)**	10.0
Longitud E	*658872.60*	**Dirección (º)**	0

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
13	6.5*	12.1	11:47:32	28.28	0.11	247.40
			11:48:32	28.26	0.08	227.80
			11:49:32	28.26	0.07	234.00
			11:50:32	28.29	0.07	156.50
		12.1	11:51:32	28.25	0.08	225.40

TABLA 13-B1.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)
MAREA MUERTA (MAREA MEDIA BAJANDO)

Alineación	Punta Guinea
Sitio	B1
Fecha	13/11/2002

Coordenadas		*Viento	
Latitud N	*986530.73*	**Velocidad (Kt)**	3
Longitud E	*658872.60*	**Dirección (º)**	128

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
12	6*	10.8	12:51:27	28.30	0.30	157.50
			12:52:27	28.30	0.28	173.40
			12:53:27	28.30	0.31	163.70
			12:54:27	28.30	0.29	162.80
		10.7	12:55:27	28.29	0.29	173.80

TABLA 13-B2.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)
MAREA MUERTA (MAREA MEDIA BAJANDO)

Alineación	Punta Guinea
Sitio	B2
Fecha	13/11/2002

Coordenadas		*Viento	
Latitud N	*986716.80*	**Velocidad (Kt)**	7
Longitud E	*659194.08*	**Dirección (º)**	113

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
53	43	10.3	13:05:17	28.12	0.11	326.90
			13:06:17	28.12	0.11	327.10
			13:07:17	28.12	0.09	324.30
			13:08:17	28.13	0.09	335.60
		10.3	13:09:17	28.13	0.08	338.10
	26.5	10.2	13:12:06	28.17	0.03	295.10
			13:13:06	28.17	0.02	180.90
			13:14:06	28.17	0.02	154.60
			13:15:06	28.17	0.05	133.40
		10.1	13:16:06	28.17	0.04	133.80
	10*	10.0	13:19:12	28.21	0.07	172.20
			13:20:12	28.20	0.05	186.70
			13:21:12	28.22	0.08	192.10
			13:22:12	28.19	0.06	193.80
		9.8	13:23:12	28.19	0.06	185.60

TABLA 13-B3.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)

MAREA MUERTA (MAREA MEDIA BAJANDO)

Alineación	Punta Guinea
Sitio	B3
Fecha	13/11/2002

Coordenadas		*Viento	
Latitud N	*986788.69*	**Velocidad (Kt)**	2.0
Longitud E	*659318.33*	**Dirección (º)**	75

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
56	46	9.7	13:29:02	28.11	0.04	36.60
			13:30:02	28.12	0.18	3.50
			13:31:02	28.12	0.10	37.70
			13:32:02	28.12	0.23	156.10
		9.4	13:33:02	28.12	0.13	336.20
	28	9.4	13:35:22	28.14	0.03	119.10
			13:36:22	28.14	0.10	254.20
			13:37:22	28.14	0.09	354.90
			13:38:22	28.14	0.16	336.90
		9.3	13:39:22	28.14	0.21	347.60
	10*	9.2	13:41:37	28.23	0.10	69.00
			13:42:37	28.23	0.08	5.80
			13:43:37	28.23	0.22	156.00
			13:44:37	28.22	0.05	281.30
		9.0	13:45:37	28.23	0.12	328.80

TABLA 13-B4.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)

MAREA MUERTA (MAREA MEDIA BAJANDO)

Alineación	Punta Guinea
Sitio	B4
Fecha	13/11/2002

Coordenadas		*Viento	
Latitud N	*986881.93*	**Velocidad (Kt)**	6.0
Longitud E	*659331.47*	**Dirección (º)**	275

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
55	45	8.9	13:51:57	28.12	0.10	312.40
			13:52:57	28.12	0.08	331.40
			13:53:57	28.12	0.10	316.80
			13:54:57	28.12	0.10	333.10
		8.7	13:55:57	28.12	0.10	325.80
	27.5	8.6	13:58:52	28.14	0.11	277.30
			13:59:52	28.14	0.07	295.10
			14:00:52	28.14	0.10	13.20
			14:01:52	28.14	0.08	321.00
		8.5	14:02:52	28.14	0.06	321.40
	10*	8.4	14:05:11	28.19	0.06	130.80
			14:06:11	28.19	0.05	104.00
			14:07:11	28.19	0.04	110.20
			14:08:11	28.18	0.05	137.50
		8.2	14:09:11	28.18	0.04	104.70

TABLA 13-B5.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)
MAREA MUERTA (MAREA MEDIA BAJANDO)

Alineación	Punta Guinea
Sitio	B5
Fecha	13/11/2002

Coordenadas		*Viento	
Latitud N	*986869.70*	**Velocidad (Kt)**	6.0
Longitud E	*659755.99*	**Dirección (º)**	302

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
16	8*	8.0	14:17:26	28.26	0.00	137.90
			14:18:26	28.26	0.00	127.80
			14:19:26	28.24	0.05	146.50
			14:20:26	28.32	0.08	174.90
		7.8	14:21:26	28.34	0.07	152.30

TABLA 13-B5.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)
MAREA MUERTA (BAJAMAR)

Alineación	Punta Guinea
Sitio	B5
Fecha	13/11/2002

Coordenadas		*Viento	
Latitud N	*986869.70*	**Velocidad (Kt)**	8.0
Longitud E	*659755.99*	**Dirección (º)**	332

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
15	7.5*	5.2	15:42:47	28.30	0.06	152.70
			15:43:47	28.31	0.06	164.30
			15:44:47	28.30	0.08	164.30
			15:45:47	28.29	0.09	179.90
		5.1	15:46:47	28.29	0.11	161.80

TABLA 13-B4.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)

MAREA MUERTA (BAJAMAR)

Alineación	Punta Guinea
Sitio	B4
Fecha	13/11/2002

Coordenadas		*Viento	
Latitud N	*986881.93*	**Velocidad (Kt)**	7.0
Longitud E	*659331.47*	**Dirección (º)**	305

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
51	41	4.9	15:57:22	28.08	0.09	353.50
			15:58:22	28.07	0.06	306.10
			15:59:22	28.08	0.07	321.50
			16:00:22	28.07	0.11	13.70
		4.8	16:01:22	28.07	0.06	333.80
	25.5	4.7	16:04:47	28.12	0.06	174.30
			16:05:47	28.12	0.04	122.60
			16:06:47	28.12	0.05	120.30
			16:07:47	28.12	0.05	161.40
		4.7	16:08:47	28.12	0.05	123.80
	10*	4.6	16:11:47	28.16	0.08	142.30
			16:12:47	28.15	0.08	151.80
			16:13:47	28.15	0.13	154.90
			16:14:47	28.15	0.08	128.70
		4.6	16:15:47	28.16	0.09	121.90

TABLA 13-B3.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)

MAREA MUERTA (BAJAMAR)

Alineación	Punta Guinea
Sitio	B3
Fecha	13/11/2002

Coordenadas		*Viento	
Latitud N	*986788.69*	**Velocidad (Kt)**	10.0
Longitud E	*659318.33*	**Dirección (º)**	305

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
51	41	4.3	16:51:27	28.05	0.13	127.30
			16:52:27	28.05	0.51	357.70
			16:53:27	28.06	0.67	324.90
			16:54:27	28.06	0.39	316.50
		4.2	16:55:27	28.06	0.14	309.30
	25.5	4.2	16:57:27	28.12	0.33	45.90
			16:58:27	28.13	0.59	355.00
			16:59:27	28.11	0.18	164.80
			17:00:27	28.12	0.33	327.10
		4.2	17:01:27	28.11	0.73	325.80
	10*	4.2	17:04:17	28.18	0.56	325.00
			17:05:17	28.17	0.58	320.70
			17:06:17	28.17	0.57	320.00
			17:07:17	28.17	0.59	321.20
		4.2	17:08:17	28.18	0.59	318.50

TABLA 13-B2.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)

MAREA MUERTA (BAJAMAR)

Alineación	Punta Guinea
Sitio	B2
Fecha	13/11/2002

Coordenadas		*Viento	
Latitud N	*986716.80*	**Velocidad (Kt)**	7.0
Longitud E	*659194.08*	**Dirección (º)**	286

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
49	39	4.3	17:16:37	28.07	0.14	316.10
			17:17:37	28.07	0.16	321.80
			17:18:37	28.06	0.18	344.30
			17:19:37	28.06	0.16	324.50
		4.3	17:20:37	28.05	0.17	310.50
	24.5	4.4	17:23:22	28.11	0.12	311.90
			17:24:22	28.12	0.15	327.60
			17:25:22	28.11	0.14	314.00
			17:26:22	28.11	0.14	324.10
		4.4	17:27:22	28.12	0.15	311.60
	10*	4.4	17:31:52	28.20	0.06	317.10
			17:32:52	28.19	0.09	322.40
			17:33:52	28.19	0.11	322.80
			17:34:52	28.20	0.08	328.80
		4.5	17:35:52	28.20	0.08	323.20

TABLA 13-B1.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)

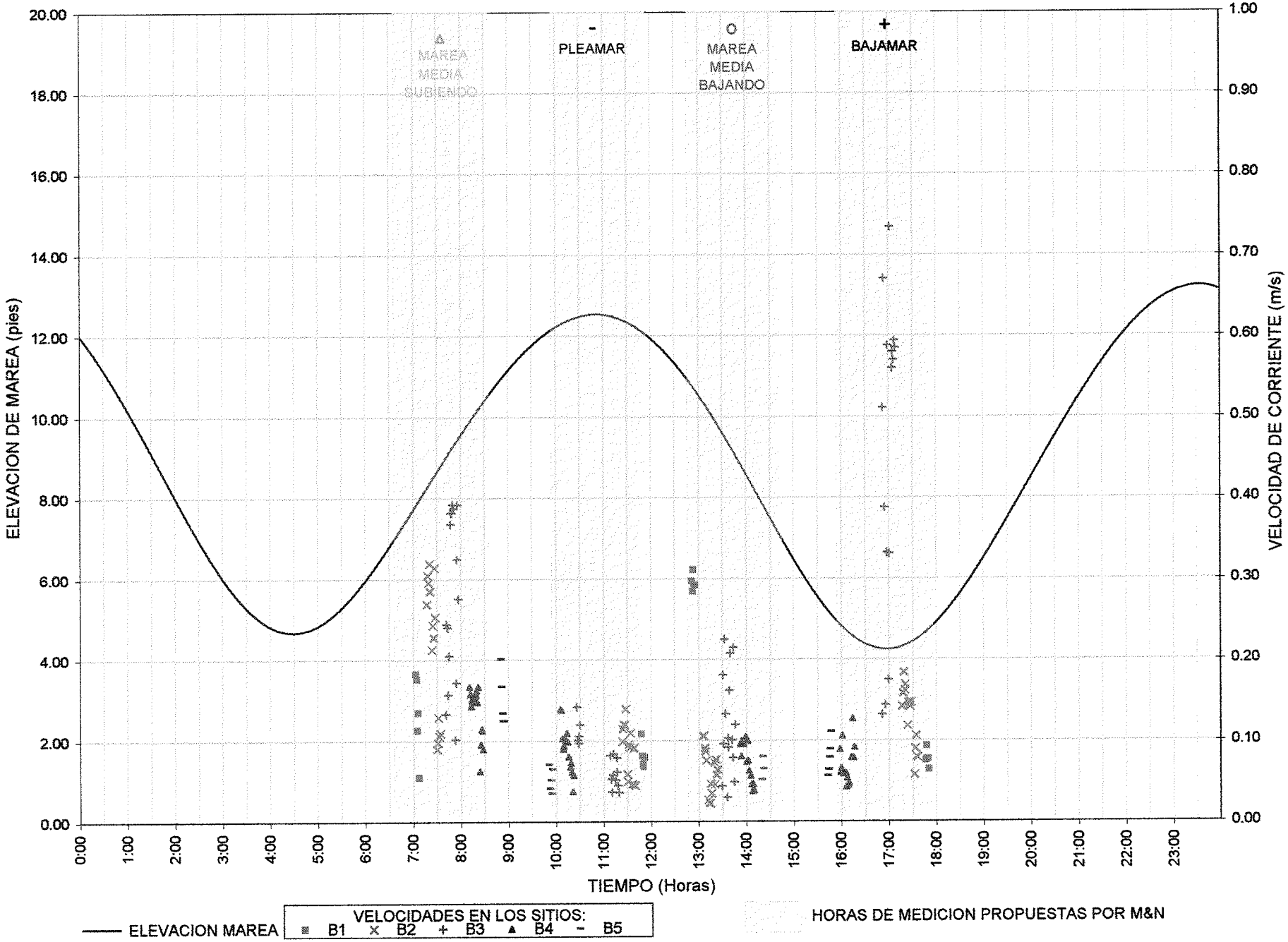
MAREA MUERTA (BAJAMAR)

Alineación	Punta Guinea
Sitio	B1
Fecha	13/11/2002

Coordenadas		*Viento	
Latitud N	*986530.73*	**Velocidad (Kt)**	9.0
Longitud E	*658872.60*	**Dirección (º)**	342

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
7	5*	4.6	17:46:06	28.21	0.08	207.40
			17:47:06	28.20	0.09	253.20
			17:48:06	28.20	0.08	29.60
			17:49:06	28.20	0.08	34.90
		4.7	17:50:06	28.20	0.06	259.60

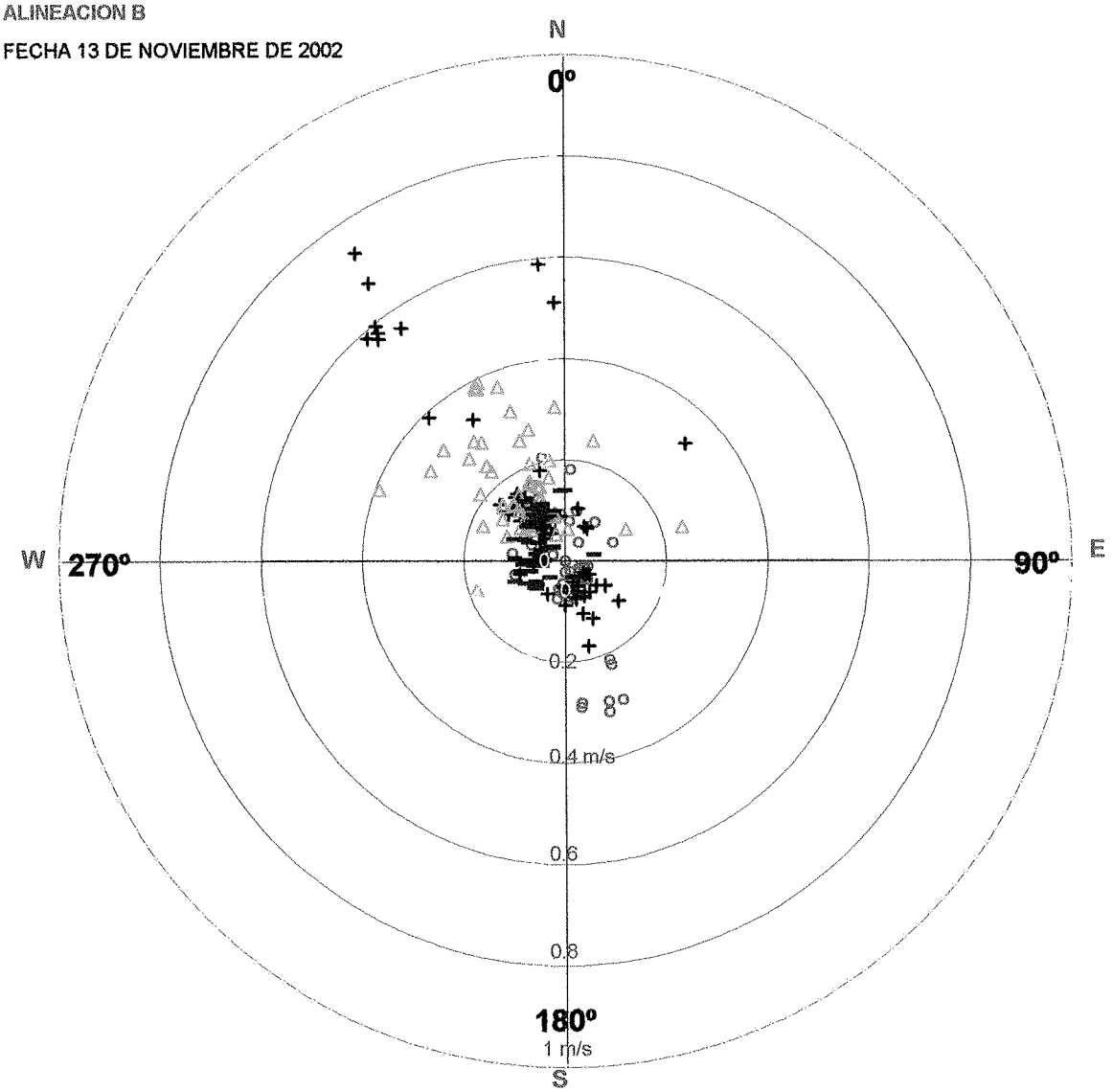
VELOCIDAD DE CORRIENTES MARINAS EN LA ENTRADA SUR DEL CANAL SEGUN HORA, CONDICION DE MAREA Y SITIOS DE MEDICION (B1, B2, B3, B4 Y B5) DE ALINEACION B (PUNTA GUINEA). 13 DE NOVIEMBRE DE 2002.



VELOCIDAD Y DIRECCION DE LAS CORRIENTES MARINAS EN LA ENTRADA SUR DEL CANAL DE PANAMÁ SEGÚN CONDICION DE MAREA

ALINEACION B

FECHA 13 DE NOVIEMBRE DE 2002



- ○ Marea media bajando
- + Bajamar
- △ Marea media subiendo
- – Pleamar

Unidad de Operaciones-ACP

TABLA 14-A1.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)
MAREA MUERTA (MAREA MEDIA SUBIENDO)

Alineación	P. de las Americas
Sitio	A1
Fecha	14/11/2002

Coordenadas		*Viento	
Latitud N	*988683.76*	**Velocidad (Kt)**	3.5
Longitud E	*657637.26*	**Dirección (º)**	352

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
54	44	6.9	7:42:03	27.80	0.08	153.60
			7:43:03	28.10	0.33	330.40
			7:44:03	28.11	0.33	316.00
			7:45:03	28.11	0.34	318.20
		6.9				
	27	6.9	7:47:18	28.11	0.29	335.10
			7:48:18	28.11	0.28	336.90
			7:49:18	28.12	0.30	335.40
			7:50:18	28.12	0.29	330.20
		7.0	7:51:18	28.11	0.28	331.40
	10*	7.1	7:52:52	28.06	0.02	253.90
			7:53:52	28.06	0.02	60.40
			7:54:52	28.06	0.05	116.60
			7:55:52	28.07	0.06	158.50
		7.2	7:56:52	28.07	0.03	110.30

TABLA 14-A2.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)
MAREA MUERTA (MAREA MEDIA SUBIENDO)

Alineación	P. de las Americas
Sitio	A2
Fecha	14/11/2002

Coordenadas		*Viento	
Latitud N	*988751.56*	**Velocidad (Kt)**	0.0
Longitud E	*657714.48*	**Dirección (º)**	0

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
54	44	7.3	8:01:23	28.10	0.32	327.10
			8:02:23	28.10	0.35	318.70
			8:03:23	28.10	0.40	333.30
			8:04:23	28.10	0.43	331.20
		7.5	8:05:23	28.10	0.45	332.80
	27	7.8	8:16:53	28.10	0.03	101.50
			8:17:53	28.10	0.31	321.40
			8:18:53	28.10	0.46	314.60
			8:19:53	28.10	0.50	322.30
		7.9	8:20:53	28.10	0.54	320.80
	10*	8.0	8:23:53	28.02	0.03	199.30
			8:24:53	28.03	0.20	308.30
			8:25:53	28.02	0.31	314.50
			8:26:53	28.03	0.31	309.90
		8.1	8:27:53	28.06	0.31	314.80

TABLA 14-A3.1

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)
MAREA MUERTA (MAREA MEDIA SUBIENDO)

Alineación	P. de las Americas
Sitio	A3
Fecha	14/11/2002

Coordenadas		*Viento	
Latitud N	*988886.56*	**Velocidad (Kt)**	1.0
Longitud E	*657739.72*	**Dirección (º)**	350

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
47	37	8.3	8:33:53	28.10	0.43	324.70
			8:34:53	28.10	0.27	305.00
			8:35:53	28.11	0.20	317.10
			8:36:53	28.11	0.19	337.50
		8.4	8:37:53	28.11	0.20	342.80
	28	8.5	8:39:53	28.12	0.26	321.10
			8:40:53	28.12	0.24	324.90
			8:41:53	28.12	0.23	319.80
			8:42:53	28.12	0.25	323.70
		8.6	8:43:53	28.12	0.23	328.40
	10*	8.7	8:46:28	28.03	0.16	107.40
			8:47:28	28.03	0.17	116.00
			8:48:28	28.04	0.15	134.80
			8:49:28	28.04	0.13	143.40
		8.8	8:50:28	28.04	0.16	112.90

TABLA 14-A3.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)
MAREA MUERTA (PLEAMAR)

Alineación	P. de las Americas
Sitio	A3
Fecha	14/11/2002

Coordenadas		*Viento	
Latitud N	*988886.56*	**Velocidad (Kt)**	5.0
Longitud E	*657739.72*	**Dirección (º)**	167

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
40	30	12.2	11:18:03	28.18	0.05	199.20
			11:19:03	28.14	0.07	58.70
			11:20:03	28.15	0.04	268.10
			11:21:03	28.15	0.01	229.60
		12.3	11:22:03	28.14	0.01	358.70
	20	12.3	11:23:42	28.14	0.03	349.60
			11:24:42	28.14	0.02	293.40
			11:25:42	28.14	0.03	308.80
			11:26:42	28.14	0.02	314.90
		12.3	11:27:42	28.13	0.02	326.60
	10*	12.4	11:30:43	28.12	0.14	107.50
			11:31:43	28.13	0.08	101.60
			11:32:43	28.14	0.06	96.70
			11:33:43	28.14	0.02	96.00
		12.4	11:34:43	28.13	0.02	74.60

TABLA 14-A2.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)
MAREA MUERTA (PLEAMAR)

Alineación	P. de las Americas
Sitio	A2
Fecha	14/11/2002

Coordenadas		*Viento	
Latitud N	*988751.56*	**Velocidad (Kt)**	2.0
Longitud E	*657714.48*	**Dirección (º)**	155

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
57	47	12.4	11:41:18	28.10	0.33	279.50
			11:42:18	28.10	0.17	307.10
			11:43:18	28.10	0.25	316.70
			11:44:18	28.09	0.25	299.90
		12.5	11:45:18	28.09	0.20	3.90
	28	12.5	11:47:33	28.11	0.20	339.40
			11:48:33	28.11	0.18	317.30
			11:49:33	28.10	0.12	50.50
			11:50:33	28.11	0.08	317.60
		12.5	11:51:33	28.10	0.27	289.30
	10*	12.5	11:53:48	28.16	0.32	149.70
			11:54:48	28.16	0.30	148.40
			11:55:48	28.16	0.41	123.50
			11:56:48	28.16	0.31	113.40
		12.5	11:57:48	28.17	0.15	100.70

TABLA 14-A1.2

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)
MAREA MUERTA (PLEAMAR)

Alineación	P. de las Americas
Sitio	A1
Fecha	14/11/2002

Coordenadas		*Viento	
Latitud N	*988683.76*	**Velocidad (Kt)**	4
Longitud E	*657637.26*	**Dirección (º)**	155

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
58	48	12.5	12:02:18	28.09	0.18	282.80
			12:03:18	28.09	0.07	304.60
			12:04:18	28.09	0.09	330.90
			12:05:18	28.09	0.10	335.40
		12.5	12:06:18	28.09	0.12	339.90
	28	12.5	12:07:58	28.11	0.12	302.90
			12:08:58	28.11	0.11	297.30
			12:09:58	28.11	0.12	316.80
			12:10:58	28.11	0.10	303.00
		12.5	12:11:58	28.11	0.13	316.40
	10*	12.5	12:13:48	28.26	0.37	142.70
			12:14:48	28.27	0.39	142.70
			12:15:48	28.23	0.35	137.90
			12:16:48	28.16	0.33	131.90
		12.5	12:17:48	28.18	0.33	152.30

TABLA 14-A1.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)
MAREA MUERTA (MAREA MEDIA BAJANDO)

Alineación	P. de las Americas
Sitio	A1
Fecha	14/11/2002

Coordenadas		*Viento	
Latitud N	*988683.76*	**Velocidad (Kt)**	7.0
Longitud E	*657637.26*	**Dirección (º)**	330

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
56	46	9.9	14:26:17	28.08	0.04	337.70
			14:27:17	28.08	0.03	324.60
			14:28:17	28.08	0.04	321.40
			14:29:17	28.08	0.05	316.80
		9.8	14:30:17	28.09	0.02	345.00
	28	9.8	14:31:58	28.09	0.04	2.00
			14:32:58	28.10	0.04	335.00
			14:33:58	28.10	0.03	346.60
			14:34:58	28.09	0.02	355.10
		9.7	14:35:58	28.10	0.03	5.30
	10*	9.6	14:38:43	28.30	0.40	148.50
			14:39:43	28.32	0.41	143.20
			14:40:43	28.48	0.38	143.30
			14:41:43	28.34	0.39	143.00
		9.4	14:42:43	28.41	0.41	147.30

TABLA 14-A2.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)
MAREA MUERTA (MAREA MEDIA BAJANDO)

Alineación	P. de las Americas
Sitio	A2
Fecha	14/11/2002

Coordenadas		*Viento	
Latitud N	*988751.56*	**Velocidad (Kt)**	6.0
Longitud E	*657714.48*	**Dirección (º)**	315

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
56	46	9.3	14:47:28	28.09	0.07	289.10
			14:48:28	28.09	0.19	162.10
			14:49:28	28.09	0.12	134.40
			14:50:28	28.09	0.23	132.50
		9.1	14:51:28	28.09	0.14	142.40
	28	9.1	14:53:43	28.11	0.26	133.80
			14:54:43	28.12	0.35	146.50
			14:55:43	28.12	0.31	135.20
			14:56:43	28.12	0.18	132.00
		8.9	14:57:43	28.12	0.30	150.60
	10*	8.8	14:59:18	28.21	0.54	142.20
			15:00:18	28.20	0.40	146.80
			15:01:18	28.19	0.37	146.50
			15:02:18	28.20	0.33	146.00
		8.7	15:03:18	28.24	0.51	135.20

TABLA 14-A3.3

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)
MAREA MUERTA (MAREA MEDIA BAJANDO)

Alineación	P. de las Americas
Sitio	A3
Fecha	14/11/2002

Coordenadas		*Viento	
Latitud N	*988886.56*	**Velocidad (Kt)**	2.0
Longitud E	*657739.72*	**Dirección (º)**	347

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
48	38	8.6	15:07:08	28.10	0.17	170.90
			15:08:08	28.10	0.14	169.80
			15:09:08	28.11	0.16	167.00
			15:10:08	28.11	0.11	155.80
		8.4	15:11:08	28.11	0.09	127.60
	24	8.4	15:12:43	28.12	0.23	139.90
			15:13:43	28.13	0.21	136.60
			15:14:43	28.13	0.22	133.30
			15:15:43	28.14	0.24	132.70
		8.2	15:16:43	28.13	0.23	142.90
	10*	8.1	15:18:13	28.29	0.12	133.00
			15:19:13	28.23	0.15	137.60
			15:20:13	28.20	0.18	169.50
			15:21:13	28.17	0.19	141.30
		8.0	15:22:13	28.23	0.14	139.80

TABLA 14-A3.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)
MAREA MUERTA (BAJAMAR)

Alineación	P. de las Americas
Sitio	A3
Fecha	14/11/2002

Coordenadas		*Viento	
Latitud N	*988886.56*	**Velocidad (Kt)**	2.0
Longitud E	*657739.72*	**Dirección (º)**	350

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
40	30	4.6	17:22:23	28.11	0.14	50.50
			17:23:23	28.10	0.03	107.00
			17:24:23	28.10	0.02	160.30
			17:25:23	28.11	0.06	224.80
		4.5	17:26:23	28.11	0.01	218.50
	20	4.5	17:28:23	28.12	0.15	109.40
			17:29:23	28.12	0.09	149.80
			17:30:23	28.12	0.08	66.50
			17:31:23	28.12	0.10	68.70
		4.5	17:32:23	28.12	0.12	113.10
	10*	4.4	17:34:28	28.17	0.19	149.80
			17:35:28	28.18	0.16	149.80
			17:36:28	28.28	0.19	160.20
			17:37:28	28.33	0.18	122.40
		4.4	17:38:28	28.25	0.16	129.10

TABLA 14-A2.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)

MAREA MUERTA (BAJAMAR)

Alineación	P. de las Americas
Sitio	A2
Fecha	14/11/2002

Coordenadas		*Viento	
Latitud N	*988751.56*	**Velocidad (Kt)**	2.0
Longitud E	*657714.48*	**Dirección (º)**	296

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
50	40	4.4	17:44:13	28.09	0.11	283.20
			17:45:13	28.09	0.11	273.50
			17:46:13	28.09	0.22	330.20
			17:47:13	28.09	0.18	349.80
		4.4				
	25	4.4	17:49:43	28.11	0.13	13.70
			17:50:43	28.11	0.17	14.00
			17:51:43	28.10	0.05	162.10
			17:52:43	28.11	0.13	168.40
		4.3	17:53:43	28.11	0.13	285.80
	10*	4.3	17:56:18	28.25	0.26	155.90
			17:57:18	28.27	0.33	148.70
			17:58:18	28.25	0.41	149.90
			17:59:18	28.29	0.15	148.10
		4.3	18:00:18	28.28	0.24	144.20

TABLA 14-A1.4

VELOCIDAD, DIRECCION Y TEMPERATURA DE LAS CORRIENTES EN LA ENTRADA DEL CANAL (SECTOR PACIFICO)

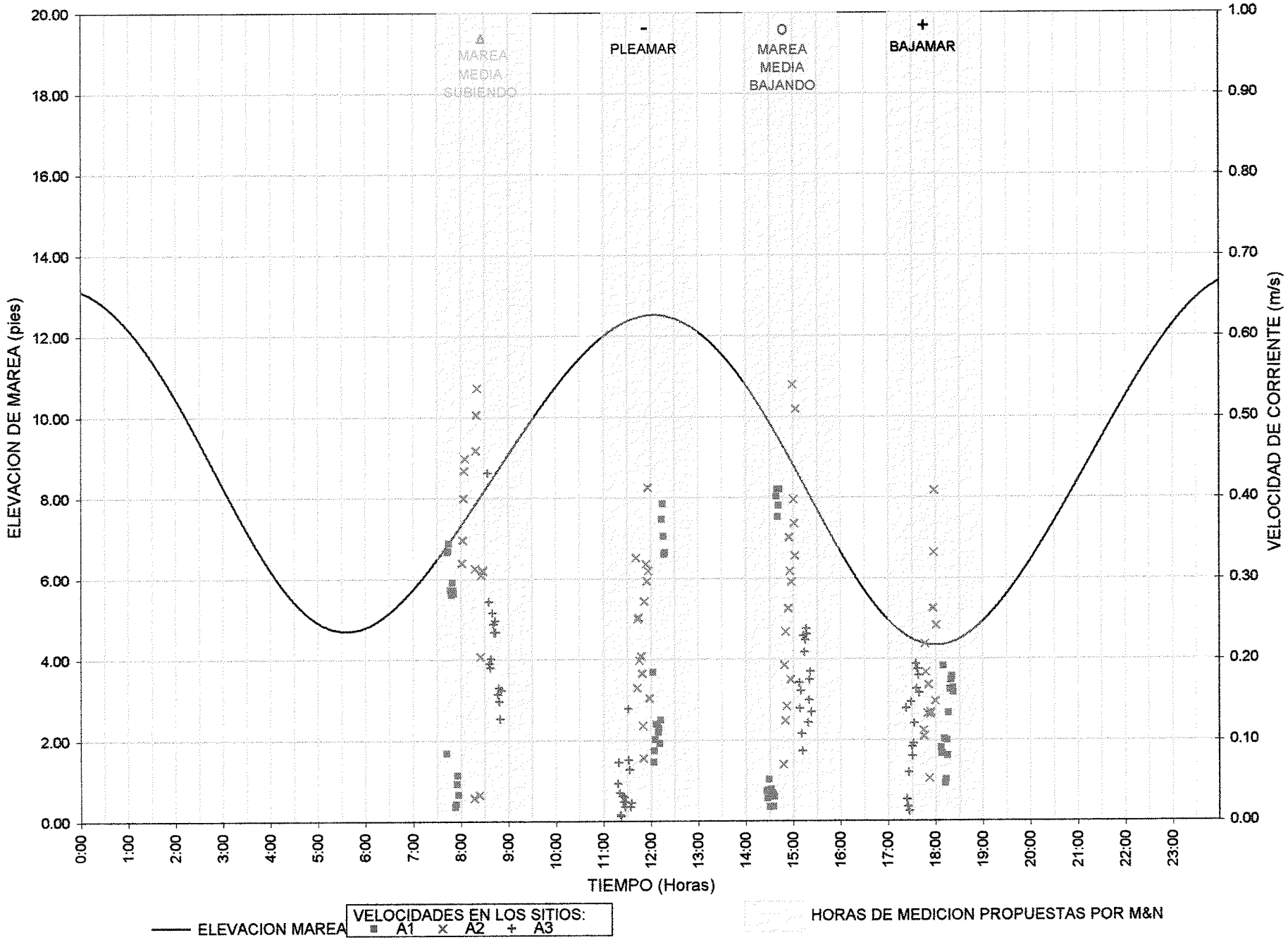
MAREA MUERTA (BAJAMAR)

Alineación	P. de las Americas
Sitio	A1
Fecha	14/11/2002

Coordenadas		*Viento	
Latitud N	*988683.76*	**Velocidad (Kt)**	5.0
Longitud E	*657637.26*	**Dirección (º)**	320

Profundidad Total (Pies)	Profundidad Obs. (Pies)	Elevación de Marea (Pies)	Hora	Temperatura (ºC)	Velocidad (m/s)	Dirección (º)
51	41	4.3	18:06:28	28.09	0.09	316.10
			18:07:28	28.09	0.08	339.60
			18:08:28	28.09	0.08	317.40
			18:09:28	28.09	0.19	310.30
		4.3	18:10:28	28.10	0.10	354.20
	25	4.3	18:11:57	28.12	0.05	353.00
			18:12:57	28.12	0.05	26.30
			18:13:57	28.11	0.10	259.20
			18:14:57	28.10	0.08	312.40
		4.4	18:15:57	28.10	0.13	329.40
	10*	4.4	18:18:18	28.19	0.16	144.20
			18:19:18	28.19	0.17	180.70
			18:20:18	28.18	0.18	180.10
			18:21:18	28.18	0.16	165.30
		4.4	18:22:18	28.17	0.16	187.00

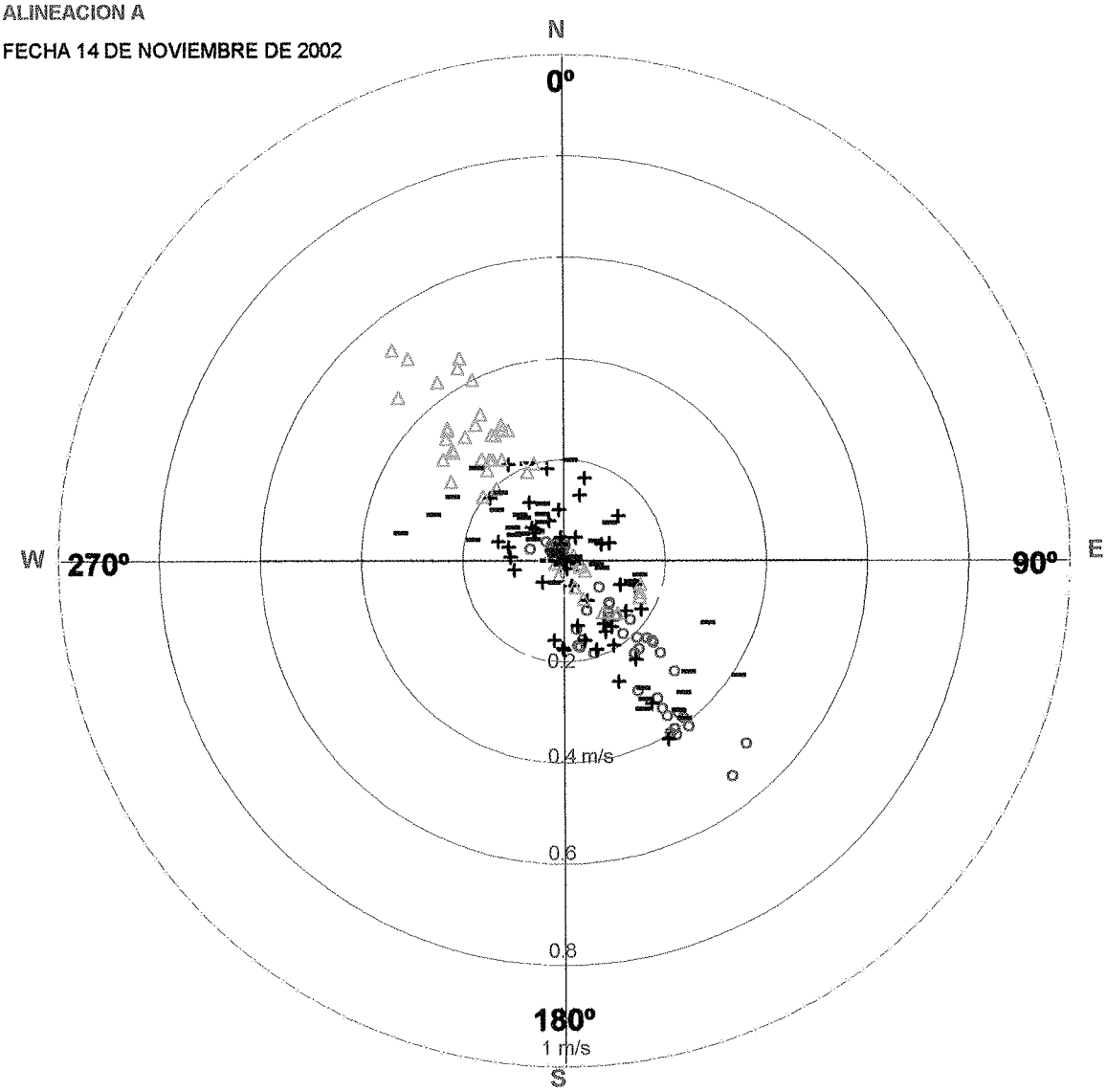
VELOCIDAD DE CORRIENTES MARINAS EN LA ENTRADA SUR DEL CANAL SEGUN HORA, CONDICION DE MAREA Y SITIOS DE MEDICION (A1, A2 Y A3) DE ALINEACION A (P. DE LAS AMERICAS). 14 DE NOVIEMBRE DE 2002.



VELOCIDAD Y DIRECCION DE LAS CORRIENTES MARINAS EN LA ENTRADA SUR DEL CANAL DE PANAMÁ SEGÚN CONDICION DE MAREA

ALINEACION A

FECHA 14 DE NOVIEMBRE DE 2002



- ○ Marea media bajando
- + Bajamar
- △ Marea media subiendo
- – Pleamar

Unidad de Operaciones-ACP

APÉNDICE Nº2
TABLAS

TABLA 1.
POSICIÓN DE LOS SITIOS DE MEDICION PROGRAMADOS DE LA ENTRADA SUR DEL CANAL DE PANAMA POR ALINEACIÓN UTM

PUNTO	COORDENADAS (PIES)		COORDENADAS (METROS)	
	X(ESTE)	Y(NORTE)	X(ESTE)	Y(NORTE)
B1	2161577.04	3236706.13	986550.00	6518850.00
B2	2162889.38	3237362.29	986750.00	659250.00
B4	2163545.54	3237444.31	986775.00	659450.00
B5	2164447.77	3237854.42	986900.00	659725.00
B3	2163217.46	3237362.29	986750.00	659350.00
A1	2157804.08	3243595.88	988650.00	657700.00
A2	2158050.15	3243841.94	988725.00	657775.00
A3	2158296.21	3243923.96	988750.00	657850.00
B1 a	**2161651.20**	**3236642.89**	**986530.73**	**658872.60**
B2 a	**2162705.92**	**3237253.38**	**986716.80**	**659194.08**
B3 a	**2163113.56**	**3237489.23**	**986788.69**	**659318.33**
B4 a	**2163156.65**	**3237795.14**	**986881.93**	**659331.47**
B5 a	**2164549.44**	**3237755.01**	**986869.70**	**659755.99**
A1 a	**2157598.23**	**3243706.65**	**988683.76**	**657637.26**
A2 a	**2157851.59**	**3243929.09**	**988751.56**	**657714.48**
A3 a	**2157934.40**	**3244371.99**	**988886.56**	**657739.72**

Nota: a Coordenadas definitivas obtenidas en los sitios de medición.

A1a (BOYA 17), A2a (BOYA 20), B2a (BOYA 13) , B4a (BOYA 14)

TABLA 2

PROGRAMACIÓN DE LA CAMPAÑA 1 DE MEDICION DE MAREA EN LA ENTRADA SUR DEL CANAL DE PANAMA, POR ALINEACIÓN, SEGÚN LA FECHA Y EL HORARIO DE LA MEDICION

FECHA 2002	ALINEACIÓN	HORARIO DE MEDICIÓN
NOVIEMBRE 6	PUNTA GUINEA	Marea media bajando: 6:30 - 8:30 Bajamar: 9:40 - 11:50 Marea media subiendo: 13:00 - 15: 00 Pleamar: 15:58-17:58
NOVIEMBRE 7	P. DE LAS AMERICAS	Marea media bajando 7:06 - 9:06 Bajamar 10:20 - 12:20 Marea media subiendo 13:24 - 15:24 Pleamar 16:24 - 18:24
NOVIEMBRE 13	PUNTA GUINEA	Marea media subiendo 6:29 - 8:29 Pleamar 9:51 - 11:51 Marea Media bajando 12:51 - 14:51 Bajamar 15:57 - 17:57
NOVIEMBRE 14	PUENTE DE LAS AMERICAS	Marea media subiendo 7:35 - 9:35 Pleamar 11:04 - 13:04 Marea Media bajando 14:00 - 16:00 Bajamar 17:00 - 19:00

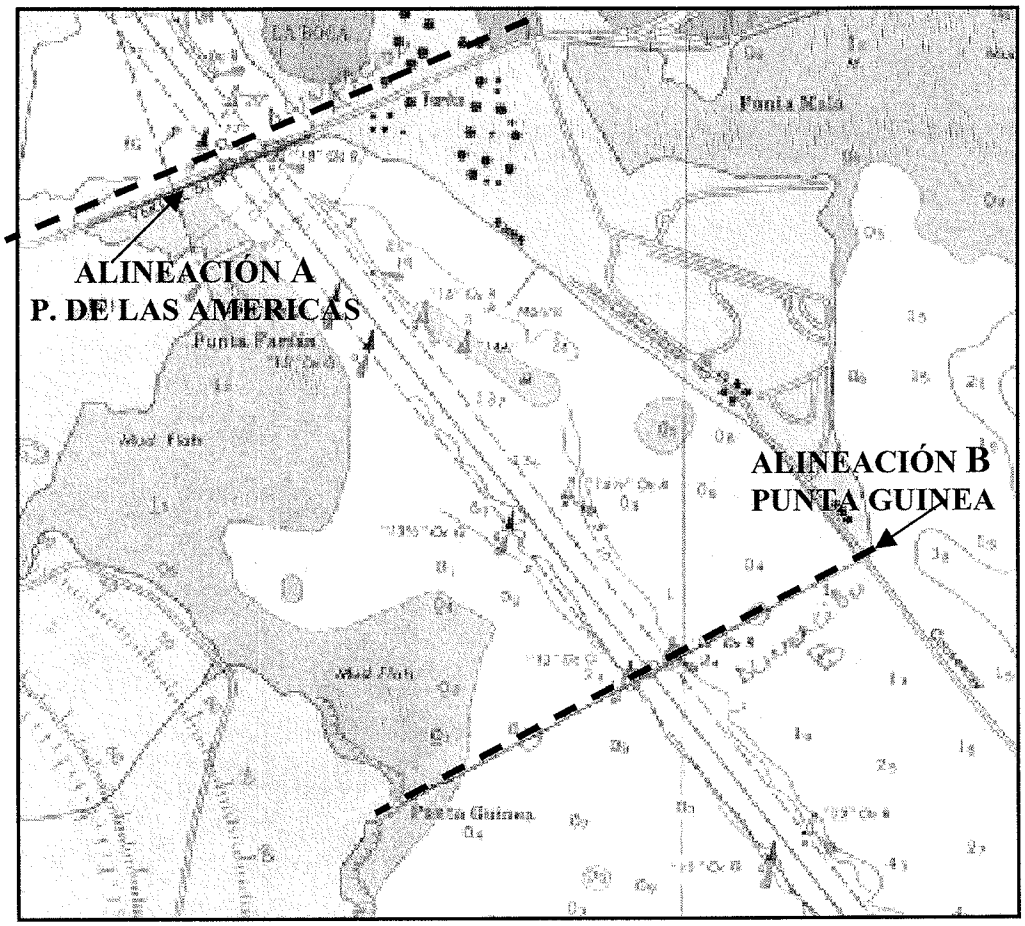
TABLA 3
PERSONAL QUE PARTICIPO EN LAS MEDICIONES DE CORRIENTES MARINAS EN LA BAHIA DE PANAMA Y OBSERVACIONES DE LOS RESULTADOS SEGÚN FECHA Y CAMPAÑA

FECHA	TECNICO	ALINEACIÓN	OBSERVACIONES
6 DE NOVIEMBRE	G. LEIS	P. GUINEA	El cable del Valeport se corto en la propela de la lancha Cazón. Se aplazó las mediciones para el 8 de noviembre para la reparación del cable.
8 DE NOVIEMBRE	O. BALOYES	P. DE LAS AMERICAS/ P. GUINEA	Se combinaron las mediciones faltantes del 6 de noviembre con las del 8 de noviembre, es decir las de Punta Guinea y Puente de Las Américas simultáneas para aprovechar las condiciones de marea parecidas.
13 DE NOVIEMBRE	G.LEIS	P. GUINEA	
14 DE NOVIEMBRE	G.LEIS	P. DE LAS AMERICAS	Se realizó unas pruebas amarrando la lancha a las boyas y luego sin amarrar para comparar las lecturas entre sí. Se observó pocas diferencias en velocidad y dirección de las corrientes. Esto se realizó para tener un grado de certeza en las mediciones en el centro delCanal donde no es posible anclarse por razones de seguridad.

APÉNDICE Nº3

MAPAS

ALINEACIONES PARA LA MEDICION DE CORRIENTES MARINAS EN LA ENTRADA SUR DEL CANAL DE PANAMA- NOVIEMBRE 2002



APÉNDICE Nº4

DOCUMENTOS Y FORMULARIOS

AUTORIDAD DEL CANAL DE PANAMA

UNIDAD DE OPERACIONES AMBIENTALES

MEDICION DE CORRIENTES (VELOCIDAD Y DIRECCION)

FECHA: Nombre del Sitio: Lancha:

No. Punto	Circuito	Hora Inicio	Profundidad Total	Profundidad Observacion	Elevacion Marea		Viento		Posición		Nombre Archivo (.CAL)	Técnico
					Inicio	Final	Vel. (Nudos)	Dir. (Grados)	Latitud	Longitud		

Comentarios:

APENDICE Nº5

FOTOGRAFIAS

Medición en proceso con la grúa.

Lancha Cazón, amarrada a la Boya 13, alineación Punta Guinea.

Alineación Puente de las Américas

Amarrado a la boya 17.

Medición de la dirección y velocidad del viento.

ANEXO

New York, 1 de Noviembre de 2002

Descripción de la campaña de mediciones de campo de corrientes para la modelacion hidrodinámica (III).

Rafael Cañizares

Introducción

La campaña de mediciones presentada en este documento esta diseñada para complementar las campañas de mediciones de corrientes llevadas a cabo por la ACP durante el año 2002. El objetivo de esta campaña adicional es el de tomar mediciones de las corrientes en las zona de entrada al canal, mas concretamente entre Punta Guinea y el causeway la primera, y en la zona del puente de las Americas la segunda. Se proponen dos dias de medicines uno durante marea muerta y el otro durante marea de sicigia.

Campaña adicional de Mediciones de campo de corrientes para Noviembre 2002

La posición aproximada del nuevo alineamiento se ha definido con ayuda de la Unidad de Operaciones Ambientales de la ACP y puede observarse en la Figura adjunta. El alineamiento consiste de dos partes una localizada entre Punta Guinea y el causeway y otra en la zona del Puente de las Americas. Las mediciones han de tomarse durante bajamar, pleamar y dos mareas medias cada día Cada una de estas mediciones debe efectuarse en un periodo de aproximadamente dos horas, comenzando una hora antes del tiempo marcado como bajamar, pleamar y marea media. El tiempo en el que se presenta bajamar y pleamar ha sido tomado de la Tabla de Mareas del 2002 confeccionada por el Departamento de Ingeniería Proyectos, División de Ingeniería, Sección de Meteorología e Hidrología, para la estación de Balboa en el Pacífico. Los datos en estas tablas están en hora local de la República de Panama.

Como ya ha sido sugerido al ACP si durante la campaña de mediciones se perdiera algun dia se debera continuar tan pronto como sea posible con el alineamiento que no pudo medirse y continuar con la campaña aunque terminara uno o dos dias despues.

Mediciones durante Marea de Sicigia

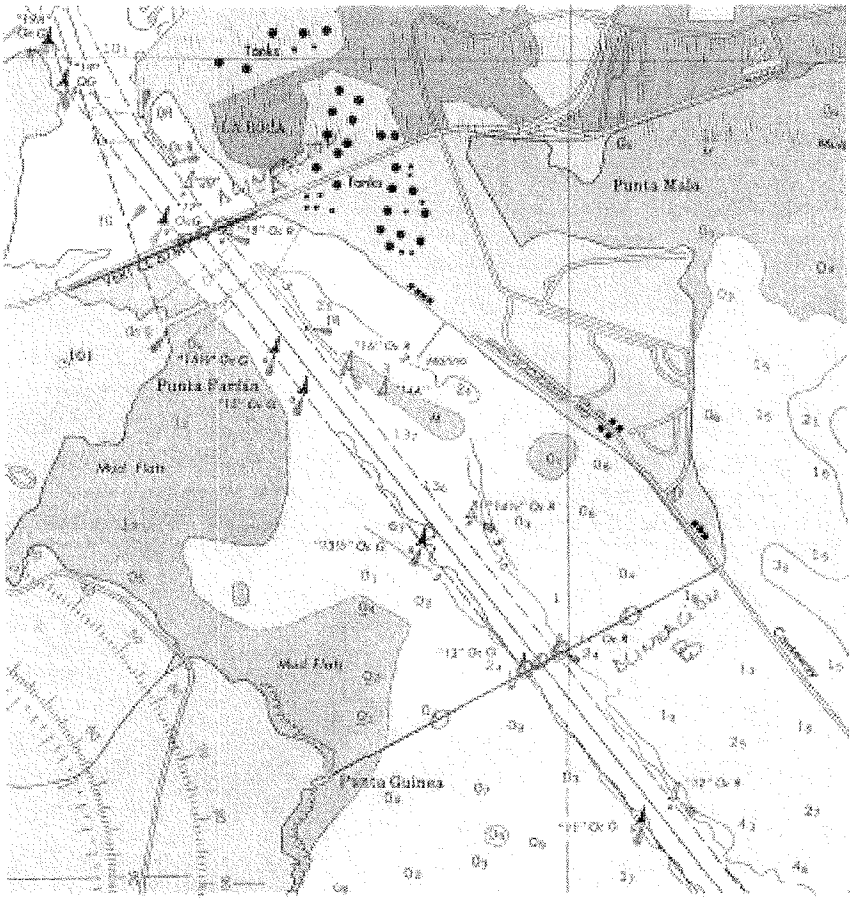
Miercoles, 6 de Noviembre del 2002
Toma de datos en alineación.
Tiempo de Medición:

Marea Media bajando: 6:30 – 8:30
Bajamar : 9:46 – 11:46
Marea Media subiendo: 13:00 – 15:00
Pleamar: 15:58 – 17:58

Mediciones durante Marea Muerta

Miercoles, 13 de Noviembre del 2002
Toma de datos en alineación.
Tiempo de Medición:

Marea Media subiendo: 6:30 – 8:30
Bajamar : 10:00 – 12:00
Marea Media subiendo: 13:00 – 15:00
Pleamar: 16:00 – 18:00



Posicion aproximada del nuevo alineamiento

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2. SECCIÓN DE METEOROLOGÍA E HIDROLOGÍA (ACP) — Tabla de Mareas 2002, Balboa - Pacífico

3. THE PANAMA CANAL ZONE, — Current Observations off The Pacific Entrance to The Panama Canal, 1945.

4. VALEPORT LIMITED — Operation Manual Model 308, 2001

5. WXTIDE 32 VERSIÓN 2.7 — Programa para Cálculos de Marea

APPENDIX E - ENVIRONMENTAL CHARACTERIZATION REPORT

1 ENVIRONMENTAL CHARACTERIZATION

1.1 Background

The Bay of Panama and nearby areas are located within the zone of influence of the north winds that move across the isthmus with greater intensity during the dry season and cause the movement of deep waters towards the surface (Kwiecinski & D´Croz, 1994), breaking the stratification of the water column and bringing to the surface cold waters characterized by their low temperature, high salinity, high concentration of nutrients, strong reduction in transparency and reduced levels of dissolved oxygen (Smayda, 1963, 1966; Forsbergh, 1969; D´Croz *et al*., 1991); this leads to a great level of biological productivity (Kwiecinski *et al.*, 1975) and stimulates plankton production (D´Croz & Robertson, 1997).

On the other hand, during the rainy season, run-off waters and drainage from rivers and streams produce an increase in temperature, reduction in the levels of salinity and elevation of nitrates and silicates (Kwiecinski & D´Croz, 1994).

The high level of contamination from organic matter in the area near the entry of the canal, presents a strong biochemical demand for oxygen (BOD), reducing the levels of dissolved oxygen. This is in addition to the presence of hydrocarbons and contamination resulting from industrial waste (Kwiecinski & D´Croz, 1994). In particular, discharges from wastewaters coming from the zone around the study area, (Albrook, Amador, Balboa, Ancón, Curundú, Diablo) and effluents from the Ancon treatment plant, discharged through the Curundu river, have created a great level of eutrophication, manifested in reduced levels of dissolved oxygen related to the environment where there is a high degree of microbial activity (Chial, 1997); this may possibly have a great impact over the distribution of plankton in the area of Panama Bay.

1.1.1 General Characterization of the Panama Bay Area

Coral and Reefs

The important marine communities in the Bay include coral reefs, mangroves and fishing communities, benthic or pelagic. In the Bay of Panama located near to the Canal there is a remnant colony of coral reefs that historically was important. These communities include the reefs located around the islands of Taboga, Urabá, and Taboguilla. Information obtained through interviews with local experts (Dr. Luis D'Croz) revealed the existence of a coral species (*Siderastrea glynni*) endemic to the zone of Panama and endangered in the Oriental Pacific. This species is represented through 5 colonies that were found in Uravá Island.

The coral reefs in the Pacific historically contained only 20 species compared with the 49 species in the Caribbean coast. Nevertheless, they have one of the highest growth rates in the world (6 cm/year). In the area of the Canal, the communities have almost disappeared and only a few representatives remain around Taboga and Urabá islands (Morales y Muñiz, 1988).

In general terms, the pollution in the area, as well as the increase of suspended sediments in coastal waters (originated as a result of fluvial erosion, dredging, etc.) and the consequent deterioration of the water quality with a reduction of the *photic zone* (area where the light penetrates in the water column), have caused continuos harm to coral reef populations. Historically, there existed coral communities close to the entrance of the Canal de Panamá, at the level of Taboga, Urabá, Taboguilla, Otoque (Dames & Moore, 2000). Currently, the only population known in the Eastern Pacific, and endemic for Panamá, is the species *Siderastrea glynni*, which has been observed around of the Island of Uravá.

The upwelling (*eutrophicatión*) and the difference in the abundance of coral species between the Caribbean and the Pacific, strengthen the theory that coral organisms and the development of coral reefs is quicker and more productive in warm zones, oligotrophic as the Caribbean waters, than in conditions with varied temperatures, eutrophic waters, as those found in certain seasons of the year in Pacific waters (D'Croz and Robertson, 1997).

Mangroves

Typical mangroves communities are located in Perequete, Caimito, Veracruz, Balboa, and Juan Díaz. A helicopter over flight over these zones on July 13, 2002, confirmed the presence of these communities. These are important ecosystems that have an influence on the recruitment of marine species like *anchovetas* and *camarones peneidos* in the area. The mangroves in the Pacific of Panama are one of the ecosystems that have suffered under strong humane pressure, manifested mainly by expansion of agriculture, livestock, urban development and oceanculture activities (D'Croz, – Personal communication). Among the communities associated to these mangroves are algae, invertebrates (crustaceans, mollusks, sponges), birds, mammals, and larva and young fish stages (D'Croz, Personal communication).

Mangroves offer protection and source of nourishment for the biotic community previously mentioned. Studies conducted by D'Croz et al. (1976), D'Croz, L., and Kwiecinski, B. (1980), indicate the presence of eight species of shrimps inhabiting among its roots. According to D'Croz, the species known as white shrimps or prawns (*Penaeus occidentalis, P. stylirostris,* y *P. vannamei*) are the most abundant in the mangroves. The young stages remain there for a long time, and as adults they migrate to deeper waters of the Panama Bay.

Among the common species in the mangroves are the *mojarra* (*Eucinostomus californiensis*), the *anchoveta* (*Anchoa panamensis*), and the false *anchoveta* (*Cetengraulis mysticetus*) that is used for fish flour production (Bayliff, 1966). The young stages of the false anchoveta get nourishment mainly food filtered in the pelagic zone, while the adult phases are mostly *iliófagos*, but also feed on plankton (Bayliff, 1966). The *anchoveta* is known for spawning in front of the coast of Juan Díaz and Panamá Viejo (D'Croz,).

The economic importance of the mangroves ecosystems was estimated D'Croz, L., by Kwiecinski, B. (1980): the benefit from *anchoveta* fishing are estimated as B/.65,164 per kilometer of mangrove, and $26,350 per kilometer for the shrimps. Other common species in artisan fishing are the *corvina lona (Micropogon sp*.), *pargos* (*Lutjanus sp*.), and *robalos* (*Centropomus sp*). It was calculated in this study that the economic benefit per kilometer of mangrove for these species is approximately of B/.3,100. These values are considerably low, as they were estimated many years ago, but show the economic importance of mangroves.

Coastal birds and marine mammals

Information obtained from Adrián Carrillo (Responsible for the Office of the Autoridad Nacional del Ambiente in Taboga) in an interview made by the Consultant on June 26, 2002, indicates that the coastal life around Island of Taboga is very rich and includes a protected area, Refugio de Vida Silvestre (252 ha) with bird populations ranging between 55,000 and 70,000 individuals, and having their nesting area at the Southweast corner of the island. The majority of these birds include pelícanos and paticuervos. Both species feed in the Bay waters and in the proximity of the entrance to the Panama Canal. Mr. Carrillo indicated as well, that humpback whales come close to the island between June and September, not staying longer due to the presence of humans and ships to the East, which generate noise disturbances. Other marine mammals present in the zone include dolphins.

Sea-grasses

According to recent research (ANCON/Universidad de Panamá, 1994), there are no known sea-grass prairies in the Pacific coast of the Panama Canal; there are some communities in nearby zones where the water quality (transparency) is good. Sea-grass are known worldwide as communities which offer refuge to young and adult phases of many fish species with economic value and therefore great importance for local communities.

Benthic organisms

The factors that may influence the water quality may also have a negative effect on plankton larvae communities, whose adult stages are also of economic importance.

Some examples are the shrimp post-larvae as *Penaeus occidentales, P. stylorostis* and *P. vannamai.*

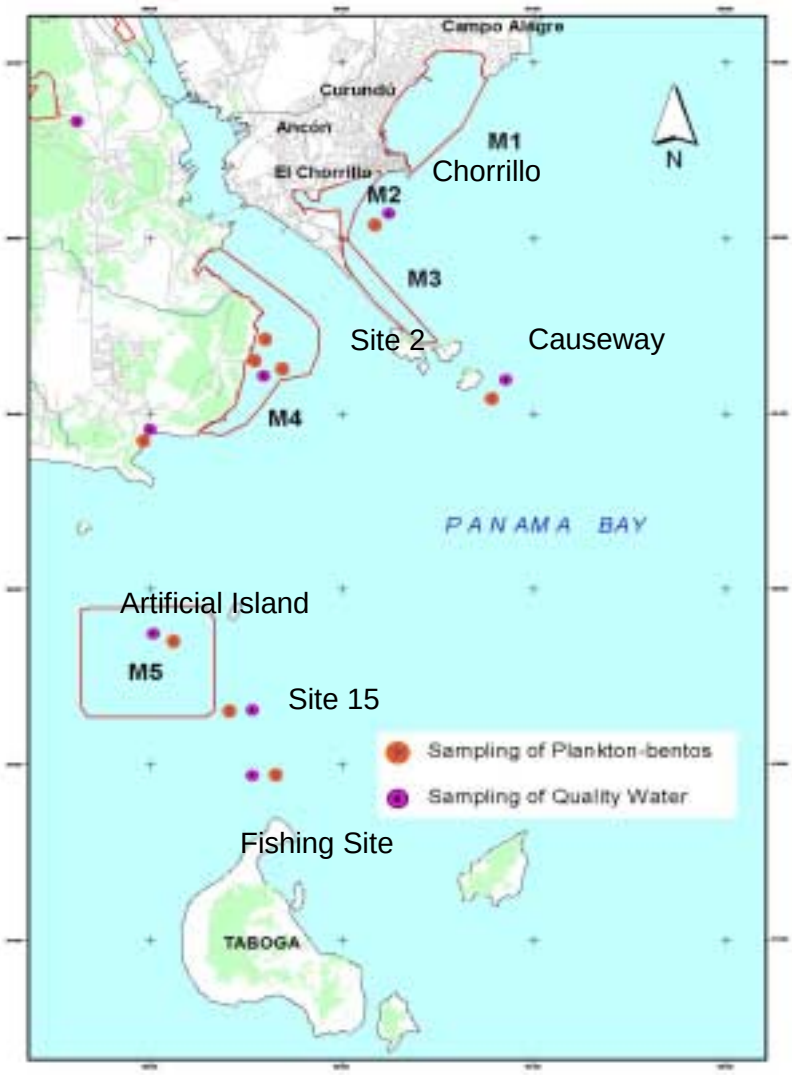
The most common benthic organisms found in sediment samples of the Canal area include the polychaets, crustaceans and mollusks; which comprise almost 90% of the biological communities in these habitats. Many of these organisms are commonly used as biological indicators in environmental studies.

1.1.2 Results of Marine Sampling Program

Two sets of marine data collections were conducted in the area of study, the first one during the year 2002 and the second one between February and March of 2003.

The sampling locations for both programs are indicated in Figure 1-1.

Figure 1-1: Location of Marine Sampling Stations



First study

The data of the physical and chemical parameters is provided in Table 1-1. The surface temperature during the day for the entire area varied between 24.4 -25.05 ºC. This was the maximum temperature registered at all the sites and corresponded to the Fishing Site station. At this station, the greatest amount of suspended solids (34.06 mg/L) and the greatest degree of salinity (35.1 0/00) were also found. The lowest biomass value reported during the diurnal collection was recorded in Site 15.

Table 1-1: Physical-chemical parameters at the data collection sites.

Site	Type of Collection	Temperature (°C)	Salinity (o/oo)	Suspended Solids (mg/L)
Causeway 2	Diurnal	24.27	34.24	33.3
Causeway 2	Nocturnal			
Causeway 4	Diurnal	24.84	33.89	33.01
Causeway 4	Nocturnal			
Causeway	Diurnal	24.4	34.05	33.13
Causeway	Nocturnal			
Artificial Island Site	Diurnal	24.53	34.09	33.17
Artificial Island Site	Nocturnal			
Site 15	Diurnal	24.83	34.94	33.92
Site 15	Nocturnal			
Fishing Site	Diurnal	25.05	35.1	34.06
Fishing Site	Nocturnal			

Note: No nocturnal physio-chemical data was collected during the first set of field studies.

The composition of the average density of the total number of zooplankton organisms is presented in Table 1-2. The greatest density was recorded during the night at Causeway 4 (5,987,826.00 org/m^3). During the day, the highest value was recorded at both Site 2 and the Artificial Site (249,753 org/m^3).

Table 1-2: Density of organisms (org/m^3) N=1. Standard error of the mean (±SEM).

Site	Collection	Total Organisms	
		Mean	±SEM
Causeway 2	Diurnal	2,824.11	107.72
Causeway 2	Nocturnal	33,936.12	1,153.10
Causeway 4	Diurnal	249,753.10	24,169.65
Causeway 4	Nocturnal	5,987,826.00	17,957,430.00
Causeway	Diurnal	55,252.46	3,665.40
Causeway	Nocturnal	279,171.30	1,499.87
Artificial Site	Diurnal	49,724.23	14,311.54
Artificial Site	Nocturnal	38,431.39	17,848.89
Site 15	Diurnal	12,467.06	2,067.88
Site 15	Nocturnal	3,841,729.00	104,999.00
Fishing Site	Diurnal	6,262.93	517.12
Fishing Site	Nocturnal	2,576,471.00	311,307.70

A total of 26 taxa were identified. Copepods represented approximately 58.19 % of the total density or organisms collected during the day, with the greatest number recorded at Causeway 4 Station during the night (Table EA-1 in appendix). Calanoid copepods were outstanding as the most abundant group and the dominant species, followed by Cladoceros and Chaetognatha for the same season. The density of fish eggs (Table 1-2) at night, was very high in Site 15 (811,169.01 org/m^3) in an order of magnitude, when compared with the diurnal values.

The greatest density of fish larvae during the diurnal and nocturnal collections was recorded in Causeway 4 and Causeway 5 (3,718.41 and 3,486.60 org/m^3) respectively.

At the Artificial Island Site, a total of 384.79 larvae were recorded during the day. In the rest of the collection sites, no fish larvae were reported during the day. The most abundant larvae were Scianidae, Engraulidae, Gobiidae and Haemulidae.

The greatest richness was registered during the night at the Fishing Site with a value of 15 taxa. At this same site, during the day, a total of 13 taxa were recorded at the two places.

The total biomass of the organisms is represented in Table 1-3. The mean of the nocturnal biomass samples ranged from 0.26 to 3.96 mg/m^3. The greatest biomass reached during the night periods was at site Causeway 4 (3.96 mg/m^3). The mean biomass for diurnal samples of all stations, ranged from 0.12 to 1.64 mg/m^3, with this last value recorded at the Causeway.

Table 1-3: Biomass values for diurnal and nocturnal collections.

Site	Collection	Dry weight (mg/m^3)
Causeway 2	Diurnal	0.32
Causeway 2	Nocturnal	1.38
Causeway 4	Diurnal	0.38
Causeway 4	Nocturnal	3.96
Causeway	Diurnal	1.64
Causeway	Nocturnal	3.92
Artificial Island	Diurnal	0.42
Artificial Site	Nocturnal	3.78
Site 15	Diurnal	0.12
Site 15	Nocturnal	0.26
Fishing Site	Diurnal	0.52
Fishing Site	Nocturnal	0.80

First Study Discussion

The values for temperature, salinity and suspended solids obtained during the first study were homogeneous throughout the entire area of the study, and they cannot be of use to characterize the area and correlate them with collected organisms. Everything seems to indicate that the greater recruiting of zooplankton occurs at Causeway 4; however, there are equidistant values at the collection sites that do not agree with the values for the zone in other studies, producing a distortion of data. For example, we expected the number of larvae to be greater at night (the time when they migrate to the surface); however, the data show the opposite. Possibly, this is due to the inadequate values of the flux meter in some data collection areas, and apparently did not register a correct number. In addition,

the samples were saturated with phytoplankton, which shows that there was a need to use a net designed to capture of zooplankton. This study also presents a low number of samples collected making statistical analyses hard to implement.

Second study

Based on the data from the physical-chemical parameters provided by the collection group, (Table 1-4), the surface temperature cited during the day for the entire study area ranged from 25.1 to 27.9 ºC. At night, the temperature fluctuated between 24-25 ºC. These values were recorded at the Artificial Site and Site 15, respectively. The maximum temperature recorded in all collection sites was 27.9 ºC during the day in the Causeway station. The highest turbidity was registered in site 2 during the day (10.2) and the lower turbidity obtained was (2) for the Fishing Site. The oxygen levels were higher in this same station. The extreme salinity records variations were between 31 and 37‰ for Site 2 during the day and el Chorrillo at night.

Table 1-4: Physical Chemical parameters recorded at the collection sites.

Sites	SHIFT	TEMP (ºC)	TURB (NTU)	OXYGEN (mg/L)	SAL. (‰)
Causeway	Day	27.9	2.6	5.9	34.0
Causeway	Night	25.6	4.7	6.1	36.0
Chorrillo	Day	26.8	3.1	6.8	35.0
Chorrillo	Night	25.8	10.0	5.3	37.0
Artificial Site	Day	26.4	2.5	6.9	32.0
Artificial Site	Night	24.0	4.3	6.4	31.9
Site 15	Day	26.7	1.7	6.7	35.0
Site 15	Night	25.0	1.9	7.8	33.1
Site 2	Day	25.1	10.2	5.2	31.0
Site 2	Night	24.7	8.3	6.4	31.2
Fishing Site	Day	26.3	2.1	6.9	33.0
Fishing Site	Night	25.2	2.0	8.5	33.4

The composition of the density mean of the total number of zooplankton organisms and the biomass by station is presented in Table 1-5. The greatest density during the night was recorded at el Chorrillo and the Causeway (302,044.65 and 149,756.18 org/m^3, respectively).

During the day, the highest value was recorded in Site 2 and the Artificial Site (123,076.33 and 73,049.28 org/m^3). The density found at el Chorrillo represents two times the value found at the Causeway at night time.

Table 1-5: Density of planktonic organisms (org/m^3) N=3. Biomass expressed in (mg/m^3)

Sites	Shift	Total # of organisms		Dry weight (mg/m^3)		Ash weight (mg/m^3)	
		Prom.	± SEM	Prom.	± SEM	Prom.	± SEM
Causeway	Day	33,790.65	6,852.03	0.37	0.07	0.07	0.02
Causeway	Night	149,756.18	49,115.26	0.67	0.04	0.17	0.02
Chorrillo	Day	22,934.36	4,094.61	0.38	0.04	0.08	0.01
Chorrillo	Night	302,044.65	107,848.50	1.50	0.01	0.31	0.01
Artificial Site	Day *	73,049.28	18,729.28	0.52	0.04	0.11	0.01
Artificial Site	Night	15,572.77	3,067.96	0.27	0.02	0.79	0.46
Site 15	Day	18,816.15	1,332.25	0.47	0.04	0.10	0.02
Site 15	Night	4,421.55	913.24	0.11	0.01	0.05	0.02
Site 2	Day *	123,076.33	66,738.75	0.50	0.07	0.12	0.01
Site 2	Night	35,162.04	10,591.48	1.07	0.16	0.28	0.08
Fishing Site	Day	21,983.83	7,688.89	0.47	0.03	0.13	0.02
Fishing Site	Night	5,228.61	1,480.94	0.13	0.02	0.03	0.01

The values registered in the rest of the collection sites did not exceed the level of 35,162 org/m^3 for this same shift (Figure 1-2).

The density of fish eggs (Figure 1-3) at night, was greater at el Chorrillo (25,711 org/m^3) followed by the Causeway (9,095 org/m^3) reaching high percentages. A total of 31 taxa were identified, where copepods represented approximately 66.4% of the total density of organisms collected during the day. It was greatest at Site 2, and 65% at night in el Chorrillo (Table 1-6 and Table 1-7). During the study period, in the fraction of zooplankton, Calanoid copepods were the most abundant group, and dominant species, with 7.90% and 5.74%, respectively. In these same collection sites, the greatest density of fish larvae was also recorded (Figure 1-4). During the day time, the highest value of fish eggs and larvae was recorded at Site 2 (5,833 and 2,204 org/m^3). At Site 15 and the Fishing Site no fish larvae were reported. This could be attributed to timing in sampling. At the Causeway, the larvae identified were Engraulidae (anchovies), Gobiesocidae (a typical reef group), Polynemidae and Paralichthydae (soft bottom group). The

representation of species of various habitat types (pelagic, reef bottoms, sandy bottoms) is an indication of the coastal dispersion of these larval stages. At the el Chorrillo and Artificial Site the larvae were Engraulidae. At Site 2, the reported larvae were Carangidae and Gobiidae.

Figure 1-2: Density total of organisms collected during night and day periods.

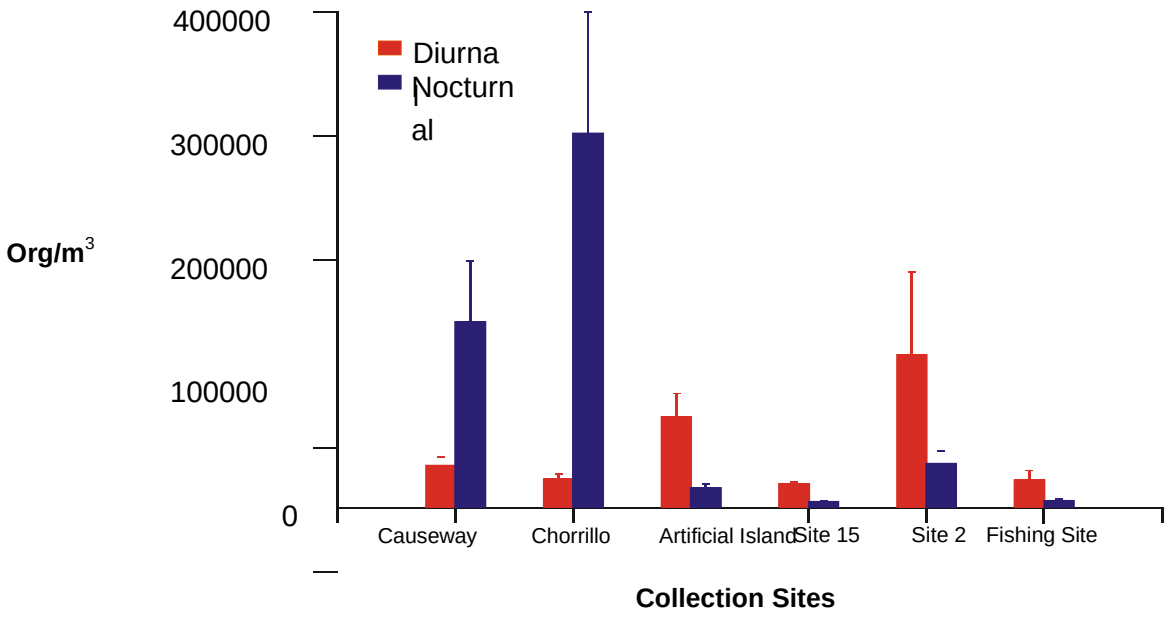


Figure 1-3: Density of fish eggs collected during day and night periods

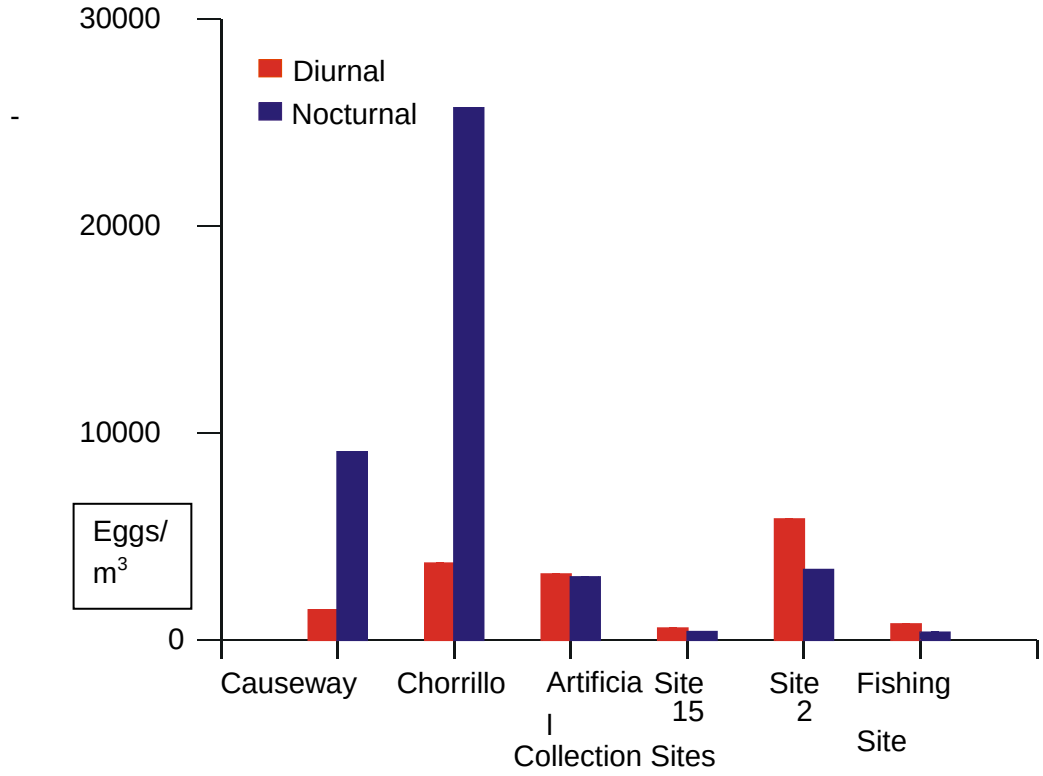
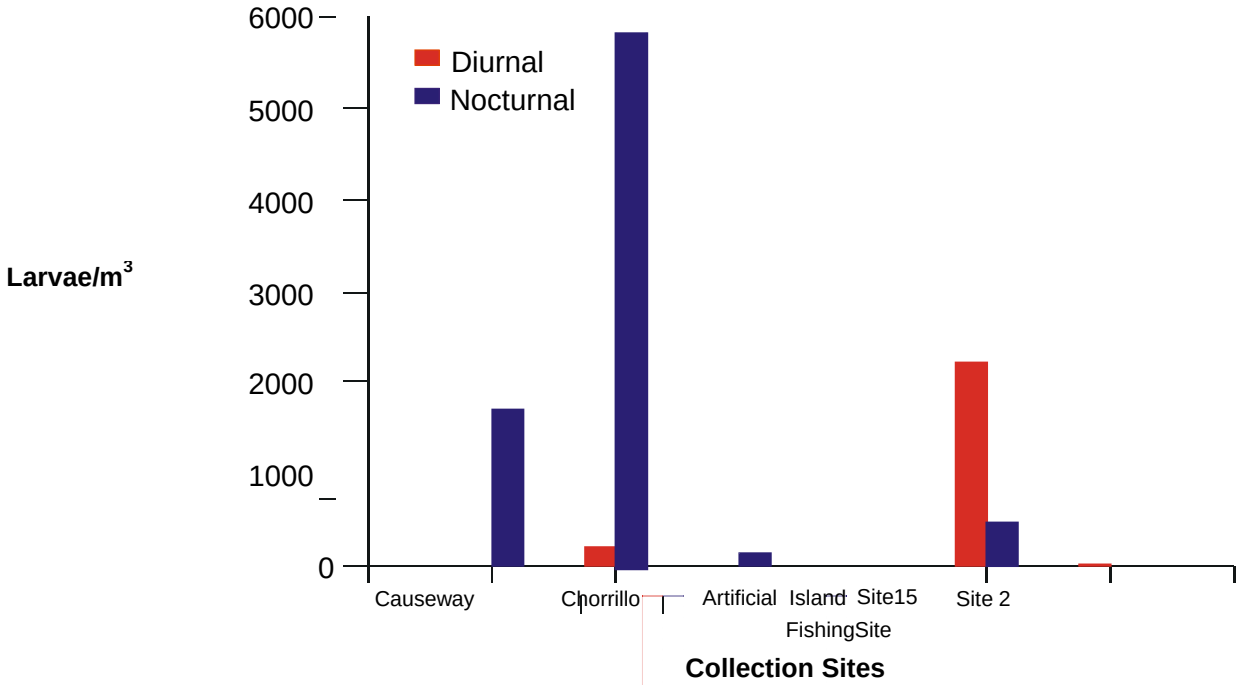


Figure 1-4: Density of fish larvae collected during the diurnal and night periods



The greatest richness (Table 1-6 and Table 1-7) was registered during the night at the sites of the Causeway with a value of 18 taxa and Artificial Site with 16. During the day, el Chorrillo and Site 2 presented a richness of 13 taxa for both sites.

Table 1-6: Density (org/m^3) and percentage (%), by taxa during the diurnal and nocturnal shifts.

Taxa	Causeway				Chorrillo				Artificial Site			
	Day		Night		Day		Night		Day		Night	
	Prom.	%	Prom.	%	Prom.	%	Prom.	%	Prom.	%	Prom.	%
Larvae of anelids	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Larvae of asteroideos	0.00	0.00	0.00	0.00	73.02	0.30	4312.45	1.33	0.00	0.00	0.00	0.00
Anphiípods caprelids	0.00	0.00	0.00	0.00	0.00	0.00	2342.78	0.72	0.00	0.00	0.00	0.00
Calanoid copepods	21339.03	61.74	112995.91	71.33	13852.24	57.17	210682.96	64.74	49370.05	65.79	10940.57	63.68
Chaetognatha	897.09	2.60	3206.07	2.02	320.76	1.32	29819.26	9.16	4164.76	5.55	610.81	3.56
Cladoceros	9922.01	28.71	14361.92	9.07	4640.75	19.15	20660.46	6.35	14736.59	19.64	883.75	5.14

For all collections only a summary of the most common species are presented. A copy of this table with full descriptions is included in “Environmental Appendix”

Table 1-7: Density (org/m^3) and percentage (%), by taxa during diurnal and nocturnal shifts.

Taxa	Site 15				Site 2				Fishing Site			
	Day		Night		Day		Night		Day		Night	
	Prom.	%	Prom.	%	Prom.	%	Prom.	%	Prom.	%	Prom.	%
Larvae of anelids	0.00	0.00	0.00	0.00	125.83	0.10	0.00	0.00	0.00	0.00	0.00	0.00
Larvae of asteroideos	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Caprelid Anphipods	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Calanoid copepods	16066.90	81.04	2845.97	61.93	93169.48	71.30	25613.93	70.82	13962.02	61.80	3142.89	57.56
Chaetognatha	311.87	1.57	88.19	1.92	426.22	0.33	3777.35	10.44	409.43	1.81	162.95	2.98
Cladoceros	2070.73	10.44	1075.43	23.40	15271.35	11.69	465.88	1.29	6721.30	29.75	1298.38	23.78
Cumaceos	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Doliolidos	0.00	0.00	0.00	0.00	4295.30	3.29	0.00	0.00	0.00	0.00	8.72	0.16
Eufausidos	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fish eggs	568.01	2.87	403.72	8.78	5833.92	4.46	3398.53	9.40	765.59	3.39	368.31	6.75

Taxa	Site 15				Site 2				Fishing Site			
	Day		Night		Day		Night		Day		Night	
	Prom.	%	Prom.	%	Prom.	%	Prom.	%	Prom.	%	Prom.	%
Fish larvae	0.00	0.00	0.00	0.00	2204.28	1.69	471.60	1.30	38.41	0.17	0.00	0.00
Isopodos	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Megalopa of braquiros	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.72	0.16
Misidaceos	0.00	0.00	38.58	0.84	846.93	0.65	0.00	0.00	135.28	0.60	36.15	0.66
Misis	156.47	0.79	34.38	0.75	1199.66	0.92	532.40	1.47	68.18	0.30	0.00	0.00
Nauplio of copepodos	0.00	0.00	0.00	0.00	0.00	0.00	1048.67	2.90	0.00	0.00	0.00	0.00
Oikopleura	123.70	0.62	46.86	1.02	0.00	0.00	0.00	0.00	264.90	1.17	203.90	3.73
Ostracodos	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	39.44	0.72
Others	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Larvae of pelecipods	0.00	0.00	35.26	0.77	166.41	0.13	149.44	0.41	85.22	0.38	57.72	1.06
Larvae of poliquetos	247.41	1.25	0.00	0.00	102.41	0.08	0.00	0.00	0.00	0.00	9.94	0.18
Post Larvae of paniluridos	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29.00	0.53
Pteropods	156.47	0.79	0.00	0.00	0.00	0.00	137.71	0.38	0.00	0.00	8.72	0.16
Sifonofores	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Porcelanids	0.00	0.00	0.00	0.00	3201.59	2.45	0.00	0.00	0.00	0.00	0.00	0.00
Notilucas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Larvae of anomuros	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Larvae of pagúridos	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Larvae of braquiuros	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Zoea of braquiros	123.70	0.62	27.33	0.59	3829.63	2.93	573.24	1.58	141.34	0.63	84.92	1.56

The total biomass of the organisms and the ash weight are presented in Figure 1-5 and Figure 1-6. The mean of the biomass for nocturnal samples was between 0.13 and 1.50 mg/m^3. The greatest biomass reached during the nocturnal periods was recorded at the sites of Chorrillo (1.50 mg/m^3), Site 2 (1.07 mg/m^3) and the Causeway (0.67 mg/m^3), respectively. The mean biomass for diurnal samples for all stations was between 0.37 and 0.52 mg/m^3; this last value was recorded at Artificial Site.

Figure 1-5: Total biomass of organisms (mg/m^3) collected during day and night periods

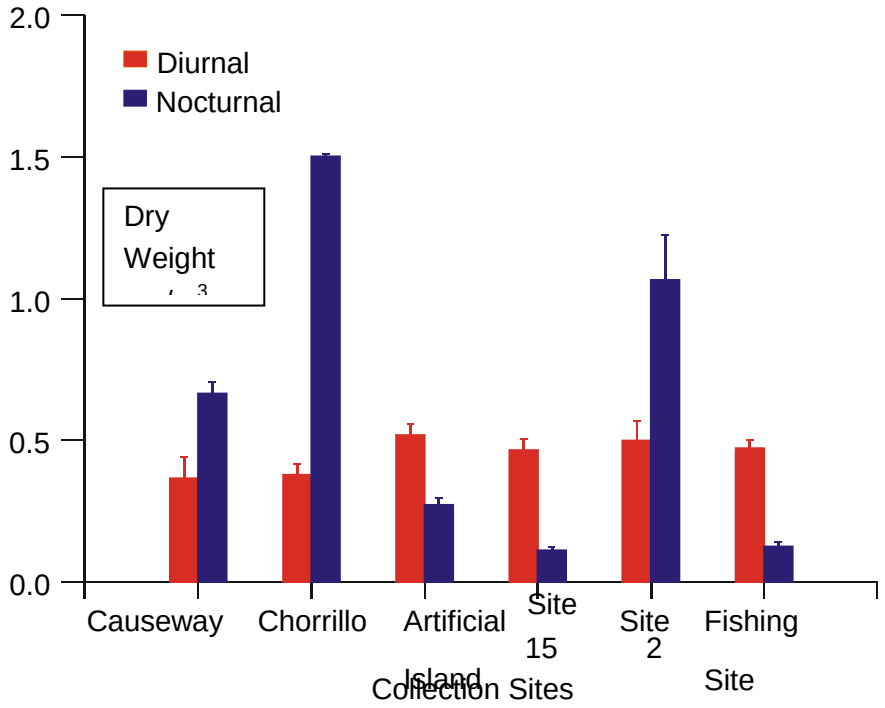
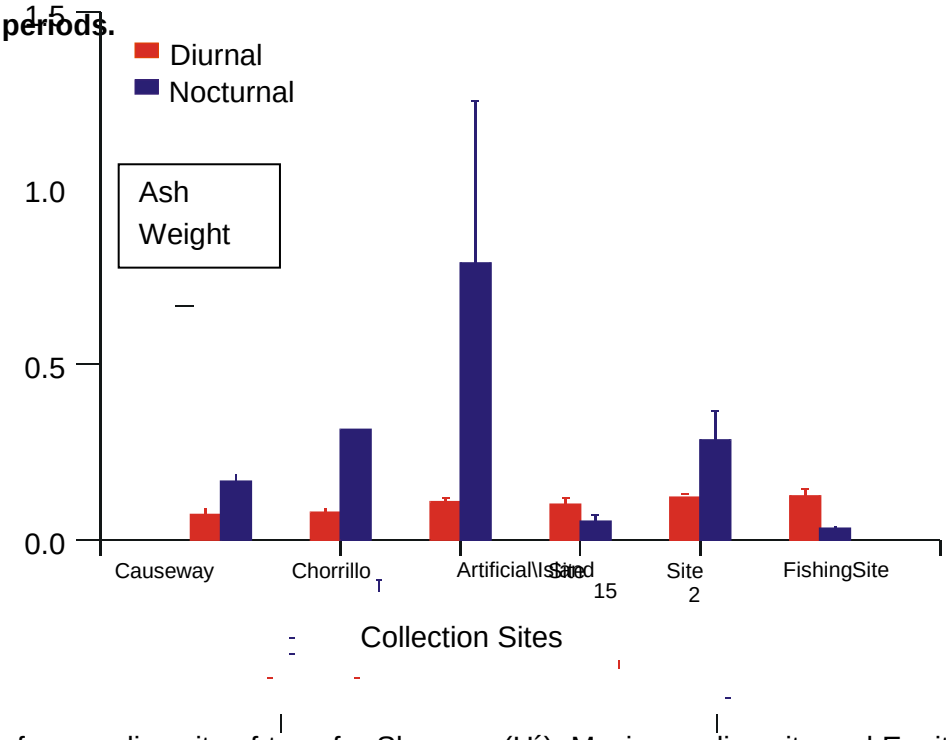


Figure 1-6: Total biomass (ash weight) of organisms (mg/m^3) collected during day and night periods.



The index of mean diversity of taxa for Shannon (H´), Maximum diversity and Equitability, can be seen in Table 1-8. During the day diversity ranged between 0.52 and 1.03 bits.ind^{-1}, with this last value recorded at el Chorrillo. During the night shift diversity was higher and ranged between 0.89 and 1.10 bits.ind^{-1}, with this last value being the highest of all collection sites and corresponding to the Fishing Site. At the same time, the values for Maximum Diversity were similar and fluctuated between 1.38 and 2.08 bits.ind^{-1} during the day and 1.64 and 2.22 bits.ind^{-1} at night. The highest value for Equitability was for the diurnal period: 0.58, bits.ind^{-1} recorded at el Chorrillo and 0.55 bits.ind^{-1} during the night period for Site 15.

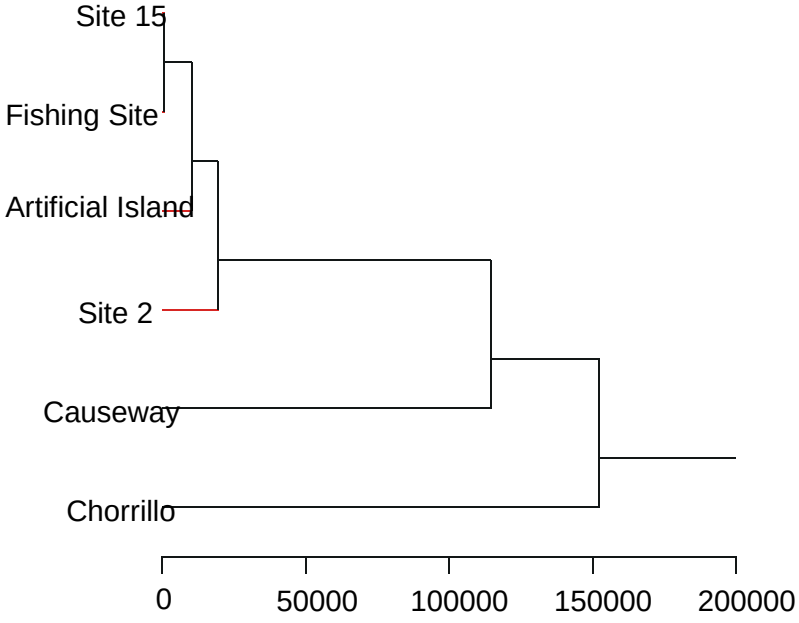
Table 1-8: Indices of Diversity for Shannon (H`), Maximum Diversity (H_{max}) and Equitability (J). Standard error of the mean (± SEM).

Sites	Shift	H'		H_{max}		J	
		Prom.	± SEM	Prom.	± SEM	Prom.	± SEM
Causeway	Day	0.91	0.03	1.70	0.04	0.54	0.02
Causeway	Night	1.03	0.08	2.22	0.07	0.47	0.03
Chorrillo	Day	1.03	0.03	1.78	0.07	0.58	0.01
Chorrillo	Night	0.99	0.07	1.97	0.10	0.51	0.03
Artificial Site	Day	0.99	0.04	1.92	0.04	0.52	0.02
Artificial Site	Night	0.94	0.05	1.96	0.07	0.48	0.03
Site 15	Day	0.52	0.07	1.38	0.13	0.37	0.02
Site 15	Night	0.89	0.07	1.64	0.12	0.55	0.06
Site 2	Day	0.85	0.05	2.08	0.03	0.41	0.02
Site 2	Night	0.94	0.07	1.91	0.07	0.49	0.02
Fishing Site	Day	0.81	0.06	1.75	0.08	0.46	0.02
Fishing Site	Night	1.10	0.04	2.01	0.06	0.55	0.02

The use of the similarity index in the development of dendrograms allowed for the determination of the degree of association of the taxa. The results during the day and night periods are observed in and Figure 1-8. In both periods, the taxa are grouped into two well delineated groups. The distribution of these groups characterizes the existing homogeneity of the taxa found at the following stations: Site 15, Fishing Site, Artificial Site and Site 2, considered to be oceanic, and the association between the Causeway and Chorrillo, considered to be coastal, and corroborated with the distance observed in the separation of the groups formed. The coastal area near the entrance to the Canal was sampled during upwelling season and it show typical signs of organic richness and associated biodiversity and abundances. The area showed a healthy abundance of fish eggs and fish larvae, another indication that in spite of heavy maritime operations in the area it still remains a very productive zone.

Figure 1-7: Dendrogram for diurnal collections

Figure 1-8: Dendrogram for nocturnal collections



(This is a multivariate analysis of Principle Components)

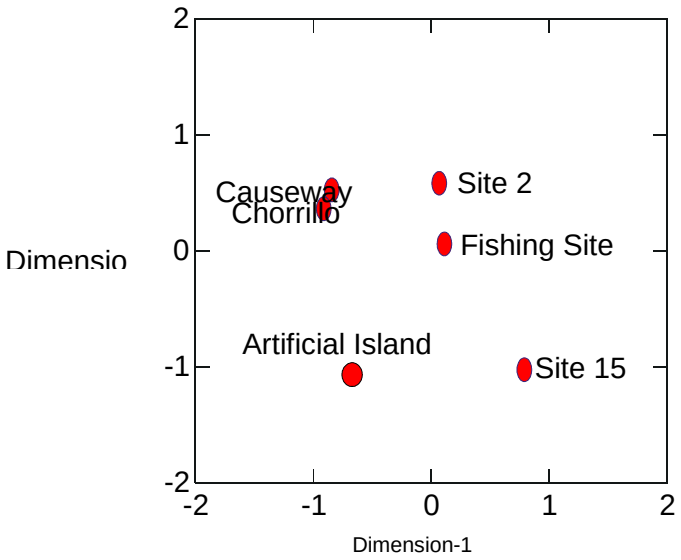
The non-parametric analysis of zooplankton and its different taxa (Table 1-9), found significant differences for sites at a significance level of p= 0.003. There were no significant differences during the day and night (p=0.119). However, in the interaction by sites, the collection period (night vs. day), the different taxa presented differences which were highly significant (p<0.001). So was the case for copepods were significant differences by sites (p=0.003) were found. There was no differences between shifts p=0.108 and the interaction by site and collection period was highly significant, p<0.001. For dry weight there were significant differences by site, collection period and the interaction of site-collection periods, which was highly significant at p<0.001. There were no statistically significant differences for ash weight by site, p=0.078 nor in the interaction, p=0.079.

Table 1-9: Results of the statistical analysis (Two-way ANOVA) to determine the differences between sites and collection periods.

Source of variation	Total Organisms		Copepods		Dry weight		Ash weight	
	F	P	F	P	F	P	F	P
Sites	4.100	0.003	4.057	0.003	40.203	<0.001	2.098	0.078
Collection period	2.501	0.119	2.657	0.108	25.206	<0.001	4.806	0.032
Site and collection period interaction	5.964	<0.001	6.259	<0.001	49.944	<0.001	2.093	0.079

The multivariate analysis presented in Figure 1-9 shows the affinity of the stations closest to the coast (Causeway and Chorrillo) and he difference found between these sites with respect to the ocean stations (Site 2, Fishing Site, Site 15 and Artificial Site).

Figure 1-9: Multivariate analysis of the collection areas.



In the Pearson matrix (Table 1-10) we can see a good positive correlation between the total density of organisms, the dry weight of biomass and turbidity. The negative values recorded for temperature and oxygen indicate an inverse dependent relationship.

Table 1-10: Pearson correlation matrix (p<0.05)

	Total organism	Total copepods	Dry weight	Ash weight
Total organism				
Total copepods	0.99			
Dry weight	0.80	0.79		
Ash weight	0.12	0.12	0.20	
Temperature	-0.02	-0.03	-0.03	0.59
Turbidity	0.71	0.72	0.74	0.30
Oxygen	-0.66	-0.66	-0.62	0.30
Salinity	0.51	0.51	0.34	0.17

Second Study Discussion

The decrease in the temperature, the increase in salinity beyond 30 ‰ and the elevated concentration of oxygen, confirm the patterns of the study zone, where the events of water changes are well defined. Previous studies have indicated that the changes caused in the plankton communities during the upwelling is affected by the temperature and assimilation of chemical species (nutrients), that can explain the relative abundance of organisms (in particular copepods) recorded in the area of the study. D´Croz *et al*. (2003) show that upwellings in the Gulf of Panama occur in pulsations, and 70% of these begin between January and February, and vary in intensity according to the decrease in the temperature (which can reach a decrease of 28-29ºC in November and less than 25 ºC during the previously mentioned months.) On the other hand, salinity increases from 27-28‰ to 34‰ for the same period. These characteristics are completely normal and inverse during the rainy season (Smayda, 1963, 1966; Forsbergh, 1969; D´Croz *et al*., 1991).

The great majority of organisms found at the collection sites were common for the coastal region and associated with the continental platform and many of them have been reported in other studies. There was a high level of copepods (mainly phytoplankton-phage) and cladoceros that do not present a clear and uniform distribution in the density of zooplankton with respect to night and day collections. However, this abundance is relatively high in comparison with other results obtained during the first study. In this sense, D'Croz (D´Croz *et al*. 2003) maintain that during the beginning of the upwelling season (January and February), the abundance of copepods was the lowest one of the year, and in March there is an abundant pulse.

In this study, during the dry season, calanoid copepods accounted for the greatest percentage of total density of zooplankton. It is important to understand the dynamic of zooplankton, especially of copepods, since they play an important role in trophic levels, including fish larvae. In this sense, Poulet & Williams (1991) indicate that the dynamic and behavior of populations of zooplankton, have repercussions on the exploitation of commercial fish.

During the study period of the fraction of zooplankton, cladoceros copepods and chaetognatha were the most abundant, especially at Site 2 during the day and el Chorrillo at night. Both of these stations are located in coastal areas and provide an insight on the importance of coastal hydrological processes and their potential influence on commercial fisheries.

The data obtained on the density of zooplankton shows that stations near the coast (Chorrillo and Causeway) can be considered as the most productive during the night; however, during the diurnal period, the density was very low when compared to stations that were farther offshore. However, although the concentrations shifted between sampling stations, in both cases abundance was higher in nearshore waters.

The density of organisms during the collection period, had the following sequence:

Night: Chorrillo**>**Causeway**>**Site2**>**Artificial Island**>**Fishing Site**>**Site 15.

Day: Site2**>** Artificial Island**>**Causeway**>**Chorrillo**>**Fishing Site**>**Site 15.

The high turbidity values and the decrease in the concentration of oxygen in both sampling events (diel) for the stations of el Chorrillo and Site 2 can be associated with possible discharges and re-suspension of sediment at these sites, since these stations are very close to the coast. The low density found at the Fishing Site and Site 15, for both collection periods, can be related to the location of the stations near the entry to the Canal since the turbidity recorded was lowest at these sites, or the twilight time of collection.

The values for dry biomass found in all collection sites during the day can be the result of the uniformity in the Physical Chemical parameters; however, these values are very low if compared with the figures presented by Morales (2002, in press) which shows that the total dry biomass of zooplankton dragged by the next of 500 and 1000 μm for the summer season in the Gulf of Nicoya, can be between 18.2 and 22. 69 mg/m^3. It is likely that the low biomass values found in this study can be strongly related to the quality of the plankton, the season and the type of net used.

The number of taxa reported in the study is an indication that the zooplankton fauna is relatively poor when compared to other areas that are more productive in the region; this may be corroborated by the richness of species found. However, there is a predominance of copepods, with a cosmopolitan distribution, which is to be expected after the coastal upwelling occurred. Studies conducted by Morales & Brugnoli (2001) indicate that copepods were the most abundant group of zooplankton in the area of Punta Morales.

Nevertheless, the differences that are found when the specific relationships of zooplankton are studied may be due to a particular structure in a complex community (Gómez *et al*., 1995) that varies as a function of hydrographic region and seasonality (McGowan & Miller, 1980). Therefore, the distribution of organisms in zooplankton presents seasonal variations, and the changes in diversity and density, depend on the tolerance of these organisms to environmental factors (Hernández-Trujillo, 1989c).

The reduction or absence of fish eggs and larvae at Site 15 and Fishing Site can be related to the recruiting zones, or changes in the area, since these sites are located in the area of ship transit in the Panama Canal. However, the density values of eggs found in the Causeway coincide with the figures reported by Gómez (1994) in a station near the entry to the Canal, where the density was not high due to the salinity of the area (34 and 36 ‰). Simpson (1959) indicates that Engraulidae *Cetengraulis mysticetus* lays eggs in areas with low salinity where the Panama Canal enters the Pacific Ocean, and their abundance is greater during the rainy season. In addition, there is also evidence of egg densities throughout the year, which suggests that these fish, which were also reported in the study, can be spawning throughout the year.

The Diversity Indices obtained for the study area indicate that the population that comprises the zooplankton macro-fauna is very homogeneous. The diversity of Shannon (H´) calculated for all stations, presents accepted values for the number of taxonomic species reported. At the same time, the Maximum Diversity values were similar for both collection periods, ranging between 1.70 and 2.22 bits.ind^{-1} throughout the study area. Nevertheless, the low values for Shannon, Maximum Diversity and Equitability found at Site 15 during the two collection periods are complemented by the low density reported in both collection events.

The analysis of similarities observed in the dendrograms, hints to the formation of two different groups which are associated with the location of collection sites.

In this study, the statistically significant differences found in the density of zooplanktonic organisms and the interaction by site and collection periods (between the periods of days of sample), suggest the existence of a typical zooplankton community in the Bay of Panama, with vertical movement and migration, accentuated in coastal stations.

Biological considerations of the spatial distribution of zooplankton

Copepods play an important role in the energy transfer processes from primary producers (phyto and bacterio-plankton) to organisms with higher trophic levels such as fish (Roman, 1991).

Their contribution to the regeneration of nutrients through their excreting activity (Ikeda, 1985), their active participation in the regulation of particle flow (Painert *et al*., 1989) and their role as stabilizers of the marine environment (Paffenhofer, 1993), make this group the focus of attention in the majority of ecological studies related to marine zooplankton.

Cladoceros and pelagic ostracods have a pattern of distribution that is closely related to hydrographic circulation as an expression of water mass and in tropical latitudes; they are abundant at night, but especially on the surface water, and are the prey of certain species of fish and *sifonoforos* (Angel, 1993).

The presence of *Chaetognatha* in some of the collection sites during the nocturnal period is an indicator of waters with relatively high salinity levels.

The sites near the coast (Chorrillo and Causeway) can be considered productive given the values reflected in the density of organisms. El Chorrillo is affected by the discharge of domestic wastewater, that results in a high level of organic matter, whose decomposition makes the level of dissolved oxygen decrease, reflected in the high level of turbidity found in the area. Site 2, Site 15 and the Fishing Site, can be considered ocean stations where the impact of human factors such as movement of ships can make the plankton community less stable.

The greatest variety of larvae species were found at the Causeway station.

The zooplankton community identified in the collection sites is characteristic of the sector, with a density level that matches the type of net used.

Phytoplankton

Introduction

This section of the study describes the qualitative and quantitative analysis of marine phytoplankton collected in the Bay of Panama during diurnal and nocturnal sampling events. In addition, the ecology and the bio-indicator nature of some species are also discussed.

During this study, 115 microalgae taxa were identified, of which 91 were diatoms (Bacilloriophyceae) divided in 39 genera. In addition, 24 taxa of dinoflagellates grouped in 10 genera were also identified. The more abundant Bacillariophyceae were: *Chaetoceros anastomosans*, *Chaetoceros lorenzianus*, *Chaetoceros socialis*, *Coscinodiscus* spp, *Proboscia alata*, and *Pseudonotzschia pungens*. Among the frequently observed dinoflagellates were *Ceratium furca, Ceratium tripos*, *Noctiluca scintillans*, *Peridinium* cf. *granii* and *Pyrophacus horologium*. The analyses of the samples collected during the month of February showed a higher number of species and of individuals per species than samples collected during the month of January. In contrast, studies conducted in the same geographic area during winter months showed lower numbers of organisms than those samples collected during the summer.

Several seasonal studies conducted in the Gulf of Panama in recent decades have concluded that upwelling occurrs typically between January and April, and occasionally during December and May and during July/August (Smayda, 1966; D'Croz et al. 1991). Other studies provided evidence on the formatuion of red tides, such as those of the

dinoflagellate *Gymnodinium catenatum* (Gómez and Soler, 1991), and diatoms (Aguilar, 1992), that formed at relatively short distances form some of the sampling sites for this proyect.

Recent nocturnal and diurnal phytoplankton studies conducted during the rainy season in the area of the proposed artificial island site (June-August 2002), revealed the presence of four groups of microalgae: Bacillariophyta, Dinophyta, Cyanophyta, Heterocontophyta, con predominancia de las diatomeas (Aguilar, 2002).

This study consisted in the analysis of forty-eight (48) samples of phytoplankton collected during January-February of 2003, during day and night hours, in six (6) sampling stations. Three to six samples were taken at each sampling event at each sampling station (Table EA-4 in Appendix D). The analysis conducted consisted in the identification of various taxa of microalgae to the lowest taxomomic level possible (genera or species). Each organism was classified, its frequency in the samples was registered, and a comparison among taxonomic groups, occurrence values, and their diel/seasonal variations, was conducted.

Laboratory Methods

Upon completion of sampling efforts, each sample was preserved in-situ with formaldehyde, and assigned a specific ID code with collection date and location. At the laboratory the samples were homogenized and a sample-drop deposited over a microscope slide for analysis. The standard counting for all samples was a top 300 organisms/colonies. Observations were conducted utilizing an Olympus differential contrast microscope (Model BX50), with attached 35mm Olympus camera, and exposure control model PM-30. All identified species were recorded; those with no clear ID were photographed, and preserved for subsequent analysis.

Phytoplankton Results

Table EA-5 and Table EA-6 in Appendix D show that the most common species among diatoms were: *Chaetoceros anastomosans*, *Chaetoceros lorenzianus*, *Chaetoceros socialis*, *Coscinodiscus* spp, *Proboscia alata*, and *Pseudonotzschia pungens*. *Pyrophacus horologium, Noctiluca scintillans*, *Peridinium* cf. *granii*, *Ceratium furca* and *Ceratium tripos,* are the taxons dominating the dinoflagellates present in the samples.

Table EA-5 and Table EA-6 in Appendix D show *Chaetoceros anastomosum* as a dominant species in nocturnal samples from stations “Fishing Grounds” and “Site 15” (February); *Chaetoceros lorenzianus* was abundant in diurnal samples from “Fishing Grounds”, “Site 15”, and Causeway; and *Chaetoceros socialis* in nocturnal samples from “Fishing Grounds” and “Site 15”.

Coscinodiscus spp was observed in 45 out of 48 samples but in higher frequency in samples from the Artificial Island station (bioth in January and February), nocturnal

samples in Chorrillo, and in both nocturnal and diurnal samples from the Causeway station.

In spite of the spatial distribution previously described, *Coscinodiscus* spp showed the highest occurrency frequency in Site 2 (night and day samples), Causeway, and Chorrillo (night samples). It is important to emphasize that these sampling stations are all located in nearshore areas.

Proboscia alata was observed with higher frequency in samples 2N, 4N y 1D, 2D for Fishing Grounds station; 1N in Site 15, 1D, 2D, 3D (during February) y 4D (enero con mayor número de individuos); Artificial Island 1N, 2N (night) and1D, 2D y 3D (January day samples). The highest abundance was found in samples 2N, 3N, 1D, and 2D of Causeway sampling station.

Pseudonitzschia pungens was a major contributor to cell-counting in "Fishing Grounds" 1N, 2D, and 3D and in Site 15 1N, 1D, 2D, and 3D.

Division Dinophytes was dominated by *Ceratium furca* in 1D in Fishing Grounds, 1D, 3D at Site 15, 3D Artificial Island, 3N Causeway, and 1D, 2D, and 3D at Chorrillo.

In the January samples *Ceratium horridum* was the dominant species in sample 4D of the Artificial Island site. On the other hand, *Noctiluca scintillans* was the second species behind *Coscinodiscus* spp. (among diatoms and dinoflagellates). Its dominance in the sample was observed in sampling stations "Fishing Grounds" (2N, 3N, and 4D). That is, this species dominated de January cell countings.

Another common species found in the samples was *Peridinium* cf. *granii* , particularly in the site Fishing Grounds (1D, 2D), Artificial Island (1D, 2D, and 3D), and Causeway (3N).

Pyrophacus horologium was dominant species in Fishing Grounds (2N, 3N, 1D, 2D and 3D); Site 15 (1N and 3N), and Causeway (1N, 2N, 3N, 1D, 2D and 3D), Chorrillo (1D, 3D).

Pyrophacus horologium was a common species in same sampling stations. However, it was absent in 19 out of 48 analyzed samples. It was particularly absent in January samples.

In general, diatoms did not show a preferential diel distribution among the nocturnal or diurnal samples. Such is the case of the species *Coscinodiscus* spp. Another example was *Chaetoceros lorenzianus,* which was abundant in three samples of three different sampling stations and absent in all January samples. *Chaetoceros socialis* showed highest abundance in 3 diurnal samples of different stations.

In the case of dinoflagellates, there was a tendency to show higher occurrence during diurnal samples. The exception was *Pyrophacus horologicum* whose cells were counted 109 during the nocturnal samples in the Causeway sampling stations.

The comparison of samples taken during the winter for stations ACP4, ACP5, ACP6, ACP7 and ACP14 and those taken during the summer (corresponding names: Causeway

day, Artificial Island day, Artificial Island night, Fishing Grounds day, and night, respectively) are shown in Table 1-11. The average registered during the summer samples was slightly lower than those samples for common sampling stations taken during the winter (January February).

Table 1-11: Number of species collected in Summer (January-February) and Winter (June-August) in common sampling stations.

Stations/Samples	Number of Species	
	Winter	Summer
Causeway diurnal (ACP 4)	37	42
Artificial Island diurnal (ACP 5)	42	39
Artificial Island nocturnal (ACP 6)	32	35
Fishing Grounds diurnal (ACP 7)	46	35
Fishing Grounds nocturnal (ACP 14)	51	34

On the other hand, some species abundant during summer samples such as *Pyrophacus horologium*, *Noctiluca scintillans*, *Chaetoceros anastomosans* and *Chaetoceros socialis*, were not observed during winter samples; others maintained their abundance levels, and other species showed no clear difference among seasons. The occurrence of diatoms and dinoflagellates was higher during the month of February than during January. In fact most of the species were absent during January, reaching a maximum of 22 species compared to a total of 115 identified during this investigation.

A reduced number of cells per species were collected during the month of January, except for *Coscinodiscus* spp in Site 15 D, Artificial Island D, and Causeway D. Some species like *Noctiluca scintillans* were present in significant quantitites in all January samples contrary to *Chaetoceros lorenzianus* and *Pyrophacus horologicum***,** which were absent.

Species present in most of the sampling stations included Coscinodiscus spp, Proboscia alata, Pseudonitzschia pungens, Chaetoceros curvisetus, Pseudosolenia calcar avis, Ceratium furca, Noctiluca scintillans and Pyrophacus horologium. In general, there were no samples that did not contained diatoms or dinoflagellates.

Similar studies conducted in the vicinity on the sampling stations of this proyect showed a red tide collected in February 1991 at the entrance of the Panama Canal, consisted primarily of diatoms of the genera *Coscinodiscus* (Aguilar, 1992). These results, as well as others described in that work, validates the findings of our study that showed more species and number of organisms per species during the month of February than in the

winter samples, and that the dominant species in most samples were those of the Genera *Coscinodiscus.*

During the months of July-August-September of 1988, Soler y Gómez (1991) studied an algal upwelling at the entrance of the Panama Canal. These samples were dominated by the dinoflagellate *Gymnodinium catenatum* Graham. The authors described this as a monospecific upwelling. In spite of the proximity of their sampling station to the ones sampled during this study in 2002, similar results (other than the presence of some colonies of *Gymnodinium* sp) were not observed.

Smayda (1966), mentioned that the algal upwelling in the Gulf of Panama during the samples collected between November and May of 1957, occurred between January and April and occasionally in May and December.

The samples collected during this study did not show the occurrence of monospecific upwellings, although in some samples *Coscinodiscus* spp and *Noctiluca scintillans* were abundant. However, the richness of some samples (4N in all stations and 5N and 6 N in Causeway Station during February) are in contrast to the low cell density of other samples. This could indicate that some massive upwellings did take place.

According to Robles y Robles (2003), the impact of el "El Niño" and its effects during 1997-1998 it expressed in its oceanographic, meteorologic, and biological indicators. Among the bioindicators they found were the oceanic dinoflagellates present in coastal waters. These included *Amphisolenia bidentata*, *Ceratium candelabrum*, *Ceratium tripos* and *Pyrocistis noctiluca*. It is important to emphasize that the first three species were common in the current study.

The spatial distribution of each species in the various sampling locations and times is due to the specific nutritional requirements for each taxon, as well as the wind patterns, and the drainage waters of rivers and streams.

Summary of Phytoplankton Studies

- This study identified a total of 115 taxa of microalgae, belonging to 49 genera, including the divisions Bacillariophyta and Dinophyta. The diatoms contributed a total of 39 genera and 91 species. Dinoflagelates were represented by 10 genera and 24 taxa.
- The Bacillariophyceae species determined as abundant during this study were: Chaetoceros anastomosans, Chaetoceros lorenzianus, Chaetoceros socialis, Coscinodiscus spp, Proboscia alata, and Pseudonotzschia pungens.
- Almost all diatom species cited are planktonic in nature.
- Among the dinoflagellates the highest abundance was shown by Ceratium furca, Ceratium tripos, Noctiluca scintillans, Peridinium cf. granii and Pyrophacus horologium.

- The Dinophyta *Pyrophacus horologium*, was considered as one of 11 species observed with highest frequency in all sampling stations; however, it was absent in 19 out of 48 samples evaluated. This species was particularly absent in the January samples.
- *Pyrophacus horologicum*, *Noctiluca scintillans*, *Chaetoceros anastomosans* and *Chaetoceros* socialis were abundant in the summer collections, but were not observed in winter samples; other species maintained their abundance. Diatoms and dinoflagellates were better represented in February samples than in January.
- Dinoflagellates contributed higher numbers of cells per species in diurnal samples, with the exception of *Pyrophacus horologicum,* which showed large numbers of cells during the night samples taken in the Causeway station.
- In general winter samples showed higher number of species than summer samples.
- The analyses of February samples showed higher number of species and organisms than in January. However, numerically summer samples contained higher specific numbers.

1.1.3 Benthos

In the marine environment, organisms are closely affected by the physical and chemical conditions in which they exist. In marine coastal zones the environmental parameters vary in broader intervals because of proximity to land, or for example because salinity levels and water clarity values are altered by periods of rain and of drought. In addition to the natural conditions that modify the environmental characteristics in a determined area, there are atrophic factors that alter the equilibrium of those ecosystems. Some of these activities produce impacts of notable intensity for long periods of time in wide areas, causing precarious imbalances in marine communities.

Amongst the environmental parameters more frequently affected is water clarity. This is related primarily to suspended sediments carried by currents from streams and rivers, or that are re-suspended by hydrodynamics (tides and marine currents), and the proliferation of phytoplankton.

Added to these natural alterations to water clarity are those caused by human activity, related to dredge material from port activities (dikes, docks, marinas, etc.)

The reduction in water clarity produces alterations in the structure of biotic communities. On one hand, phytoplankton is favored by the presence of suspended particles, since these are rich in nutrient salts and vitamins that are necessary for the development of these communities. At the same time, an increase in the phytoplankton populations reduces the penetration of sunlight in the water column.

At the deepest portions of the water column, an elevated concentration of suspended sediments also may modify the benthonic communities; mainly because of the negative

effect suspended sediments have over the filtering organisms, which must dedicate a high level of their energy to eliminating particles on their filtrating organs. If the re-suspension of sediments is elevated and the filtering organisms are unable to eliminate the excess particles on their filtering organs, it could adversely affect the biological communities at all the trophic levels.

On the other hand, if the re-suspended sediments contain a high concentration of organic material (mainly from domestic waste) or contaminated compounds (hydrocarbons, pesticides, industrial, etc) environmental risk increases. Decomposing of organic material requires the consumption of oxygen, reducing the amounts of this gas and creating anoxic zones that hamper the development of macroscopic life or at less reducing their numbers considerably. These conditions allow only for organisms adapted to live in those conditions making them typical bioindicators as is the case with some polichaetes (*Capitella capitata*, *Heteromastus filiformis*) and of *ulvanean* macroalgae.

In cases of chemical contaminants, the adverse effect to the environment is translated into death or high levels of alteration of there physiology, producing among others, disorientation, incapacity to capture food and to escape predators, impossibility to reproduce, or larvae malformation amongst others.

Background

The Panama Bay and surrounding areas are under the influence of northern winds that blow over the isthmus with greater intensity during the dry season and induce water from the bottom of the sea to flow up to the surface (Kwiecinski & D´Croz, 1994). This season is characterized by its low water temperatures, elevated salinity, high concentration of nutrients, strong reduction in clarity and reduced value in dissolved oxygen (Smayda, 1966; Forsbergh, 1969; D´Croz *et al*., 1991), as a result of great biological productivity (Kwiecinski *et al.*, 1975). Contrary to this, in the rainy season, the torrent waters and drainage from the rivers and streams produce an increase in the water temperature, reducing the salinity and elevation of nitrates and silicates. (Kwiecinski & D´Croz, 1994).

The Panama Bay constitutes the most severe case of marine contamination in the country, because the untreated waters coming from the city, which are calculated to be 40 million tons per, and producing elevated concentrations of fecal coliforms. In some areas there are levels that are 496 times higher than those established for water consumption and public recreation, and 50 times higher for the proliferation of wild life (D´Croz *et al*., 1991).

With respect to hydrocarbon concentrations, Kwiecinski *et al*. (1994) establishes that in some areas (navegation channel and zones close to docks) the concentration of hydrocarbons of high molecular weight originating in the transit of ships was minimum, not observing an accumulation of them in the sediments.

Objective

The objective of the study of benthic communities was to determine the composition and abundance of benthonic macro fauna in stations situated in Kobe and Palo Seco beaches as well as the Panama Bay.

Study Area

The sampling stations were situated in nearshore and oceanic areas. The stations were: Kobbe Beach (high and low tide), as well as Palo Seco Beach (west and east side). On the west side of Palo Seco samples were collected at (high and low tides) while on the east side of the Causeway they were collected only during high tides. The differences in beaches incline simplified collection during high and low tides in some cases. The samples were taken on January 9 and 10, 2003.

The stations in open waters where set at the Panama Bay and were at the following locations: Chorrillo, Causeway (Flamenco Island), Site 2 (Palo Seco), Artificial Island, Site 15, Fishing Zone (Taboga Island). The oceanic station samples were collected on February 10 and 11, 2003.

Benthos Methodology

Samples were collected in beaches (Palo Seco and Kobbe) as well as the ocean, and each one used a system that has been standardized.

At the beach, six sediment samples were taken, and each station with a core sampler of 0,005 m^2 in diameter, obtaining a sample of approximately $6{,}25.10^{-4}$ m^3 of sediment. The material collected at each station was set in a plastic bag, labeled, and transported to the lab. The replicates were sifted through filters of 1.0 and 0.5 mm openings, where the organisms from the benthonic macro fauna were separated, counted, and identified. The collected organisms were identified with a *stereoscopic* microscope Nikon SM2-10ª.

The samples analysis allowed for the Shannon-Weaver Index to be used, that is:

$$H = Ep_i (\log_n p_i).$$

Benthic Macrofauna Results and Discussion

Results of bentic collections are shown in tables EA-7 through EA17 in Environmental Appendix D in Volume 3.

At the Palo Seco west station at high tide, 38 organisms from three phyla were collected (Crustacea, Molluska and Annelida), of which the most abundant was the Crustacea, with three species being collected, representing 60.53% of total. The second group in abundance was the Mollusks (11 types, 28.9%) followed by Polycheates (10.53%) (Table EA-7). At this station 6 taxa were collected.

In station Palo Seco West (low tide), organisms belonging to 3 phyla were collected (Crustacea, Mollusca y Annelida), of which the most abundant one was Polychaeta, with 14 specimens (60,86% of total). The second group in order of abundance was Crustacea (26,09%), followed by Mollusca (13,04%) Table EA-8). 9 Taxa were identified in this sampling station.

At Palo Seco station (East) during low tide 49 organisms from three types of phylla were collected (Crustacea, Mollusk and Annelida), of which the most abundant was the Crustacea, with 18 collected species collected, representing 36.73% of total. The second group in abundance was the Mollusk (16 types, 32.65%), followed by the Anellida (30.61%). At this station 9 taxa were identified.

At Kobbe Beach station (during high tide) organisms collected belonged to five phylla (Crustacea, Molluscs, Annelida, Echinodermata and Echiura), of which the most abundant were Molluscs, with 27 species, representing 34.17% of total. The second group in order of abundance were the Polychaets (24 types, 30.38%), followed by Crustacea (25.32%). Finally, the phylla of least abundance were Echinodermata and Echiura. A total of fourteen taxa of macro invertebrates were identified at Kobbe Beach.

At Kobbe station (during low tide) 43 organisms were collected belonging to four phylla (Crustacea, Mollusca, Annelida and Echinodermata), of which the most abundant was Molluscs, with 27 specimens representing 62.79% of total. The second group in abundance was the Crustacea (8 types, 18.60%), followed by Polychaets (13.95%) and Echinodermata (4.65%).

At Site 2 264 organisms were collected belonging to five phylla (Crustacea, Mollusca, Annelida, Nematoda and Echiura), of which the most abundant was the Annelida, with 194 species collected, and representing 73.48% of total. The second group greatest in number was the Mollusk (29 types, 10.98%), followed by the Crustacea (8.33%), Nematoda (5.68%) and Echiura (1.51%). 25 Taxa were collected at this station.

The Artificial Island station contained 138 organisms belonging to seven phylla (Crustacea, Mollusca, Annelida, Nematoda, Echinodermata, Echiura and Chordata), of which the most abundant was the Annelida, with 96 species collected, and representing 69.57% of the total. The second most abundant group wer the Nematods (19 types, 13.77%), followed by the Crustacea (6.52%), Echiura (5.80%), Mollusks (2.90%), Echinodermata (0.72% y Pisces (0.72%). 28 taxa were collected at this station.

Site 15 station contained 45 organisms belonging to four phylla (Crustacea, Mollusca, Annelida and Nematoda), of which the most abundant was the Annelida, having 26 species collected, representing 57.78% of total. The most abundant group was the Crustacea (11 samples, 10.98%), followed by the Mollusks (8.88%), and Nematoda (8.88%). 15 taxa were collected in total.

At the Fishing grounds station, 122 organisms were collected belonging to five phylla (Crustacea, Mollusks, Annelida, Nematoda and Echiura), of which the most abundant was the Annelida, with 69 species collected representing 56.48% of total. The second most abundant group was the Crustacea (31 types, 25.41%), followed by the Nematoda (12.30%), Echiura (4.10) and Mollusk (1.64%). Fifteen taxa were collected at this station.

At the Chorrillo station 72 organisms were collected belonging to six phylla (Crustacea, Mollusca, Annelida, Nematoda, Echiura and Pisces), of which the most abundant was the Annelida, having 45 collected species, representing 62.50% of total. The second group most abundant in quantity was the Mollusks (14 types, 19.44%), followed by Nematods (8.33%), Crustacea (4.17%), Echiura (2.78%) and Pisces (1.39%). Twelve species were collected at this station.

At the Causeway station 51 organisms were collected belonging to four phylla (Crustacea, Mollusks, Annelida and Echinodermata), of which the most abundant was the Annelida, having 34 species collected, representing 66.67% of total. The second most abundant group were the Molluscs and Crustacea (with 7 samples of each, 13.73%) and finally the Echinodermata (3.92%). 15 samples were collected at this station.

Nearshore

The study determined that the higher number of organisms in nearshore areas, as well as of species, was collected at the Kobbe beach at high tide. The lowest number was collected at Palo Seco at low tide. The average of these stations was 46 and the taxa of Molluscs was determined to be the most abundant.

Offshore

The results of sample analysis of stations located in open waters indicated that the highest number of organisms was located at Site 2, and the highest diversity was found at the Artificial Island. The most abundant was detected at Site 15, but the lowest was at Chorrillo station. At the stations the polychaets were the most abundant organisms.

Abundance Trends

This section was prepared through the process of standardization that allows for comparisons of samples collected from stations collected at the beach and offshore. The station at Kobbe Beach was the one showing the highest density (at the high tide zone) with 2,633 individuals per m^2. The least density was collected at the stations located at Site 15 and Causeway with 227 individuals per m^2. When calculating the average for each area it was observed that the beach stations had 1,547 individuals per m^2, while the offshore stations showed an average density of 490 individuals per m^2 (Table 1-12 and Table 1-13).

Table 1-12: List and abundance of the macrofauna collected at the 11 stations included in this study.

TAXA	PS-West HT	PS-West LT	PS-East	Kobbe-HT	Kobbe-LT	Site 2	Artificial Island	Site 15	Fishing zone	Chorrillo	Causeway
Nematods						15	19	4	15	6	
Polychaets	4	14	15	24	6	194	96	26	69	45	34
Molluscs	11	3	16	27	27	29	4	4	2	14	7
Crustacea	23	6	18	20	8	22	9	11	31	3	7
Echiuras				6		4	8		4	2	
Equinodermata				2	2		1				2
Chordata							1			1	
TOTAL	38	23	49	79	43	232	138	45	122	72	51
TAXA	7	10	8	14	12	24	28	15	14	12	15

Table 1-13: List and abundance of macrofauna standarized for the 11 stations included in the study (Densities per m^2).

TAXA	PS-West M	PS-West LT	PS-East	Kobbe-HT	Kobbe-LT	Site 2	Artificial Island	Site 15	Fishing Zone	Chorrillo	Causeway	Average (Beach)	Average (Ocean)
Nematods						67	85	18	67	27	0		
Polychaets	133	467	500	800	200	865	428	116	307	201	152	420	345
Moluscs	367	100	533	900	900	129	18	18	9	62	31	560	45
Crustacea	767	200	600	667	267	98	40	49	138	13	31	500	62
Echiuras				200		18	36		18	9		200	16
Equinodermata				67	67		4				9	67	7
Chordata							4			4			3
TOTAL	1267	767	1633	2633	1433	1034	615	201	544	321	227	1547	490
TAXA	233	333	267	467	400	107	125	67	62	53	67	340	80

The study detected the bivalve *Protothaca asperimma,* as the most abundant organism at the beach station. This may be associated with the feeding strategy of this organism that feeds on nutrients from this high activity zone. The first 10 individuals in Table 1-14 are equally distributed in three dominant taxa, that is the Molluscs (3), Crustaceans (3) and Annelids (4). The 10 most abundant taxa comprised almost 80% of samples collected.

Table 1-14: List, percentage and accumulated percentage of macrofauna at five stations of the beach area.

TAXA	Number	Percentage	Accumulated Percentage
Prothotaca asperimma	35	13.73	13.73
Amphipods	32	12.55	26.28
Nereidae	29	11.37	37.65
Isopodos	27	10.59	48.24
Capitellidae	17	6.67	54.91
Cossurridae	15	5.88	60.79
Copepod	14	5.49	66.28
Tellina sp. (1)	14	5.49	71.77
Nephtyidae	9	3.53	75.30
Mytella guyanensis	8	3.14	78.44
ECHIURA	6	2.35	80.79
Nucula sp	5	1.96	82.75
Tellina sp	5	1.96	84.71
Anadara sp	4	1.57	86.28
Donax sp.	4	1.57	87.85
Ofiuroideo sp.	4	1.57	89.42
Ostracods	4	1.57	90.98
Pisionidae	4	1.57	92.55
Tellina sp.(2)	4	1.57	94.12
Nassarius sp.	3	1.18	95.30
Cladocera	2	0.78	96.08
Crassinella sp.	2	0.78	96.87
Larva of bivalve	2	0.78	97.65
Ophedidae	2	0.78	98.44

Porcelanidae	2	0.78	99.22
Bivalvia (1)	1	0.39	99.61
Serpulidae	1	0.39	100.00
Total	255	100.00	

Table 1-15: Listed, percentage and accumulated percentages of macrofauna located at six offshore stations.

TAXA	Number	Percentage	Percentage Accumulated
Phyllodocidae	96	13.62	13.62
NEMATODS	74	10.50	24.12
Nephtyidae	53	7.52	31.63
Spionidae	47	6.67	38.30
Anfipodo	46	6.52	44.83
Glyceridae	40	5.67	50.50
Nereidae	38	5.39	55.89
Capitelidae	36	5.11	61.00
Cirratulidae	23	3.26	64.26
Goniadidae	21	2.98	67.24
Sabellidae	20	2.84	70.07
ECHIURA	19	2.70	72.77
Copepod Calanoideo	17	2.41	75.18
Protothaca asperimma	14	1.99	77.17
Arenicolidae	13	1.84	79.01
Cossuridae	12	1.70	80.71
Tellina sp (1)	12	1.70	82.41
Ophelidae	11	1.56	83.97
Solen sp.	11	1.56	85.53
Lumbrineridae	9	1.28	86.81
Magelonidae	9	1.28	88.09
Serpulid	8	1.13	89.22
Anadara sp.	7	0.99	90.22
Ostracods	6	0.85	91.07

TAXA	Number	Percentage	Percentage Accumulated
Callinectes sp.	5	0.71	91.78
Crassinella sp.	5	0.71	92.49
Owenidae	5	0.71	93.19
Pilargidae	5	0.71	93.90
Larva de bivalvo	4	0.57	94.47
Pilargidae	4	0.57	95.04
Arca sp.	3	0.43	95.46
Dorvidallidae	3	0.43	95.89
Onuphidae (1)	3	0.43	96.32
Onuphidae (3)	3	0.43	96.74
Ophiuroideo	3	0.43	97.17
Squilla sp.	3	0.43	97.59
OLYGOCHAET	2	0.28	97.88
Onuphidae	2	0.28	98.16
Porcellanidae	2	0.28	98.44
Trachypenaeus sp.	2	0.28	98.73
Gobidae	1	0.14	98.87
Isopod	1	0.14	99.01
Larva of Brachyura	1	0.14	99.15
Larva of gastropodo	1	0.14	99.29
Mytella guyanensis	1	0.14	99.44
Onuphidae (2)	1	0.14	99.58
Pisces	1	0.14	99.72
Polyodontidae	1	0.14	99.86
Starnospidae	1	0.14	100.00
Total	705	100.00	

The most abundant organism at the offshore stations were the polychaete Phyllodocidae, that feeds on detritus (quite abundant at the Panama Bay). Eight of the 10 dominant species are polychaets, which are a group specialized in feeding from organic material from sediment.

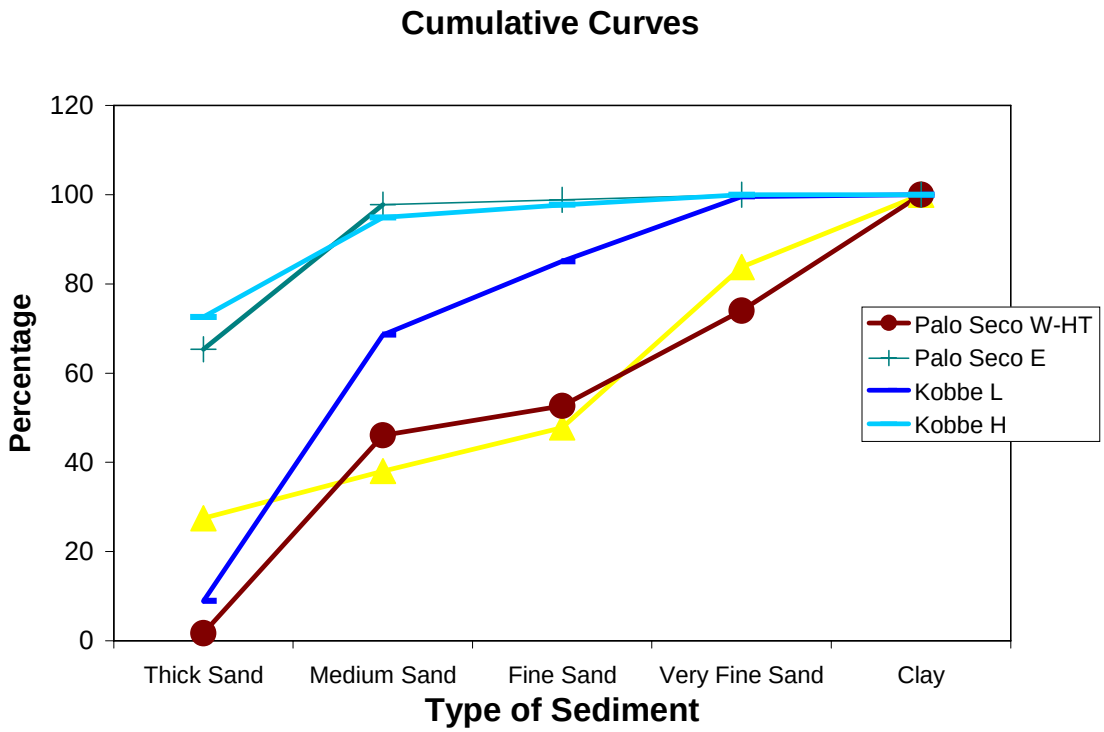
During this study a greater number of organisms were obtained, compared to previous studies carried out at the same zone (Villalaz and Gómez (2002); Garcés and García (2002). Flamenco Island station also contained polychaetes as the dominant group in the zone.

Table 1-16: Index of Shannon-Weaver Diversity (H) from the collection stations.

Stations	INDEX OF DIVERSITY (H)
Palo Seco-E-HT	2.002
Palo Seco-W-HT	1.236
Palo Seco-W-M	1.957
Kobbe-HT	2.475
Kobbe-LT	2.032
Artificial Island	2.883
Site 2	2.998
Site 15	2.386
Fishing Grounds	2.165
Causeway	2.025
Chorrillo	1.755

The Diversity Index from collection stations showed samples collected in the beach areas with the lowest values, while the offshore stations presented the highest ones. It is important to indicate that the highest values were at the Site 2 station, and the lower values at Palo Seco station West (Table 1-16).The diversity values are higher than previous studies of the offshore stations (Garcés and García, 2002), possibly caused by the greater number of samples collected in this study.

The study of the granulometry of the sediment samples collected in Palo Seco and Kobbe beach provides an insight into the biological abundance and specific taxonomic groups found in those areas.



The method for the granulometric analysis was based on the Webthmore scale. Thick sand corresponds to grain size ranging 1.0 mm and 0.5 mm in size; medium sand 0.49 mm to 0.25 mm; fine sand 0.24 mm to 0.125 mm; very fine sand 0.124 mm to 0.062 mm; and clay particles smaller than 0.062 mm.

The analysis of sediment shows the presence of significantly larger grain size in Kobbe beach and smaller clayish grain size in Palo Seco. This could be due to lower flow of currents in the protected area of Palo Seco Beach and the action of dredge material deposition and suspended sediment being carried “downstream” from the Canal.

Conclusions on Benthic Samples

The study determined that the greater quantity of organisms, as well as diversity, was obtained at Kobbe Beach at high tide. However, the lowest number of individuals was collected at West Palo Seco at low tide. The average for these stations was 46 individuals, and Mollusks was the most abundant group.

The greater number of organisms were found at Site 2, but the greater diversity was at Artificial Island and Site 2. The station at Kobbe beach showed more density (at the high tide zone) with 2,633 individuals per m^2. The least density was collected at the stations situated at Site 15 and Causeway having 201 and 227 individuals per m^2.

The average abundance of the beach stations was 1,547 individuals per m^2, while the oceanic stations showed an average density of 490 individuals per m^2, which allows us to note that the beach surpasses the ocean density three times.

The bivalve *Protothaca asperimma,* was the most abundant organism at the beach stations studied. These organisms are of economic importance since are collected by fishermen in low tide as a protein source. Other bivalves commonly collected too include *Mytella guyanensis, Anadara sp y and Donax sp.* These molusks are sold in the public market.

The most abundant organism at the offshore stations was the Phyllodocidae polychaets.

Eight of the dominant taxas at the offshore stations were polychaets which are a group specialized in feeding from organic material from sediment.

The highest values of diversity were located at Site 2, and the lowest value was located at the West Palo Seco station.

This study also showed the presence of polychaets of the Capitellidae family which are bioindicators of pollution and/or of physically perturbed areas. However, additional studies during the EIA phase of this Project will require extensive sampling for these oranisms in order to obtain a more clear correlation with numbers found. The highest number of these oranisms was found at the Artificial Island site, followed by Sites 2, Fishing Grounds, and Palo Seco East

1.1.4 Area Fisheries

The abundant fishing resources in the Pacific region of Panama show yields that vary significantly in time and space (D´Croz *et al*., 1994). The wide inter-annual fluctuations in fishing have been attributed to variations in the density of annual water movement in the Gulf of Panama, or to the El Niño phenomenon, which affects all of the Gulf area. (Kwiecinski *et al.*, 1988).

At the icthyological level, plankton samples showed the presence of fish larvae (icthyioplankton) *engraulidos, carangidos, mugilidos*, and *cianidos*, all of them being commercial species. Of importance to this project is the massive spawning of the *anchovetas* (*Cetengraulis mysticetus*) that occurs in coastal areas in front of Juan Díaz and Panamá Viejo (Bayliff, 1966). The life cycle of this species is also directly associated with the presence of mangroves. Economic estimations presented by D'Croz and Kwiecinski (1980) indicate than a kilometer of coast surrounded by mangroves brings benefit in fishing of $100,000/year. These mangroves and the associated muddy bottom are spawning habitats for anchovetas. Consequently, the biological cycle of this species is completed in waters far away from the coast between Isla Melones and the entrance to the Canal, as well as in the areas of Punta Chame, where the adult stages congregate to feed on planktonic organisms found in the zone.

Studies of upwelling of algae and waters masses movement in the Panama Bay (D'Croz, et. al. 1991), indicate that during the raining season there is a warm mass of water with salinity 30 $^{0}/_{00}$, low concentration of phosphates and chlorophyll, and low density of phytoplankton; on the contrary, in the dry season, there is an increase in the concentration of the previously mentioned components. These changes are also evident in higher trophic levels with an increase in the presence of *anchoas, carangidos* and *escómbridos* fish schools, and marine birds such *pelícanos* and *cormoranes* (Glynn, 1972).

The fishing industry in Panama is more active in the Pacific coast, involving more than 10,000 persons. The predominant fishing resources include shrimps, *anchovetas* and *arenques*. The shrimps are collected in waters of varied depth, from shallow waters until 200 m deep. The shrimps can be classified according to their bathymetryc distribution: the coastal shrimps (white, tití, carabalí, and red) are found until 100 m of depth; shrimps of high depth are *fidel* and *cabezón*, which, in concordance with the environment in which they grow, show a different life cycle compared to the former ones (NORAD_OLDEPESCA, 1994).

Environmental Appendix

Tables and Figures

Table EA-1: Density (org/m^3) and percentage (%) by taxa during night and diurnal samples.

Taxa	Causeway 2				Causeway 4				Causeway			
	Day		Night		Day		Night		Day		Night	
	Total	%	Total		Total	%	Total	%	Total	%	Total	%
Annelids larvae	13.79	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Amphipods	0.00	0.00	0.00	0.00	4957.88	0.99	0.00	0.00	0.00	0.00	0.00	0.00
Copepods calanoids	3490.28	61.79	48263.19	71.11	287556.89	57.57	6968147.59	58.19	77869.32	70.47	376662.56	67.46
Chaetognatha	158.57	2.81	4433.94	6.53	97918.08	19.60	0.00	0.00	9720.09	8.80	35619.84	6.38
Cladoceros	1478.84	26.18	1758.13	2.59	69410.28	13.90	3462894.01	28.92	6570.56	5.95	23526.69	4.21
Ctenophores	0.00	0.00	211.38	0.31	0.00	0.00	63539.34	0.53	0.00	0.00	0.00	0.00
Doliolids	0.00	0.00	211.38	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Eufasids	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fish eggs	13.79	0.24	586.04	0.86	2478.94	0.50	25718.30	0.21	0.00	0.00	6643.39	1.19
Fish larvae	0.00	0.00	211.38	0.31	3718.41	0.74	0.00	0.00	0.00	0.00	3486.60	0.62
Young Gastropods	0.00	0.00	0.00	0.00	0.00	0.00	25718.30	0.21	0.00	0.00	0.00	0.00
Gastropod Larvae	0.00	0.00	0.00	0.00	1239.47	0.25	0.00	0.00	0.00	0.00	0.00	0.00
Mollusk Larvae	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	23416.75	4.19
Young mollusks	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5010.02	0.90
Misidáceos	56.88	1.01	211.38	0.31	2478.94	0.50	319209.54	2.67	1194.65	1.08	0.00	0.00
Mysis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5119.96	0.92
Oikopleura	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ostrácodos	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	44650.45	8.00
Other groups	124.10	2.20	3213.75	4.73	3718.41	0.74	488647.78	4.08	4724.29	4.28	0.00	0.00
Larvae of pelecipods	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Larvae of poliquetos	0.00	0.00	821.47	1.21	0.00	0.00	204233.59	1.71	0.00	0.00	15689.69	2.81
Post larva of paniluridos	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pendidos	0.00	0.00	845.52	1.25	1239.47	0.25	0.00	0.00	0.00	0.00	0.00	0.00
Pterópodos	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1194.65	1.08	1743.30	0.31
Noctilucas	198.21	3.51	5745.26	8.46	0.00	0.00	385774.56	3.22	7765.21	7.03	0.00	0.00
Zoea	113.76	2.01	1359.42	2.00	24789.39	4.96	31769.67	0.27	1466.16	1.33	16773.36	3.00

Table EA-2: Density (org/m^3) and percentage (%) of Zooplankton by during night and day samples.

Taxa	Causeway 2				Causeway 4				Causeway			
	Day		Night		Day		Night		Day		Night	
	Total	%	Total		Total	%	Total	%	Total	%	Total	%
Annelids larvae	13.79	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Amphipods	0.00	0.00	0.00	0.00	4957.88	0.99	0.00	0.00	0.00	0.00	0.00	0.00
Copepods calanoids	3490.28	61.79	48263.19	71.11	287556.89	57.57	6968147.59	58.19	77869.32	70.47	376662.56	67.46
Chaetognatha	158.57	2.81	4433.94	6.53	97918.08	19.60	0.00	0.00	9720.09	8.80	35619.84	6.38
Cladoceros	1478.84	26.18	1758.13	2.59	69410.28	13.90	3462894.01	28.92	6570.56	5.95	23526.69	4.21
Ctenophores	0.00	0.00	211.38	0.31	0.00	0.00	63539.34	0.53	0.00	0.00	0.00	0.00
Doliolids	0.00	0.00	211.38	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Eufasids	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fish eggs	13.79	0.24	586.04	0.86	2478.94	0.50	25718.30	0.21	0.00	0.00	6643.39	1.19
Fish larvae	0.00	0.00	211.38	0.31	3718.41	0.74	0.00	0.00	0.00	0.00	3486.60	0.62
Young Gastropods	0.00	0.00	0.00	0.00	0.00	0.00	25718.30	0.21	0.00	0.00	0.00	0.00
Gastropod Larvae	0.00	0.00	0.00	0.00	1239.47	0.25	0.00	0.00	0.00	0.00	0.00	0.00
Mollusk Larvae	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	23416.75	4.19
Young mollusks	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5010.02	0.90
Misidáceos	56.88	1.01	211.38	0.31	2478.94	0.50	319209.54	2.67	1194.65	1.08	0.00	0.00
Mysis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5119.96	0.92
Oikopleura	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ostrácodos	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	44650.45	8.00
Other groups	124.10	2.20	3213.75	4.73	3718.41	0.74	488647.78	4.08	4724.29	4.28	0.00	0.00
Larvae of pelecipods	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Larvae of poliquetos	0.00	0.00	821.47	1.21	0.00	0.00	204233.59	1.71	0.00	0.00	15689.69	2.81
Post larva of paniluridos	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pendidos	0.00	0.00	845.52	1.25	1239.47	0.25	0.00	0.00	0.00	0.00	0.00	0.00
Pterópodos	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1194.65	1.08	1743.30	0.31
Noctilucas	198.21	3.51	5745.26	8.46	0.00	0.00	385774.56	3.22	7765.21	7.03	0.00	0.00
Zoea	113.76	2.01	1359.42	2.00	24789.39	4.96	31769.67	0.27	1466.16	1.33	16773.36	3.00

Table EA-3: Density (org/m^{-3}) and percentage (%), by taxa during the night and day shifts.

Taxa	Artificial Island				Site 15				Fishing Site			
	Day		Night		Day		Night		Day		Night	
	Total	%	Total	%	Total	%	Total	%	Total	%	Total	%
Larva of annelids	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	28.73	0.23	0.00	0.00
Amphipods	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9133.72	0.18
Calanoid copepods	29305.77	29.47	46953.83	61.09	12510.36	50.17	4545840.57	59.16	7622.77	60.86	2281908.56	44.28
Chaetognatha	1079.88	1.09	4180.82	5.44	824.68	3.31	133822.30	1.74	507.55	4.05	112649.25	2.19
Cladoceros	67709.85	68.09	321.60	0.42	7838.56	31.44	271762.21	3.54	191.53	1.53	2319965.74	45.02
Ctenophores	0.00	0.00	0.00	0.00	0.00	0.00	78234.58	1.02	0.00	0.00	0.00	0.00
Doliolids	0.00	0.00	0.00	0.00	0.00	0.00	22646.85	0.29	28.73	0.23	9133.72	0.18
Eufasids	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10656.01	0.21
Fish eggs	0.00	0.00	2572.81	3.35	0.00	0.00	811169.01	10.56	181.95	1.45	21312.02	0.41
Fish larvae	384.79	0.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Young Gastropods	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Larvae of gastropods	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Larvae of mollusks	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	41101.76	0.80
Young mollusks	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Young poliquets	111.71	0.11	321.60	0.42	0.00	0.00	100881.43	1.31	0.00	0.00	41101.76	0.80
Misidaces	0.00	0.00	0.00	0.00	0.00	0.00	45293.70	0.59	124.49	0.99	0.00	0.00
Mysis	0.00	0.00	3216.02	4.18	593.77	2.38	174998.39	2.28	679.92	5.43	62413.78	1.21
Oikopleura	0.00	0.00	0.00	0.00	1434.94	5.75	183233.61	2.38	0.00	0.00	0.00	0.00
Ostracods	0.00	0.00	9004.84	11.72	667.99	2.68	220292.09	2.87	392.63	3.13	111126.97	2.16
Other groups	111.71	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Larvae of pelecipods	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	91337.23	1.77
Larvae of poliquets	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	28.73	0.23	9133.72	0.18
Post Larvae of panilurids	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	38.31	0.31	0.00	0.00
Peneids	273.07	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pteropods	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10656.01	0.21
Noctilucas	0.00	0.00	8040.04	10.46	1063.83	4.27	1095284.05	14.26	2480.27	19.80	0.00	0.00
Zoea braquiuras	471.67	0.47	2251.21	2.93	0.00	0.00	0.00	0.00	220.26	1.76	21312.02	0.41

Table EA-3: Density (org/m^3) and percentage (%), by taxa during day and night shifts.

Taxa	Causeway				Chorrillo				Artificial Site			
	Day		Night		Day		Night		Day		Night	
	Prom.	%	Prom.	%	Prom.	%	Prom.	%	Prom.	%	Prom.	%
Larvae of anelids	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Larvae of asteroideos	0.00	0.00	0.00	0.00	73.02	0.30	4312.45	1.33	0.00	0.00	0.00	0.00
Anphiípods caprelids	0.00	0.00	0.00	0.00	0.00	0.00	2342.78	0.72	0.00	0.00	0.00	0.00
Calanoid copepods	21339.03	61.74	112995.91	71.33	13852.24	57.17	210682.96	64.74	49370.05	65.79	10940.57	63.68
Chaetognatha	897.09	2.60	3206.07	2.02	320.76	1.32	29819.26	9.16	4164.76	5.55	610.81	3.56
Cladoceros	9922.01	28.71	14361.92	9.07	4640.75	19.15	20660.46	6.35	14736.59	19.64	883.75	5.14
Cumaceos	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	715.50	0.95	0.00	0.00
Doliolids	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Eufausids	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	45.75	0.27
Fish eggs	1459.01	4.22	9095.53	5.74	3717.13	15.34	25711.22	7.90	3188.50	4.25	3050.20	17.75
Fish larvae	0.00	0.00	1694.61	1.07	204.71	0.84	5813.56	1.79	0.00	0.00	137.88	0.80
Isopods	0.00	0.00	260.97	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Megalopa of braquiros	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Misidaceos	0.00	0.00	260.97	0.16	106.16	0.44	0.00	0.00	575.97	0.77	144.86	0.84
Misis	0.00	0.00	0.00	0.00	0.00	0.00	1846.68	0.57	0.00	0.00	165.56	0.96
Nauplio of copepods	0.00	0.00	2298.52	1.45	491.31	2.03	0.00	0.00	0.00	0.00	287.40	1.67
Oikopleura	421.01	1.22	1765.52	1.11	155.44	0.64	59.88	0.02	715.50	0.95	269.03	1.57
Ostracods	0.00	0.00	1627.60	1.03	0.00	0.00	0.00	0.00	0.00	0.00	137.88	0.80
Others	0.00	0.00	1838.82	1.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Larvae of pelecipods	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	576.78	0.77	82.78	0.48
Larvae of poliquets	0.00	0.00	916.94	0.58	0.00	0.00	1764.82	0.54	366.77	0.49	82.78	0.48
Post Larvae of panilurids	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pteropods	0.00	0.00	1644.63	1.04	73.02	0.30	2906.78	0.89	0.00	0.00	105.66	0.62
Sifonofores	0.00	0.00	0.00	0.00	0.00	0.00	4685.56	1.44	0.00	0.00	0.00	0.00
Porcelanids	247.96	0.72	260.97	0.16	204.71	0.84	6903.60	2.12	0.00	0.00	0.00	0.00
Notilucas	0.00	0.00	1838.82	1.16	106.16	0.44	0.00	0.00	0.00	0.00	106.99	0.62
Larvae of anomuros	0.00	0.00	651.04	0.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Larvae of pagurids	0.00	0.00	2068.67	1.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Larvae of braquiuros	202.72	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Zoea of braquitos	74.19	0.21	1631.09	1.03	283.65	1.17	7896.72	2.43	636.31	0.85	127.78	0.74

Table EA-4: Collection information for diurnal and nocturnal phytoplankton samples – Panama Bay

Nocturnal Samples						Diurnal Samples					
Sample ID	Sample Number	Location/ Date	Coordinates		FLOW METER (Differential Reading)	Sample ID	Sample Number	Location/ Date	Coordinates		FLOW METER (Differential Reading)
			X	Y					X	Y	
		Fishing Grounds						Fishing Grounds			
1N	1	24-2-03	658061	974411	00005	1D	1	26-2-03	658061	974411	00073
2N	2	“	“	“	00016	2D	2	“	“	“	00039
3N	3	“	“	“	00019	3D	3	“	“	“	00030
4N	-	7-2-03	-	-	-	4D	-	30-1-03	-	-	-
		Site 15						Site 15			
1N	4	24/2-03	659565	977170	00022	1D	1	26-2-03	659582	977241	00037
2N	5	“	“	“	00013	2D	2	“	“	“	00048
3N	6	“	“	“	00016	3D	3	“	“	“	00061
4N	-	7-2-03	-	-	-	4D	-	30-1-03	-	-	-
		Artificial Island						Artificial Island			
1N	7	24-2-03	655906	980595	00013	1D	1	26-2-03	658483	984347	00016
2N	8	“	“	“	00010	2D	2	“	“	“	00032

Table EA-4. Continued -											
3N	9	“	“	“	00019	3D	3	“	“	“	00037
4N	-	6-2-03	-	-	-	4D	-	29-1-03	-	-	-
		Site 2						Site 2			
1N	10	24-2-03	658507	984409	00018	1D	1	26-2-03	658507	984409	00028
2N	11	“	“	“	00014	2D	2	“	“	“	00044
3N	12	“	“	“	00023	3D	3	“	“	“	00061
		Causeway						Causeway			
1N	1	25-2-03	662321	984382	00046	1D	1	27-2-03	662321	984382	00069
2N	2	“	“	“	00032	2D	2	“	“	“	00035
3N	3	“	“	“	00046	3D	3	“	“	“	00035
4N	-	6-2-03	-	-	-	4D	Causeway 4	28-1-03	-	-	-
5N	Causeway4	6-2-03	-	-	-	5D	-	28-1-03	-	-	-
6N	Causeway 2	7-2-03	-	-	-	6D	Causeway 2	29-1-03	-	-	-
		Chorrillo						Chorrillo			
1N	1	25-2-03	661088	987809	00008	1D	1	27-2-03	661088	987809	00019
2N	2	“	“	“	00007	2D	2	“	“	“	00022
3N	3	“	“	“	387741	3D	3	“	“	“	00057

Table EA-5: Absolute frequency of phytoplankton species collected during day and night offshore samples in Panama Bay.

Species	Fishing Grounds Night				Fishing Grounds Day				Site 15 Night				Site 15 Day				Artificial Island Night				Artificial Island Day			
	1N	2N	3N	4N	1D	2D	3D	4D	1N	2N	3N	4N	1D	2D	3D	4D	1N	2N	3N	4N	1D	2D	3D	4D
BACILLARIOPHYTA																								
Actinocyclus spp				1	2	4	4					1										1	4	1
Actinoptychus senarius (Ehrenberg) Ehrenberg																								
Asterionellopsis glacialis (Castracane) Round (en Round *et al*., 1990)															1									
Bacteriastrum cf. *mediterraneum* Pavillard																								
Bacteristrum delicatulum Cleve		1				1	5					5	1											
Bacteriastrum furcatum Shadbolt		2		8		1				1				1	2					1				
Bacteriatrum hyalinum Lauder				4	3				1		3	2	3	1	3	1	1		3		4	2	1	
Cerataulina pelagica (Cleve) Hendey	2	1	1		2	1	3			1				2	2			2			2			
Chaetoceros affinis Lauder				22	19	9	3			1	2	6	16	13	15	2			2	1	9	6	5	
Chaetoceros affinis Lauder var. *willei* (Gran) Hustedt																								
Chaetoceros anastomosans Grunow en Van Heurck	134	114	179		2	14	11		69	137	178		65	27	11		1	8	9		7	1	5	
Chaetoceros brevis Schütt	7	2	1		1	2	4		8	1	3		6	8	8			1			2	1	2	
Chaeotceros coarctatus Lauder							1																2	
Chaetoceros cf. *densus* Cleve				3			1					3		1	1					3				
Chaetoceros costatus Pavillard		1																						
Chaetoceros curvisetus Cleve	2	4	1	25	11	3	18		3	11	5	25	6	8	3		8	4	13	7	3	3	1	
Chaetoceros debilis Cleve					1				2		1													
Chaetoceros decipiens Cleve		1			3	3	4		1	1	1		5	4	16		2				8		4	

Table EA-5 – Continued

Species	Fishing Grounds Night				Fishing Grounds Day				Site 15 Night				Site 15 Day				Artificial Island Night				Artificial Island Day			
	1N	2N	3N	4N	1D	2D	3D	4D	1N	2N	3N	4N	1D	2D	3D	4D	1N	2N	3N	4N	1D	2D	3D	4D
BACILLARIOPHYTA																								
Chaetoceros denticulatus forma *angusta* Hustedt						1	1																	
Chaetoceros didymus var. *didymus* Ehrenberg					1								1	1			1						1	
Chaetoceros didymus var. *protuberans* (Lauder) Gran y Yendo							1										1		2					
Chaetoceros diversus Cleve														1										
Chaetoceros filiferum Karsten									2															
Chaetoceros laciniosus Schütt	1						1			1				3	5				1		3			
Chaetoceros lorenzianus Grunow	7	8		4	21	27	17		11	8	4	1	34	26	45		6	4			11	3	14	
Chaetoceros pelagicus Cleve													2	1	1									
Chaetoceros peruvianus Cleve	3				6	7	2		2	1	2		10	8	9						6	7	6	
Chaetoceros pseudocurvisetus Mangin											1		1	1	1						2			
Chaetoceros radicans Schütt																								
Chaetoceros rostratus Lauder				5						1	1							2						
Chaetoceros socialis Lauder				111					26	35		198		12					7	81	1			
Chaetoceros sp_1		1				2																		
Chaetoceros tortissimus Gran	5		2				2		4	6	4		1	7	1			1			1			
Chaetoceros whigamii Brightwell																	1	2						

Table EA-5 – Continued

Species	Fishing Grounds Night				Fishing Grounds Day				Site 15 Night				Site 15 Day				Artificial Island Night				Artificial Island Day			
	1N	2N	3N	4N	1D	2D	3D	4D	1N	2N	3N	4N	1D	2D	3D	4D	1N	2N	3N	4N	1D	2D	3D	4D
BACILLARIOPHYTA																								
Coscinodiscus asteromphalus Ehrenberg											1					2				2		1	1	4
Coscinodiscus concinnus W. Smith																				3				1
Coscinodiscus granii Gough	1	1	1																	1	2		1	
Coscinodiscus oculus iridis Ehrenberg																								
Coscinodiscus spp	1		1	7	7	2	1	1		1	1	5	4	4	1	125	95	142	151	152	63	50	57	177
Cylindrotheca clostherium (Ehrenberg) Lewin y Reimann	1			30			1			6		12	1		9			2	2	3	1		1	
Dactyliosolen fragilissimus (Bergon) Hasle													1											
Ditylum brightwellii (West) Grun	1				7	3	3						7	1	4		1	2	3		3	1		
Entomoneis alata (Ehrenberg) Ehrenberg																		1			2	1		
Eucampia zoodiacus Ehrenberg	1	3	1			1				2							1							
Grammatophora sp																						64		
Guinardia flaccida (Castracane) H. Peragallo	2	2		1		2	2	1	2	2	2	3	2	3	2		6	2			1	4	3	
Guinardia striata (Stolterfoth) Hasle	9	10	4	1	4	13	26		5	9	5		15	12	6		7	9	2	2	10	1	6	
Helicotheca tamesis (Shrubsole) Ricard	2	5	1	2	4	2	4		2	1	3			1	3	11					1		1	1
Hemiaulus hauckii Grun	1	1			1	3	2			6	1		7	6	3		1	3	3		1			
Hemiaulus membranaceus Cleve	2	1	2		2								2	2	3			1				1		
Hemiaulus sinensis Grev.							1																	
Lauderia annulata Cleve		1	4			4	8		1	3	3		10	8	10	1		7	4		1	1		

Table EA-5 – Continued

Species	Fishing Grounds Night				Fishing Grounds Day				Site 15 Night				Site 15 Day				Artificial Island Night				Artificial Island Day			
	1N	2N	3N	4N	1D	2D	3D	4D	1N	2N	3N	4N	1D	2D	3D	4D	1N	2N	3N	4N	1D	2D	3D	4D
BACILLARIOPHYTA																								
Lectocilyndrus danicus Cleve	8		2		2	3	13	1	10	3	3		13	12	5	2	3	4	2	1	5	2	4	
Licmophora sp	3																					16		
Lioloma pacificum (Cupp) Hasle	7	4	2	15	18	5	5		5	5	4	10	2	10	12	12	4	4	4	3	13	4	10	1
Lithodesmium undulatum Ehrenberg				2													1			2	4	2	2	
Meuniera membranacea (Cleve) P. C. Silva															1									
Neocalyptrella robusta Hernández -Becerril y Meave del Castillo *Neoestreptotheca subindica* von Stosch	1		1	1	1		3		3		1		1	2		1	1		1	2		1		3
Nitzschia behrei Hustedt *Nitzschia* cf *ventricosa* Kitton																					3	1		
Nitzschia reversa W. Smith																								
Nitzschia sp1		2	2				2		1	2	1			5	2		1			1	6			
Nitzschia sigma (Kützing) W. Smith																			1					
Odontella mobiliensis (Bailey) Grunow						1							1	1							1			
Odontella regia C. A. Agardh																								
Odontella sinensis (Grville) Grunow																1	1	1			3		2	
Paralia sulcata (Ehrenberg) Cleve																		1						
Petrodictyon gemma (Ehr.) D. G. Mann *en* Round *et al*., 1990																								
Planktoniella muriformis (Loeblich, Wight y Darley) Round																								
Pleurosigma cf. *angulatum* (Quekett) Wm. Smith																								

Table EA-5 – Continued

Species	Fishing Grounds Night				Fishing Grounds Day				Site 15 Night				Site 15 Day				Artificial Island Night				Artificial Island Day			
	1N	2N	3N	4N	1D	2D	3D	4D	1N	2N	3N	4N	1D	2D	3D	4D	1N	2N	3N	4N	1D	2D	3D	4D
BACILLARIOPHYTA																								
Pleurosigma naviculaceum Brébisson																	2						1	
Pleurosigma normanii Ralfs																								
Proboscia alata (Brightwell) Sundström	9	19	2	40	20	20	10	1	9	6	5	6	15	22	25	50	32	21	10	5	30	23	30	13
Pseudonitzschia pungens (Grunow) Hasle forma *pungens* (Grunow) Hasle	29	12	16	7	46	19	21		42	8	6	2	15	15	15	1	5	2	6	8	10	5	2	1
Pseudosolenia calcar-avis (Schultze) Sundström	2	7	1	3	1	2	14	1	2	3	4	7	5	8	4	29	8	5	5	1	1	6	2	3
Rizosolenia acuminata (H. Peragallo) H. Peragallo			1				4																	
Rizosolenia bergonii H. Pér.	2	1			1	1	2		2	1	2		4	8	2	1	4	4	5		1	1	3	
Rizosolenia hyalina Ostenfeld	1		1	2	2	2					1					1	2	2	1		1	1		
Rizosolenia imbricata Brightwell																								
Rizosolenia pungens Cleve-Euler	1			1	3	1			1	1			3	7	2		2	5			3		1	
Rizosolenia setigera Brightwell	1	1			2	4	3					7		1	2		4	1	1	4				
Rizosolenia striata Greville		1		1			3								1					3			1	
Rizosolenia styliformis Brightwell		3		2	3	4	3				1		5	3	13	3				4	1			
Skeletonema costatum (Greville) Cleve					1	2				1			5	1	1		1				1		1	
Stephanopyxis turris (Grev. And Arn.) Ralfs													1	2	1									
Synedra goulardi Brébison	2	2	2			4	5							3										
Thalassionema frauenfeldii (Grunow) Hallegraeff																							1	

Table EA-5 – Continued

Species	Fishing Grounds Night				Fishing Grounds Day				Site 15 Night				Site 15 Day				Artificial Island Night				Artificial Island Day			
	1N	2N	3N	4N	1D	2D	3D	4D	1N	2N	3N	4N	1D	2D	3D	4D	1N	2N	3N	4N	1D	2D	3D	4D
BACILLARIOPHYTA																								
Thalassionema nitzschioides Grun														1				1						
Thalassisira sp (líneal + sedimento) *******																	2							
Thalassiosira eccentrica (Ehr.) Cleve																	1	2						
DINOPHYTA																								
Amphisolenia bidentata Schröder					1																			
Ceratium candelabrum (Ehrenberg) Stein	1																							
Ceratium furca (Ehrenberg) Claparède y Lachmann	6	6	5		17	7	8		1	1	2		13	10	17	2	7	4	5	2	12	9	20	5
Ceratium fusus (Ehrenberg) Dujardin	1	1			1	3				2							2	5	4		3	6	5	
Ceratium horridum Gran		1			1							1				6							10	27
Ceratium karstenii Pavillard															2		2	2	3		4	2	5	
Ceratium pentagonum Gourret	1	1					1														2	2	1	
Ceratium trichoceros (Ehrenberg) Kofoid	2	2	1		5	1					2		1	1	2	2	2				3		10	6
Ceratium tripos (O. F. Müller) Nitzsch		1	4		1	3	1		1		1			1	4	8	1	2			3	7	16	17
Ceratium tripos forma *semipulchellum* Jörgensen				1																				
Dinophysis caudata Stein													1				1	2					1	1
Noctiluca scintillans (Macartney) Kofoid y Swezy	23	31	28		1	4	21	295	49	14	19	4		10	2	38	51	13	35	8	3	3	6	30

Table EA-5 – Continued

Species	Fishing Grounds Night				Fishing Grounds Day				Site 15 Night				Site 15 Day				Artificial Island Night				Artificial Island Day			
	1N	**2N**	**3N**	**4N**	**1D**	**2D**	**3D**	**4D**	**1N**	**2N**	**3N**	**4N**	**1D**	**2D**	**3D**	**4D**	**1N**	**2N**	**3N**	**4N**	**1D**	**2D**	**3D**	**4D**
DINOPHYTA																								
Ornithocercus steini Schütt							1								1									
Oxytoxum sp																	1				1			
Peridinum cf *granii* Ostenfeld	6	5	10		22	18	10		8	8	3		4	1	8	1	16	17	10		28	42	20	6
Peridinium cf. *oceanicum* Vanhöffen		10	1		1	1	4				3			2	2		3	3	1		2	4	3	
Peridinium crassipes Kofoid												1												2
Peridinium pedunculatum Schütt	1	6			2				4	2	1		1				1	1			3	3		1
Peridinium sp_1					1												5	4	2		2	1		
Peridinium sp_2																								
Prorocentrum gracile Schütt	2	2	1				5		2	1	1		3	1	2		2				2	1	3	
Prorocentrum micans Ehrenberg											1							1	2		4			
Pyrocystis fusiformis Wyville-Thomson y Blackman						1																		
Pyrophacus horologium Stein	9	23	22	1	50	89	35		21	7	19		7	11	12						1	10	25	
TOTAL	**300**	**300**	**300**	**300**	**300**	**300**	**300**	**300**	**300**	**300**	**300**	**300**	**300**	**300**	**300**	**300**	**300**	**300**	**300**	**300**	**300**	**300**	**300**	**300**

Table EA-6: Absolute Frequency of Phytoplankton Species in Dirunal and Nocturnal nearshore samples in the Bay of Panama.

Species	Site 2 Night			Site 2 Day			Causeway Night						Causeway Day						Chorrillo Night			Chorrillo Day		
	1N	2N	3N	1D	2D	3D	1N	2N	3N	4N	5N	6N	1D	2D	3D	4D	5D	6D	1N	2N	3N	1D	2D	3D
BACILLARIOPHYTA																								
Actinocyclus spp							81	51	18				19	25	13	1	2		4	15	76			
Actinoptychus senarius (Ehrenberg) Ehrenberg		2	2		1	2														1				1
Asterionellopsis glacialis (Castracane) Round (en Round *et al*., 1990)																								
Bacteriastrum cf. *mediterraneum* Pavillard													1	1										1
Bacteristrum delicatulum Cleve							1						4		4									1
Bacteriastrum furcatum Shadbolt	1									1												1		
Bacteriatrum hyalinum Lauder	1									1				4										
Cerataulina pelagica (Cleve) Hendey								1						1	2									
Chaetoceros affinis Lauder							1	3		2		3	11	15	17					1		4	2	6
Chaetoceros affinis Lauder var. *willei* (Gran) Hustedt														1	1									
Chaetoceros anastomosans Grunow en Van Heurck	4						2	2	2				34	45	31							15	7	
Chaetoceros brevis Schütt	7								2				1	9	3							3	2	
Chaeotceros coarctatus Lauder								1	1				3	2	7							2	2	2
Chaetoceros cf. *densus* Cleve							1					3		1										
Chaetoc eros costatus Pavillard														1										
Chaetoceros curvisetus Cleve	2	2	9	1	1		1	2	2	34	4	55	17	3	13				3	2	3	11	7	4
Chaaetoceros debilis Cleve																								
Chaetoceros decipiens Cleve							1	1	1				2	1	5								2	

Table EA-6 – Continued

Species	Site 2 Night			Site 2 Day			Causeway Night						Causeway Day						Chorrillo Night			Chorrillo Day		
	1N	2N	3N	1D	2D	3D	1N	2N	3N	4N	5N	6N	1D	2D	3D	4D	5D	6D	1N	2N	3N	1D	2D	3D
BACILLARIOPHYTA																								
Chaetoceros denticulatus forma angusta Hustedt													1	1	1							1		
Chaetoceros didymus var. didymus Ehrenberg													1		1									
Chaetoceros didymus var. protuberans (Lauder) Gran y Yendo													1										1	
Chaetoceros diversus Cleve									1						1									
Chaetoceros filiferum Karsten																								
Chaetoceros laciniosus Schütt															1									
Chaetoceros lorenzianus Grunow	1							1	6	1		3	25	23	24				1			8	4	5
Chaetoceros pelagicus Cleve														1										
Chaetoceros peruvianus Cleve									1				5	6	4							5	3	1
Chaetoceros pseudocurvisetus Mangin																								
Chaetoceros radicans Schütt														2										
Chaetoceros rostratus Lauder												2	2											
Chaetoceros socialis Lauder	1									37		151												
Chaetoceros sp1																								
Chaetoceros tortissimus Gran	1												1											
Chaetoceros whigamii Brightwell																								

Table EA-6 – Continued

Species	Site 2 Night			Site 2 Day			Causeway Night						Causeway Day						Chorrillo Night			Chorrillo Day		
	1N	2N	3N	1D	2D	3D	1N	2N	3N	4N	5N	6N	1D	2D	3D	4D	5D	6D	1N	2N	3N	1D	2D	3D
BACILLARIOPHYTA																								
Coscinodiscus asteromphalus Ehrenberg							3		3	5	2	1			1	1	3	3	7	3	15			
Coscinodiscus concinnus W. Smith										8	4										4			1
Coscinodiscus granii Gough	1		2	3		2	1	4	2				4			1			2	1	4		1	1
Coscinodiscus oculus iridis Ehrenberg							3												1	2	1			
Coscinodiscus spp	196	255	253	267	268	276	100	30	4	60	233	15	25	5		244	251	267	215	245	151	36	81	142
Cylindrotheca clostherium (Ehrenberg) Lewin y Reimann					1					20	27	35	8	9	4									
Dactiliosolen fragilissimus (Bergon) Hasle																								
Ditylum brightwellii (West) Grun									2	1			1	1	3								1	
Entomoneis alata (Ehrenberg) Ehrenberg																								
Eucampia zoodiacus Ehrenberg													1											
Grammatophora sp																								
Guinardia flaccida (Castracane) H. Peragallo								1				2		3	2							1		
Guinardia striata (Stolterfoth) Hasle	2	1						1	1	7	2	7	10	10	6									
Helicotheca tamesis (Shrubsole) Ricard									1										1					2
Hemiaulus hauckii Grun	2												2	1										
Hemiaulus membranaceus Cleve													1											
Hemiaulus sinensis Grev.																								
Lauderia annulata Cleve	1		1										10	7	3									2

Table EA-6 – Continued

Species	Site 2 Night			Site 2 Day			Causeway Night						Causeway Day						Chorrillo Night			Chorrillo Day		
	1N	2N	3N	1D	2D	3D	1N	2N	3N	4N	5N	6N	1D	2D	3D	4D	5D	6D	1N	2N	3N	1D	2D	3D
BACILLARIOPHYTA																								
Lectocilyndrus danicus Cleve							2	1	1	1			7	12	13				1			2	1	1
Licmophora sp	3																							
Lioloma pacificum (Cupp) Hasle				1	2		1	2	11	1	3	2	1	12	13				3		2	5	4	7
Lithodesmium undulatum Ehrenberg				1			1				1											3	1	
Meuniera membranacea (Cleve) P. C. Silva																								
Neocalyptrella robusta Hernández - Becerril y Meave del Castillo		1							1				1									1		
Neoestreptotheca subindica von Stosch	1																			1				
Nitzschia behrei Hustedt					2					9														
Nitzschia cf *ventricosa* Kitton																	1							
Nitzschia reversa W. Smith										84		1												
Nitzschia sp1	3												1	2								2		
Nitzschia sigma (Kützing) W. Smith					1									1	1							1		
Odontella mobiliensis (Bailey) Grunow																								1
Odontella regia C. A. Agardh					1								1									2		
Odontella sinensis (Grville) Grunow							1		3										6		5		5	
Paralia sulcata (Ehrenberg) Cleve	1																							
Petrodictyon gemma (Ehr.) D. G. Mann *en* Round *et al*., 1990						1																		
Planktoniella muriformis (Loeblich, Wight y Darley) Round																1			1					1
Pleurosigma cf. *angulatum* (Quekett) Wm. Smith		1						1																1

Table EA-6 – Continued

Species	Site 2 Night			Site 2 Day			Causeway Night						Causeway Day						Chorrillo Night			Chorrillo Day		
	1N	2N	3N	1D	2D	3D	1N	2N	3N	4N	5N	6N	1D	2D	3D	4D	5D	6D	1N	2N	3N	1D	2D	3D
BACILLARIOPHYTA																								
Pleurosigma naviculaceum Brébisson					1																			
Pleurosigma normanii Ralfs							1																	
Prosbocia alata (Brightwell) Sundström	13	2	3	2	3	3	3	11	35	2	4	4	8	18	36				1		1	11	15	6
Pseudonitzschia pungens (Grunow) Hasle forma *pungens* (Grunow) Hasle	6			2		1			2	5	1	1	15	15	7							1		1
Pseudosolenia calcar-avis (Schultze) Sundström	1	2	1		1		1	4	2	5	2	2	6	3	4		1			1	1	2	1	1
Rizosolenia acuminata (H. Peragallo) H. Peragallo								1					1										1	
Rizosolenia bergonii H. Pér.	2		1				2		1				1	4	4								1	
Rizosolenia hyalina Ostenfeld		1							1													1		
Rizosolenia imbricata Brightwell			1																					
Rizosolenia pungens Cleve-Euler				1	1								1	1	1									
Rizosolenia setigera Brightwell	2									10	5	5									1			
Rizosolenia striata Greville						1				2	1	2											1	
Rizosolenia styliformis Brightwell										1	5	5	2	2	4	1								
Skeletonema costatum (Greville) Cleve				2	7	2	1			1			1		6				1			8	3	4
Stephanopyxis turris (Grev. And Arn.) Ralfs																						1		
Synedra goulardii Brébison													2	1	3									
Thalassionema frauenfeldii (Grunow) Hallegraeff																								

Table EA-6 – Continued

Species	Site 2 Night			Site 2 Day			Causeway Night						Causeway Day						Chorrillo Night			Chorrillo Day		
	1N	2N	3N	1D	2D	3D	1N	2N	3N	4N	5N	6N	1D	2D	3D	4D	5D	6D	1N	2N	3N	1D	2D	3D
BACILLARIOPHYTA																								
Thalassionema nitzschioides Grun						1								1										
Thalassisira sp																								
Thalassiosira eccentrica (Ehr.) Cleve																								
DINOPHYTA																								
Amphisolenia bidentata Schröder																								
Ceratium candelabrum (Ehrenberg) Stein									2					1									1	
Ceratium furca (Ehrenberg) Claparède y Lachmann	9	5	6	7	3	3	3	8	20	2	3		10	1	14		1		7	3	5	84	75	45
Ceratium fusus (Ehrenberg) Dujardin							2	3	20				3	4				1	2	1	2	15	18	7
Ceratium horridum Gran							1		4		1			1	8				2			3	2	3
Ceratium karstenii Pavillard																								
Ceratium pentagonum Gourret								1	2				1	3									1	
Ceratium trichoceros (Ehrenberg) Kofoid	1			1		5	1	1	7				1	1	12				1			11	9	10
Ceratium tripos (O. F. Müller) Nitzsch							2	12	17				3	1	9				3	2		10	5	3
Ceratium tripos forma *semipulchellum* Jörgensen			1																					
Dinophysis caudata Stein		2						2	1				1					1	1	1	2			
Noctiluca scintillans (Macartney) Kofoid y Swezy	7	4	3	2	3		8	7	11		2	1	7	2	2	50	40	27	7	7	16	8	10	3

Table EA-6 – Continued

Species	Site 2 Night			Site 2 Day			Causeway Night						Causeway Day						Chorrillo Night			Chorrillo Day		
	1N	2N	3N	1D	2D	3D	1N	2N	3N	4N	5N	6N	1D	2D	3D	4D	5D	6D	1N	2N	3N	1D	2D	3D
DINOPHYTA																								
Ornithocercus steini Schütt																								
Oxytoxum sp									1						1									
Peridinium cf granii Ostenfeld	6	9	10	2	2		12	15	33				1	2				1	6	2		3	9	3
Peridinium cf. oceanicum Vanhöffen	3						1	3	5				3	4	1				2			1		
Peridinium crassipes Kofoid	9						5	2	14				1						14		2	3	2	
Peridinium pendunculatus Schütt	3						7	8	15				1	1	1	1	1		2	2		8	4	8
Peridinium sp_1	6		5	1	2															3	3			
Peridinium sp_3	1																							1
Prorocentrum gracile Schütt	1	3	2					11	8				4	6					4	3		2	4	4
Prorocentrum micans Ehrenberg	2			7		3			1						2								1	
Pyrocystis fusiformis Wyville - Thomson y Blackman																								
Pyrophacus horologium Stein		10					50	109	35				26	23	21				2	4	6	25	13	21
TOTAL	**300**	**300**	**300**	**300**	**300**	**300**	**300**	**300**	**300**	**300**	**300**	**300**	**300**	**300**	**300**	**300**	**300**	**300**	**300**	**300**	**300**	**300**	**300**	**300**

Table EA-7: Abundance of macrofauna collected at Palo Seco (West) in low water, at high tide zone.

TAXA	R11	R12	R13	R14	R15	R16	TOTAL
POLYCHAETS							
Nereidae	2	2					4
MOLLUSCS							
Bivalvia							
Protothaca asperimma	1	1	1	1	1		5
Protothaca sp. (1)	1						1
Mytella guyanensis	1	1	1	1			4
Bivalvia (1)					1		1
CRUSTACEA							
Isopods	7	3	3	7		3	23
TOTAL	12	7	5	9	2	3	38

Table EA-8: List Abundance of macrofauna collected from from the Palo Seco station at the low tide.

TAXA	B21	B22	B23	B24	B25	TOTAL
POLYCHAETS						
Nereidae	2	3			1	6
Ophedidae				1		1
Nephtyidae	1			1		2
Cossurridae	2	1		1	1	5
MOLLUSC						
Bivalvia						
Tellina sp.(2)	1	1				2
Larva of bivalvo					1	1
CRUSTACEA						
Cladocera					1	1
Amphipod		1		2	1	4
Porcelanidae					1	1
TOTAL	6	6	0	5	6	23

Table EA-9: List and abundance of macrofauna collected in Palo Seco East during high tide.

TAXA	R1	R2	R3	R4	R5	R6	TOTAL
POLYCHAETS							
Nereidae	3	1	2	1	1		8
Capitellidae	2		1	2	1	1	7
MOLLUSC							
Bivalvia							
Anadara sp	1	1		1			3
Mytilus sp.		1	1		1		3
Protothaca asperimma	1	1		1	2		5
Tellina sp	1	1	1		2		5
CRUSTACEA							
Amphipods	3	1	3	1	1	1	10
Copepods	2	1		1	1	3	8
TOTAL	13	7	8	7	9	5	49

Table EA-10: List and abundance of macrofauna collected from 6 samples at the station of Kobbe Beach, at the high tide zone.

TAXA	C1	C2	C3	C4	C5	C6	TOTAL
POLYCHAETS							
Nereidae	2	1	1	1			5
Cosurridae	1	1	2		1		5
Nephtyidae	1		2			2	5
Capitellidae	1	2		1	1	4	9
MOLLUSC							
Bivalvia							
Donax sp.	2	1		1			4
Protothaca sp.	5	1	1	1	2		10
Tellina sp. (1)	2		1		3		6
Anadara sp.	1						1
Nuculana sp.		1	1			1	3
Gastropoda							
Nassarius sp.	1			1	1		3
CRUSTACEA							
AMPHIPOD	2	6				6	14
Copepodo		2	3		1		6
EQUINODERMATA							
Ofiuroideo sp.		1		1			2
ECHIURA	1	2		1	1	1	6
TOTAL	19	18	11	7	10	14	79

Table EA-11: List and abundance of macrofauna collected at station Kobbe Beach, at the low tide zone.

TAXA	R19	R20	R21	R22	R23	R24	TOTAL
POLYCHAETS							
Serpulidae		1					1
Pisionidae		2			2		4
Capitellidae			1				1
MOLLUSC							
Bivalvia							
Nucula sp	1					1	2
Mytella guyanensis					1		1
Prothotaca asperimma	2	2	4	5	1		14
Tellina sp. (1)		2	1	2	3		8
Crassinella		2					2
CRUSTACEA							
Isopods		2		1	1		4
Ostracods	1	3					4
EQUINODERMATA							
Ofiuroideo sp.						2	2
TOTAL	4	14	6	8	8	3	43

Table EA-12: List and Abundance of macrofauna collected at Site 2.

TAXA	R1	R2	R3	R4	R5	R6	TOTAL
NEMATODA	3	3	4	2	2	1	15
POLYCHAETS							
Nereidae	6	3	4		5	4	22
Phyllodocidae	6	1	7	3	4	3	24
Glyceridae	6		7	5	6	2	26
Nephtyidae	4	1	4	3	9	3	24
Arenicolidae	2	1	1	1	1	2	8
Cossuridae	1	1	2	1	1	1	7
Sabellidae	2	1	4	1	4	2	14
Goniodidae	3	2	1	2	1	1	10
Ophelidae	2	1	3		2	1	9
Capitellidae	3		1	3	1	2	10
Lumbrineridae	2		1	2	1	1	7
Cirratulidae	4	6	4	2	1	3	20
Owenidae		1	2		1	1	5
Serpulidae	1	2	1	1	2	1	8
MOLLUSC							
Bivalvia							
Anadara sp.	1	2	1	2		1	7
Tellina sp. (1)	1	1	1	2	1	2	8
Protothaca asperimma	1	1	2	2	2	1	9
Crassinella sp.		1		1	1	2	5
CRUSTACEA							
Amphipod	1	2	1	3	3	2	12
Copepod calanoidea	1			1	2	1	5
Porcellanidae		1	1				2
Callinectes sp.	1		1	1			3
ECHIURA	1	1	2				4
TOTAL	45	26	47	38	45	31	264

Table EA-13: List and abundance of macrofauna collected at the Artificial Island station.

TAXA	R1	R2	R3	R4	R5	R6	TOTAL
NEMATODS	3	3	6	3	1	3	19
POLYCHAETS							
Cossuridae	1	1		1	1		4
Nephtyidae	2	5	4	4	2	5	22
Capitelidae	3	1	1	2	4	2	13
Nereidae	2	2	1	3			8
Glyceridae	3	1		2			6
Spionidae	4						4
Pilargidae	2	1			2		5
Goniodidae		2				2	4
Phyllodocidae		1	3	5		1	10
Dorvidallidae		1		1	1		3
Starnospidae				1			1
Ophellidae				1		1	2
Cirratulidae					2	1	3
Lumbrineridae						2	2
Sabellidae						3	3
Magelonidae			3		1	2	6
MOLLUSCA							
Bivalvia							

Table EA-13 (continued)

TAXA	R1	R2	R3	R4	R5	R6	TOTAL
Tellina sp (1)						1	1
Larva of bivalve	1		1				2
Gastropoda							
Larva of gastropod	1						1
CRUSTACEA							
Amphipod		1		3			4
Trachypenaeus sp.				2			2
Callinectes sp.		1	1				2
Larva of Brachyura		1					1
EQUINODERMATA							
Ophiuroideo sp						1	1
ECHIURA	1			3		4	8
CHORDATA							
Pisces							
Gobidae	1						1
TOTAL	24	21	20	31	14	28	138

Table EA-14: List and abundance of macrofauna collected from Site 15 station.

TAXA	R1	R2	R3	R4	R5	R6	TOTAL
NEMATODS			2			2	4
POLYCHAETS							
Cossuridae		1					1
Nephtyidae	2	3	2				7
Nereidae				1		1	2
Goniodidae	1	2	1			1	5
Phyllodocidae			1			1	2
Polyodontidae					1		1
Magelonidae			1				1
Capitellidae		3					3
Glyceridae	1	3					4
MOLLUSC							
Bivalvia							
Protothaca asperimma		1					1
Larva of bivalve		1					1
Gastropod		2					
Larva de gastropod							2
CRUSTACEA							
Anfipodo	1	3	2	1	1		8
Copepod Calanoideo	1		1		1		3
TOTAL	6	19	10	2	3	5	45

Table EA-15: List and abundance of macrofauna collected from Fishing Grounds station.

TAXA	C1	C2	C3	C4	C5	C6	TOTAL
NEMATODS	4	3	1	1	5	1	15
POLYCHAETS							
Spionidae	12	10	6	7	4	4	43
Capitellidae	1	2			2	3	8
Arenicollidae		1		2		2	5
Glyceridae				2		2	4
Sabellidae				2		1	3
Goniadidae				2			2
Pilargidae						4	4
MOLUSCS							
Bivalvia							
Tellina sp (1)			1				1
Larva of bivalve				1			1
CRUSTACEOS							
Amphipods	4	2	6	1	1	1	15
Copepod Calanoideo	2	1	1	3	1	1	9
Ostracods	1	3		1	1		6
Squilla sp.				1			1
ECHIUROIDEA	1	1		2		1	5
TOTAL	2	23	15	25	14	20	122

Table EA-16: List and abundance of macrofauna collected at Chorrillo.

TAXA	R1	R2	R3	R4	R5	R6	TOTAL
NEMATODS		1		3		2	6
OLYGOCHAETS			1				1
POLYCHAETS							
Nereidadae		2		3			5
Capitellidae				2			2
Phyllodocidae	5	2	12	2	2	13	36
Onuphidae					2		2
MOLLUSC							
Bivalvia							
Mytella guyanensis			1				1
Solen sp.					1	9	10
Protothaca asperimma				1	2		3
CRUSTACEA							
Amphipod			2		1		3
ECHIURA						2	2
CHORDATA							
Pisces					1		1
TOTAL	5	5	16	11	9	26	72

Table EA-17: List and abundance of macrofauna collected from the Causeway station.

TAXA	R1	R2	R3	R4	R5	R6	TOTAL
OLYGOCHAETS				1			1
POLYCHAETS							
Onuphidae (1)			3				3
Onuphidae (2)		1					1
Onuphidae (3)					3		3
Phyllodocidae	6	3	3	6	4	2	24
Magelonidae						2	2
Nereidae	1						1
MOLLUSC							
Bivalvia							
Arca sp.	2		1				3
Tellina sp. (1)		1	1				2
Solen sp.			1				1
Protothaca asperimma				1			1
CRUSTACEA							
Isopodo		1					1
Anfipodo		2		2			4
Squilla sp.	1				1		2
ECHINODERMATA							
Ophiuroideo	1			1			2
TOTAL	1	8	9	11	8	4	51

Table EA-18: Flora Species Identified at Site T1

Flora Species Recorded

CLASS MAGNOLIOPSIDA			T1	Global Rank	National Rank	END	EPL panameñas	CITES	UICN
FAMILY	SPECIES	COMMON NAME							
ACANTHACEAE	*Aphelandra sinclairiana*	camaroncillo	*	G4	N4				
	Trichantera gigantea	palo de agua	*						
ANACARDIACEAE	*Anacardium excelsum*	espavé	*	G5	N5				
	Mangifera indica (c)	mango	*	G5	NE				
	Spondias mombin	jobo	*	G5	N5				
ANNONACEAE	*Annona hayesii*	chirimoya	*	G3	N3				
	Annona spraguei	chirimoya	*	G3	N3				
APOCYNACEAE	*Stemmadenia grandiflora*		*	G5	N5				
	Thevetia ahouai	huevo de gato	*	G5	N5				
ARALIACEAE	*Dendropanax arboreus*	muñequito	*	G5	N5				
	Schefflera morototoni		*	G5	N4				
BIGNONIACEAE	*Jacaranda copaia*	pie de elefante	*	G5	N4				
	Parmentiera cereifera		*						
	Tabebuia rosea	roble	*	G5	N5				
BOMBACACEAE	*Cavanillesia platanifolia*	cuipo	*	G5	N4				
BORAGINACEAE	*Cordia alliodora*	laurel	*	G5	N5				
BURSERACEAE	*Bursera simaruba*	almácigo - carate	*	G5	N5				
	Protium tenuifolium	chutra - cicuadro	*	G3	N3				
CECROPIACEAE	*Cecropia obtusifolia*	guarumo	*	G5	N5				
CHRYSOBALANACEAE	*Hirtella americana*	camaroncillo	*	G5	N5				
	Hirtella racemosa	camaroncillo	*	G5	N5				
	Hirtella triandra	camaroncillo	*	G5	N5				
CLUSIACEAE	*Clusia sp.*		*						
COCHLOSPERMACEAE	*Cochlospermum vitifolium*	poro - poro	*	G5	N5				
COMBRETACEAE	*Terminalia amazonia*	amarillo	*	G5	N4				
CONNARACEAE	*Connarus panamensis*		*	G5	N5				
	Connarus sp.		*						
EUPHORBIACEAE	*Acalypha diversifolia*		*	G5	N5				
	Adelia triloba		*	G5	N5				
	Alchornea latifolia		*						
	Croton draco	sangrillo	*	G5	N4				
	Hyeronima alchorneoides		*						
	Mabea occidentales		*	G5	N4				
	Margaritaria nobilis		*						
	Phyllanthus acuminatus		*						
FAB-CAESALPINIOIDEAE	*Bauhinia sp.*	escalera de mono	*						
FAB-CAESALPINIOIDEAE	*Cassia moschata*	caña fistula	*	G4	N3				
FAB-CAESALPINIOIDEAE	*Hymenaea courbaril*	algarrobo	*	G5	N4				
FAB-CAESALPINIOIDEAE	*Swartzia simplex*	naranjillo	*	G5	N5				
FAB-FABOIDEAE	*Andira inermis*	harino	*	G5	N5				
FAB-FABOIDEAE	*Lonchocarpus latifolius*	peronil	*						
FAB-FABOIDEAE	*Machaerium kegelii*	falsa uña de gato	*	G3	N3				
FAB-MIMOSOIDEAE	*Acacia melanoceras*	cachito	*	G4	N2				
FAB-MIMOSOIDEAE	*Cojoba rufescens*	coralillo	*	G4	N4				
FAB-MIMOSOIDEAE	*Enterolobium cyclocarpum*	corotú	*	G5	N4				
FAB-MIMOSOIDEAE	*Enterolobium schomburgkii*	corotú	*						
FAB-MIMOSOIDEAE	*Inga goldmanii*		*	G3	N3				
FAB-MIMOSOIDEAE	*Inga hayesii*	guabo	*	G3	N3				LR
FAB-MIMOSOIDEAE	*Inga nobilis*		*						
FAB-MIMOSOIDEAE	*Inga ruiziana*		*						
FAB-MIMOSOIDEAE	*Inga vera*		*						

Flora Species Recorded

CLASS MAGNOLIOPSIDA			T1	Global Rank	National Rank	END	EPL panameñas	CITES	UICN
FAMILY	SPECIES	COMMON NAME							
FLACOURTIACEAE	*Casearia aculeata*	pica lengua	*	G5	N5				
	Casearia commersoniana	corta lengua - mauro	*	G5	N5				
	Casearia guianensis		*						
	Casearia sylvestris		*	G5	N5				
	Hasseltia floribunda	parimontón	*	G5	N5				
	Lacistema aggregatum	huesito	*	G5	N5				
	Lindackeria laurina	carbonero	*	G5	N4				
	Tetrathylacium johansenii	palo de chancho	*	G4	N3				
	Zuelania guidonea	árbol caspa	*	G5	N3				
LAURACEAE	*Phoebe cinnamomifolia*	sigua blanca	*	G5	N5				
LECYTHIDACEAE	*Gustavia superba*	membrillo	*	G5	N4				
MELASTOMATACEAE	*Miconia argentea*	papelillo	*	G5	N5				
MELIACEAE	*Cedrela odorata*	cedro amargo	*	G4	N4		X		VU
	Guarea guidonea	cedro	*	G4	N4				
	Trichilia pleeana		*	G4	N4				
MONIMIACEAE	*Siparuna pauciflora*	pasmo	*	G5	N4				
MORACEAE	*Brosimum alicastrum*	berbá - cacique	*	G5	N4				
	Castilla elastica	árbol de goma	*	G5	N3				
	Ficus insipida	higuerón	*	G5	N4				
	Ficus trigonata		*						
	Maclura tinctoria	palo mora	*	G5	N4				
	Trophis caucana		*	G5	N4				
MYRSINACEAE	*Stylogyne standleyi*		*	G4	N3				
MYRTACEAE	*Eugenia oerstediana*		*						
NYCTAGINACEAE	*Neea delicatula*		*	G4	N3				
OCHNACEAE	*Ouratea lucens*	caidita	*	G5	N5				
PASSIFLORACEAE	*Passiflora ambigua*	pasionaria	*	G3	N3				
	Passiflora foetida	calzoncillo	*	G5	N5				
	Passiflora vitifolia	pasionaria	*	G5	N5				
PIPERACEAE	*Piper aequale*	hinojo	*	G5	N5				
	Piper auritum	hinojo	*	G5	N5				
	Piper cordulatum	hinojo	*	G2	N2				
	Piper culebranum	hinojo	*						
	Piper reticulatum	hinojo	*	G5	N4				
POLYGONACEAE	*Coccoloba manzanillensis*	hueso - uvito	*	G2	N2	N			
	Triplaris cumingiana	guayabo hormiguero	*	G4	N3				
RUBIACEAE	*Alibertia edulis*	madroño - trompito	*	G5	N4				
	Alseis blackiana	mameicillo	*	G3	N3				
	Antirhea trichantha	mazanuco	*	G2	N2				
	Coutarea hexandra		*						
	Pentagonia macrophylla	hoja de murciélago	*	G4	N4				
	Posoqueria latifolia	boca de vieja	*	G5	N5				
	Psychotria marginata		*	G4	N4				
RUTACEAE	*Zanthoxylum ekmanii*	tachuelo	*						
	Zanthoxylum panamense	cicuadro - tachuelo	*	G3	N3				
SAPINDACEAE	*Cupania latifolia*	gorgojero	*						
	Cupania rufescens	gorgojero colorao	*	G5	N3				
	Cupania scrobiculata	gorgojero	*						
	Cupania sylvatica	gorgojero	*	G3	N3				
	Matayba scrobiculata	matillo	*	G4	N3				
	Sapindus saponaria	jaboncillo	*	G5	N3				

Flora Species Recorded

CLASS MAGNOLIOPSIDA			T1	Global Rank	National Rank	END	EPL panameñas	CITES	UICN
FAMILY	SPECIES	COMMON NAME							
SAPOTACEAE	*Chrysophyllum cainito* (c)	caimito	*	G5	N5				
SIMAROUBACEAE	*Simaba cedron*	cedrón	*	G4	N3				
STERCULIACEAE	*Guazuma ulmifolia*	negrito	*	G5	N5				
	Herrania purpurea	cacao de monte	*	G3	N3				
THEOPHRASTACEAE	*Clavija mezii*		*						
TILIACEAE	*Apeiba aspera*	peine de mono	*	G5	N4				
	Luehea seemannii	guácimo colorado	*	G5	N4				
	Luehea speciosa	guácimo	*	G5	N4				
ULMACEAE	*Celtis schippii*		*						
URTICACEAE	*Urera baccifera*	hortiga	*	G5	N4				
VERBENACEAE	*Vitex cymosa*		*						
VIOLACEAE	*Hybanthus prunifolius*		*						
	Rinorea sylvatica		*	G4	N3				
VOCHYSIACEAE	*Vochysia ferruginea*	flor de mayo	*	G5	N4				

CLASE LILIOPSIDA			T1	Global Rank	National Rank	END	EPL panameñas	CITES	UICN
FAMILY	SPECIES	COMMON NAME							
ARACEAE	*Dieffenbachia longispatha*	otoe lagarto	*	G4	N3				
	Montrichardia arborescens (a)	castaño	*	G4	N4				
ARECACEAE	*Astrocarium standleyanum*	chunga	*	G4	N2				
	Attalea butyracea	palma real	*	G3	N3				
	Bactris barronis		*	G2	N2	N			
	Bactris major	caña brava	*	G5	N3				
	Crysophila warscewiczii	palma guagara	*	G3	N3				
	Elaeis oleifera	palma aceitera	*	G5	N3				
	Oenocarpus mapora	maquenque	*	G4	N3				
BROMELIACEAE	*Aechmea magdalenae*	pita	*	G5	N3				
	Tillansia flexuosa	barba de chivo	*	G4	N3				
CYCLANTHACEAE	*Carludovica palmata*	sombrero panamá	*	G5	N3				
CYPERACEAE	*Cyperus sp.*		*						
	Scleria sp.	cortadera	*						
HELICONIACEAE	*Heliconia latispatha*	chichica	*	G5	N4				
	Heliconia platystachys	platanillo	*	G4	N4				
ORCHIDACEAE	*Brassavola nodosa*	dama de la noche	*	G4	N3			AII	
	Catasetum viridiflavum	orquidea	*	G3	N3			AII	
	Dichaea panamensis	orquidea	*					AII	
	Epidendrum difforme	orquidea	*					AII	
	Notylia pentachne	orquidea	*	G2	N2			AII	
	Oeceoclades maculata	orquidea	*	G3	N3			AII	
	Oncidium stipitatum	orquidea	*	G3	N3			AII	
POACEAE	*Bambusa sp.*	bambú	*						
	Chusquea sp.	caricillo	*						
	Scleria sp.		*						
ZINGIBERACEAE	*Costus sp.*	gengibre	*						
	Costus villosissimus		*	G5	N5				

Nota: RG: Global Rank; **RN:** Nacional Rank, **END:** Endémic Species; **N:** National; **EPL:** Protected by National Wildlife Laws, **CITES**: Apéndice I (AI), Apéndice II (AII); **IUCN: CR:** Critically in Danger; **E:** In Danger; **I:** Indetermined, **R:** Rare, **V:** Vulnerable. Cultivated Species (c), Naturalized Species (n), Aquatic (a).

Table EA-19: Bird Species Identified at Site T1

GAME BIRDS				T1	Global	National	END	EPL	CITES	UICN
ORDER	FAMILY	SPECIES	COMMON NAME		Rank	Rank		Panama		
TINAMIFORMES	TINAMIDAE	*Crypturellus soui*	tinamú chico	*	G5	N4				
		Tinamus major	tinamú grande	*	G5	N4				
COLUMBIFORMES	COLUMBIDAE	*Columba cayennensis*	paloma colorada	*	G5	N5		x		
		Columba speciosa	paloma escamosa	*	G5	N4				
		Columba nigrirostris	paloma piquicorta	*	G4	N4				
		Leptotila v. verreauxi	paloma rabiblanca	*	G5	N5				
		Leptotila cassini	paloma pechigris	*	G4	N4				
		Geotrygon montana	paloma-perdiz roja	*	G5	N5				
GALLIFORMES	ODONTOPHORIDAE	*Odontophorus gujanensis*	codorniz jaspeda	*						
	CRACIDAE	*Crax rubra*	pavón grande	*						
		Penelope purpurascens	pava crestada	*	G4	N2				
		Ortalis cinereiceps	chachalaca cabecigris	*	G5	N3		x		
PICIFORMES	RAMPHASTIDAE	*Pteroglossus t. torquatus*	tucancillo collarejo	*						
		Ramphastos sulfuratus	tucán pico iris	*	G4	N4			AII	
		Ramphastus swainsonii	tucán de swainson	*						
PSITTACIFORMES	PSITTACIDAE	*Amazon autumnalis*	amazona frentirrojo	*	G4	N4				
		Amazona farinosa	amazona harinoso	*	G4	N4			AII	
		Amazona ochrocephala	amazona coroniamarillo	*	G4	N4		x	AII	
		Brotogeris j. jugularis	perico barbinaranja	*	G5	N5		x	AII	
		Pionopsitta haematotis	loro cabecipardo	*	G4	N4		x	AII	
		Poinus menstrus	loro cabeciazul	*	G5	N5				

FOREST BIRDS				T1	Global	National	END	EPL	CITES	UICN
ORDER	FAMILY	SPECIES	COMMON NAME		Rank	Rank		Panama		
CHARADRIIFORMES	JACANIDAE	*Jacana jacana hypomelaena*	jacana carunculada	*	G5	N5				
CICONIIFORMES	ARDEIDAE	*Ardea h. herodias*	garza azul mayor	*	G5	NN				
		Casmerodius albus egretta	garceta grande	*	G5	N5				
		Egretta caerulea	garza azul chica	*	G5	N5				
		Egretta t. thula	garceta nívea	*	G5	N5				
		Trigrisoma l. lineatum	garza tigre castaña	*						
PELICANIFORMES	ANHINGIDAE	*Anhinga anhinga*	aninga	*	G5	N4				
FALCONIFORMES	FALCONIDAE	*Herpetotheres cachinnas*	halcón reidor	*	G4G5	N3			AII	
		Micrastur mirandollei	halcón-montés dorsogris	*					AII	
		Micrastur ruficollis	halcón-montés barreteado	*					AII	
		Micrastur semitorquatus	halcón-montes collarejo	*	G3G5	N4			AII	
CUCULIFORMES	CUCULIDAE	*Dromococcyx phasianellus*	cuclillo faisán	*						
CORACIIFORMES	MOMOTIDAE	*Baryphthengus martii semirufus*	momoto rufo	*	G4	N4				
		Electron platyrhynchum minor	momoto piquiancho	*	G4	N4				
		Momotus momota conexus	momoto coroniazulado	*	G4G5	N4				
PICIFORMES	BUCCONIDAE	*Notharchus pectoralis*	buco pechinegro	*						
	PICIDAE	*Celeus loricatus*	carpintero canelo	*						

FOREST BIRDS				T1	Global	National	END	EPL	CITES	UICN
ORDER	FAMILY	SPECIES	COMMON NAME		Rank	Rank		Panama		
PASSERIFORMES	CORVIDAE	*Cyanocorax affinis zeledoni*	urraca pechinegra	*	G4	N4				
	COTINGIDAE	*Querula purpurea*	quérula gorgimorada	*						
	DENDROCOLAPTIDAE	*Dendrocolaptes certhia*	trepatroncos barreteado	*						
		Xiphorhynchus l. lachrymosus	trepatroncos pinto	*						
	EMBERIZIDAE	*Cyanerpes cyaneus carneipes*	mielero patirrojo	*	G5	N5				
		Eucometis penicillata cristata	tangara cabecigris	*	G4	N4				
		Euphonia luteicapilla	eufonia coroniamarilla	*	G4	N4				
		Ramphocelus d. dimidiatus	sangre de toro	*	G5	N5				
		Tachyphonus luctuosus	tangara hombriblanca	*	G5	N5				
		Thraupis episcopus cana	tangara azuleja	*	G5	N5				
	FORMICARIDAE	*Gymnopithys leucapsis*	hormiguero bicolor	*						
		Hylopezus perspicillatus	tororoi de anteojos	*						
		Hylophylax n. naevioides	hormiguero collarejo	*	G4	N4				
		Microrhopias quixensis virgata	hormiguerito alipunteado	*	G5	N5				
		Mymotherula axillaris	hormiguero flanqueado	*	G5	N5				
		Mymotherula fulviventris	hormiguerito leonado	*						
		Myrmeciza exsul	hormiguero dorsicastaño	*	G4	N4				
		Phaenostictus mcleannani	hormiguero ocelado	*						
		Formicarius analis	formicario carinegro	*	G5	N5				
	FURNARIDAE	*Automolus ochrolaemus*	hojarrasquero gorgipálido	*						
		Sclerurus guatemalensis	tirahojas gorgiescamoso	*						
		Sclerurus mexicanus	tirahojas gorgicastaño	*	G4	N3				
	HIRUNDINIDAE	*Progne chalybea*	martín pechigris	*	G5	N5				
		Stelgidopteryx ruficollis	golondrina-alirrasposa sureña	*	G5	N5				
		Stelgidopteryx s.serripennis	golondrina-alirrasposa norteña	*	G5	NN				
		Tachycineta a. albilinea	golondrina manglera	*	G3	N3				
	ICTERIDAE	*Cacicus cela vitellinus*	cacique lomiamarillo	*						
		Cacicus uropygialis	cacique lomiescarlata	*						
	MUSCICAPIDAE	*Turdus grayi casius*	mirlo pardo	*	G5	N5				
	PIPRIDAE	*Chiroxiphia lanceolata*	saltarín coludo	*	G4	N4				
		Pipra coronata	saltarín coroniceleste	*	G5	N5				
		Pipra mentalis ignifera	saltarín cabecirrojo	*	G4	N4				
	SYLVIIDAE	*Microbates cinereiventris*	soterillo caricafé	*						
	TROGLODYTIDAE	*Cyphorhinus phaeocephalus*	soterreyes canoro	*						
		Henicorhina leucosticta	soterrey-selvatico pechiblanco	*						
		Henicorhina leucophrys	soterrey-selvático pechigris	*	G5	N4				
		Microcerculus marginatus	soterrey-ruiseñor sureño	*	G5	N4				
	TYRANNIDAE	*Attila spadiceus*	atila lomiamarillo	*						
		Elaenia flavogaster	elania penachuda	*	G5	N5				
		Cnipodectes subbrunneus	alitorcido pardo	*						
		Conopias albovittata	mosquero blanquianillado	*						
		Onychorhychus coronatus	mosquero real	*						
	VIREONIDAE	*Hylophilus ochraceiceps*	verdillo coronileonado	*						

Note:
RG: Global Rank; **RN**:National Rank, **BBS:** Migratory species in decline (Breeding Bird Survey)
END: Endémic; N: National; B: Binacional, Costa Rica and Panamá, **B2:** Southern Pacific portion of Central America; **EPL:** Proteced by National Wildlife Laws
CITES: Apéndice 1 (1), Apéndice 2 (2); **IUCN:CR:** Critically in Danger; **EN:**In Danger, **VU:** Vulnerable.

Table EA-20: Mammal Species Identified at Site T1

CLASS MAMMALIA				T1	Global	National	END	EPL	CITES	UICN
ORDER	FAMILY	SPECIES	COMMON NAME		Rank	Rank		Panama		
DIDELPHIMORPHIA	DIDELPHIDAE	*Didelphis marsupialis*	zorra común	*	G5	N5				
XENARTHRA	MYRMECOPHAGIDAE	*Tamandua mexicana*	hormiguero	*	G5	N3		x		
		Cyclopes didactylus	tapa cara	*	G4	N4		x		
	BRADYPODIDAE	*Bradypus variegatus*	perezoso de tres dedos	*	G5	N5				
	CHOLOEPIDAE	*Choloepus hoffmanni*	perezoso de dos dedos	*	G4	N4				DD
	DASYPODIDAE	*Dasypus novemcinctus*	armadillo de nueve bandas	*	G5	N5		x		
CHIROPTERA	PHYLLOSTOMIDAE	*Corallia castanea*	murcielago frugivoro	*	G5	N5				
		Carollia perspicillata	murciélago frugivoro	*	G5	N5				
		Artibeus jamaicensis	murciélago frugivoro	*	G5	N5				
		Artibeus lituratus	murciélago frugivoro	*	G5	N5				
PRIMATES	CALLITRICIDAE	*Saguinus geoffroyi*	mono tití	*	G3	N3		x	AI	
	CEBIDAE	*Alouatta palliata*	mono aullador	*	G3	N3		x	AI	
		Aotus lemurinus	mono jujuná	*	G4	N4		x	AII	VU
		Ateles geoffroyi	mono araña colorado	*	G3	N3		x	AI - AII	VU
		Cebus capucinus	mono cariblanco	*	G4	N4		x	AII	
RODENTIA	AGOUTIDAE	*Agouti paca*	conejo pintado	*	G5	N5		x		
	DASYPROCTIDAE	*Dasyprocta punctata*	ñeque	*	G5	N5		x		
	ECHIMYIDAE	*Proechimys semispinosus*	rata espinosa - mocangué	*	G5	N5				
	ERETHIZONTIDAE	*Coendou rothschildi*	puerco espín	*	G3	N3	N			
	HYDROCHAERIDAE	*Hydrochaeris hydrochaeris*	capybara - poncho	*	G5	N5		x		
	MURIDAE	*Oryzomys sp.*	rata arrocera	*						
	SCIURIDAE	*Sciurus granatensis*	ardilla colorada	*	G5	N5				
LAGOMORPHA	LEPORIDAE	*Sylvilagus brasiliensis*	muleto	*	G5	G5				
CARNIVORA	FELIDAE	*Leopardus pardalis*	manigordo	*	G3	N3		x	AI	VU
		Leopardus wiedii	tigrillo	*				x	AI	
		Panthera onca	jaguar	*	G3	N3		x	AI	VU
	MUSTELIDAE	*Eira barbara*	tayra	*	G5	N2				
		Lontra longicaudis	nutria - gato de agua	*	G4	N3		x	AI	VU
	PROCYONIDAE	*Nasua narica*	gato solo	*	G5	N5		x		
PERISSODACTYLA	TAPIRIDAE	*Tapirus bairdii*	macho de monte	*	G3	N3		x	AI	VU
ARTIODACTYLA	TAYASSUIDAE	*Tayassu tajacu*	saíno	*	G5	N5		x	AII	
	CERVIDAE	*Mazama americana*	venado corzo	*	G5	N5		x		DD
		Odocoileus virginianus	venado cola blanca	*	G5	N5		x		

Note:

END: Endémic; N: National;B: Binational, Costa Rica y Panamá, **B2:** Southern Pacific Side of Central

EPL: Protected nationally; CITES: Apéndice 1 (1), Apéndice 2 (2); **IUCN:CR:** Critically in Danger; **EN:** In danger, **VU:** Vulnerable.

Table EA-21: Amphibian and Reptile Species Identified at Site T1

CLASS REPTILIA				T1	Global	National	END	EPL	CITES	UICN
FAMILY	FAMILIA	SPECIES	COMMON NAME		Rank	Rank		Panama		
CROCODYLIA	CROCODYLIDAE	*Crocodylus acutus*	lagarto aguja	*	G2	N2		X	AI	VU
SQUAMATA	BOIDAE	*Boa constrictor*	boa	*	G5	N4		X	AI - AII	
	COLUBRIDAE	*Oxybelis brevirostris*	bejuquilla verde	*	G5	N5				
		Spilotes pullatus	cazadora	*	G5	N4				
	CORYTOPHANIDAE	*Basiliscus basiliscus*	meracho	*	G4	N4				
	ELAPIDAE	*Micrurus nigrocinctus*	coral	*	G5	N4				
	IGUANIDAE	*Iguana iguana*	iguana verde	*	G4	N3		X	AII	
	TEIIDAE	*Ameiva ameiva*	borriguero	*	G5	N5				
	VIPERIDAE	*Bothrops asper*	serpiente equis	*	G5	N5				
TESTUDINES	EMYDIDAE	*Trachemys scripta*	tortuga	*	G5	N4				

CLASS AMPHIBIANS				T1	Global	National	END	EPL	CITES	UICN
FAMILY	FAMILIA	SPECIES	COMMON NAME		Rank	Rank		Panama		
ANURA	BUFONIDAE	*Bufo typhonius*	sapo	*	G5	N4				
	DENDROBATIDAE	*Colostethus inguinalis*		*	G3G4	N3				
	LEPTODACTYLIDAE	*Eleutherodactylus fitzingeri*		*	G5	N4				

Note:

END: Endémic; N: National;B: Binational, Costa Rica y Panamá, **B2:** Southern Pacific Side of Central

EPL: Protected nationally; CITES: Apéndice 1 (1), Apéndice 2 (2); **IUCN:CR:** Critically in Danger; **EN:** In danger, **VU:** Vulnerable.

Table EA-22: Flora Species Identified at Site T2

Flora Species Recorded

CLASS MAGNOLIOPSIDA			T1	Global Rank	National Rank	END	EPL panameñas	CITES	UICN
FAMILY	SPECIES	COMMON NAME							
ACANTHACEAE	*Aphelandra sinclairiana*	camaroncillo	*	G4	N4				
ANACARDIACEAE	*Anacardium excelsum*	espavé	*	G5	N5				
	Astronium graveolens	zorro	*	G4	N3				
	Mangifera indica (c)	mango	*	G5	NE				
	Spondias mombin	jobo	*	G5	N5				
	Tapirira guianensis	palo gusano	*	G3	N2				
ANNONACEAE	*Annona hayesii*	chirimoya	*	G3	N3				
	Annona spraguei	chirimoya	*	G3	N3				
	Xylopia frutescens	malegueto macho	*	G5	N4				
APOCYNACEAE	*Stemmadenia grandiflora*		*	G5	N5				
	Thevetia ahouai	huevo de gato	*	G5	N5				
ARALIACEAE	*Dendropanax arboreus*	muñequito	*	G5	N5				
	Schefflera morototoni	guarumo de pava	*	G5	N4				
	Sciadodendron excelsum	jobo lagarto	*	G4	N3				
ARISTOLOCHIACEAE	*Aristolochia sp.*	farolito	*						
ASTERACEAE	*Vernonanthura patens*		*	G5	N5				
BIGNONIACEAE	*Godmania aesculifolia*	cacho del diablo	*						
	Jacaranda copaia	pie de elefante	*	G5	N4				
	Tabebuia guayacan	guayacán	*	G5	N4				
BOMBACACEAE	*Cavanillesia platanifolia*	cuipo	*	G5	N4				
	Ochroma pyramidale (c)	balso	*	G5	N5				
	Pachira quinata	cedro espino	*	G5	N2				VU
	Pseudobombax septenatum	barrigón	*	G5	N4				
BORAGINACEAE	*Cordia alliodora*	laurel	*	G5	N5				
BURSERACEAE	*Bursera simaruba*	almácigo - carate	*	G5	N5				
	Protium tenuifolium	chutra - cicuadro	*	G3	N3				
	Carica sp.	papaya de monte	*						
CECROPIACEAE	*Cecropia obtusifolia*	guarumo	*	G5	N5				
	Cecropia peltata	guarumo	*	G5	N5				
CHRYSOBALANACEAE	*Hirtella americana*	camaroncillo	*	G5	N5				
	Hirtella racemosa	camaroncillo	*	G5	N5				
CLUSIACEAE	*Clusia sp.*		*						
COMBRETACEAE	*Terminalia amazonia*	amarillo	*	G5	N4				
CONNARACEAE	*Connarus panamensis*		*	G5	N5				
	Connarus sp.		*						
DILLENIACEAE	*Davilla sp.*		*						
ERYTHROXYLACEAE	*Erythroxylum sp.*		*						
EUPHORBIACEAE	*Acalypha diversifolia*		*	G5	N5				
	Alchornea latifolia		*						
	Croton draco	sangrillo	*	G5	N4				
	Hura crepitans	tronador	*	G5	N4				
	Hyeronima alchorneoides		*						
	Sapium glandulosum	cauchillo	*						
FAB-CAESALPINIOIDEAE	*Cassia moschata*	caña fistula	*	G4	N3				
FAB-CAESALPINIOIDEAE	*Swartzia simplex*	naranjillo	*	G5	N5				
FAB-FABOIDEAE	*Dalbergia retusa*	cocobolo	*	G4	N4		X		VU
FAB-FABOIDEAE	*Flemingia strobilifera*		*	G5	NE				
FAB-MIMOSOIDEAE	*Cojoba rufescens*	coralillo	*	G4	N4				
FAB-MIMOSOIDEAE	*Enterolobium cyclocarpum*	corotú	*	G5	N4				
FAB-MIMOSOIDEAE	*Inga hayesii*	guabo	*	G3	N3				LR

CLASS MAGNOLIOPSIDA			T1	Global	National	END	EPL	CITES	UICN
FAMILY	SPECIES	COMMON NAME		Rank	Rank		panameñas		
FAB-MIMOSOIDEAE	*Inga laurina*	guabito cansa boca	*						
FAB-MIMOSOIDEAE	*Inga sapindoides*	guabo de monte	*	G4	N4				
FAB-MIMOSOIDEAE	*Inga sp.*	guabo de monte	*						
FAB-MIMOSOIDEAE	*Inga vera*		*						
FLACOURTIACEAE	*Casearia commersoniana*	corta lengua - mauro	*	G5	N5				
	Casearia sp.		*						
	Casearia sylvestris		*	G5	N5				
	Hasseltia floribunda	parimontón	*	G5	N5				
	Lacistema aggregatum	huesito	*	G5	N5				
	Tetrathylacium johansenii	palo de chancho	*	G4	N3				
	Xylosma sp.	roseto - cachito	*						
	Zuelania guidonea	árbol caspa	*	G5	N3				
LAURACEAE	*Phoebe cinnamomifolia*	sigua blanca	*	G5	N5				
LECYTHIDACEAE	*Gustavia superba*	membrillo	*	G5	N4				
MALVACEAE	*Hampea appendiculata*		*	G5	N5				
MELASTOMATACEAE	*Clidemia sp.*		*						
	Miconia argentea	papelillo	*	G5	N5				
MELIACEAE	*Guarea glabra*	cedro macho	*	G5	N5				
	Guarea guidonea	cedro	*	G4	N4				
	Trichilia pleeana		*	G4	N4				
MORACEAE	*Brosimum guianense*	cacique	*	G5	N3				
	Castilla elastica	árbol de goma	*	G5	N3				
	Ficus insipida	higuerón	*	G5	N4				
	Trophis racemosa	lechosa	*	G5	N4				
MYRISTICACEAE	*Virola sebifera*	velario colorado	*	G5	N3				
MYRSINACEAE	*Ardisia sp.*	raspa lengua	*						
	Stylogyne standleyi		*	G4	N3				
MYRTACEAE	*Calycolpus warszewiczianus*	guayabillo	*	G3	N3				
	Eugenia nesiotica		*	G2	N2	N			
	Myrcia gatunensis	pimiento	*	G2	N2				
OCHNACEAE	*Ouratea lucens*	caidita	*	G5	N5				
PASSIFLORACEAE	*Passiflora ambigua*	pasionaria	*	G3	N3				
	Passiflora vitifolia	pasionaria	*	G5	N5				
PIPERACEAE	*Piper aequale*	hinojo	*	G5	N5				
	Piper marginatum	hinojo	*	G5	N5				
	Piper reticulatum	hinojo	*	G5	N4				
POLYGONACEAE	*Coccoloba manzanillensis*	hueso - uvito	*	G2	N2	N			
	Coccoloba sp.		*						
	Triplaris cumingiana	guayabo hormiguero	*	G4	N3				
RUBIACEAE	*Alibertia edulis*	madroño - trompito	*	G5	N4				
	Alseis blackiana	mameicillo	*	G3	N3				
	Antirhea trichantha	mazanuco	*	G2	N2				
	Cephaelis tomentosa	labios ardientes	*	G4	N4				
	Coussarea curvigemmia	huesito	*	G3	N3				
	Faramea occidentalis	benjamín - garrotillo	*	G5	N3				
	Posogueria latifolia	boca de vieja	*	G5	N5				
	Rosenbergiodendron formosum		*	G4	N3				
	Zanthoxylum setolosum	tachuelo - arcabú	*						
SAPINDACEAE	*Cupania cinerea*	gorgojero	*	G5	N3				
	Cupania rufescens	gorgojero colorao	*	G5	N3				
	Cupania scrobiculata	gorgojero	*						
	Cupania sylvatica	gorgojero	*	G3	N3				
	Matayba glaberrima	matillo	*	G3	N3				

CLASS MAGNOLIOPSIDA			T1	Global Rank	National Rank	END	EPL panameñas	CITES	UICN
FAMILY	SPECIES	COMMON NAME							
SAPOTACEAE	*Chrysophyllum argenteum*	caimito de monte	*	G2T4	N3				
	Chrysophyllum cainito (c)	caimito	*	G5	N5				
SIMAROUBACEAE	*Quasia amara*	amargo	*						
STERCULIACEAE	*Guazuma ulmifolia*	negrito	*	G5	N5				
	Herrania purpurea	cacao de monte	*	G3	N3				
	Sterculia apetala	árbol panamá	*	G5	N4				
THEOPHRASTACEAE	*Clavija mezii*		*						
TILIACEAE	*Luehea seemannii*	guácimo colorado	*	G5	N4				
	Luehea speciosa	guácimo	*	G5	N4				
VIOLACEAE	*Rinorea sylvatica*		*	G4	N3				
VOCHYSIACEAE	*Vochysia ferruginea*	flor de mayo	*	G5	N4				

CLASS LILIOPSIDA			T1	Global Rank	National Rank	END	EPL panameñas	CITES	UICN
FAMILY	SPECIES	COMMON NAME							
ARACEAE	*Dieffenbachia longispatha*	otoe lagarto	*	G4	N3				
	Montrichardia arborescens **(a)**	castaño	*	G4	N4				
	Philodendron sp.		*						
ARECACEAE	*Astrocarium standleyanum*	chunga	*	G4	N2				
	Attalea butyracea	palma real	*	G3	N3				
	Bactris coloradonis		*	G2	N2				
	Bactris major	caña brava	*	G5	N3				
	Crysophila warscewiczii	palma guagara	*	G3	N3				
	Desmoncus isthmius	matamba	*	G3	N3				
	Elaeis oleifera	palma aceitera	*	G5	N3				
	Oenocarpus mapora	maquenque	*	G4	N3				
BROMELIACEAE	*Aechmea magdalenae*	pita	*	G5	N3				
CYCLANTHACEAE	*Carludovica palmata*	sombrero panamá	*	G5	N3				
CYPERACEAE	*Cyperus sp.*		*						
MARANTACEAE	*Calathea sp.*	bijao	*						
ORCHIDACEAE	*Brassavola nodosa*	dama de la noche	*	G4	N3			AII	
	Dichaea panamensis	orquidea	*					AII	
	Epidendrum difforme	orquidea	*					AII	
	Oncidium stipitatum	orquidea	*	G3	N3			AII	
POACEAE	*Chusquea sp.*	caricillo	*						
	Scleria sp.		*						
ZINGIBERACEAE	*Costus sp.*	gengibre	*						

Nota: RG: Global Rank; **RN:** Nacional Rank, **END:** Endémic Species; **N:** National; **EPL:** Protected by National Wildlife Laws, **CITES**: Apéndice I (AI), Apéndice II (AII); **IUCN: CR:** Critically in Danger; **E:** In Danger; **I:** Indetermined, **R:** Rare, **V:** Vulnerable. Cultivated Species (c), Naturalized Species (n), Aquatic (a).

Table EA-23: Bird Species Identified at Site T2

GAME BIRDS				T2	Global	National	END	EPL	CITES	UICN
ORDER	FAMILY	SPECIES	COMMON NAME		Rank	Rank		Panama		
COLUMBIFORMES	COLUMBIDAE	*Columba cayennensis*	paloma colorada	*	G5	N5		x		
		Leptotila v. verreauxi	paloma rabiblanca	*	G5	N5				
PICIFORMES	RAMPHASTIDAE	*Ramphastos sulfuratus*	tucán pico iris	*	G4	N4			AII	
PSITTACIFORMES	PSITTACIDAE	*Amazona farinosa*	amazona harinoso	*	G4	N4			AII	
		Amazona ochrocephala	amazona coroniamarillo	*	G4	N4		x	AII	
		Brotogeris j. jugularis	perico barbinaranja	*	G5	N5		x	AII	
FOREST BIRDS				**T2**	**Global**	**National**	**END**	**EPL**	**CITES**	**UICN**
ORDER	**FAMILY**	**SPECIES**	**COMMON NAME**		**Rank**	**Rank**		**Panama**		
CHARADRIIFORMES	JACANIDAE	*Jacana jacana hypomelaena*	jacana carunculada	*	G5	N5				
CICONIIFORMES	ARDEIDAE	*Ardea h. herodias*	garza azul mayor	*	G5	NN				
		Casmerodius albus egretta	garceta grande	*	G5	N5				
		Egretta caerulea	garza azul chica	*	G5	N5				
		Egretta t. thula	garceta nívea	*	G5	N5				
		Trigrisoma l. lineatum	garza tigre castaña	*						
PELICANIFORMES	ANHINGIDAE	*Anhinga anhinga*	aninga	*	G5	N4				
APODIFORMES	TROCHILIDAE	*Amazilia t. tzacatl*	amazilia colirrufa	*	G5	N5			AII	
		Phaethornis superciliosus	ermitaño colilargo	*	G5	N5				
PASSERIFORMES	DENDROCOLAPTIDAE	*Deconychura longicauda*	trepatroncos colilargo	*						
	EMBERIZIDAE	*Cyanerpes cyaneus carneipes*	mielero patirrojo	*	G5	N5				
		Eucometis penicillata cristata	tangara cabecigris	*	G4	N4				
		Ramphocelus d. dimidiatus	sangre de toro	*	G5	N5				
		Tachyphonus luctuosus	tangara hombriblanca	*	G5	N5				
		Thraupis episcopus cana	tangara azuleja	*	G5	N5				
	FORMICARIDAE	*Hylophylax n. naevioides*	hormiguero collarejo	*	G4	N4				
		Myrmeciza exsul	hormiguero dorsicastaño	*	G4	N4				
	HIRUNDINIDAE	*Riparia riparia*	martín arenero	*	G5	NN/BBS				
		Stelgidopteryx ruficollis	golondrina-alirrasposa sureña	*	G5	N5				
		Tachycineta a. albilinea	golondrina manglera	*	G3	N3				
	ICTERIDAE	*Cacicus cela vitellinus*	cacique lomiamarillo	*						
	MUSCICAPIDAE	*Turdus grayi casius*	mirlo pardo	*	G5	N5				
	PIPRIDAE	*Chiroxiphia lanceolata*	saltarín coludo	*	G4	N4				
		Pipra coronata	saltarín coroniceleste	*	G5	N5				
		Pipra mentalis ignifera	saltarín cabecirrojo	*	G4	N4				
	TYRANNIDAE	*Conopias albovittata*	mosquero blanquianillado	*						
		Myiozetetes similis	mosquero social	*	G5	N5				
		Tyrannus melancholicus	tirano tropical	*	G5	N5				

Note:
RG: Global Rank; **RN**:National Rank, **BBS:** Migratory species in decline (Breeding Bird Survey)
END: Endémic; N: National; B: Binacional, Costa Rica and Panamá, **B2:** Southern Pacific portion of Central America; **EPL:** Proteced by National Wildlife Laws
CITES: Apéndice 1 (1), Apéndice 2 (2); **IUCN:CR:** Critically in Danger; **EN:** In Danger, **VU:** Vulnerable.

Table EA-24: Mammal Species Identified at Site T2

CLASS MAMMALIA				T2	Global	National	END	EPL	CITES	UICN
ORDER	FAMILY	SPECIES	COMMON NAME		Rank	Rank		Panama		
XENARTHRA	MYRMECOPHAGIDAE	*Tamandua mexicana*	hormiguero	*	G5	N3		x		
	DASYPODIDAE	*Dasypus novemcinctus*	armadillo de nueve bandas	*	G5	N5		x		
CHIROPTERA	PHYLLOSTOMIDAE	*Carollia perspicillata*	murciélago frugivoro	*	G5	N5				
		Artibeus jamaicensis	murciélago frugivoro	*	G5	N5				
		Artibeus lituratus	murciélago frugivoro	*	G5	N5				
RODENTIA	DASYPROCTIDAE	*Dasyprocta punctata*	ñeque	*	G5	N5		x		
	ECHIMYIDAE	*Proechimys semispinosus*	rata espinosa - mocangué	*	G5	N5				
	HYDROCHAERIDAE	*Hydrochaeris hydrochaeris*	capybara - poncho	*	G5	N5		x		
LAGOMORPHA	LEPORIDAE	*Sylvilagus brasiliensis*	muleto	*	G5	G5				
CARNIVORA	PROCYONIDAE	*Nasua narica*	gato solo	*	G5	N5		x		
		Procyon lotor	mapache - gato manglatero	*	G5	N5		x		
ARTIODACTYLA	TAYASSUIDAE	*Tayassu tajacu*	saíno	*	G5	N5		x	AII	
	CERVIDAE	*Odocoileus virginianus*	venado cola blanca	*	G5	N5		x		

Note:
END: Endémic; N: National;B: Binational, Costa Rica y Panamá, **B2:** Southern Pacific Side of Central
EPL: Protected nationally; CITES : Apéndice 1 (1), Apéndice 2 (2); **IUCN:CR:** Critically in Danger; **EN:** In danger, **VU:** Vulnerable.

Table EA-25: Amphibian and Reptile Species Identified at Site T2

CLASS REPTILIA				T2	Global	National	END	EPL	CITES	UICN
FAMILY	FAMILIA	SPECIES	COMMON NAME		Rank	Rank		Panama		
CROCODYLIA	CROCODYLIDAE	*Crocodylus acutus*	lagarto aguja	*	G2	N2		X	AI	VU
SQUAMATA	BOIDAE	*Boa constrictor*	boa	*	G5	N4		X	AI - AII	
	COLUBRIDAE	*Oxybelis brevirostris*	bejuquilla verde	*	G5	N5				
		Oxybelis aeneus	bejuquilla chocolate	*	G5	N4				
	CORYTOPHANIDAE	*Basiliscus basiliscus*	meracho	*	G4	N4				
	GEKKONIDAE	*Gonatodes albogularis*	cabeza naranja	*	G5	N4				
		Iguana iguana	iguana verde	*	G4	N3		X	AII	
	TEIIDAE	*Ameiva ameiva*	borriguero	*	G5	N5				
		Ameiva festiva	borriguero	*	G5	N4				
	VIPERIDAE	*Bothrops asper*	serpiente equis	*	G5	N5				
TESTUDINES	EMYDIDAE	*Trachemys scripta*	tortuga	*	G5	N4				

CLASS AMPHIBIANS				T2	Global	National	END	EPL	CITES	UICN
ORDEN	FAMILIA	ESPECIE	NOMBRE COMUN		Rank	Rank		Panama		
ANURA	BUFONIDAE	*Bufo marinus*	sapo	*	G5	N5				
		Bufo typhonius	sapo	*	G5	N4				
	DENDROBATIDAE	*Colostethus inguinalis*		*	G3G4	N3				

Note:

END: Endémic; N: National;B: Binational, Costa Rica y Panamá, **B2:** Southern Pacific Side of Central

EPL: Protected nationally; CITES: Apéndice 1 (1), Apéndice 2 (2); **IUCN:CR:** Critically in Danger; **EN:** In danger, **VU:** Vulnerable.

Table EA-26: Flora Species Identified at Site T4

Vegetation			Global Rank	National Rank	END	EPL Panameñas	CITES	UICN
Family	Species	Common Name						
ACANTHACEAE	*Aphelandra scabra*		G5	N5				
ANACARDIACEAE	*Anacardium excelsum*	espavé	G5	N5				
	Astronium graveolens	zorro	G4	N3				
	Spondias mombin	jobo	G5	N5				
ANNONACEAE	*Annona hayesii*	chirimoya	G3	N3				
	Annona spraguei	chirimoya	G3	N3				
ARACEAE	*Dieffenbachia longispatha*	otoe lagarto	G4	N3				
ARALIACEAE	*Dendropanax arboreus*	muñequito	G5	N5				
	Schefflera morototoni	guarumo de pava	G5	N4				
ARECACEAE	*Astrocarium standleyanum*	chunga	G4	N2				
	Bactris major	caña brava	G5	N3				
	Desmoncus isthmius	matamba	G3	N3				
	Elaeis oleifera	palma aceitera	G5	N3				
	Oenocarpus mapora	maquenque	G4	N3				
	Roystonea regia (c)	palma real	G4	NE				
BIGNONIACEAE	*Godmania aesculifolia*	cacho del diablo						
	Pithecoctenium cruciqerum		G5	N5				
	Tabebuia rosea	roble	G5	N5				
BOMBACACEAE	*Ochroma pyramidale* (c)	balso	G5	N5				
	Pseudobombax septenatum	barrigón	G5	N4				
BORAGINACEAE	*Cordia alliodora*	laurel	G5	N5				
BROMELIACEAE	*Tillansia flexuosa*	barba de chivo	G4	N3				
CECROPIACEAE	*Cecropia peltata*	guarumo	G5	N5				
CRYSOBALANACEAE	*Hirtella racemosa*	camaroncillo	G5	N5				
COCHLOSPERMACEAE	*Cochlospermum vitifolium*	poro - poro	G5	N5				
COMBRETACEAE	*Terminalia oblonga*	guayabo de montaña	G5	N5				
CONNARACEAE	*Connarus panamensis*		G5	N5				
CYCLANTHACEAE	*Carludovica palmata*	sombrero panamá	G5	N3				
CYPERACEAE	*Cyperus sp.*							
EUPHORBIACEAE	*Croton billbergianus*	sangrillo	G5	N5				
FAB-CAESALPINIOIDEAE	*Swartzia simplex*	naranjillo	G5	N5				
FAB-FABOIDEAE	*Andira inermis*	harino	G5	N5				
FAB-FABOIDEAE	*Erythrina fusca*	palo santo	G5	N5				
FAB-FABOIDEAE	*Hymenaea courbaril*	algarrobo	G5	N4				
FAB-FABOIDEAE	*Ormosia macrocalyx*	coralillo						
FAB-MIMOSOIDEAE	*Albizia adinocephala*		G4	N2				
FAB-MIMOSOIDEAE	*Cassia moschata*	caña fistula	G4	N3				
FAB-MIMOSOIDEAE	*Cojoba rufescens*	coralillo	G4	N4				
FAB-MIMOSOIDEAE	*Enterolobium cyclocarpum*	corotú	G5	N4				
FAB-MIMOSOIDEAE	*Inga acuminata*	guabo de monte	G3	N3				
FAB-MIMOSOIDEAE	*Inga punctata*	guabito cansa boca	G5	N5				
FAB-MIMOSOIDEAE	*Inga sapindoides*	guabo de monte	G4	N4				
FAB-MIMOSOIDEAE	*Inga sp.*	guabo de monte						
FLACOURTIACEAE	*Casearia arguta*	pica lengua	G4	N3				
	Lacistema aggregatum	huesito	G5	N5				
	Zuelania guidonea	árbol caspa	G5	N3				
HELICONIACEAE	*Heliconia latispatha*	chichica	G5	N4				
LAURACEAE	*Nectandra turbacensis*	sigua	G3	N3				
	Ocotea puberula	sigua	G3	N3				
	Phoebe cinnamomifolia	sigua blanca	G5	N5				
LECYTHIDACEAE	*Gustavia superba*	membrillo	G5	N4				
MALPIGHIACEAE	*Bunchosia corniflora*							
MARANTACEAE	*Calathea latifolia*	bijao	G5	N5				
MELASTOMATACEAE	*Miconia argentea*	papelillo	G5	N5				
MELIACEAE	*Guarea glabra*	cedro macho	G5	N5				
MORACEAE	*Ficus insipida*	higuerón	G5	N4				
	Ficus maxima	higuerón	G3	N3				
	Ficus sp.	higuerón						

Vegetation (Cont.)			Global	National	END	EPL	CITES	UICN
Family	**Species**	**Common Name**	**Rank**	**Rank**		**Panameñas**		
MYRISTICACEAE	*Virola sebifera*	velario colorado	G5	N3				
MYRSINACEAE	*Ardisia sp.*	raspa lengua						
MYRTACEAE	*Myrcia gatunensis*	pimiento	G2	N2	N			
NYCTAGINACEAE	*Neea sp.*							
ORCHIDACEAE	*Dichaea panamensis*	orquidea				x		
	Epidendrum difforme	orquidea				x		
PASSIFLORACEAE	*Passiflora ambigua*	pasionaria	G3	N3				
	Passiflora foetida	calzoncillo	G5	N5				
	Passiflora vitifolia	pasionaria	G5	N5				
PIPERACEAE	*Piper marginatum*	hinojo	G5	N5				
	Piper reticulatum	hinojo	G5	N4				
POACEAE	*Chusquea sp.*	caricillo						
	Hyparrhenia rufa	paja faragua	G5	NE				
	Panicum maximum	paja de guinea	G5	NE				
	Paspalum plicatulum	paspalum	G5	N4				
	Saccharum spontaneum (n)	paja canalera	G5	NE				
POLYGONACEAE	*Coccoloba obovata*		G4	N4				
	Coccoloba sp.							
	Triplaris cumingiana	guayabo hormiguero	G4	N3				
RUBIACEAE	*Alibertia edulis*	madroño - trompito	G5	N4				
	Antirhea trichantha	mazanuco	G2	N2				
	Faramea occidentalis	benjamín - garrotillo	G5	N3				
	Genipa americana	jagua	G5	N4				
	Psychotria sp.	cafecillo						
RUTACEAE	*Zanthoxylum setolosum*	tachuelo - arcabú						
SAPINDACEAE	*Cupania rufescens*	gorgojero colorao	G5	N3				
	Cupania scrobiculata	gorgojero						
	Cupania sylvatica	gorgojero	G3	N3				
	Matayba glaberrima	matillo	G3	N3				
	Matayba scrobiculata	matillo	G4	N3				
SAPOTACEAE	*Chrysophyllum cainito* (c)	caimito	G5	N5				
STERCULIACEAE	*Guazuma ulmifolia*	negrito	G5	N5				
	Herrania purpurea	cacao de monte	G3	N3				
	Sterculia apetala	árbol panamá	G5	N4				
TILIACEAE	*Apeiba tibourbou*	peine de mono	G5	N5				
	Luehea seemannii	guácimo colorado	G5	N4				
	Luehea speciosa	guácimo	G5	N4				
ZINGIBERACEAE	*Costus sp.*	gengibre						

Note:

GR: Global Rank; NR: National Rank, END: Endemic Species N: Nacional; CITES: Apéndix 1 (1), Apéndix (2); IUCN:CR: Crítically Endangered; E: Endangered; I: Indetermined, R: Rare , V: Vulnerable.

Species (n): Introduced species accepted as part of natural resources
Species (c): Species used for labndscaping and other uses

Table EA-27: Bird Species Identified at Site T4

Game Birds				Global Rank	National Rank	END	EPL National	CITES	UICN
ORDER	Family	Species	Common Name						
COLUMBIFORMES	COLUMBIDAE	*Leptotila v. verreauxi*	paloma rabiblanca	G5	N5				
PICIFORMES	RAMPHASTIDAE	*Pteroglossus t. torquatus*	tucancillo collarejo	G4	N4				
		Ramphastos sulfuratus	tucán pico iris	G4	N4			AII	
PSITTACIFORMES	PSITTACIDAE	*Amazona ochrocephala*	amazona coroniamarillo	G4	N4		x	AII	
		Brotogeris j. jugularis	perico barbinaranja	G5	N5		x	AII	
Wild Birds				**Global Rank**	**National Rank**	**END**	**EPL National**	**CITES**	**UICN**
ORDER	**Family**	**Species**	**Common Name**						
CICONIIFORMES	ARDEIDAE	*Egretta caerulea*	garza azul chica	G5	N5				
		Egretta t. thula	garceta nívea	G5	N5				
FALCONIFORMES	CATHARTIDAE	*Coragyps atratus*	gallinazo negro	G5	N5				
	FALCONIDAE	*Milvago chimachima*	caracara cabeciamarilla	G5	N5			AII	
COLUMBIFORMES	COLUMBIDAE	*Columbina talpacoti*	tortolita rojiza	G5	N5				
CAPRIMULGIFORMES	CUCULIDAE	*Piaya cayana thermophila*	cuco ardilla	G5	N5				
APODIFORMES	TROCHILIDAE	*Amazilia t. tzacatl*	amazilia colirrufa	G5	N5			AII	
		Chlorostilbon assimilis	esmeralda jardinera	G4	N4	B2			
		Phaethornis longuemareus	ermitaño chico	G5	N5				
		Phaethornis superciliosus	ermitaño colilargo	G5	N5				
TROGONIFORMES	TROGONIDAE	*Trogon massena hoffmanni*	trogón colipizarra	G4	N4				
CORACIIFORMES	ALCEDINIDAE	*Chloroceryle americana*	martín pescador verde	G5	N5				
PICIFORMES	BUCCONIDAE	*Notharchus macrorhynchus*	buco cuelliblanco	G5	N4				
	PICIDAE	*Melanerpers rubricapillus*	carpintero coronirrojo	G5	N5				
PASSERIFORMES	DENDROCOLAPTIDAE	*Deconychura longicauda*	trepatroncos colilargo						
		Xiphorhynchus guttatus nanus	trepatroncos gorgianteado	G5	N5				
	EMBERIZIDAE	*Cyanerpes cyaneus carneipes*	mielero patirrojo	G5	N5				
		Eucometis penicillata cristata	tangara cabecigris	G4	N4				
		Euphonia luteicapilla	eufonia coroniamarilla	G4	N4				
		Ramphocelus d. dimidiatus	sangre de toro	G5	N5				
		Tachyphonus luctuosus	tangara hombriblanca	G5	N5				
		Thraupis episcopus cana	tangara azuleja	G5	N5				
		Thraupis palmarum atripennis	tangara palmera	G5	N5				
		Volatinia jacarina splendens	semillero negriazulado	G5	N5				
	FORMICARIIDAE	*Hylophylax n. naevioides*	hormiguero collarejo	G4	N4				
		Microrhopias quixensis virgata	hormiguerito alipunteado	G5	N5				
		Myrmeciza exsul	hormiguero dorsicastaño	G4	N4				
		Thamnophilus doliatus nigricristatus	batará barreteado	G5	N5				
	ICTERIDAE	*Cacicus cela vitellinus*	cacique lomiamarillo						
	MUSCICAPIDAE	*Turdus grayi casius*	mirlo pardo	G5	N5				
	PARULIDAE	*Seiurus n. noveboracensis*	reinita-acuática norteña	G5	NN				
	PIPRIDAE	*Pipra coronata*	saltarín coroniceleste	G5	N5				
		Pipra mentalis ignifera	saltarín cabecirrojo	G4	N4				
	TYRANNIDAE	*Elaenia flavogaster pallidorsalis*	elania penachuda	G5	N5				
		Myiarchus panamensis	copetón panameño	G4	N4				
		Myiozetetes similis columbianus	mosquero social	G5	N5				
		Tyrannus melancholicus chloronotus	tirano tropical	G5	N5				

Table EA-28: Mammal Species Identified at Site T4

Mammals				Global	National	END	EPL	CITES	UICN
ORDER	Family	Species	Common Name	Rank	Rank		Panameñas		
DIDELPHIMORPHIA	DIDELPHIDAE	*Didelphis marsupialis*	zorra común	G5	N5				
XENARTHRA	MYRMECOPHAGIDAE	*Tamandua mexicana*	hormiguero	G5	N3		x		
	BRADYPODIDAE	*Bradypus variegatus*	perezoso de tres dedos	G5	N5				
	DASYPODIDAE	*Dasypus novemcinctus*	armadillo de nueve bandas	G5	N5		x		
CHIROPTERA	PHYLLOSTOMIDAE	*Carollia perspicillata*	murciélago frugívoro	G5	N5				
		Artibeus jamaicensis	murciélago frugívoro	G5	N5				
		Artibeus lituratus	murciélago frugívoro	G5	N5				
RODENTIA	DASYPROCTIDAE	*Dasyprocta punctata*	ñeque	G5	N5		x		
	MURIDAE	*Oryzomys sp.*	rata arrocera						
	SCIURIDAE	*Sciurus granatensis*	ardilla colorada	G5	N5				
LAGOMORPHA	LEPORIDAE	*Sylvilagus brasiliensis*	muleto	G5	G5				
CARNIVORA	PROCYONIDAE	*Nasua narica*	gato solo	G5	N5		x		
		Potos flavus	kinkajou - cusumbí	G5	N5				
ARTIODACTYLA	CERVIDAE	*Odocoileus virginianus*	venado cola blanca	G5	N5		x		

Table EA-29: Amphibian and Reptile Species Identified at Site T4

REPTILES				Global	National	END	EPL	CITES	UICN
ORDER	Family	Species	Common Name	Rank	Rank		Panameñas		
SQUAMATA	BOIDAE	*Boa constrictor*	boa	G5	N4		x	AI - AII	
	COLUBRIDAE	*Oxybelis aeneus*	bejuquilla chocolate	G5	N4				
	CORYTOPHANIDAE	*Basiliscus basiliscus*	meracho	G4	N4				
	GEKKONIDAE	*Gonatodes albogularis*	cabeza naranja	G5	N4				
	IGUANIDAE	*Iguana iguana*	iguana verde	G4	N3		x	AII	
	TEIIDAE	*Ameiva ameiva*	borriguero	G5	N5				
		Ameiva festiva	borriguero	G5	N4				
	VIPERIDAE	*Bothrops asper*	serpiente equis	G5	N5				
	BUFONIDAE	*Bufo marinus*	sapo	G5	N5				
		Bufo typhonius	sapo	G5	N4				
ANURA	DENDROBATIDAE	*Colostethus inguinalis*		G3G4	N3				
	LEPTODACTYLIDAE	*Eleutherodactylus fitzingeri*		G5	N4				
TESTUDINES	EMYDIDAE	*Trachemys scripta*	tortuga	G5	N4				

Table EA-30: Flora Identified at Site T7

CLASS MAGNOLIOPSIDA			T7	Global	National	END	EPL	CITES	UICN
FAMILY	SPECIES	COMMON NAME		Rank	Rank		panameñas		
	Trichantera gigantea	palo de agua	*						
ANACARDIACEAE	*Anacardium excelsum*	espavé	*	G5	N5				
	Astronium graveolens	zorro	*	G4	N3				
	Mangifera indica (c)	mango	*	G5	NE				
	Spondias mombin	jobo	*	G5	N5				
	Spondias purpurea (c)	ciruela traquedora	*						
ANNONACEAE	*Annona hayesii*	chirimoya	*	G3	N3				
	Annona muricata (c)	guanabana	*	G5	N4				
	Annona spraguei	chirimoya	*	G3	N3				
	Desmopsis panamensis	yaya	*						
	Xylopia frutescens	malegueto macho	*	G5	N4				
APOCYNACEAE	*Thevetia ahioua*	huevo de gato	*	G5	N5				
ARALIACEAE	*Dendropanax arboreus*	muñequito	*	G5	N5				
	Sciadodendron excelsum	jobo lagarto	*	G4	N3				
ASTERACEAE	*Vernonanthura patens*		*	G5	N5				
BIGNONIACEAE	*Godmania aesculifolia*	cacho del diablo	*						
BOMBACACEAE	*Cavanillesia platanifolia*	cuipo	*	G5	N4				
	Pachira quinata	cedro espino	*	G5	N2				VU
	Pachira sessilis	yuco de monte	*	G5	N4				
	Pseudobombax septenatum	barrigón	*	G5	N4				
BORAGINACEAE	*Cordia alliodora*	laurel	*	G5	N5				
BURSERACEAE	*Bursera simaruba*	almácigo - carate	*	G5	N5				
CECROPIACEAE	*Cecropia peltata*	guarumo	*	G5	N5				
CHRYSOBALANACEAE	*Hirtella racemosa*	camaroncillo	*	G5	N5				
CLUSIACEAE	*Vismia sp.*		*						
COCHLOSPERMACEAE	*Cochlospermum vitifolium*	poro - poro	*	G5	N5				
COMBRETACEAE	*Terminalia amazonia*	amarillo	*	G5	N4				
CONNARACEAE	*Connarus panamensis*		*	G5	N5				
DILLENIACEAE	*Davilla sp.*		*						
ELAEOCARPACEAE	*Mutingia calabura*	periquito -majaguillo	*						
ERYTHROXYLACEAE	*Erythroxylum sp.*		*						
EUPHORBIACEAE	*Adelia triloba*		*	G5	N5				
	Phyllanthus acuminatus		*						
	Sapium glandulosum	cauchillo	*						
FAB-CAESALPINIOIDEAE	*Bauhinia sp.*	escalera de mono	*						
FAB-CAESALPINIOIDEAE	*Cassia moschata*	caña fistula	*	G4	N3				
FAB-CAESALPINIOIDEAE	*Hymenaea courbaril*	algarrobo	*	G5	N4				
FAB-CAESALPINIOIDEAE	*Swartzia simplex*	naranjillo	*	G5	N5				
FAB-FABOIDEAE	*Andira inermis*	harino	*	G5	N5				
FAB-FABOIDEAE	*Crotalaria sp.*		*						
FAB-FABOIDEAE	*Dalbergia retusa*	cocobolo	*	G4	N4		X		VU
FAB-FABOIDEAE	*Erythrina fusca*	palo santo	*	G5	N5				
FAB-FABOIDEAE	*Flemingia strobilifera*		*	G5	NE				
FAB-FABOIDEAE	*Lennea viridiflora*	algarrobillo	*			N			
FAB-MIMOSOIDEAE	*Acacia melanoceras*	cachito	*	G4	N2				
FAB-MIMOSOIDEAE	*Adenopodia polystachya*		*						
FAB-MIMOSOIDEAE	*Albizia adinocephala*		*	G4	N2				
FAB-MIMOSOIDEAE	*Chloroleucon mangense*		*						

CLASS MAGNOLIOPSIDA			T7	Global	National	END	EPL	CITES	UICN
FAMILY	SPECIES	COMMON NAME		Rank	Rank		panameñas		
FAB-MIMOSOIDEAE	*Cojoba rufescens*	coralillo	*	G4	N4				
FAB-MIMOSOIDEAE	*Enterolobium cyclocarpum*	corotú	*	G5	N4				
FAB-MIMOSOIDEAE	*Inga hayesii*	guabo	*	G3	N3				LR
FAB-MIMOSOIDEAE	*Inga laurina*	guabito cansa boca	*						
FLACOURTIACEAE	*Casearia arguta*	pica lengua	*	G4	N3				
	Casearia commersoniana	corta lengua - mauro	*	G5	N5				
	Lacistema aggregatum	huesito	*	G5	N5				
	Zuelania guidonea	árbol caspa	*	G5	N3				
LAURACEAE	*Phoebe cinnamomifolia*	sigua blanca	*	G5	N5				
LECYTHIDACEAE	*Gustavia superba*	membrillo	*	G5	N4				
LOGANIACEAE	*Strychnos sp.*		*						
MALPIGHIACEAE	*Byrsonima crassifolia* (c)	nance	*	G5	N5				
MELASTOMATACEAE	*Clidemia sp.*		*						
	Miconia argentea	papelillo	*	G5	N5				
	Miconia minutiflora	copo de nieve	*	G4	N4				
MELIACEAE	*Cedrela odorata*	cedro amargo	*	G4	N4		X		VU
	Guarea glabra	cedro macho	*	G5	N5				
MORACEAE	*Ficus insipida*	higuerón	*	G5	N4				
	Trophis racemosa	lechosa	*	G5	N4				
MYRSINACEAE	*Ardisia sp.*	raspa lengua	*						
MYRTACEAE	*Calycolpus warszewiczianus*	guayabillo	*	G3	N3				
	Myrcia gatunensis	pimiento	*	G2	N2				
OCHNACEAE	*Ouratea lucens*	caidita	*	G5	N5				
PASSIFLORACEAE	*Passiflora ambigua*	pasionaria	*	G3	N3				
	Passiflora foetida	calzoncillo	*	G5	N5				
	Passiflora vitifolia	pasionaria	*	G5	N5				
PIPERACEAE	*Piper aduncum*	hinojo	*	G5	N5				
	Piper aequale	hinojo	*	G5	N5				
	Piper hirtellipetiollum	hinojo	*			N			
	Piper marginatum	hinojo	*	G5	N5				
	Piper reticulatum	hinojo	*	G5	N4				
POLYGONACEAE	*Coccoloba sp.*		*						
	Triplaris cumingiana	guayabo hormiguero	*	G4	N3				
PROTEACEAE	*Roupala montana*	carne asado	*	G5	N4				
RHAMNACEAE	*Colubrina heteroneura*	carbonero	*						
RUBIACEAE	*Alibertia edulis*	madroño - trompito	*	G5	N4				
	Alseis blackiana	mameicillo	*	G3	N3				
	Antirhea trichantha	mazanuco	*	G2	N2				
	Calycophyllum candidissimum	alazano - guayabo	*	G4	N3				
	Coussarea curvigemmia	huesito	*	G3	N3				
	Faramea occidentalis	benjamín - garrotillo	*	G5	N3				
	Genipa americana	jagua	*	G5	N4				
	Posoqueria latifolia	boca de vieja	*	G5	N5				
	Psychotria sp.	cafecillo	*						
	Randia sp.	rosetillo	*						
	Rosenbergiodendron formosum		*	G4	N3				
RUTACEAE	*Zanthoxylum panamense*	cicuadro - tachuelo	*	G3	N3				
SAPINDACEAE	*Cupania rufescens*	gorgojero colorao	*	G5	N3				
	Cupania sylvatica	gorgojero	*	G3	N3				
	Matayba glaberrima	matillo	*	G3	N3				
	Serjania sp.		*						

CLASS MAGNOLIOPSIDA			T7	Global	National	END	EPL	CITES	UICN
FAMILY	SPECIES	COMMON NAME		Rank	Rank		panameñas		
SAPOTACEAE	*Chrysophyllum cainito* (c)	caimito	*	G5	N5				
SIMAROUBACEAE	*Quasia amara*	amargo	*						
SOLANACEAE	*Solanum sp.*		*	G5	N5				
STERCULIACEAE	*Guazuma ulmifolia*	negrito	*	G5	N5				
	Helicteres guazumaefolia	torcidillo	*	G4	N3				
	Sterculia apetala	árbol panamá	*	G5	N4				
THEOPHRASTACEAE	*Clavija mezii*		*						
TILIACEAE	*Apeiba tibourbou*	peine de mono	*	G5	N5				
	Luehea seemannii	guácimo colorado	*	G5	N4				
	Luehea speciosa	guácimo	*	G5	N4				
VERBENACEAE	*Lantana camara*	siete negritos	*	G5	N5				

CLASS LILIOPSIDA			T1	Global	National	END	EPL	CITES	UICN
FAMILY	SPECIES	COMMON NAME		Rank	Rank		panameñas		
ARACEAE	*Montrichardia arborescens* (a)	castaño	*	G4	N4				
ARECACEAE	*Attalea butyracea*	palma real	*	G3	N3				
	Bactris major	caña brava	*	G5	N3				
	Desmoncus isthmius	matamba	*	G3	N3				
	Elaeis oleifera	palma aceitera	*	G5	N3				
	Oenocarpus mapora	maquenque	*	G4	N3				
	Roystonea regia (c)	palma real	*	G4	NE				
BROMELIACEAE	*Aechmea magdalenae*	pita	*	G5	N3				
CYCLANTHACEAE	*Carludovica palmata*	sombrero panamá	*	G5	N3				
	Cyclanthus bipartitus		*	G5	N5				
HELICONIACEAE	*Heliconia latispatha*	chichica	*	G5	N4				
MARANTACEAE	*Calathea latifolia*	bijao	*	G5	N5				
ORCHIDACEAE	*Brassavola nodosa*	dama de la noche	*	G4	N3			All	
	Notylia pentachne	orquidea	*	G2	N2			All	
	Oeceoclades maculata	orquidea	*	G3	N3			All	
	Oncidium stipitatum	orquidea	*	G3	N3			All	
POACEAE	*Chusquea sp.*	caricillo	*						
	Hyparrhenia rufa	paja faragua	*	G5	NE				
	Saccharum spontaneum (n)	paja canalera	*	G5	NE				
	Scleria sp.		*						
ZINGIBERACEAE	*Costus sp.*	gengibre	*						

Nota: RG: Global Rank; **RN:** Nacional Rank, **END:** Endémic Species; **N:** National; **EPL:** Protected by National Wildlife Laws, **CITES**: Apéndice I (AI), Apéndice II (AII); **IUCN: CR:** Critically in Danger; **E:** In Danger; **I:** Indetermined, **R:** Rare, **V:** Vulnerable. Cultivated Species (c), Naturalized Species (n), Aquatic (a).

Table EA-31: Birds Identified at Site T7

GAME BIRDS				T7	Global	National	END	EPL	CITES	UICN
ORDER	FAMILY	SPECIES	COMMON NAME		Rank	Rank		Panama		
COLUMBIFORMES	COLUMBIDAE	*Leptotila v. verreauxi*	paloma rabiblanca	*	G5	N5				
GALLIFORMES	CRACIDAE	*Ortalis cinereiceps*	chachalaca cabecigris	*	G5	N3		x		
PICIFORMES	RAMPHASTIDAE	*Pteroglossus t. torquatus*	tucancillo collarejo	*						
		Ramphastos sulfuratus	tucán pico iris	*	G4	N4			All	
PSITTACIFORMES	PSITTACIDAE	*Amazona ochrocephala*	amazona coroniamarillo	*	G4	N4		x	All	
FOREST BIRDS				**T7**	**Global**	**National**	**END**	**EPL**	**CITES**	**UICN**
ORDER	**FAMILY**	**SPECIES**	**COMMON NAME**		**Rank**	**Rank**		**Panama**		
FALCONIFORMES	ACCIPITRIDAE	*Buteo brachyurus*	gavilán colicorto	*	G4	N4			All	
	FALCONIDAE	*Milvago chimachima*	caracara cabeciamarilla	*	G5	N5			All	
		Leptodon cayanensis	elanio cabecigris	*						
APODIFORMES	TROCHILIDAE	*Amazilia t. tzacatl*	amazilia colirrufa	*	G5	N5			All	
		Chlorostilbon assimilis	esmeralda jardinera	*	G4	N4	B2			
		Phaethornis superciliosus	ermitaño colilargo	*	G5	N5				
		Phaethornis longuemareus	ermitaño chico	*	G5	N5				
TROGONIFORMES	TROGONIDAE	*Trogon massena hoffmanni*	trogón colipizarra	*	G4	N4				
CORACIIFORMES	ALCEDINIDAE	*Chloroceryle americana*	martín pescador verde	*	G5	N5				
	MOMOTIDAE	*Momotus momota conexus*	momoto coroniazulado	*	G4G5	N4				
PICIFORMES	PICIDAE	*Melanerpers rubricapillus*	carpintero coronirrojo	*	G5	N5				
PASSERIFORMES	DENDROCOLAPTIDAE	*Deconychura longicauda*	trepatroncos colilargo	*						
		Xiphorhynchus guttatus nanus	trepatroncos gorgianteado	*	G5	N5				
	EMBERIZIDAE	*Ramphocelus d. dimidiatus*	sangre de toro	*	G5	N5				
		Sporophila americana hicksii	espiguero variable	*	G4	N4				
		Thraupis episcopus cana	tangara azuleja	*	G5	N5				
		Thraupis palmarum atripennis	tangara palmera	*	G5	N5				
		Volatinia jacarina splendens	semillero negriazulado	*	G5	N5				
	FORMICARIDAE	*Hylophylax n. naevioides*	hormiguero collarejo	*	G4	N4				
	HIRUNDINIDAE	*Hirundo rustica*	golondrina tijereta	*	G5	NN				
		Progne chalybea	martín pechigris	*	G5	N5				
		Riparia riparia	martín arenero	*	G5	NN/BBS				
	ICTERIDAE	*Cacicus cela vitellinus*	cacique lomiamarillo	*						
		Cassidix mexicanus	talingo	*	G5	N5				
	MUSCICAPIDAE	*Turdus grayi casius*	mirlo pardo	*	G5	N5				
	PIPRIDAE	*Chiroxiphia lanceolata*	saltarín coludo	*	G4	N4				
		Pipra mentalis ignifera	saltarín cabecirrojo	*	G4	N4				
	TROGLODYTIDAE	*Henicorhina leucophrys*	soterrey-selvático pechigris	*	G5	N4				
	TYRANNIDAE	*Elaenia flavogaster*	elania penachuda	*	G5	N5				
		Tyrannus melancholicus	tirano tropical	*	G5	N5				

Note:
RG: Global Rank; **RN:**National Rank, **BBS:** Migratory species in decline (Breeding Bird Survey)
END: Endémic; N: National; B: Binacional, Costa Rica and Panamá, **B2:** Southern Pacífic portion of Central America; **EPL:** Proteced by National Wildlife Laws
CITES: Apéndice 1 (1), Apéndice 2 (2); **IUCN:CR:** Critically in Danger; **EN:** In Danger, **VU:** Vulnerable.

Table EA-32: Mammals Identified at Site T7

CLASS MAMMALIA				T7	Global	National	END	EPL	CITES	UICN
ORDER	FAMILY	SPECIES	COMMON NAME		Rank	Rank		Panama		
XENARTHRA	DASYPODIDAE	*Dasypus novemcinctus*	armadillo de nueve bandas	*	G5	N5		x		
CHIROPTERA	PHYLLOSTOMIDAE	*Corallia castanea*	murcielago frugivoro	*	G5	N5				
		Carollia perspicillata	murciélago frugivoro	*	G5	N5				
		Artibeus jamaicensis	murciélago frugivoro	*	G5	N5				
		Artibeus lituratus	murciélago frugivoro	*	G5	N5				
RODENTIA	DASYPROCTIDAE	*Dasyprocta punctata*	ñeque	*	G5	N5		x		
	ECHIMYIDAE	*Proechimys semispinosus*	rata espinosa - mocangué	*	G5	N5				
LAGOMORPHA	LEPORIDAE	*Sylvilagus brasiliensis*	muleto	*	G5	G5				
CARNIVORA	PROCYONIDAE	*Nasua narica*	gato solo	*	G5	N5		x		
		Procyon lotor	mapache - gato manglatero	*	G5	N5		x		

Note:
END: Endémic; N: National;B: Binational, Costa Rica y Panamá, **B2:** Southern Pacific Side of Central
EPL: Protected nationally; CITES: Apéndice 1 (1), Apéndice 2 (2); **IUCN:CR:** Critically in Danger; **EN:** In danger, **VU:** Vulnerable.

Table EA-33: Amphibian and Reptile Species Identified at Site T7

CLASS REPTILIA				T7	Global	National	END	EPL	CITES	UICN
ORDER	FAMILY	SPECIES	COMMON NAME		Rank	Rank		Panama		
CROCODYLIA	CROCODYLIDAE	*Crocodylus acutus*	lagarto aguja	*	G2	N2		X	AI	VU
SQUAMATA	BOIDAE	*Boa constrictor*	boa	*	G5	N4		X	AI - AII	
	COLUBRIDAE	*Oxybelis brevirostris*	bejuguilla verde	*	G5	N5				
		Oxybelis aeneus	bejuguilla chocolate	*	G5	N4				
		Spilotes pullatus	cazadora	*	G5	N4				
	GEKKONIDAE	*Gonatodes albogularis*	cabeza naranja	*	G5	N4				
		Iguana iguana	iguana verde	*	G4	N3		X	AII	
	POLYCHROTIDAE	*Anolis auratus*		*	G4G5	N4				
	TEIIDAE	*Ameiva ameiva*	borriguero	*	G5	N5				
		Ameiva festiva	borriguero	*	G5	N4				
	VIPERIDAE	*Bothrops asper*	serpiente equis	*	G5	N5				
TESTUDINES	EMYDIDAE	*Trachemys scripta*	tortuga	*	G5	N4				

CLASS AMPHIBIANS				T7	Global	National	END	EPL	CITES	UICN
ORDER	FAMILY	SPECIES	COMMON NAME		Rank	Rank		Panama		
ANURA	BUFONIDAE	*Bufo marinus*	sapo	*	G5	N5				
		Bufo typhonius	sapo	*	G5	N4				
	DENDROBATIDAE	*Colostethus inguinalis*		*	G3G4	N3				
	LEPTODACTYLIDAE	*Eleutherodactylus fitzingeri*		*	G5	N4				

Note:

END: Endémic; N: National;B: Binational, Costa Rica y Panamá, **B2:** Southern Pacific Side of Central

EPL: Protected nationally; CITES: Apéndice 1 (1), Apéndice 2 (2); **IUCN:CR:** Critically in Danger; **EN:** In danger, **VU:** Vulnerable.

Table EA-34: Flora Species Identified at Site T8

CLASS MAGNOLIOPSIDA			T8	Global	National	END	EPL	CITES	UICN
FAMILY	SPECIES	COMMON NAME		Rank	Rank		panameñas		
ANACARDIACEAE	*Anacardium excelsum*	espavé	*	G5	N5				
	Spondias mombin	jobo	*	G5	N5				
ASTERACEAE	*Vernonanthura patens*		*	G5	N5				
BOMBACACEAE	*Ochroma pyramidale* (c)	balso	*	G5	N5				
	Pseudobombax septenatum	barrigón	*	G5	N4				
BORAGINACEAE	*Cordia alliodora*	laurel	*	G5	N5				
BURSERACEAE	*Bursera simaruba*	almácigo - carate	*	G5	N5				
CECROPIACEAE	*Cecropia peltata*	guarumo	*	G5	N5				
COCHLOSPERMACEAE	*Cochlospermum vitifolium*	poro - poro	*	G5	N5				
DILLENIACEAE	*Curatela americana*	chumico	*	G5	N5				
ELAEOCARPACEAE	*Mutingia calabura*	periquito -majaguillo	*						
FAB-CAESALPINIOIDEAE	*Cassia moschata*	caña fistula	*	G4	N3				
FAB-FABOIDEAE	*Erythrina fusca*	palo santo	*	G5	N5				
FAB-MIMOSOIDEAE	*Enterolobium cyclocarpum*	corotú	*	G5	N4				
FAB-MIMOSOIDEAE	*Pseudosamanea gauchapele*	guachapalí	*	G4	N2				
EUPHORBIACEAE	*Persea americana* (c)	aguacate	*	G5	N5				
MELIACEAE	*Cedrela odorata*	cedro amargo	*	G4	N4		X		VU
MORACEAE	*Ficus sp.*	higuerón	*						
	Ficus trigonata		*						
STERCULIACEAE	*Guazuma ulmifolia*	negrito	*	G5	N5				
	Helicteres guazumaefolia	torcidillo	*	G4	N3				
	Sterculia apetala	árbol panamá	*	G5	N4				
TILIACEAE	*Apeiba tibourbou*	peine de mono	*	G5	N5				
	Luehea seemannii	guácimo colorado	*	G5	N4				

CLASS LILIOPSIDA			T8	Global	National	END	EPL	CITES	UICN
FAMILY	SPECIES	COMMON NAME		Rank	Rank		panameñas		
POACEAE	*Bambusa sp.*	bambú	*						
	Hyparrhenia rufa	paja faragua	*	G5	NE				
	Panicum maximum	paja de guinea	*	G5	NE				
	Saccharum spontaneum (n)	paja canalera	*	G5	NE				

Nota: RG: Global Rank; **RN:** Nacional Rank, **END:** Endémic Species; **N:** National; **EPL:** Protected by National Wildlife Laws, **CITES**: Apéndice I (AI), Apéndice II (AII); **IUCN: CR:** Critically in Danger; **E:** In Danger; **I:** Indetermined, **R:** Rare, **V:** Vulnerable. Cultivated Species (c), Naturalized Species (n), Aquatic (a).

Table EA-35: Bird Species Identified at Site T8

	COASTAL BIRDS			T8	Global	National	END	EPL	CITES	UICN
ORDER	FAMILY	SPECIES	COMMON NAME		Rank	Rank		Panama		
PELICANIFORMES	FREGATIDAE	*Fregata magnificens*	fragata magnífica	*	G5	N5				
	PELICANIDAE	*Pelecanus occidentalis carolinensis*	pelícano marrón	*	G4	N4				
	PHALACROCORACIDAE	*Phalacrocorax o. olivaceus*	cormorán neotropical	*						
	GAME BIRDS			**T8**	**Global**	**National**	**END**	**EPL**	**CITES**	**UICN**
ORDER	**FAMILY**	**SPECIES**	**COMMON NAME**		**Rank**	**Rank**		**Panama**		
COLUMBIFORMES	COLUMBIDAE	*Leptotila v. verreauxi*	paloma rabiblanca	*	G5	N5				
PICIFORMES	RAMPHASTIDAE	*Ramphastos sulfuratus*	tucán pico iris	*	G4	N4			AII	
	FOREST BIRDS			**T8**	**Global**	**National**	**END**	**EPL**	**CITES**	**UICN**
ORDER	**FAMILY**	**SPECIES**	**COMMON NAME**		**Rank**	**Rank**		**Panama**		
FALCONIFORMES	ACCIPITRIDAE	*Pandion haliaetus*	águila pescadora	*	G5	NN				
PASSERIFORMES	EMBERIZIDAE	*Sporophila americana hicksii*	espiguero variable	*	G4	N4				
		Volatinia jacarina splendens	semillero negriazulado	*	G5	N5				
	HIRUNDINIDAE	*Hirundo rustica*	golondrina tijereta	*	G5	NN				
		Progne chalybea	martín pechigris	*	G5	N5				
		Riparia riparia	martín arenero	*	G5	NN/BBS				
		Stelgidopteryx ruficollis	golondrina-alirrasposa sureña	*	G5	N5				
		Stelgidopteryx s.serripennis	golondrina-alirrasposa norteña	*	G5	NN				
		Tachycineta a. albilinea	golondrina manglera	*	G3	N3				
	ICTERIDAE	*Cassidix mexicanus*	talingo	*	G5	N5				
	MIMIDAE	*Mimus gilvus*	sinsonte tropical	*	G5	NE				
	MUSCICAPIDAE	*Turdus grayi casius*	mirlo pardo	*	G5	N5				
	TYRANNIDAE	*Elaenia flavogaster*	elania penachuda	*	G5	N5				
		Myiozetetes similis	mosquero social	*	G5	N5				
		Tyrannus melancholicus	tirano tropical	*	G5	N5				
		Tyrannus savana monacha	tijereta sabanera	*	G5	N5				

Note:
RG: Global Rank; **RN**:National Rank, **BBS:** Migratory species in decline (Breeding Bird Survey)
END: Endémic; N: National; B: Binacional, Costa Rica and Panamá, **B2:** Southern Pacific portion of Central America; **EPL:** Proteced by National Wildlife Laws
CITES: Apéndice 1 (1), Apéndice 2 (2); **IUCN:CR:** Critically in Danger; **EN:** In Danger, **VU:** Vulnerable.

Table EA-36: Mammal Species Identified at Site T8

CLASS MAMMALIA				T8	Global	National	END	EPL	CITES	UICN
ORDER	FAMILY	SPECIES	COMMON NAME		Rank	Rank		Panama		
DIDELPHIMORPHIA	DIDELPHIDAE	*Didelphis marsupialis*	zorra común	*	G5	N5				
XENARTHRA	BRADYPODIDAE	*Bradypus variegatus*	perezoso de tres dedos	*	G5	N5				
	DASYPODIDAE	*Dasypus novemcinctus*	armadillo de nueve bandas	*	G5	N5		X		
CHIROPTERA	PHYLLOSTOMIDAE	*Carollia perspicillata*	murciélago frugivoro	*	G5	N5				
		Artibeus jamaicensis	murciélago frugivoro	*	G5	N5				
		Artibeus lituratus	murciélago frugivoro	*	G5	N5				
RODENTIA	DASYPROCTIDAE	*Dasyprocta punctata*	ñeque	*	G5	N5		X		
	MURIDAE	*Oecomys trinitatis*	gran rata arocera arborea	*						
CARNIVORA	PROCYONIDAE	*Nasua narica*	gato solo	*	G5	N5		X		

Note:
END: Endémic; N: National;B: Binational, Costa Rica y Panamá, **B2:** Southern Pacific Side of Central
EPL: Protected nationally; CITES: Apéndice 1 (1), Apéndice 2 (2); **IUCN:CR:** Critically in Danger; **EN:** In danger, **VU:** Vulnerable.

Table EA-37: Amphibian and Reptile Species Identified at Site T8

CLASS REPTILIA				T8	Global	National	END	EPL	CITES	UICN
ORDER	FAMILY	SPECIES	COMMON NAME		Rank	Rank		Panama		
CROCODYLIA	CROCODYLIDAE	*Crocodylus acutus*	lagarto aguja	*	G2	N2		X	AI	VU
SQUAMATA	COLUBRIDAE	*Oxybelis brevirostris*	bejuquilla verde	*	G5	N5				
		Oxybelis aeneus	bejuquilla chocolate	*	G5	N4				
	CORYTOPHANIDAE	*Basiliscus basiliscus*	meracho	*	G4	N4				
	GEKKONIDAE	*Gonatodes albogularis*	cabeza naranja	*	G5	N4				
	IGUANIDAE	*Iguana iguana*	iguana verde	*	G4	N3		X	AII	
	TEIIDAE	*Ameiva ameiva*	borriguero	*	G5	N5				
TESTUDINES	EMYDIDAE	*Trachemys scripta*	tortuga	*	G5	N4				

CLASS AMPHIBIANS				T8	Global	National	END	EPL	CITES	UICN
ORDER	FAMILY	SPECIES	COMMON NAME		Rank	Rank		Panama		
ANURA	BUFONIDAE	*Bufo marinus*	sapo	*	G5	N5				

Note:

END: Endémic; N: National;B: Binational, Costa Rica y Panamá, **B2:** Southern Pacific Side of Central

EPL: Protected nationally; CITES : Apéndice 1 (1), Apéndice 2 (2); **IUCN:CR:** Critically in Danger; **EN:** In danger, **VU:** Vulnerable.

Table EA-38: Flora Species Identified at Site T9

CLASS MAGNOLIOPSIDA			T9	Global	National	END	EPL	CITES	UICN
FAMILY	SPECIES	COMMON NAME		Rank	Rank		panameñas		
ANACARDIACEAE	*Anacardium excelsum*	espavé	*	G5	N5				
	Astronium graveolens	zorro	*	G4	N3				
	Spondias mombin	jobo	*	G5	N5				
ANNONACEAE	*Annona hayesii*	chirimoya	*	G3	N3				
	Annona spraguei	chirimoya	*	G3	N3				
	Xylopia frutescens	malegueto macho	*	G5	N4				
BIGNONIACEAE	*Tabebuia rosea*	roble	*	G5	N5				
BOMBACACEAE	*Pachira sessilis*	yuco de monte	*	G5	N4				
	Pseudobombax septenatum	barrigón	*	G5	N4				
BORAGINACEAE	*Cordia alliodora*	laurel	*	G5	N5				
	Cordia collococo	laurel blanco	*						
BURSERACEAE	*Protium tenuifolium*	chutra - cicuadro	*	G3	N3				
CAPPARIDACEAE	*Capparis frondosa*		*	G5	N3				
CECROPIACEAE	*Cecropia peltata*	guarumo	*	G5	N5				
CHRYSOBALANACEAE	*Hirtella racemosa*	camaroncillo	*	G5	N5				
CLUSIACEAE	*Vismia baccifera*	pinta moso	*						
COMBRETACEAE	*Terminalia amazonia*	amarillo	*	G5	N4				
ELAEOCARPACEAE	*Mutingia calabura*	periquito -majaguillo	*						
ERYTHROXYLACEAE	*Erythroxylum sp.*		*						
FAB-CAESALPINIOIDEAE	*Cassia moschata*	caña fistula	*	G4	N3				
FAB-CAESALPINIOIDEAE	*Hymenaea courbaril*	algarrobo	*	G5	N4				
FAB-CAESALPINIOIDEAE	*Swartzia simplex*	naranjillo	*	G5	N5				
FAB-FABOIDEAE	*Andira inermis*	harino	*	G5	N5				
FAB-FABOIDEAE	*Erythrina fusca*	palo santo	*	G5	N5				
FAB-FABOIDEAE	*Lonchocarpus latifolius*	peronil	*						
FAB-MIMOSOIDEAE	*Acacia melanoceras*	cachito	*	G4	N2				
FAB-MIMOSOIDEAE	*Cojoba rufescens*	coralillo	*	G4	N4				
FAB-MIMOSOIDEAE	*Inga hayesii*	guabo	*	G3	N3				LR
FAB-MIMOSOIDEAE	*Inga laurina*	guabito cansa boca	*						
FAB-MIMOSOIDEAE	*Inga sp.*	guabo de monte	*						
FLACOURTIACEAE	*Casearia commersoniana*	corta lengua - mauro	*	G5	N5				
	Casearia sylvestris		*	G5	N5				
	Lacistema aggregatum	huesito	*	G5	N5				
	Lindackeria laurina	carbonero	*	G5	N4				
	Zuelania guidonea	árbol caspa	*	G5	N3				
LECYTHIDACEAE	*Gustavia superba*	membrillo	*	G5	N4				
MELASTOMATACEAE	*Miconia argentea*	papelillo	*	G5	N5				
	Miconia minutiflora	copo de nieve	*	G4	N4				
MELIACEAE	*Guarea glabra*	cedro macho	*	G5	N5				
	Guarea guidonea	cedro	*	G4	N4				
	Trichilia hirta	conejo colorado	*	G5	N4				
MONIMIACEAE	*Siparuna pauciflora*	pasmo	*	G5	N4				
MORACEAE	*Ficus insipida*	higuerón	*	G5	N4				
	Ficus sp.	higuerón	*						
	Maclura tinctoria	palo mora	*	G5	N4				
	Trophis racemosa	lechosa	*	G5	N4				
MYRSINACEAE	*Ardisia sp.*	raspa lengua	*						
MYRTACEAE	*Myrcia gatunensis*	pimiento	*	G2	N2				
PASSIFLORACEAE	*Passiflora ambigua*	pasionaria	*	G3	N3				
	Passiflora foetida	calzoncillo	*	G5	N5				
	Passiflora vitifolia	pasionaria	*	G5	N5				
PIPERACEAE	*Piper aequale*	hinojo	*	G5	N5				
	Piper marginatum	hinojo	*	G5	N5				
POLYGONACEAE	*Coccoloba sp.*		*						
	Triplaris cumingiana	guayabo hormiguero	*	G4	N3				
PROTEACEAE	*Roupala montana*	carne asado	*	G5	N4				
RUBIACEAE	*Alibertia edulis*	madroño - trompito	*	G5	N4				
	Antirhea trichantha	mazanuco	*	G2	N2				
	Coussarea sp.		*						
	Faramea occidentalis	benjamín - garrotillo	*	G5	N3				

CLASS MAGNOLIOPSIDA			T9	Global	National	END	EPL	CITES	UICN
FAMILY	SPECIES	COMMON NAME		Rank	Rank		panameñas		
RUTACEAE	*Zanthoxylum panamense*	cicuadro - tachuelo	*	G3	N3				
SAPINDACEAE	*Cupania rufescens*	gorgojero colorao	*	G5	N3				
	Cupania scrobiculata	gorgojero	*						
	Matayba glaberrima	matillo	*	G3	N3				
	Sapindus saponaria	jaboncillo	*	G5	N3				
SAPOTACEAE	*Chrysophyllum cainito* (c)	caimito	*	G5	N5				
STERCULIACEAE	*Guazuma ulmifolia*	negrito	*	G5	N5				
TILIACEAE	*Apeiba tibourbou*	peine de mono	*	G5	N5				
	Luehea seemannii	guácimo colorado	*	G5	N4				
	Luehea speciosa	guácimo	*	G5	N4				
VERBENACEAE	*Aegiphila sp.*		*						

CLASS LILIOPSIDA			T9	Global	National	END	EPL	CITES	UICN
FAMILY	SPECIES	COMMON NAME		Rank	Rank		panameñas		
ARECACEAE	*Astrocarium standleyanum*	chunga	*	G4	N2				
	Attalea butyracea	palma real	*	G3	N3				
	Bactris major	caña brava	*	G5	N3				
	Crysophila warscewiczii	palma guagara	*	G3	N3				
	Desmoncus isthmius	matamba	*	G3	N3				
	Elaeis oleifera	palma aceitera	*	G5	N3				
	Oenocarpus mapora	maquenque	*	G4	N3				
CYCLANTHACEAE	*Carludovica palmata*	sombrero panamá	*	G5	N3				
ORCHIDIACEAE	*Notylia pentachne*	orquidea	*	G2	N2			AII	
	Oeceoclades maculata	orquidea	*	G3	N3			AII	
	Oncidium stipitatum	orquidea	*	G3	N3			AII	
POACEAE	*Chusquea sp.*	caricillo	*						

Nota: RG: Global Rank; **RN:** Nacional Rank, **END:** Endémic Species; **N:** National; **EPL:** Protected by National Wildlife Laws, **CITES**: Apéndice I (AI), Apéndice II (AII); **IUCN: CR:** Critically in Danger; **E:** In Danger; **I:** Indetermined, **R:** Rare, **V:** Vulnerable. Cultivated Species (c), Naturalized Species (n), Aquatic (a).

Table EA-39: Bird Species Identified at Site T9

GAME BIRDS				T9	Global	National	END	EPL	CITES	UICN
ORDER	FAMILY	SPECIES	COMMON NAME		Rank	Rank		Panama		
COLUMBIFORMES	COLUMBIDAE	*Columba cayennensis*	paloma colorada	*	G5	N5		x		
		Leptotila v. verreauxi	paloma rabiblanca	*	G5	N5				
PSITTACIFORMES	PSITTACIDAE	*Amazona ochrocephala*	amazona coroniamarillo	*	G4	N4		x	AII	
FOREST BIRDS				**T9**	**Global**	**National**	**END**	**EPL**	**CITES**	**UICN**
ORDER	**FAMILY**	**SPECIES**	**COMMON NAME**		**Rank**	**Rank**		**Panama**		
FALCONIFORMES	FALCONIDAE	*Chondrohierax u. uncinatus*	elanio piquiganchudo	*	G5	N3			AII	
APODIFORMES	TROCHILIDAE	*Amazilia t. tzacatl*	amazilia colirrufa	*	G5	N5			AII	
		Chlorostilbon assimilis	esmeralda jardinera	*	G4	N4	B2			
CORACIIFORMES	MOMOTIDAE	*Momotus momota conexus*	momoto coroniazulado	*	G4G5	N4				
PICIFORMES	PICIDAE	*Campephilus guatemalensis*	carpintero pico plata	*	G4	N4				
		Melanerpers rubricapillus	carpintero coronirrojo	*	G5	N5				
PASSERIFORMES	DENDROCOLAPTIDAE	*Xiphorhynchus guttatus nanus*	trepatroncos gorgianteado	*	G5	N5				
	EMBERIZIDAE	*Ramphocelus d. dimidiatus*	sangre de toro	*	G5	N5				
		Sporophila americana hicksii	espiguero variable	*	G4	N4				
		Thraupis episcopus cana	tangara azuleja	*	G5	N5				
		Thraupis palmarum atripennis	tangara palmera	*	G5	N5				
	FORMICARIDAE	*Hylophylax n. naevioides*	hormiguero collarejo	*	G4	N4				
	ICTERIDAE	*Cacicus cela vitellinus*	cacique lomiamarillo	*						
		Psarocolius wagleri	oropéndola cabecicastaña	*						
		Cassidix mexicanus	talingo	*	G5	N5				
		Scaphidura oryzivora	vaquero gigante	*						
	MIMIDAE	*Mimus gilvus*	sinsonte tropical	*	G5	NE				
	MUSCICAPIDAE	*Turdus grayi casius*	mirlo pardo	*	G5	N5				
	PIPRIDAE	*Pipra mentalis ignifera*	saltarín cabecirrojo	*	G4	N4				
	TYRANNIDAE	*Elaenia flavogaster*	elania penachuda	*	G5	N5				
		Myiozetetes similis	mosquero social	*	G5	N5				
		Tyrannus melancholicus	tirano tropical	*	G5	N5				
		Tyrannus savana monacha	tijereta sabanera	*	G5	N5				

Note:
RG: Global Rank; **RN**:National Rank, **BBS:** Migratory species in decline (Breeding Bird Survey)
END: Endémic; N: National; B: Binacional, Costa Rica and Panamá, **B2:** Southern Pacífic portion of Central America; **EPL:** Proteced by National Wildlife Laws
CITES: Apéndice 1 (1), Apéndice 2 (2); **IUCN:CR:** Critically in Danger; **EN:** In Danger, **VU:** Vulnerable.

Table EA-40: Mammal Species Identified at Site T9

CLASS MAMMALIA				T9	Global	National	END	EPL	CITES	UICN
ORDER	FAMILY	SPECIES	COMMON NAME		Rank	Rank		Panama		
DIDELPHIMORPHIA	DIDELPHIDAE	*Didelphis marsupialis*	zorra común	*	G5	N5				
XENARTHRA	DASYPODIDAE	*Dasypus novemcinctus*	armadillo de nueve bandas	*	G5	N5		X		
CHIROPTERA	PHYLLOSTOMIDAE	*Carollia perspicillata*	murciélago frugivoro	*	G5	N5				
		Artibeus jamaicensis	murciélago frugivoro	*	G5	N5				
		Artibeus lituratus	murciélago frugivoro	*	G5	N5				
RODENTIA	DASYPROCTIDAE	*Dasyprocta punctata*	ñeque	*	G5	N5		X		
	SCIURIDAE	*Sciurus granatensis*	ardilla colorada	*	G5	N5				
LAGOMORPHA	LEPORIDAE	*Sylvilagus brasiliensis*	muleto	*	G5	G5				
CARNIVORA	FELIDAE	*Herpailurus yaguarondi*	jaguarundi - tigrillo congo	*	G4	N4		X	AI - AIII	
	PROCYONIDAE	*Nasua narica*	gato solo	*	G5	N5		X		
		Procyon lotor	mapache - gato manglatero	*	G5	N5		X		
ARTIODACTYLA	TAYASSUIDAE	*Tayassu tajacu*	saíno	*	G5	N5		X	AII	
		Odocoileus virginianus	venado cola blanca	*	G5	N5		X		

Note:

END: Endémic; N: National;B: Binational, Costa Rica y Panamá, **B2:** Southern Pacific Side of Central

EPL: Protected nationally; CITES: Apéndice 1 (1), Apéndice 2 (2); **IUCN:CR:** Critically in Danger; **EN:** In danger, **VU:** Vulnerable.

Table EA-41: Amphibian and Reptile Species Identified at Site T9

CLASS REPTILIA				T9	Global	National	END	EPL	CITES	UICN
ORDER	FAMILY	SPECIES	COMMON NAME		Rank	Rank		Panama		
CROCODYLIA	CROCODYLIDAE	*Crocodylus acutus*	lagarto aguja	*	G2	N2		X	AI	VU
SQUAMATA	BOIDAE	*Boa constrictor*	boa	*	G5	N4		X	AI - AII	
	COLUBRIDAE	*Spilotes pullatus*	cazadora	*	G5	N4				
	CORYTOPHANIDAE	*Basiliscus basiliscus*	meracho	*	G4	N4				
	ELAPIDAE	*Micrurus nigrocinctus*	coral	*	G5	N4				
	GEKKONIDAE	*Gonatodes albogularis*	cabeza naranja	*	G5	N4				
	IGUANIDAE	*Iguana iguana*	iguana verde	*	G4	N3		X	AII	
	POLYCHROTIDAE	*Anolis auratus*		*	G4G5	N4				
	TEIIDAE	*Ameiva ameiva*	borriguero	*	G5	N5				

CLASS AMPHIBIANS				T9	Global	National	END	EPL	CITES	UICN
ORDER	FAMILY	SPECIES	COMMON NAME		Rank	Rank		Panama		
ANURA	BUFONIDAE	*Bufo marinus*	sapo	*	G5	N5				
		Bufo typhonius	sapo	*	G5	N4				
	DENDROBATIDAE	*Colostethus inguinalis*		*	G3G4	N3				
		Dendrobates auratus	rana verdi-negra	*	G4G5	N3N4				
	LEPTODACTYLIDAE	*Eleutherodactylus fitzingeri*			G5	N4				

Note:

END: Endémic; N: National;B: Binational, Costa Rica y Panamá, **B2:** Southern Pacific Side of Central

EPL: Protected nationally; CITES : Apéndice 1 (1), Apéndice 2 (2); **IUCN:CR:** Critically in Danger; **EN:** In danger, **VU:** Vulnerable.

Table EA-42: Flora Species Identified at Site T10

CLASS MAGNOLIOPSIDA			T10	Global	National	END	EPL	CITES	UICN
FAMILY	SPECIES	COMMON NAME		Rank	Rank		panameñas		
ANACARDIACEAE	*Anacardium excelsum*	espavé	*	G5	N5				
	Spondias mombin	jobo	*	G5	N5				
ANNONACEAE	*Annona spraguei*	chirimoya	*	G3	N3				
	Xylopia frutescens	malegueto macho	*	G5	N4				
APOCYNACEAE	*Stemmadenia grandiflora*		*	G5	N5				
ARALIACEAE	*Dendropanax arboreus*	muñequito	*	G5	N5				
	Schefflera morototoni	guarumo de pava	*	G5	N4				
BIGNONIACEAE	*Godmania aesculifolia*	cacho del diablo	*						
BOMBACACEAE	*Ochroma pyramidale* (c)	balso	*	G5	N5				
	Pachira sessilis	yuco de monte	*	G5	N4				
BURSERACEAE	*Bursera simaruba*	almácigo - carate	*	G5	N5				
	Protium tenuifolium	chutra - cicuadro	*	G3	N3				
CECROPIACEAE	*Cecropia peltata*	guarumo	*	G5	N5				
	Licania platypus	sapote - sangre	*	G5	N5				
COMBRETACEAE	*Terminalia amazonia*	amarillo	*	G5	N4				
CONNARACEAE	*Connarus panamensis*		*	G5	N5				
DILLENIACEAE	*Davilla kunthii*	chumico pedorro	*	G5	N5				
EUPHORBIACEAE	*Acalypha diversifolia*		*	G5	N5				
	Croton draco	sangrillo	*	G5	N4				
	Mabea occidentales		*	G5	N4				
FAB-FABOIDEAE	*Andira inermis*	harino	*	G5	N5				
FAB-FABOIDEAE	*Machaerium kegelii*	falsa uña de gato	*	G3	N3				
FAB-MIMOSOIDEAE	*Inga sapindoides*	guabo de monte	*	G4	N4				
FAB-MIMOSOIDEAE	*Inga spectabilis*	guaba machete	*	G5	N5				
FLACOURTIACEAE	*Hasseltia floribunda*	parimontón	*	G5	N5				
	Lacistema aggregatum	huesito	*	G5	N5				
LAURACEAE	*Ocotea puberula*	sigua	*	G3	N3				
	Phoebe cinnamomifolia	sigua blanca	*	G5	N5				
MELASTOMATACEAE	*Miconia argentea*	papelillo	*	G5	N5				
	Miconia minutiflora	copo de nieve	*	G4	N4				
MELIACEAE	*Guarea glabra*	cedro macho	*	G5	N5				
	Guarea guidonea	cedro	*	G4	N4				
MYRTACEAE	*Eugenia oerstediana*		*						
PIPERACEAE	*Piper sp.*	hinojo	*						
POLYGONACEAE	*Coccoloba parimensis*	uvero	*	G5	N1				
RUBIACEAE	*Cephaelis tomentosa*	labios ardientes	*	G4	N4				
	Coutarea hexandra		*						
SAPINDACEAE	*Cupania cinerea*	gorgojero	*	G5	N3				
	Cupania rufescens	gorgojero colorao	*	G5	N3				
	Matayba glaberrima	matillo	*	G3	N3				
SAPOTACEAE	*Chrysophyllum argenteum*	caimito de monte	*	G2T4	N3				
STERCULIACEAE	*Guazuma ulmifolia*	negrito	*	G5	N5				
TILIACEAE	*Apeiba aspera*	peine de mono	*	G5	N4				
	Apeiba tibourbou	peine de mono	*	G5	N5				
	Luehea seemannii	guácimo colorado	*	G5	N4				
	Trichospermun galeottii	capulín - majaguillo	*	G5	N4				
VOCHYSIACEAE	*Vochysia ferruginea*	flor de mayo	*	G5	N4				

CLASS LILIOPSIDA			T10	Global	National	END	EPL	CITES	UICN
FAMILY	SPECIES	COMMON NAME		Rank	Rank		panameñas		
ARECACEAE	*Attalea butyracea*	palma real	*	G3	N3				
	Desmoncus isthmius	matamba	*	G3	N3				
	Elaeis oleifera	palma aceitera	*	G5	N3				
BROMELIACEAE	*Aechmea magdalenae*	pita	*	G5	N3				
CYCLANTHACEAE	*Carludovica palmata*	sombrero panamá	*	G5	N3				
	Cyclanthus bipartitus		*	G5	N5				
	Scleria sp.	cortadera	*						
HELICONIACEAE	*Heliconia latispatha*	chichica	*	G5	N4				
MARANTACEAE	*Calathea latifolia*	bijao	*	G5	N5				
POACEAE	*Chusquea sp.*	caricillo	*						
ZINGIBERACEAE	*Costus sp.*	gengibre	*						

Nota: RG: Global Rank; **RN:** Nacional Rank, **END:** Endémic Species; **N:** National; **EPL:** Protected by National Wildlife Laws, **CITES**: Apéndice I (AI), Apéndice II (AII); **IUCN: CR:** Critically in Danger; **E:** In Danger; **I:** Indetermined, **R:** Rare, **V:** Vulnerable. Cultivated Species (c), Naturalized Species (n), Aquatic (a).

Table EA-43: Bird Species Identified at Site T10

GAME BIRDS				T10	Global	National	END	EPL	CITES	UICN
ORDER	FAMILY	SPECIES	COMMON NAME		Rank	Rank		Panama		
COLUMBIFORMES	COLUMBIDAE	*Columba cayennensis*	paloma colorada	*	G5	N5		X		
		Leptotila v. verreauxi	paloma rabiblanca	*	G5	N5				
FOREST BIRDS				**T10**	**Global**	**National**	**END**	**EPL**	**CITES**	**UICN**
ORDER	**FAMILY**	**SPECIES**	**COMMON NAME**		**Rank**	**Rank**		**Panama**		
COLUMBIFORMES	COLUMBIDAE	*Columbina talpacoti rufipennis*	tortolita rojiza	*	G5	N5				
CUCULIFORMES	CUCULIDAE	*Crotophaga ani*	garrapatero piquiliso	*	G5	N5				
		Piaya cayana thermophila	cuco ardilla	*	G5	N5				
CAPRIMULGIFORMES	NYCTIBIIDAE	*Nyctibius griseus*	nictibio común	*	G5	N4				
APODIFORMES	TROCHILIDAE	*Amazilia t. tzacatl*	amazilia colirrufa	*	G5	N5			AII	
PICIFORMES	PICIDAE	*Melanerpers rubricapillus*	carpintero coronirrojo	*	G5	N5				
PASSERIFORMES	EMBERIZIDAE	*Ramphocelus d. dimidiatus*	sangre de toro	*	G5	N5				
		Sporophila americana hicksii	espiguero variable	*	G4	N4				
		Thraupis episcopus cana	tangara azuleja	*	G5	N5				
		Thraupis palmarum atripennis	tangara palmera	*	G5	N5				
		Volatinia jacarina splendens	semillero negriazulado	*	G5	N5				
	ICTERIDAE	*Cassidix mexicanus*	talingo	*	G5	N5				
	MUSCICAPIDAE	*Turdus grayi casius*	mirlo pardo	*	G5	N5				
	TROGLODYTIDAE	*Microcerculus marginatus*	soterrey-ruiseñor sureño	*	G5	N4				
	TYRANNIDAE	*Elaenia flavogaster*	elania penachuda	*	G5	N5				
		Myiarchus panamensis	copetón panameño	*	G4	N4				
		Myiozetetes similis	mosquero social	*	G5	N5				
		Tyrannus melancholicus	tirano tropical	*	G5	N5				
		Tyrannus savana monacha	tijereta sabanera	*	G5	N5				

Note:
RG: Global Rank; **RN**:National Rank, **BBS:** Migratory species in decline (Breeding Bird Survey)
END: Endémic; N: National; B: Binacional, Costa Rica and Panamá, **B2:** Southern Pacific portion of Central America; **EPL:** Proteced by National Wildlife Laws
CITES: Apéndice 1 (1), Apéndice 2 (2); **IUCN:CR:** Critically in Danger; **EN:** In Danger, **VU:** Vulnerable.

Table EA- 44: Mammal Species Identified at Site T10

CLASS MAMMALIA				T10	Global	National	END	EPL	CITES	UICN
ORDER	FAMILY	SPECIES	COMMON NAME		Rank	Rank		Panama		
DIDELPHIMORPHIA	DIDELPHIDAE	*Didelphis marsupialis*	zorra común	*	G5	N5				
XENARTHRA	BRADYPODIDAE	*Bradypus variegatus*	perezoso de tres dedos	*	G5	N5				
CHIROPTERA	PHYLLOSTOMIDAE	*Corallia castanea*	murcielago frugivoro	*	G5	N5				
		Carollia perspicillata	murciélago frugivoro	*	G5	N5				
		Artibeus jamaicensis	murciélago frugivoro	*	G5	N5				
		Artibeus lituratus	murciélago frugivoro	*	G5	N5				
RODENTIA	DASYPROCTIDAE	*Dasyprocta punctata*	ñeque	*	G5	N5		X		
	MURIDAE	*Oecomys trinitatis*	gran rata arocera arborea	*						
LAGOMORPHA	LEPORIDAE	*Sylvilagus brasiliensis*	muleto	*	G5	G5				

Note:
END: Endémic; N: National;B: Binational, Costa Rica y Panamá, **B2:** Southern Pacific Side of Central
EPL: Protected nationally; CITES: Apéndice 1 (1), Apéndice 2 (2); **IUCN:CR:** Critically in Danger; **EN:** In danger, **VU:** Vulnerable.

Table EA-45: Amphibian and Reptile Species Identified at Site T10

CLASS REPTILIA				T10	Global	National	END	EPL	CITES	UICN
FAMILY	FAMILIA	SPECIES	COMMON NAME		Rank	Rank		Panama		
SQUAMATA	COLUBRIDAE	*Oxybelis brevirostris*	bejuquilla verde	*	G5	N5				
		Oxybelis aeneus	bejuquilla chocolate	*	G5	N4				
		Spilotes pullatus	cazadora	*	G5	N4				
	GEKKONIDAE	*Gonatodes albogularis*	cabeza naranja	*	G5	N4				
	IGUANIDAE	*Iguana iguana*	iguana verde	*	G4	N3		X	AII	
	TEIIDAE	*Ameiva festiva*	borriguero	*	G5	N4				
	VIPERIDAE	*Bothrops asper*	serpiente equis	*	G5	N5				

CLASS AMPHiBIANS				T10	Global	National	END	EPL	CITES	UICN
FAMILY	FAMILIA	SPECIES	COMMON NAME		Rank	Rank		Panama		
ANURA	BUFONIDAE	*Bufo marinus*	sapo	*	G5	N5				

Note:
END: Endémic; N: National;B: Binational, Costa Rica y Panamá, **B2:** Southern Pacific Side of Central
EPL: Protected nationally; CITES : Apéndice 1 (1), Apéndice 2 (2); **IUCN:CR:** Critically in Danger; **EN:** In danger, **VU:** Vulnerable.

Table EA-46 Flora Species Identified at Site M4

CLASS MAGNOLIOPSIDA			M4	Global	National	END	EPL	CITES	UICN
FAMILY	SPECIES	COMMON NAME		Rank	Rank		panameñas		
ACANTHACEAE	*Aphelandra scabra*		*	G5	N5				
ANACARDIACEAE	*Astronium graveolens*	zorro	*	G4	N3				
	Mangifera indica (c)	mango	*	G5	NE				
	Spondias mombin	jobo	*	G5	N5				
	Tapirira guianensis	palo gusano	*	G3	N2				
ANNONACEAE	*Annona hayesii*	chirimoya	*	G3	N3				
	Annona spraguei	chirimoya	*	G3	N3				
	Xylopia frutescens	malegueto macho	*	G5	N4				
APOCYNACEAE	*Stemmadenia grandiflora*		*	G5	N5				
	Thevetia ahouai	huevo de gato	*	G5	N5				
ARALIACEAE	*Dendropanax arboreus*	muñequito	*	G5	N5				
	Schefflera morototoni	guarumo de pava	*	G5	N4				
	Sciadodendron excelsum	jobo lagarto	*	G4	N3				
ARISTOLOCHIACEAE	*Aristolochia sp.*	farolito	*						
BIGNONIACEAE	*Godmania aesculifolia*	cacho del diablo	*						
BOMBACACEAE	*Ochroma pyramidale* (c)	balso	*	G5	N5				
	Pachira quinata	cedro espino	*	G5	N2				VU
	Pachira sessilis	yuco de monte	*	G5	N4				
	Pseudobombax septenatum	barrigón	*	G5	N4				
BORAGINACEAE	*Cordia alliodora*	laurel	*	G5	N5				
	Cordia collococo	laurel blanco	*						
BURSERACEAE	*Bursera simaruba*	almácigo - carate	*	G5	N5				
	Protium tenuifolium	chutra - cicuadro	*	G3	N3				
CAPPARIDACEAE	*Capparis sp.*	olivo	*						
CARICACEAE	*Carica papaya* (c)	papaya	*	G5	N5				
	Carica sp.	papaya de monte	*						
CECROPIACEAE	*Cecropia obtusifolia*	guarumo	*	G5	N5				
	Cecropia peltata	guarumo	*	G5	N5				
CHRYSOBALANACEAE	*Hirtella racemosa*	camaroncillo	*	G5	N5				
COCHLOSPERMACEAE	*Cochlospermum vitifolium*	poro - poro	*	G5	N5				
CONNARACEAE	*Connarus panamensis*		*	G5	N5				
DILLENIACEAE	*Davilla kunthii*	chumico pedorro	*	G5	N5				
	Dillenia sp.		*						
EUPHORBIACEAE	*Croton billbergianus*	sangrillo	*	G5	N5				
	Hura crepitans	tronador	*	G5	N4				
FAB-CAESALPINIOIDEAE	*Bauhinia sp.*	escalera de mono	*						
FAB-CAESALPINIOIDEAE	*Senna sp.*		*						
FAB-CAESALPINIOIDEAE	*Swartzia simplex*	naranjillo	*	G5	N5				
FAB-FABOIDEAE	*Machaerium kegelii*	falsa uña de gato	*	G3	N3				
FAB-FABOIDEAE	*Ormosia macrocalyx*	coralillo	*						
FAB-MIMOSOIDEAE	*Acacia hayesii*		*						
FAB-MIMOSOIDEAE	*Acacia melanoceras*	cachito	*	G4	N2				
FAB-MIMOSOIDEAE	*Adenopodia polystachya*		*						
FAB-MIMOSOIDEAE	*Albizia adinocephala*		*	G4	N2				
FAB-MIMOSOIDEAE	*Cojoba rufescens*	coralillo	*	G4	N4				
FAB-MIMOSOIDEAE	*Enterolobium cyclocarpum*	corotú	*	G5	N4				
FAB-MIMOSOIDEAE	*Inga hayesii*	guabo	*	G3	N3				LR
FAB-MIMOSOIDEAE	*Inga laurina*	guabito cansa boca	*						
FAB-MIMOSOIDEAE	*Leucaena leucocephala*	leucaena	*						
FLACOURTIACEAE	*Casearia aculeata*	pica lengua	*	G5	N5				
CLASS MAGNOLIOPSIDA			M4	Global	National	END	EPL	CITES	UICN
FAMILY	SPECIES	COMMON NAME		Rank	Rank		panameñas		
FLACOURTIACEAE	*Hasseltia floribunda*	parimontón	*	G5	N5				
	Lacistema aggregatum	huesito	*	G5	N5				
	Xylosma sp.	roseto - cachito	*						
	Zuelania guidonea	árbol caspa	*	G5	N3				
LAURACEAE	*Ocotea puberula*	sigua	*	G3	N3				
	Phoebe cinnamomifolia	sigua blanca	*	G5	N5				
LECYTHIDACEAE	*Gustavia superba*	membrillo	*	G5	N4				

CLASS LILIOPSIDA			M4	Global Rank	National Rank	END	EPL panameñas	CITES	UICN
FAMILY	SPECIES	COMMON NAME							
ARECACEAE	*Acrocomia aculeata*	palma de vino	*	G3	N3	N			
	Attalea butyracea	palma real	*	G3	N3				
	Bactris barronis		*	G2	N2	N			
	Bactris coloradonis		*	G2	N2				
	Bactris guineensis	palma uva	*						
	Bactris major	caña brava	*	G5	N3				
	Crysophila warscewiczii	palma guagara	*	G3	N3				
	Desmoncus isthmius	matamba	*	G3	N3				
	Elaeis oleifera	palma aceitera	*	G5	N3				
BROMELIACEAE	*Aechmea magdalenae*	pita	*	G5	N3				
	Tillansia flexuosa	barba de chivo	*	G4	N3				
CYCLANTHACEAE	*Carludovica palmata*	sombrero panamá	*	G5	N3				
HELICONIACEAE	*Heliconia latispatha*	chichica	*	G5	N4				
	Heliconia platystachys	platanillo	*	G4	N4				
ORCHIDACEAE	*Brassavola nodosa*	dama de la noche	*	G4	N3			AII	
	Catasetum viridiflavum	orquidea	*	G3	N3			AII	
	Vanilla planifolia	vainilla	*	G5	N2			AII	
POACEAE	*Chusquea sp.*	caricillo	*						
	Saccharum spontaneum (n)	paja canalera	*	G5	NE				
ZINGIBERACEAE	*Costus sp.*	gengibre	*						

Nota: RG: Global Rank; **RN:** Nacional Rank, **END:** Endémic Species; **N:** National; **EPL:** Protected by National Wildlife Laws, **CITES**: Apéndice I (AI), Apéndice II (AII); **IUCN: CR:** Critically in Danger; **E:** In Danger; **I:** Indetermined, **R:** Rare, **V:** Vulnerable. Cultivated Species (c), Naturalized Species (n), Aquatic (a).

Table EA-47: Bird Species Identified at Site M4

	COASTAL BIRDS			M4	Global	National	END	EPL	CITES	UICN
ORDER	FAMILY	SPECIES	COMMON NAME		Rank	Rank		Panama		
CHARADRIIFORMES	SCOLOPACIDAE	*Actitis macularia*	playero coleador	*	G5	NN/BBS				
		Catoptrophorus semipalmatus	playero aliblanco	*	G5	NN				
		Numenius phaeopus	zarapito trinador	*	G5	NN				
		Calidris pusilla	playero semipalmeado	*						
CICONIIFORMES	THRESKIORNITHIDAE	*Eudocimus albus*	ibis blanco	*	G5	N4				
PELICANIFORMES	FREGATIDAE	*Fregata magnificens*	fragata magnífica	*	G5	N5				
	PELICANIDAE	*Pelecanus occidentalis carolinensis*	pelícano marrón	*	G4	N4				
	PHALACROCORACIDAE	*Phalacrocorax o. olivaceus*	cormorán neotropical	*						
	GAME BIRDS			M4	Global	National	END	EPL	CITES	UICN
ORDER	FAMILY	SPECIES	COMMON NAME		Rank	Rank		Panama		
COLUMBIFORMES	COLUMBIDAE	*Leptotila v. verreauxi*	paloma rabiblanca	*	G5	N5				
GALLIFORMES	CRACIDAE	*Ortalis cinereiceps*	chachalaca cabecigris	*	G5	N3		X		
	FOREST BIRDS			M4	Global	National	END	EPL	CITES	UICN
ORDER	FAMILY	SPECIES	COMMON NAME		Rank	Rank		Panama		
CICONIIFORMES	ARDEIDAE	*Ardea h. herodias*	garza azul mayor	*	G5	NN				
		Casmerodius albus egretta	garceta grande	*	G5	N5				
		Egretta t. thula	garceta nívea	*	G5	N5				
FALCONIFORMES	ACCIPITRIDAE	*Pandion haliaetus*	águila pescadora	*	G5	NN				
	FALCONIDAE	*Milvago chimachima*	caracara cabeciamarilla	*	G5	N5			AII	
APODIFORMES	TROCHILIDAE	*Amazilia t. tzacatl*	amazilia colirrufa	*	G5	N5			AII	
		Chlorostilbon assimilis	esmeralda jardinera	*	G4	N4	B2			
CORACIIFORMES	ALCEDINIDAE	*Chloroceryle americana*	martín pescador verde	*	G5	N5				
PASSERIFORMES		*Sporophila americana hicksii*	espiguero variable	*	G4	N4				
	HIRUNDINIDAE	*Hirundo rustica*	golondrina tijereta	*	G5	NN				
		Progne chalybea	martín pechigris	*	G5	N5				
		Riparia riparia	martín arenero	*	G5	NN/BBS				
		Stelgidopteryx ruficollis	golondrina-alirrasposa sureña	*	G5	N5				
		Stelgidopteryx s.serripennis	golondrina-alirrasposa norteña	*	G5	NN				
	ICTERIDAE	*Cacicus cela vitellinus*	cacique lomiamarillo	*						
		Psarocolius wagleri	oropéndola cabecicastaña	*						
		Cassidix mexicanus	talingo	*	G5	N5				
		Scaphidura oryzivora	vaquero gigante	*						
	MUSCICAPIDAE	*Turdus grayi casius*	mirlo pardo	*	G5	N5				
	TROGLODYTIDAE	*Microcerculus marginatus*	soterrey-ruiseñor sureño	*	G5	N4				
	TYRANNIDAE	*Elaenia flavogaster*	elania penachuda	*	G5	N5				
		Myiarchus panamensis	copetón panameño	*	G4	N4				
		Myiodynastes maculatus	mosquero rayado	*	G5	N5				
		Myiozetetes similis	mosquero social	*	G5	N5				
		Tyrannus melancholicus	tirano tropical	*	G5	N5				

Note:
RG: Global Rank; **RN:** National Rank, **BBS:** Migratory species in decline (Breeding Bird Survey)
END: Endémic; N: National; B: Binacional, Costa Rica and Panamá, **B2:** Southern Pacific portion of Central America; **EPL:** Proteced by National Wildlife Laws
CITES: Apéndice 1 (1), Apéndice 2 (2); **IUCN:CR:** Critically in Danger; **EN:** In Danger, **VU:** Vulnerable.

Table EA-48: Mammal Species Identified at Site M4

CLASS MAMMALIA				M4	Global	National	END	EPL	CITES	UICN
ORDER	FAMILY	SPECIES	COMMON NAME		Rank	Rank		Panama		
DIDELPHIMORPHIA	DIDELPHIDAE	*Didelphis marsupialis*	zorra común	*	G5	N5				
	DASYPODIDAE	*Dasypus novemcinctus*	armadillo de nueve bandas	*	G5	N5		X		
CHIROPTERA	PHYLLOSTOMIDAE	*Corallia castanea*	murcielago frugivoro	*	G5	N5				
		Carollia perspicillata	murciélago frugivoro	*	G5	N5				
		Artibeus jamaicensis	murciélago frugivoro	*	G5	N5				
		Artibeus lituratus	murciélago frugivoro	*	G5	N5				
RODENTIA	AGOUTIDAE	*Agouti paca*	conejo pintado	*	G5	N5		X		
	DASYPROCTIDAE	*Dasyprocta punctata*	ñeque	*	G5	N5		X		
LAGOMORPHA	LEPORIDAE	*Sylvilagus brasiliensis*	muleto	*	G5	G5				
CARNIVORA	PROCYONIDAE	*Nasua narica*	gato solo	*	G5	N5		X		
		Procyon lotor	mapache - gato manglatero	*	G5	N5		X		

Note:

END: Endémic; N: National;B: Binational, Costa Rica y Panamá, **B2:** Southern Pacific Side of Central

EPL: Protected nationally; CITES: Apéndice 1 (1), Apéndice 2 (2); **IUCN:CR:** Critically in Danger; **EN:** In danger, **VU:** Vulnerable.

Table EA-49: Amphibian and Reptile Species Identified at Site M4

CLASS REPTILIA				M4	Global	National	END	EPL	CITES	UICN
FAMILY	FAMILIA	SPECIES	COMMON NAME		Rank	Rank		Panama		
CROCODYLIA	CROCODYLIDAE	*Crocodylus acutus*	lagarto aguja	*	G2	N2		X	AI	VU
SQUAMATA	BOIDAE	*Boa constrictor*	boa	*	G5	N4		X	AI - AII	
	COLUBRIDAE	*Oxybelis aeneus*	bejuquilla chocolate	*	G5	N4				
	ELAPIDAE	*Micrurus nigrocinctus*	coral	*	G5	N4				
	GEKKONIDAE	*Gonatodes albogularis*	cabeza naranja	*	G5	N4				
	IGUANIDAE	*Ctenosaura similis*	iguana negra	*	G4	N4				
		Iguana iguana	iguana verde	*	G4	N3		X	AII	
	TEIIDAE	*Ameiva ameiva*	borriguero	*	G5	N5				
		Ameiva festiva	borriguero	*	G5	N4				

CLASS AMPHIBIANS				M4	Global	National	END	EPL	CITES	UICN
FAMILY	FAMILIA	SPECIES	COMMON NAME		Rank	Rank		Panama		
ANURA	BUFONIDAE	*Bufo marinus*	sapo	*	G5	N5				
	DENDROBATIDAE	*Colostethus inguinalis*		*	G3G4	N3				
		Dendrobates auratus	rana verdi-negra	*	G4G5	N3N4				

Note:

END: Endémic; N: National;B: Binational, Costa Rica y Panamá, **B2:** Southern Pacific Side of Central

EPL: Protected nationally; CITES : Apéndice 1 (1), Apéndice 2 (2); **IUCN:CR:** Critically in Danger; **EN:** In danger, **VU:** Vulnerable.