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Terminal Report
**CARTOGRAPHY
CATASTRO PROJECT**
REPUBLIC OF NICARAGUA

Prepared For
U.S. Agency for International Development
Managua, Nicaragua C.A.

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GENERAL

Many handicaps have plagued the Bureau of Cartography, such as a lack of personnel, vital equipment, material, and aerial photography, all of which are fundamental to the accomplishment of its goals. Despite these handicaps, the complete change in type and concept from basic mapping to cadastral mapping, and the many roadblocks, the Bureau has managed, by dint of hard work and persuasion, to establish production norms, quality controls, and accuracy criteria. This will lead to the achievement of the goals established for the Phase I Project; and will continue them with the ongoing program for the Phase II Project.

This, however, can only be accomplished with the full support of the Government of Nicaragua (GON). It must be assured that production is not halted or delayed by inaction, or denials of approval for needed support equipment, materials, personnel or operating funds.

One problem area that existed at the beginning of the project, and continues to exist to the present time, is the administrative operational support within the Bureau of Cartography as well as within the entire CATASTRO PROJECT. It is evident that administrative procedures for operational support requires administrative leadership to be retrained in the basic concepts of what is meant by operational support. There seems to be a tendency to look upon operations as a subservient function of administration instead of the reverse procedure. Without operational support from the administrative branches no project can be a success.

One of the main reasons for the malfunction, or non-function, of the operational support from administrative divisions stems from the fact that most administrators are political appointees or, shall we say, are placed in the position by political pressure. They have been imbued in certain concepts which are not in accord with the management principles utilized in private industry.

Administrative officials tend to put great emphasis on paper work to such an extent that at one time requisitioning of materials required as many as seventeen signatures. It is recommended that complete evaluation of administrative procedures throughout the entire CATASTRO PROJECT, including the Bureau of Cartography (DGC) be reviewed by qualified, competent, administrative personnel to make the proper recommendations to rectify the lack of operations support in all divisions.

The Bureau of Cartography, like all other GON agencies, has been, and continues, working under a tremendous handicap in the area of salaries for its personnel. Many

of these employees have a high degree of skill and technical ability. The Operations Consultant has consistently endeavored to enhance the production and quality of the work that is being performed by these personnel. This is a tremendous task, however, when the personnel realize that they will not be rewarded for better work, for more production, or for intelligent application of their skills. Instead, they know that they will get paid whether they produce good work or bad work, a large quantity or a small quantity, and that they need not work any better or harder than their co-worker. They also know that if they are threatened with termination of employment, they can sometimes by-pass all lines of organizational authority and go straight to the top and retain their positions. The establishment of a merit system for rewarding the quality producers is the only solution to this problem.

The Operations Consultant feels that there now exists a close-knit working organization which embodies a competitive spirit among individual employees within sections, and between sections and divisions. Many of the personnel are now instilled with a sense of pride in their work. This pride must be maintained by constant vigilance of their work, both as to quality and quantity. They must be informed of their progress, rewarded for their good work, and corrected for their mistakes or inferior work. They must also be kept informed of new techniques, new developments, and new approaches so that they can produce better, faster, and more economically.

Many of the Operations Consultant's group will depart Nicaragua in the very near future, thus leaving the project in the hands of the Nicaraguans to continue to its ultimate goal. During this period, while the Operations Consultants are here, they are striving to impart to their Nicaraguan counterparts the technical abilities and knowledge, the methods which function in other countries, the disciplines they have learned, and to instruct them in managing their divisions profitably and prudently. They are here to teach and train the Nicaraguans by virtue of their knowledge.

This knowledge was gained by constant application of their talents, by constant refreshing of their technical abilities, and by their constant endeavor to learn. They accomplished this through their attendance of seminars, symposiums, conventions, short courses, and extension courses so that they could absorb new techniques and new approaches towards better and more profitable performance. They cannot, by any stretch of the imagination, hope that their native counterparts can continue to improve after the consultants have left Nicaragua, unless the Nicaraguans can also continue to assimilate new and better techniques, gain new knowledge, study new developments, and understand the uses of more diverse and better equipment that is constantly being produced through technological advances in the state of the arts.

Key Nicaraguan personnel should be encouraged and given the opportunities to travel to foreign countries to attend seminars, symposiums, conferences, and extension courses. If this policy is not instituted, the work of the Operations Consultant will have been in vain, for they will have only been able to impart to their counterparts that knowledge they had the day they arrived. From that point on, there will be no progress in the sense of putting to use new developments, new approaches, and new techniques in technical and management areas.

It is sincerely hoped that this terminal report contains the ingredients, that, if properly utilized, will lead to the successful accomplishment of the project goals.

CONCLUSIONS AND RECOMMENDATIONS

The Conclusions and Recommendations of the Operations Consultant are separated for convenience. The Recommendations for each of the Conclusions reached are headed by the identical numbering sequence.

A. CONCLUSIONS

1. Administrative

- (a) The GON system of quarterly fund allocations are generally approved by the 15th. of the first month and are cut off by the 10th. of the third month of the quarter. Funds, therefore, are available for less than two months instead of three months. All funds not spent are automatically reduced from the approved budget
- (b) The above system, therefore, cuts off funds prior to the end of the year without reserves to start production at the beginning of the following year.
- (c) Production is often delayed, or halted completely, for lack of petty cash to purchase emergency materials, supplies, and services.
- (d) Accounting sections sometimes require many weeks to present balance sheets, whether they be funds or inventory.

2. Personnel

- (a) Political pressure is often employed to hire, fire or retain personnel.
- (b) Because salary increases for personnel have repeatedly been cut from budgets, there is a tendency to ignore periodic personnel evaluation. The feeling of futility is very apparent.
- (c) Starting salaries in certain positions are very low, resulting in a great turnover of personnel. The delineation section, for example, had a turnover of 116 percent. This resulted in a waste of approximately \$450,000 in salaries and per diem payments alone. There is also a lack of depth in many key positions, primarily due to Bureau of the Budget refusing to approve new positions and/or increase salaries.

3. Equipment and Vehicle Maintenance

- (a) Lack of ready cash often prohibits repair and maintenance of office equipment.
- (b) Vehicles are entering their fourth year of hard, rugged use. These will require more repairs at greater costs resulting in less operational use, thus delaying the project. Each man-day lost is equal to one-half of one percent of a man-year of programmed operation. The Highway Department repair shops are not functioning adequately for the demands imposed by the needs.
- (c) Repair and Service Maintenance funds in budget presentations have not been approved during the past three years, causing grave problems to the project.

4. Operational

- (a) Areas in the eastern and northern portions of the Phase I Project are virtually inaccessible by vehicle. This holds true for portions of the Phase II Project also. Possible

lack of 1:30,000 aerial photography in these areas will require a re-analysis of the accuracy requirements through the utilization of existing 1:60,000 scale aerial photography.

- b) The data being gathered by the Bureau of Cartography is being, and will continually be, demanded by end-users in greater volume and in less turn around time. Some end-users are already utilizing electronic data processing systems with more to follow. The manual collation of the information sought by end-users would result in their receiving obsolete information.
- c) The Integral cadastre cannot be accomplished until the entire country has been adequately mapped for this purpose.
- d) The proper development of Nicaragua depends, in part, on reliable maps of adequate scales and accuracies to fulfill the requirements imposed by the users. Highways must be built, land and communities must be developed, migration of population must be studied, dams and power plants must be built, etc.
- e) The in-persona system of real property taxation leads to subterfuge to avoid equitable payment of taxes.

B. RECOMMENDATIONS

1. Administrative

- a) Eliminate the system of quarterly fund allocations. This will:
 - Result in a smooth flow of funds at all times.
 - Assure that funds will not be lost if unspent during any quarter.
 - Eliminate haphazard purchasing procedures.
 - Assure that materials and supplies inventories will be kept at proper levels, neither over-or understocking.
 - Eliminate waste, both materials and money.

- (b) Institute a system whereby funds allocated during a fiscal year can be obligated for a short period of the following fiscal year in order to assure that operations can resume immediately upon the start of the new fiscal year. This is especially required for per diem and field expenses.
- (c) Sufficiently increase the petty cash revolving fund to enable timely purchases of emergency materials, supplies, and services.
- (d) Establish and implement modern accounting methods that reflect right balances at the right time. Re-evaluate materials and supplies inventory procedures to assure timely and sufficient procurement.

2. Personnel

- (a) Personnel should be hired on the basis of technical qualification only, thus eliminating political pressure to hire, fire, or retain personnel.
- (b) Institute periodic evaluation of personnel based exclusively on a merit system. Salary increases to be based exclusively on this evaluation.
- (c) Increase basic starting salaries, in certain job positions, commensurate with the complexity or demands of the position and approve secondary key positions in order to achieve depth required for successful operations.

3. Equipment and Vehicle Maintenance

- (a) Enter into maintenance and service contracts for all office equipment. Contracts should stipulate "loaners" while equipment is being repaired.
- (b) Vehicles

- (1) Procurement of spare parts must be made timely and sufficient for needs.
 - (2) Establish, equip, and staff an adequate vehicle repair shop to meet the demand.
- (c) Bureau of the Budget must approve maintenance budgeted funds.

4. Operational

- (a) Proper methodologies must be determined as the project extends further into low value, less populated, and least accessible areas, with availability of a helicopter being an immediate requirement.
- (b) Complete electronic automation of data must become an integral part of the program.
- (c) Continue program for the entire country without let-up.
- (d) The Bureau of Cartography should start doing mapping for other agencies and private enterprise, thus earning income by which it may eventually become self-sustaining.
- (e) Introduce legislation for in-rem taxation of real property.

OBJECTIVES AND SCOPE

The objectives of the Bureau of Cartography as basically defined in the Detailed Work Plan (Revised Edition, September 1970) are as follows:

1. Accelerate the basic mapping program.
2. Accomplish aerial photography and provide photographic products for the cadastre and for the various divisions of the Integrated Natural Resources Group.

3. Accomplish a National Fiscal Cadastre and provide sufficiently accurate cadastral maps to meet the requirements of the Valuation Division, taking into account established work schedules and budgets.
4. Provide and publish final editions of photo-mosaics for the Integrated Natural Resources Group, Soils and Land Use Division.
5. Formulate a Cadastral Maintenance Law and establish a cadastral maintenance system.
6. Provide base maps and publish final editions of technical maps and charts for all sectors of the Integrated Natural Resources Group.
7. Provide any other mapping and reproduction products required by the various divisions of the Integrated Natural Resources Group.
8. Plan for conversion of data, acquired for the Fiscal Cadastre, into a future Integral Cadastre.
9. Tabulate basic property data through Electronic Data processing systems.
10. Staff, train, and maintain qualified personnel, and acquire and maintain equipment to continuously meet the demands imposed by all of the above to ensure the continuity of the program following the termination of the Phase I Project.

The scope of this activity is as follows:

1. Basic Mapping

The Bureau of Cartography will increase its production of basic maps at 1:50,000, 1:100,000 and 1:250,000 scale from 26 sheets per year to 35 sheets per year and will double its capacity to establish horizontal and vertical geodetic networks, and geophysical and astronomic observations.

2. Aerial Photography (1:30,000, 1:20,000 and 1:5,000 scales)

The entire 35,000 square kilometers Phase I Project will be covered by aerial photography if favorable weather will permit completion of flights along the eastern Project boundary during the 1970-71 dry season. In the event that weather conditions are favorable during the

1970-71 season, the GON Banco Nacional airplane and Nicaraguan Airforce (FAN) crew will extend such photography northward and eastward into the Phase II Project as far as required to include populated areas. Aerial photography at 1:5,000 scale will be accomplished to cover all urban centers containing more than 500 parcels. Minifundios will also be covered by 1:5,000 scale photography when these are disclosed by the delineation process.

3. Photomaps (1:10,000 scale)

Establish supplemental map control, accomplish aerotriangulation, scanning, and orthoprojections in order to provide 1:10,000 scale photomaps for the full Project area (35,000 square kilometers) or to the extent that 1:30,000 or 1:20,000 scale photography is completed. If incomplete, the photomaps will be completed by two map sheet blocks (minimum) to avoid excessive geodetic control costs.

4. Photo Mosaics (Soils/Land Use) - (1:20,000 scale)

Will be completed for the entire Phase I Project area or to the same coverage as noted in (3) above in the event that full aerial photography (1:20,000 or 1:30,000 scale) coverage is not obtained in time.

5. Urban Property Maps (1:1,000 scale)

Control, compilation, delineation, and drafting of urban property maps will be completed for all but some minor villages within the 35,000 square kilometer Project. Total existing urban property parcels are now estimated by actual count on the new photography at 100,000 parcels.

6. Rural Property Maps (1:10,000 scale)

Delineation and drafting of rural Property Mapping is to proceed to cover the full 35,000 square kilometer Project area; but by selection of map sheets covering the areas containing maximum numbers of tax producing properties first, and deferring areas of low agricultural potential and containing low valued small properties until later. It is now estimated that 68,000 parcels will be mapped by June 30, 1971.

7. Real Property Ownership Investigation

When the Detailed Work Plan was prepared in 1967, the scope of work required to identify and corroborate property ownership was not fully known. The completion of ownership cadastral cards was identified as a responsibility of the Cartographic Agency.

A new unit attached to the Executive Direction during 1970 (Refer to Amendment No. 3 to the Detailed Work Plan) was activated in early 1970 in order to increase the number of mapped properties reasonably identified as to ownership. The unit will be assigned to the Cartographic Agency beginning January 1, 1971.

The unit, at the same time, will proceed to microfilm all property registry information within the Project and by scanning and cross - reference file systems, proceed to identify properties on a volume production basis. The unit will also intensify field investigation efforts and wherever feasible, use short-term contract service arrangements with locally informed people. Public exposition of completed property maps will be held in all parts of the Project to give owners the opportunity of pointing out errors, if any.

Since a complete cross-index file system is required by Catastro in order to complete all ownership information cards for the cadaster, this file system will provide a basis for up-dating indices for all public registries within the Project. Automatic data procedures may be employed in 1971 to expedite this process.

Goals for owner confirmed parcels by June 30, 1971 is 55,000 or approximately 40 percent of the total properties mapped and appraised at that time.

During 1972, the goal will be to complete investigation of the remaining properties of the Phase I Project.

Area (Refer to Figure No. 1)

During the Phase I Project period, 1:10,000 scale photo maps will be completed of the Project area for cadastral and resource inventory purposes. During the same period, 1:10,000 property maps will be completed covering about 23,000 square kilo-

NICARAGUA TAX IMPROVEMENT AND NATURAL RESOURCES PROJECT AREA

- CADASTRAL PROJECT AREA LIMITS (1967) 40,000 Km²
- NATURAL RESOURCES PROJECT AREA LIMITS (REPORT AREA, GEOLOGY SECTOR ONLY) (1967) 35,000 Km²
- CADASTRAL PROJECT LIMITS (REVISED JAN 1970) 35,000 Km²
- RESERVE AREAS 4,800 Km²
- ▨ AREAS LACKING 1:30,000 SCALE PHOTOGRAPHY (AUG 1970)
- ▧ AREAS WHERE RURAL DELINEATION WILL BE DEFERRED UNTIL JULY 1971

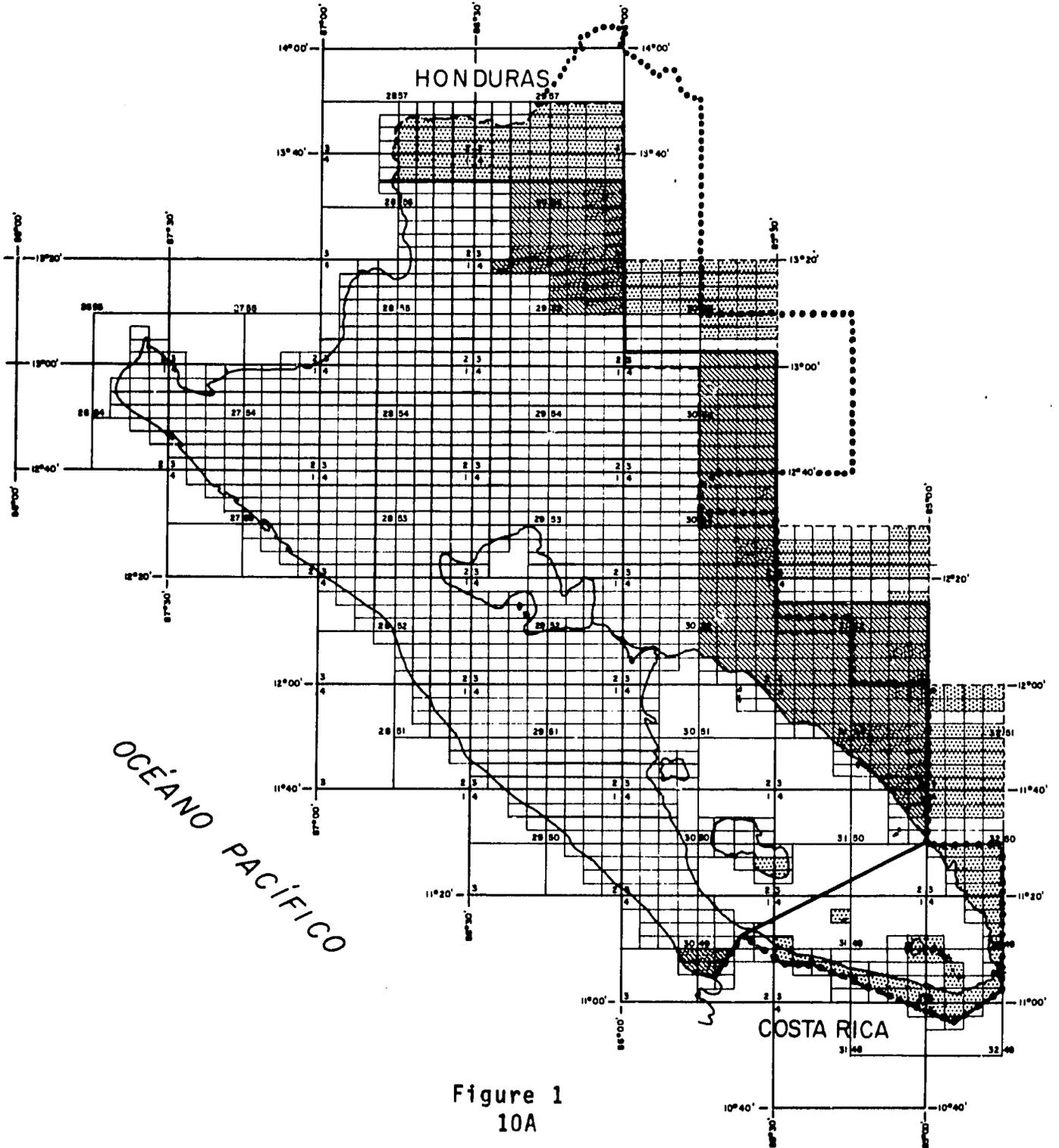


Figure 1
10A

meters, and 150 square kilometers of 1:1,000 scale urban and suburban cadastral mapping, and 50,000 square kilometers of basic mapping will be produced. Basic mapping, having been essentially completed in the Phase I Project before 1967, will be carried in the central highland and Atlantic slope areas.

Activity Development

Project activities in Cartography were, until December 1968, carried out under the supervision of the Director of the Cartographic Agency. Beginning in January 1969, the Operations Consultant was assigned the responsibility and authority to direct the agency for two years

ACKNOWLEDGEMENTS

Ing. Cristóbal Rugama N. , Director, Bureau of Cartography, merits special acknowledgement for his understanding and cooperation with the Operations Consultant during the period of realignment of the organization and implementation of new operating procedures, and for his untiring efforts in demanding quality work from every employee in the Bureau.

Ing. Francisco Hansen, Subdirector, who along with his multiple duties as Subdirector and Chief of the Cartography Department, analysed the requirements and wrote all of the many computer programs required for the project.

Ing. Humberto Porta, Chief of the Cadastral Department, whose dynamic contribution in cadastral procedures was of immeasurable aid in the success of the project.

By acknowledging the following division and section leaders responsible for the work accomplished during the project, acknowledgement is also made to all Nicaraguan technical and other personnel who performed under their guidance. The spirit of dedication and teamwork contributed immensely to the success of the project.

Leonel Salazar, Chief, Photogrammetric Division

José Morales, Chief, Reproduction Division

Ernesto Ortega, Chief, Drafting Division

Jaime Arvizú, Chief, Administrative Division,
(administrative support)

Hugo Araica, Chief, Office Computation Section

Ing. Guillermo Navarro Chief, Supplemental
Control Section

Rodolfo Baca, Chief, Photogrammetry Section

Humberto Murillo, Chief, Cadastral Stereo-
compilation Section
Roger Fajardo, Chief, Basic Mapping Stereo-
compilation Section
Casimiro Palma, Chief, Cadastral Mapping Section
Juan Bustos, Chief, Urban Control Section
Tommy Lagos, Chief, Delineation Section
Salomón Paniagua, Assistant Chief, Delineation
Section
Wladimir Basset, Chief, Electronic Data
Processing Section
Edgar Curtis, Chief, Data Handling and Area
Measurement Section
Harvey Agurto, Chief, Public Exposition of
Documents Section
Dra. Norma Lesbia de Ortega, Chief, Cadastral
Maintenance Section
Dr. Dib Eslaquit, Chief, Property Corroboration
Section
Enrique Lacayo, Assistant Chief, Property Corrob-
oration Section
Carlos Mendieta, Chief, Data Compilation and
Correction Section
Eusebio Castellón, Chief, Basic Levelling
Section

The Inter American Geodetic Survey has provided invaluable technical, material (including equipment and supplies) and financial assistance to the Cartographic Bureau since 1946. Technical assistance was rendered during the course of the CATASTRO PROJECT in training, planning, and execution of field control, photoidentification, photogrammetry, graphic arts, reproduction, and other fields. The IAGS Cartographic School in the Canal Zone has trained approximately one hundred employees of the Bureau of Cartography, the costs of which were absorbed by the IAGS. Recognition of the following IAGS staff members are acknowledged.

Col. Edward C. Bruce, Director
Col. Hans G. Ruthe, Director
Maj. William Barron, Officer-in-Charge
James R. McIntire, Cartographic Representative
John S. García, Cartographic Representative

Robert Morse, Supplemental Map Control
Ralph Bagley, Supplemental Map Control
Robert Fishbough, Supplemental Map Control
Frederick Wieand, Supplemental Map Control
William Stiles, Photo Identification
Jack D. Rosholt, Cadastral Specialist
René A. Garcia, Graphic Arts
Jesse N. Valle, Reproduction

The German Technical Mission, headed by Dr. Rudolph Elstner, Central America Mission Director is acknowledged for its cooperation, technical assistance, and loans and grants of valuable equipment. Members of the German Technical Mission staff who contributed to the success of the project included:

Dr. Ing. Manfred Hirle, Nicaragua Mission Director
and Electronic Data Processing
Ing. Jens-Peter Goellner, Supplemental Map Control
Dipl. -Ing. Horst Lorenz, Delineation
Dipl. -Ing. Wolf-Erich Von Daack, Delineation
Ing. Erwin Genssler, Aerial Photography and Photo-
grammetry
Ing. Eberhard Mendelin, Urban Control
Dipl. -Ing. Hans-Jurgen Uhlisch, Urban Control
Ing. Karl Grimmeisen, Urban Control
Ing. Siegfried Exner, Data Preparation
Ing. Gerhard Jung, Data Preparation
Dr. Walter Brucklacher, Photogrammetry
Dr. Ing. Gerhard Lindig, Photogrammetry
Mr. Peter Herms, Aerial Navigator

ORGANIZATION AND IMPLEMENTATION

The organization of the Bureau of Cartography was considered basically sound, and with few modifications, was soon working as a smooth operation.

Since the operations of the Bureau of Cartography are, by its very nature, technical, a functional form of organization structure was found to be in existence, but on paper only. In actual practice, a very informal mode of organization was being employed, whereby lines of authority and areas of responsibility were not clearly defined.

Some modifications put into effect were the establishment of staff authority, and the introduction of adherence to more formal lines of authority, thus creating a line and staff organization (Fig 2). This of course, led to the introduction of accepted management principles, which were lacking in the original organizational structure. Basically, these were, decision making, planning, organizing, directing and controlling. Once these principles were accepted by top level management, staff, intermediate, and lower level supervisory personnel, the organization began to function in a more orderly manner.

As supervisory personnel began to be involved in planning for their divisions and sections, they began to "identify" with management. As part of the management team, therefore, supervisors helped to plan, establish and accept production goals. This, in turn, created a sense of urgency, since the goals established required constant vigilance of their personnel to assure the accomplishment of scheduled production and the maintenance of quality controls. They soon recognized that a well-knit management team could accomplish much more than they thought possible.

OPERATIONAL ACTIVITIES

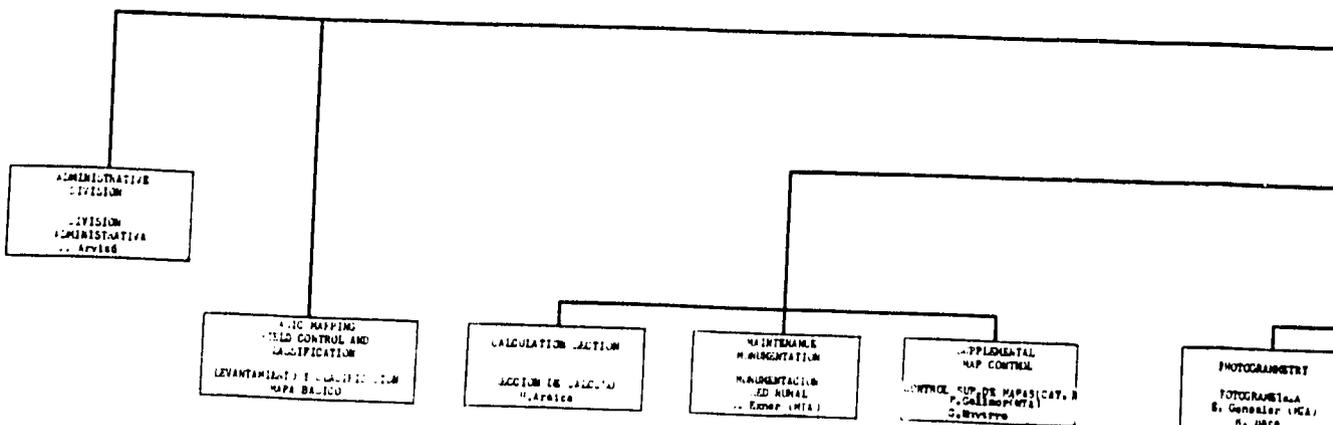
This report contains the production achieved from the inception of the project to 30 November 1970.

Aerial photography was obtained for approximately 32,000 square kilometers of 1:30,000 scale, 30,000 square kilometers of 1:20,000 scale and 200 square kilometers of 1:5,000 scale, totalling approximately 25,000 negatives.

These aerial negatives were utilized to make approximately 160,000 contact prints, 7,500 enlargements and 4,000 diapositives.

The reproduction section also accomplished 256 rectifications; 1,125 contact film positives of orthoprojections; 848 reductions of photomaps for Soils; 211 cronaflex contacts of soils mosaics; copied and made reproducibles of 306 basic maps for Hydrology, Hydrogeology and Geology; 490 reductions of rural cadastral maps for Valuation; 516 cronaflex contacts of urban cadastral maps; developed 900 rolls of microfilm for Verification Unit; made 15,000 diazo prints; printed 18 three-color maps consisting of 27,000 press runs; printed 33 two-color soils maps consisting of 33,000 press runs; and printed 73 five-color basic maps consisting of 750,000 press runs.

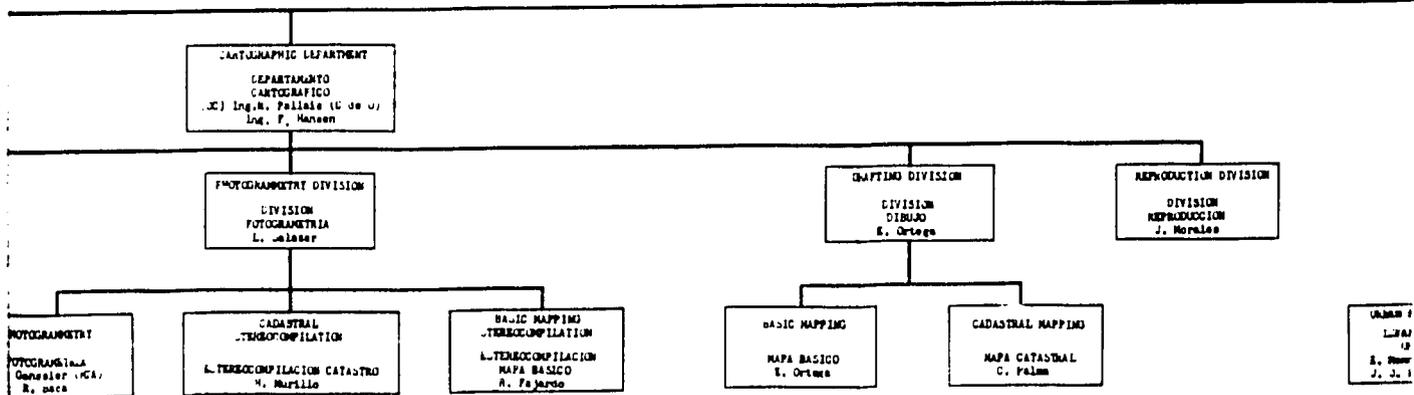
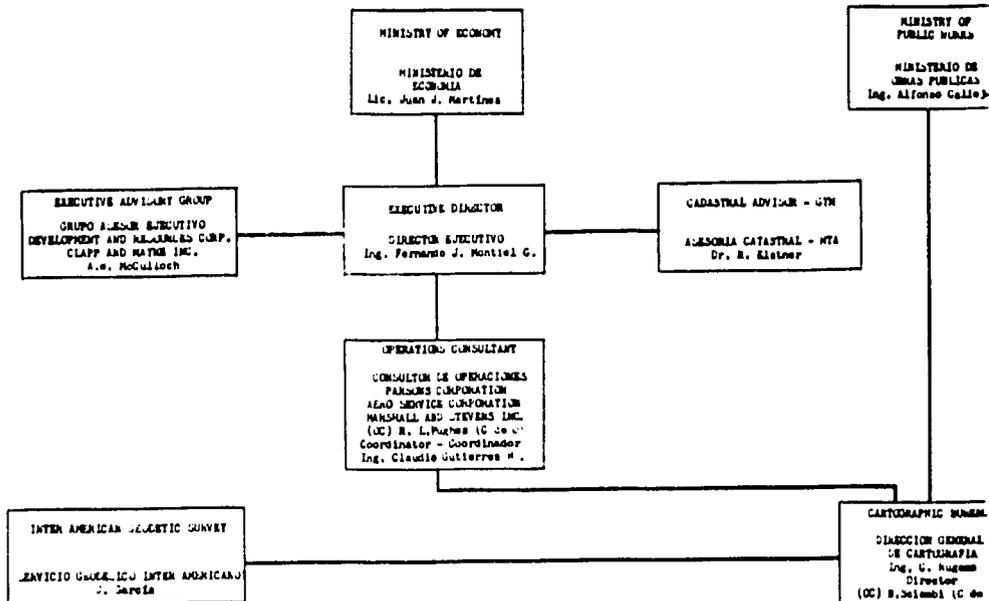
TAX IMPROVEMENT AND
 ORGANIZATI
 CARTOGRA
 BUREAU O
 MINISTRY (



CLAVE
 CSMO - TECNICOS CONSULTORES DE OPERACIONES
 MTA - MISION TECNICA ALEMANA
 SGA - SERVICIO GEODESICO INTERAMERICANO

KEY
 CO - OPERATIONS CONSULTANT
 GMT - GERMAN TECHNICAL MISSION
 IAGS - INTERAMERICAN GEODETIC

LAND AND NATURAL RESOURCES INVENTORY
 ORGANIZATION CHART OF THE
 PHOTOGRAPHIC GROUP
 BUREAU OF CARTOGRAPHY
 MINISTRY OF PUBLIC WORKS



ASTRO E INVENTARIO DE RECURSOS NATURALES
 ORGANOGRAMA DEL
 GRUPO CARTOGRAFICO
 DIRECCION GENERAL DE CARTOGRAFIA
 MINISTERIO DE OOPP

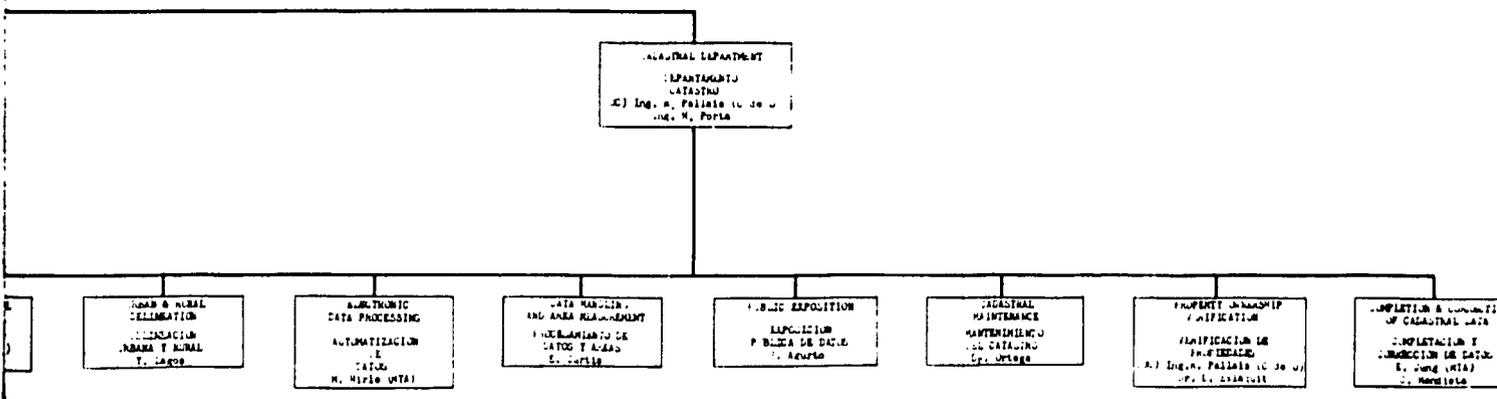


Figure 2. Organization Chart

14C

Supplemental map control established 396 control points requiring reconnaissance of 332 points; monumentation of 232 points; 396 distance observations covering approximately 4,500 kilometers; 190 photocontrol points; and 563 horizontal and vertical angles. Control for basic mapping consisted of supplemental map control for 46 sheets covering approximately 23,000 square kilometers and 742 kilometers of first and second order levelling

Urban map control established 410 control points which required reconnaissance of 345 points; monumentation of 274 points, 352 distance observations; 350 angle observations; 113 tie stations; and 118 photocontrol points.

City block control established 1,650 traverse points which required 322 kilometers of distance observations; 1,650 angle observations; and 1,926 city block measurements obtained by distance and offsets.

Urban parcels included 89,569 delineated covering 24 urban centers; 53,448 rural parcels were delineated covering approximately 15,000 square kilometers.

Photogrammetry aerotriangulated 2,423 models; scanned 1,767 models; orthoprojected 1,054 photos (double model); produced 801 orthophotomaps; and stereo - compiled 418 models covering 446 urban maps.

Drafting produced 510 urban maps containing 84,163 parcels, and 470 rural maps containing 47,225 parcels.

Area measurements were computed for 82,410 parcels contained on 498 urban maps, and 43,969 parcels contained on 437 rural maps.

TRAINING PROGRAM

OBJECTIVES AND SCOPE

The primary objective of the CADASTRAL PROJECT is the building of Nicaragua capability to carry out the program during the project period, and, in the balance of the country in the following years through the strengthening of existing capabilities by virtue of thorough and in-depth training. The teaching of Nicaraguan nationals placed emphasis on modern methods and techniques to accomplish the program efficiently with quantity and quality of production.

The scope of this technical training was to cover all activities of the cartographic and cadastral functions of the project. The major part of the training provided for the project was "on-the-job" training. This training was provided by members of the Operations Consultant Group, Inter American Geodetic Survey, and the German Technical Mission Specialists.

ACTIVITIES

Basically, technical training for cartographic and cadastral activities consisted of on-the-job training with a minimum of classroom training. Learning-by-doing was considered the best approach. Technical training was given in the following activities:

GENERAL

Planning, scheduling, production control, production reporting, quality controls, inventory controls, and budgeting were areas of great import in which top level supervisors were given intensive training. This management concept training was administered individually and in groups and consisted of classroom and learning-by-doing methods.

Production control reporting forms were developed for each unit. Weekly production meetings were rigorously maintained. These meetings served several purposes: 1) to assure that scheduled production rates were met, 2) if scheduled production rates were not met, what impact would this have on subsequent dependent activities, 3) learning to identify problems, 4) how to present problems, 5) seeking solutions to problems, 6) organization and lines of communication.

The training received by top level supervisors was passed on by them to lower level supervisors thus assuring cohesive team work within the organization, however, it should be noted that there is a definite lack of depth in all supervisory activities.

Training manuals, standard operating procedures and specifications have been prepared for all activities in the Bureau.

Each supervisor should be training an assistant in order to establish and maintain two-deep leadership.

Key personnel should attend seminars, conferences and short courses in order to keep up with the state of the art.

All levels of supervision should be continually trained in management procedures.

AERIAL PHOTOGRAPHY AND REPRODUCTION

At the inception of the project, the Operations Consultant supplied a pilot-photographer to train a crew of Nicaraguan nationals in aerial photography. All attempts to utilize a B-26 aircraft belonging to the GON proved a complete failure. Training therefore, was non-existent during the 1967-1968 photographic season.

During 1968, after the photographic season, the Banco Nacional made an Aero Commander available to the Bureau. This aircraft was ordered with aerial photography capabilities built-in, at a cost of approximately \$25,000 to the Bureau of Cartography. During the 1968-1969 photographic season, the German Technical Mission (GTM) supplied a pilot-photographer to train Nicaraguan nationals in aerial photography. Although the cameraman and navigator did receive some training, the total results of this training was less than adequate for the following reasons:

- a) The Aero Commander, although stated to be at the exclusive use of the Bureau was repeatedly commandeered by high government officials for use other than aerial photography.
- b) The government of Nicaragua would not allow training of civilian pilots, therefore only FAN (Nicaraguan Air Force) pilots were trained. This, of course, did not help the Bureau to become self-sufficient in obtaining photography since reliance had to be placed on the availability of Air Force pilots, who could, and were transferred or changed at the wishes of the FAN Commanding Officer.
- c) Only one cameraman and one navigator received training during this period, thus lacking depth of personnel.

During the 1969-1970 photographic season, the GTM again supplied a pilot-photographer to train the Nicaraguan nationals. Once again, despite orders from the President of Nicaragua, the Aero Commander was not always available. In fact, at one time, the aircraft was used for air force business without removing the aerial photography equipment. This mission resulted in damage to the navigational tele-

scope which in turn forced the grounding of the photographic crew for approximately one month during the critical photographic season.

Generally, the results of the training received during the 1969-1970 photographic season indicated that the Nicaraguan crews could accomplish good photography at 1:5,000 scale and marginal photography at 1:20,000 and 1:30,000 scales.

Training was also given in the following sub-activities of the Reproduction Division:

Flight planning and map preparation, film developing, film inspection, film titling, flight checking, photo-indexing, contact printing, diapositives (both contact and transformation reductor), enlargements, rectifications, microfilming, layout and stripping, and use of photographic screens.

Personnel are now well trained in all of the above sub-activities except flight planning, film developing, and flight checking; the reason being that these operations are performed only during the four-month photographic season. It is expected that the coming 1970-1971 photographic season will rectify this slight shortcoming.

Conclusions

- (1) The Aero Commander belonging to the Banco Nacional cannot always be relied upon to be available when photographic weather exists.
- (2) The trained FAN pilots cannot always be relied upon to be available and that when these are changed by the Commanding Officer, re-training will be required for new FAN personnel assigned.
- (3) The pilots, navigator and cameraman are not fully trained.

Recommendations

It is recommended that the Bureau of Cartography:

- (1) Obtain its own aircraft.
- (2) Hire and train two civilian pilots.
- (3) Continue training the present navigator and cameraman.

- (4) Train another navigator and cameraman. It is estimated that the above personnel could be fully trained to accomplish all scales of acceptable photography within a four-year period.

RURAL AND URBAN FIELD CONTROL

Technical training in the following sub-activities were administered with great success.

Planning, reconnaissance, monumentation, observations (both distance and angles for triangulation, trilateration, and traverse), levelling (trigonometric, barometric, and differential), distances and offsets, use of penta-prisms, use of electronic distance measuring devices and other instruments, abstracting, and office computations for field data reduction.

Personnel are now well trained and qualified to perform all sub-activities of rural and urban field control for the continuance of the project.

Refresher courses should be obtained by the Chief of the Section as these courses became available, either in Nicaragua or abroad. A deputy chief should be named and trained at IAGS.

PHOTOGRAMMETRY

This division was already established in the production of 1:50,000 scale base maps, however, considerable training was required for production of the large scale cadastral mapping program.

Aerotriangulation, a key sub-activity of this division, received and continues receiving training.

Other sub-activities for which training was given were: point selection and transfer, relative and absolute orientation (both manual and numerical), strip and block adjustment, scanning, orthoprojection, mosaicking, plotting projections and grids, large scale stereocompilation, use of desk computer, analysis of computer out-put of photogrammetric data, and use of coordinatograph.

Although personnel received training in the above mentioned sub-activities, continuous training is required in independent model orientation, aerotriangulation, and large scale stereocompilation.

DELINEATION

Property delineation, one of the key tasks of the project has been, and continues to be, on the critical path of the project. This activity requires at least three months intensive training which, in itself, is not excessive. The type of work demanded that recruits must have graduated high school, but because the pay scale is low, many employees left for better paying jobs. Training was given to 95 delineators of which 44 remain on the project today. This is a 116% turnover with attendant loss of time and waste of money. Personnel were selected on the basis of written tests, stereoscopic vision, and interviews.

Training was given in both classroom and field work, and consisted of public relations, photo identification of property corners, tape distances, compass bearings, and area determination.

Personnel are adequately trained to continue with the project, but in order to maintain trained personnel, salaries must be adjusted upwards with yearly increases based on merit systems.

DRAFTING

This division was already established in the production of 1:50,000 scale base maps by scribing methods. Considerable training, however, was required for production of large scale cadastral maps by scribing and pen and ink methods.

On-the-job training consisted of use of plotting templates, mensuration, elements of projections, plotting projections and grids, plotting by field notes, offset and distance plotting, use of drafting machines, pen and ink drafting, stereoscopy, photoidentification, edge matching, styling, editing and revisions, and reproduction precepts.

Personnel are well trained and qualified to continue with the project. All personnel should continue training as required to keep pace as the state of the art advances.

EDP AND PROGRAMMING

The Bureau of Cartography (DGC) has three programmers, all trained in Fortran IV language. They have been trained to write, program, operate computers, and

make analysis of data out-put.

Programs developed and used are as follows :

- (1) Geodetic traverse computation for rural control
- (2) Traverse computation for urban control
- (3) Offset computation (for urban blocks control)
- (4) Transformation of coordinates
 - a) Geographic to UTM, 6° and 3°
 - b) UTM to geographic
- (5) Tables for UTM-3° (rural sheet corners)
- (6) Tables for UTM-3° (urban sheet corners)
- (7) Area computation by coordinates
- (8) Meaning and sorting program (for photogrammetry)
- (9) Helmert transformation
- (10) Block adjustment (Schutt)
- (11) Theoretical gravity computation
- (12) Calculation of spectra for strong motion earthquakes
- (13) Rainfall per month (not fully developed)
- (14) Geodetic triangle computation

Training should continue to keep up with the state of art.

AREA MEASUREMENT

Training was administered in use of polar planimeters, rolling disk planimeters,

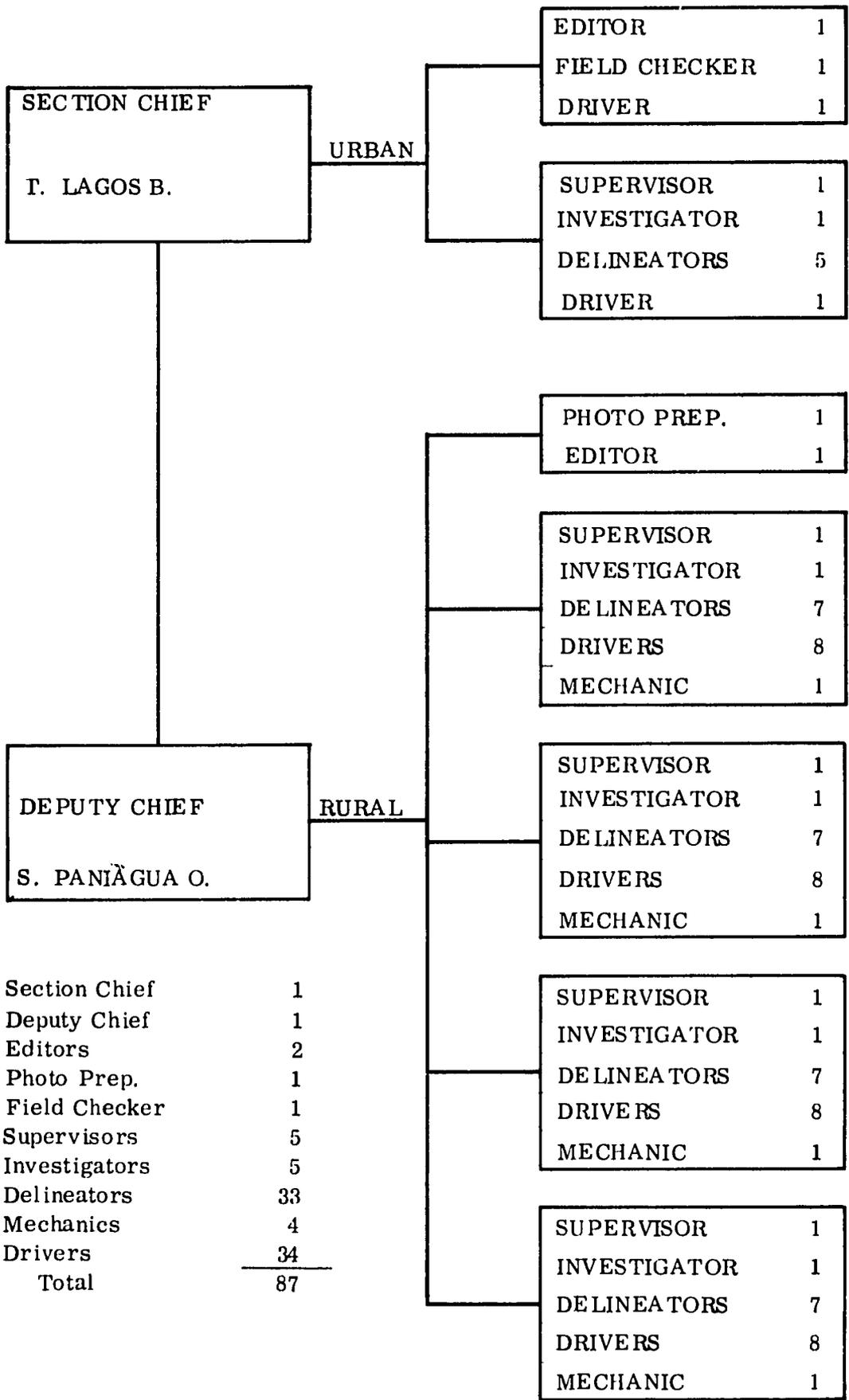
digital readout, area integrator, map preparation, logic structure, and computer preparation. Personnel are well trained to carry on the project.

OWNERSHIP CORROBORATION

This unit was started in March 1970, but did not gain its impetus until approximately September 1970. Training of all personnel, therefore, is not complete, and training continues in many areas. Sub-activities receiving training are microfilming, microfilm reading, data filing and retrieval, deed abstracting, building and checking alpha-numerical indexes, cross filing, up-dating data, and field investigation for public registry data.

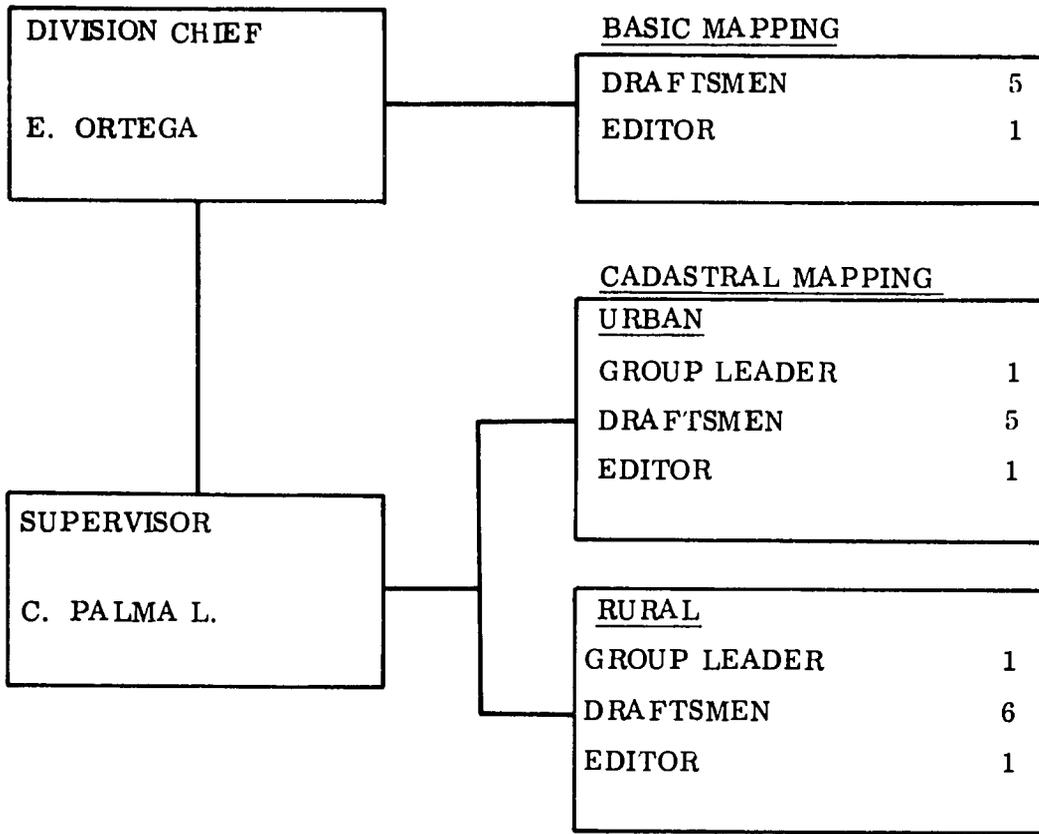
Training should be continued in all sub-activities.

APPENDIX A
ORGANIZATION CHARTS



DELINEATION SECTION - ORGANIZATION

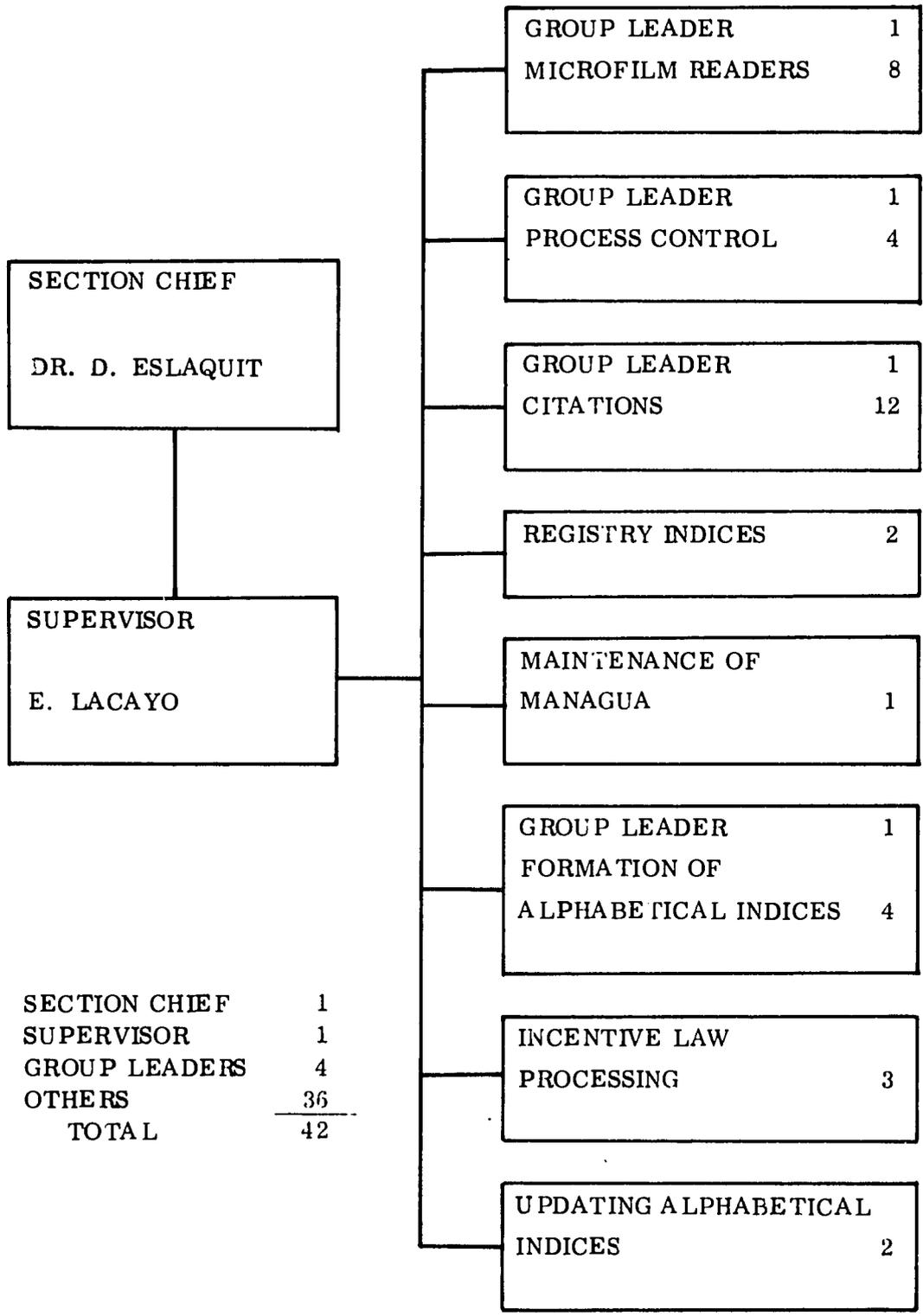
24



DIVISION CHIEF	1
SECTION CHIEF	0
SUPERVISOR	1
GROUP LEADERS	2
DRAFTSMEN	16
EDITORS	3
TOTAL	23

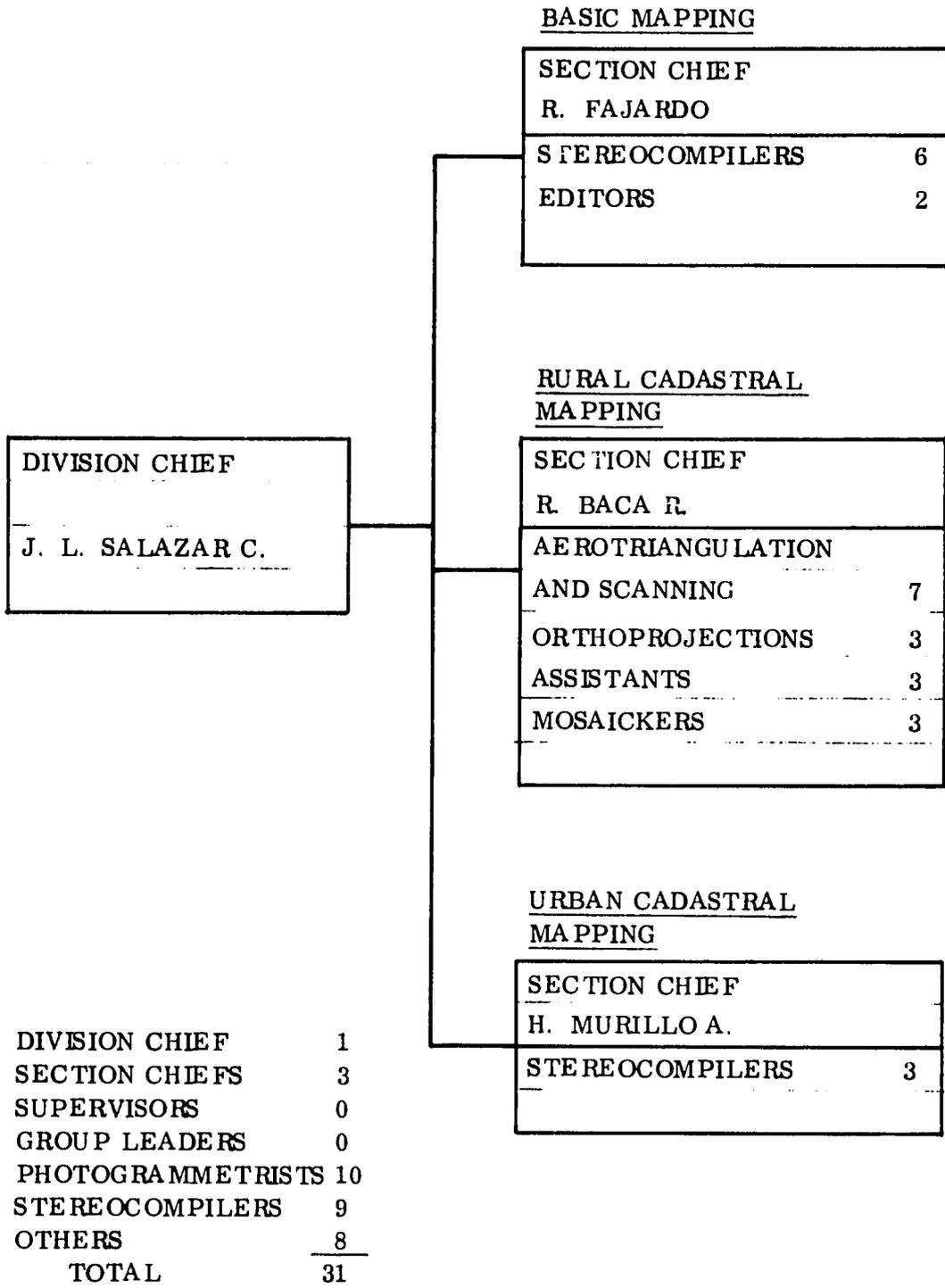
DRAFTING DIVISION - ORGANIZATION

25

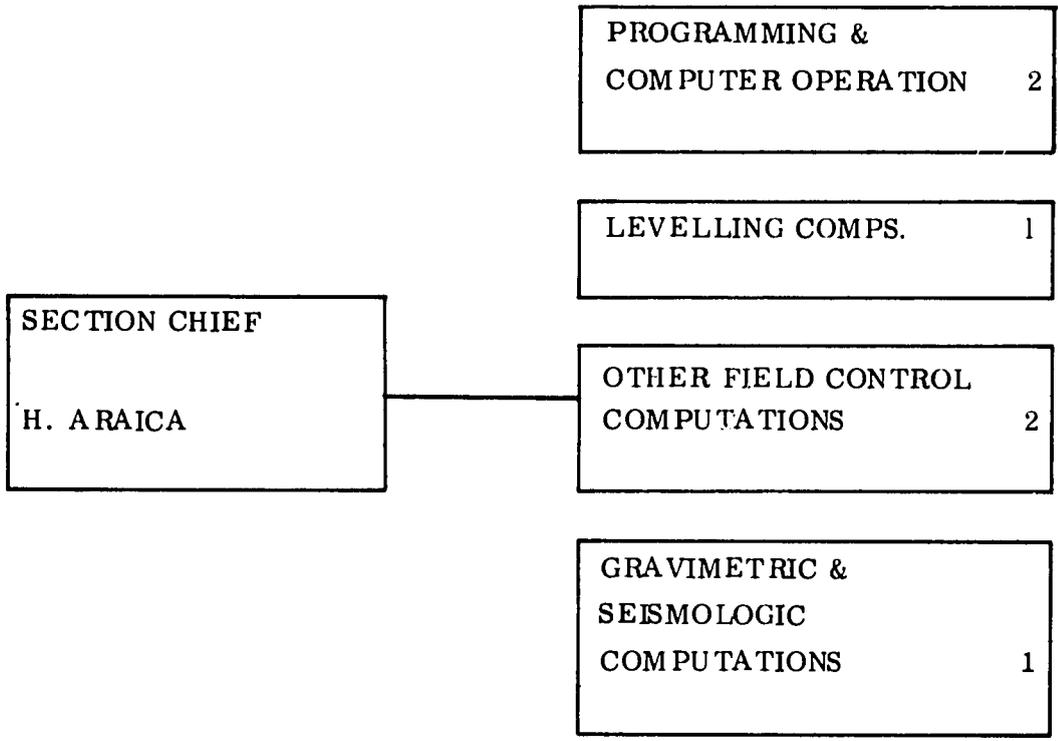


VERIFICATION SECTION - ORGANIZATION

26



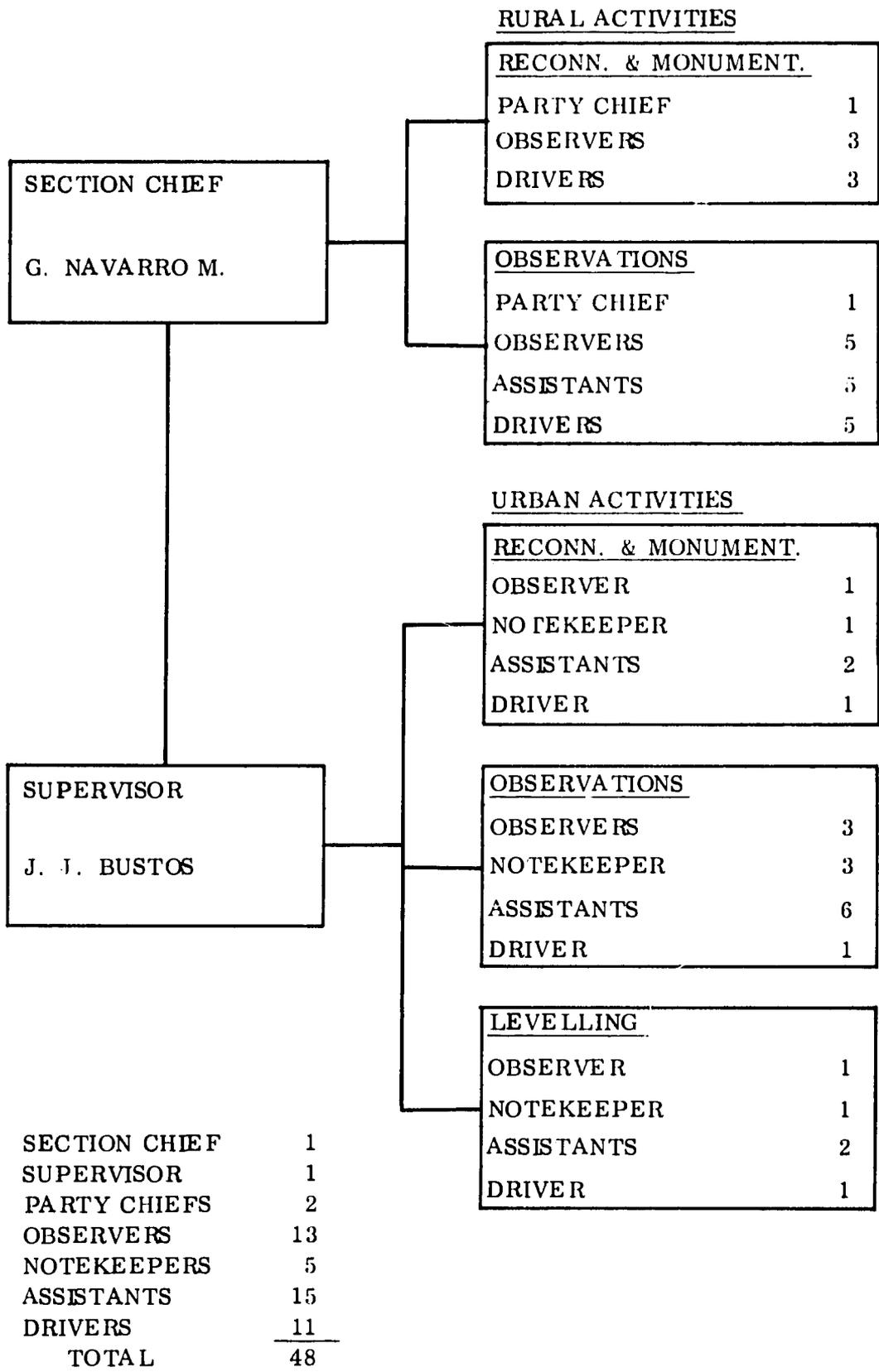
DIVISION CHIEF	1
SECTION CHIEFS	3
SUPERVISORS	0
GROUP LEADERS	0
PHOTOGRAMMETRISTS	10
STEREOCOMPILERS	9
OTHERS	8
TOTAL	<u>31</u>



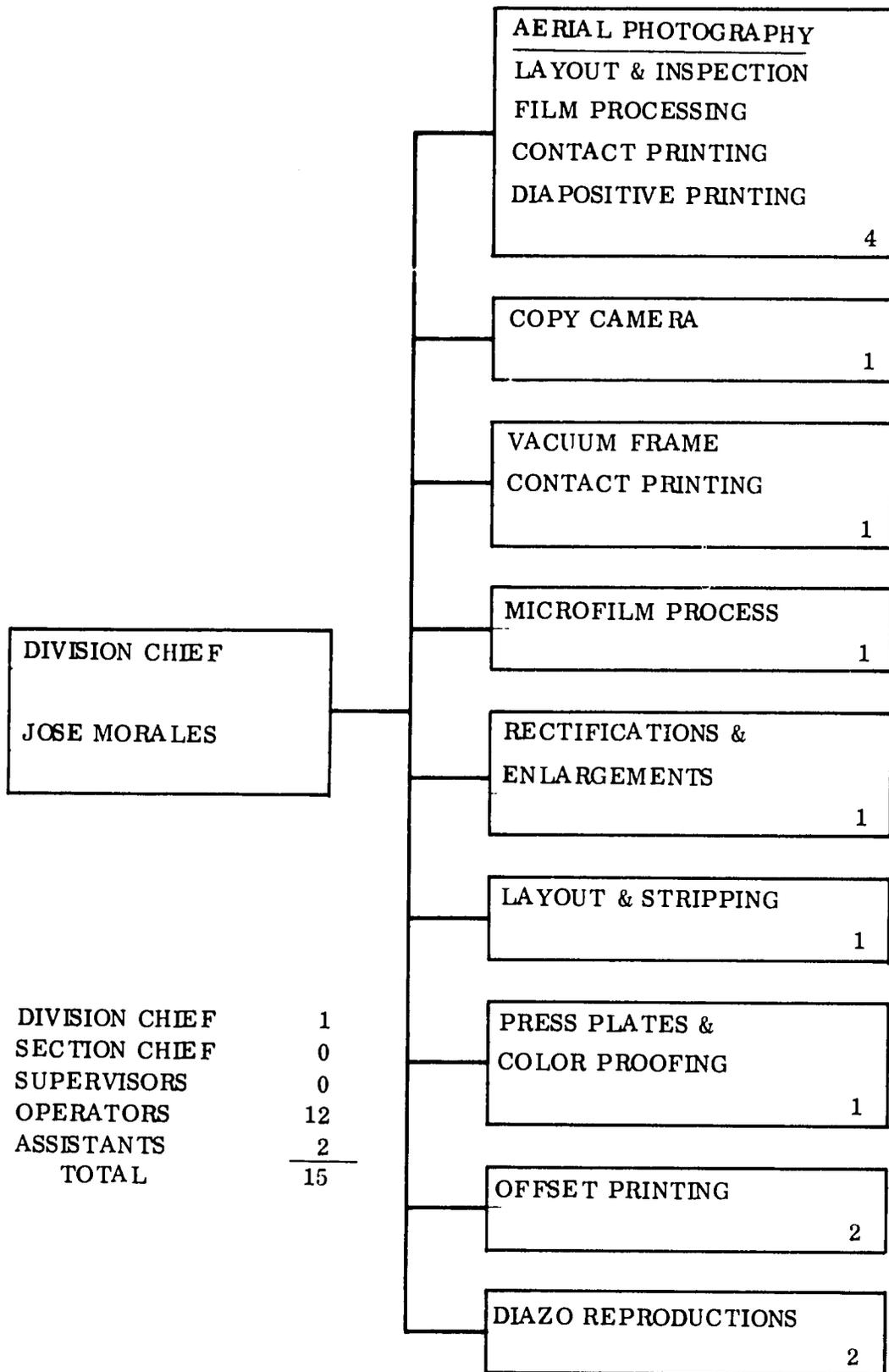
SECTION CHIEF	1
SUPERVISOR	0
GROUP LEADER	0
OTHERS	6
TOTAL	<u>7</u>

COMPUTATIONS SECTION - ORGANIZATION

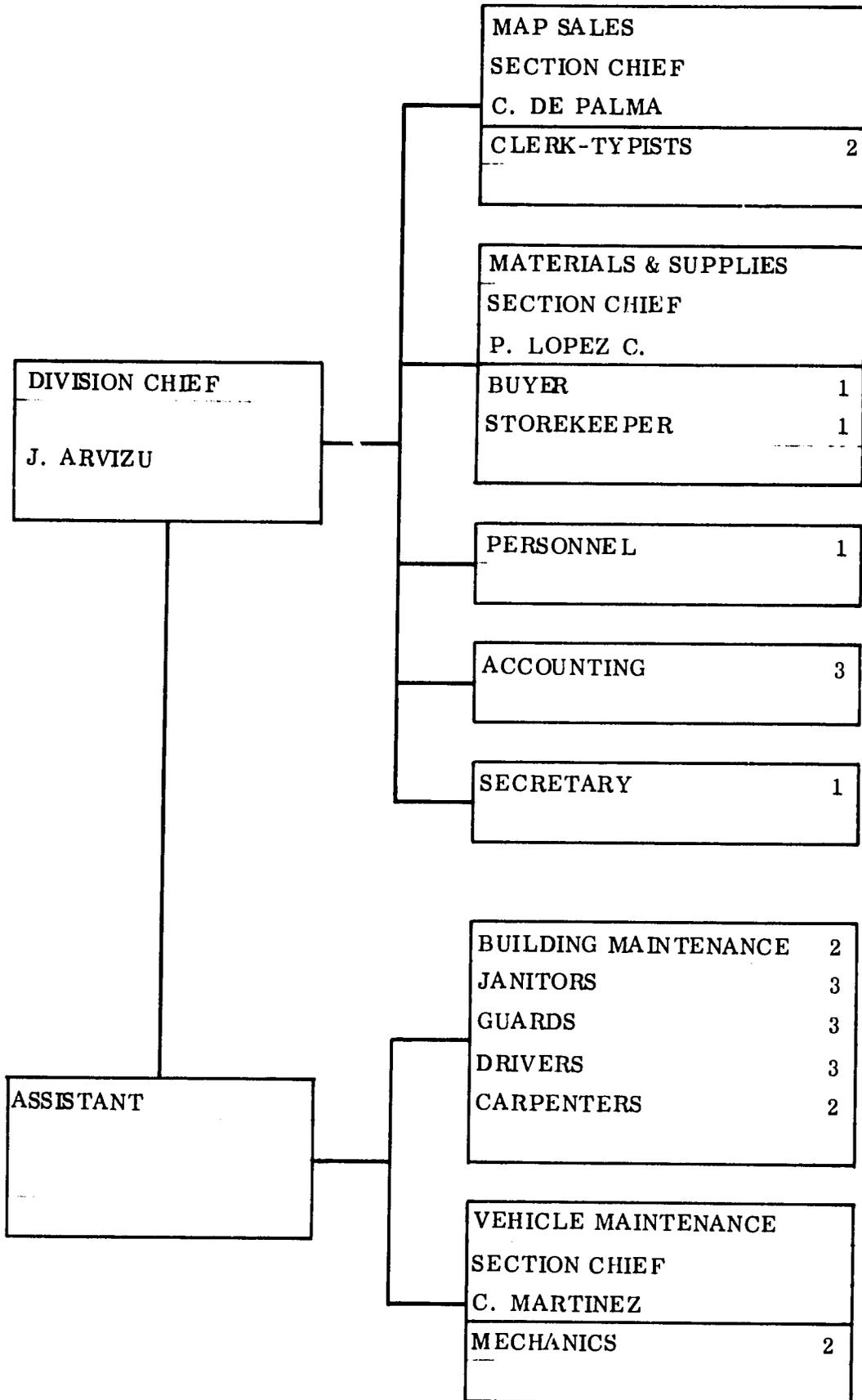
28



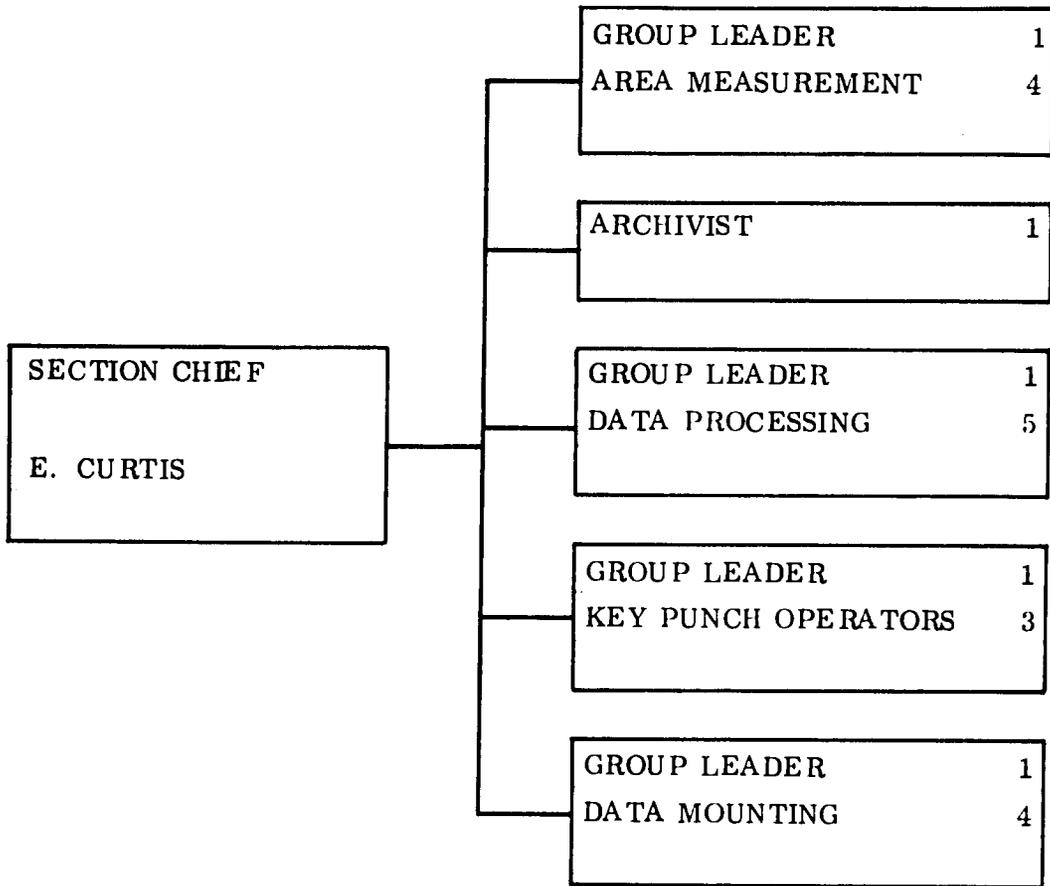
FIELD CONTROL SECTION - ORGANIZATION



RE PRODUCTION DIVISION-ORGANIZATION



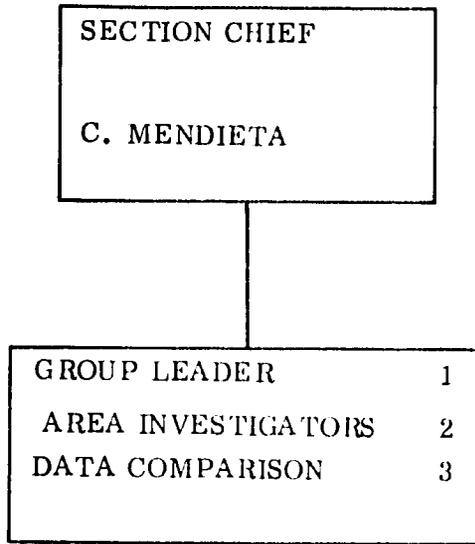
ADMINISTRATIVE DIVISION - ORGANIZATION



SECTION CHIEF	1
SUPERVISORS	0
GROUP LEADERS	4
OTHERS	<u>17</u>
TOTAL	22

AREA MEASUREMENT & DATA PROCESSING-ORGANIZATION

36



SECTION CHIEF	1
SUPERVISORS	0
GROUP LEADER	1
OTHERS	5
TOTAL	<u>7</u>

COMPLETION OF CADASTRAL DATA - ORGANIZATION

53

APPENDIX B

TRAINING CHARTS

The following charts indicate the amount of training received by individuals in the various activities. A scale of 10 indicates full training in that activity. A blank space indicates no training received.

The delineation section training chart is shown in abbreviated form, to facilitate reporting, since the activity of Delineation, per se, covers many sub-activities that must be mastered prior to going into the field. Therefore, a delineator must have been fully trained in the following in order to accomplish delineation:

- Photoidentification
- Stereoscopy
- Point pricking
- Mensuration with scales
- Tape measuring
- Use of directional compass
- Drafting
- Filling out forms
- Deed interpretation
- Public relations

Personnel whose names are prefaced with an asterisk have received additional training in other activities, therefore, their names appear more than once.

CODE

V/W - VERIFYING WITH
V/B - VERIFYING BY
RI - REGISTRY INDEX
AI - ALPHABETICAL INDEX

	V/W REGISTRY DATA	V/W FISCAL INCENTIVE	V/B PROPRIETOR	V/B TRACT NUMBER	V/B DEED ABSTRACTING	RI DATA COLLECTION	RI CONSTRUCTION	AI CONSTRUCTION	DEED INTERPRETATION	FIELD INVESTIGATION	MICROFILMING	MICROFILM READING	VERIFIED DATA CONTROL	DATA FILING	MAINTAINING FILES	SUPERVISION
DIB ESLAQUIT C.	10	7	8	10	10	10	10	10	10	7		2	9	8	9	7
ENRIQUE LACAYO S.	10	7	8	10	9	10	10	10	10	7		2	10	8	9	7
JOSE CISNE M.	10		10	10	10	10			10							8
RAQUEL M. DE ROMAN								10				10	10	10	10	10
LORENZO PARIS PORRAS	8	5		7				4	6			10		5		8
ADAN TALAVERA I.				0				6					8	8		5
FERMIN QUANT W.	10	10	9	10	9	10			9							7
ADRIAN SILVA D.	8	5	6	7	4	10			6			4				
ORION ZAMBRANA T.	9	5	10	9	8				9							7
JOSE VALDES V.	5			3		8							2			3
DAVID GONZALEZ M.						4						10	2			7
ROGER SARAVIA B.												10	3	3		7
ROGER BARBERENA F.								3								
AMADEO CASTILLO M.	8	5	4	7	5				6							
ROBERTO HUETE H.								10					7	10		5
CLAUDIO SARAVIA C.				5				5					8	8		3
RENE GUEVARA S.								5					6	7	5	5
ALEJANDRO ZAMORA R.				5									4			
ALEJANDRO DIAZ P.								10			8	10		9		5
Ma. EUGENIA N. DE RUBI								7					3	3		
NUBIA H. DE MIXCO													3	8		
MANUEL AROSTEGUI M.				6	10								6			3
SILVIO FITORIA S.																4
GERARDO GUTIERREZ F.									4	10						
FELIX CASTRILLO R.																4
FERNANDO CABEZAS L.									6	10						

VERIFICATION SECTION - TRAINING

35

	DIGITAL READOUT	ROLLING PLANIMETER	AREA INTEGRATOR	FINAL DATA CORRECTION	MAP PREPARATION	IBM KEY PUNCH	IBM VERIFICATION	MANUAL DATA PROCESSING	REGISTRY DATA	ARCHIVES (FILING)	DATA MOUNTING	TIE NUMBERING	ASSIGN PERPETUAL NO.	COMPLETION OF AREAS	SUPERVISORY
* GEORGE EDGAR CURTIS	10	10	10	10	10	3	2	10	3	10	10	8	10	10	10
FERNANDO SANTAMARIA L.	10	10	10	10	10					3	10	10	10	10	10
JORGE IBARRA R.	10	10	10	10	10	5	2							10	10
* RAFAEL ABURTO V.	10	10	10	10	10									10	8
JOSE BENAVIDES M.	10	10	10	10	10									10	5
SILVIA DE DURAN								10	10	8					10
CARLOS BALDODANO M.		10	7		5	10	10	10			3			7	7
RICARDO ARGUELLO B.						10	10	10			5				
LORENZO MANZANO		10			5	10	10	10			8	3	5		
MIRTHA DE BUSTOS	10	5	8		10						10				
MELBA MADRIZ Z.	10	10	5	2	10	10	8				10	8		5	
JOSE MADRIZ M.								10	3	8	10	3	3		5
MARICELA GALO S.								10		5					
CARLOS LEZAMA C.	10							10			10	10	10		2
JOSE R. SANDINO	10	5		2	10	2		10	10	5	10	8	10		
CARLOS ESCOBAR G.								10	10	2	10	10	10		2
JAI ME ARAUZ D.										10	10		2		2
JOAQUIN PALMA Z.					10			10	5	10	10				
PEDRO RAYO L.								10		10	10				
DOLORES ESTRADA P.	10	10	10		10	3									5
RUTH A. DE BERMUDEZ					8			10		10					
LUISA GALEANO F.										10	10				

AREA MEASUREMENT & DATA PROCESSING SECTION - TRAINING

	PHOTOIDENTIFICATION		RECONN. DESCRIPTIONS		MONUMENT. & DESCRIP'		ANGULAR OBSERVATIONS		ELECTRONIC DIST. MEAS.		TAPE DISTANCES		NOTEKEEPING		LEVEL NOTES		LEVELLING		RADIO COMMUNICATIONS		HELIOTROPE		TARGET HANDLING		HAND LEVEL		SUPERVISORY	
GUILLERMO NAVARRO M.	10	10	6	9	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
DANIEL SACASA C.	10	10	5	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	6
RAUL LARGAESPADA M.	10	10	5	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	5
JUAN HERNANDEZ F.	10	10	5	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	3
MODESTO BENAVIDES L.	10	10	10	5	6	10	5	5	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	3
LORENZO HUETE B.	5	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	1
ANTONIO LAW C.	5	5	6	5	6	10	6	10	6	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	1
HOMERO MIRANDA G.	6	3	2	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	1
RILEY ENGLEHARD G.	6	5	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	1
OSCAR BLANDINO M.	6	8	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	
ROBERTO GARCIA G.	6	6	5	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	
JUAN DIAZ C.	6	6	5	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	
JOSE BELISARIO	8	6	10	5	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	
MANUEL BENAVIDES L.	5	2	6	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	
MANUEL VEGA R.	5	2	6	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	
OCTAVIO SANCHEZ R.	5	2	6	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	
JUAN SUAREZ A.	10	10	5	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	
ADALID CARBALLO S.	10	10	5	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	
EDMUNDO SABALLOS M.	10	10	5	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	
RAUL GALEANO L.	5	0	2	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	
* EDGAR CURTIS D.	10	10	10	5	5	10	10	5	10	10	5	10	10	5	10	5	10	5	10	5	10	8	8	8	8	8	8	8
* JOSE BENAVIDES	8	10	10	10	10	10	10	10	10	10	5	10	10	5	10	10	10	10	10	10	10	10	10	10	10	10	10	

RURAL FIELD CONTROL SECTION - TRAINING

3A

	PHOTOIDENTIFICATION		RECONN. DESCRIPTIONS		MONUMENT. & DESCRIPT.		ANGULAR OBSERVATIONS		ELECTRONIC DIST. MEAS.		TAPE DISTANCES		NOTEKEEPING		LEVEL NOTES		OFFSET SURVEYING		PENTAPRISM		LEVELLING		RADIO COMMUNICATIONS		HELIO TROPE		TARGET HANDLING		HAND LEVEL		SUPERVISORY	
JUAN J. BUSTOS C.	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10		
JOSE GAMBOA R.	6	6	8	9	10	10	10	10	9	9	9	8	8	9	10	9	8	8	9	10	9	9	9	9	9	9	9	9	7			
REYNALDO VARGAS A.	8	9	8	6				8	8	9	7	5	10	6	6	5	9	5														
SANDRO RAMIREZ Z.	4	4	8					9	9		8	8		7	8	8	8	5														
GILMER GUTIERREZ M.	5	5	7					8	8	8	8	8		7	8	7	8	5														
RODOLFO MULLER O.	7	10	10	6	6	10	10	10	10	10	9	2	10	10	10	10	8															
CRISTOBAL LIZANO R.	6	6	8	9	10	10	10	10	10	8	8	8	7	9	10	10	9	6														
GONZALO MEDINA P.	9	10	10	10	9	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10		
EVARISTO ARGUELLO N.	9	10	10	10	9	10	10	10	9	10	9	9	10	9	10	10	9	10	10	10	10	10	10	10	10	10	10	10	9			
BARNEY ARANA G.	5	5	8					9	8	9	8	9	9	8	8	8	9	8	8	8	8	8	8	8	8	8	8	8	8	8		
JOSE ROSALES V.			4					7						7	5	0	5	0	4	4	4	4	4	4	4	4	4	4	4	4		
ALBERTO CASTRO L.			4											4	4	6	6	7	8	8	8	8	8	8	8	8	8	8	8	8		
ALEJANDRO MARTINEZ Q.	4	4	3					6						4		4	1															
SEBASTIAN GARCIA N.	2	4	8	7	8	10	10	10	5	10	9	6	10	10	10	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9		
LORENZO ALEMAN J.			2					8						5		9	6	8														
MODESTO GARCIA A.			4					9						7	7	8	9	9	9	9	9	9	9	9	9	9	9	9	9	9		
JORGE GONZALEZ L.			4					9	7	5	8	9		9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9		
ANTONIO ALVARADO M.			4					10						8	9	9	8	10	9													
NOEL GOMEZ O.																																
RAMON BENAVIDES L.			4					8						7	6	7	7	4														

URBAN FIELD CONTROL SECTION- TRAINING

	MENSURATION	PLOTTING SHEET CORNERS	PLOTTING GRIDS	PLOTTING CITY BLOCKS	FILLING-IN CITY BLOCKS	SCRIBING CADASTRAL MAPS	SCRIBING BASIC MAPS	DRAFTING CADASTRAL MAPS	GENERAL DRAFTING	MECHANICAL LETTERING	STICK-UP	PHOTOIDENTIFICATION	NEGATIVE PREPARATION	EDITING	SUPERVISORY
ERNESTO ORTEGA MORA	10	10	10				8				10		10	10	10
F. CASIMIRO PALMA L.	10	10	10	10	10	10	8	10	10	8	4	10	4	10	10
FIDELMO MAYORGA	10	10	10	10	10	10	6	8	10	10	1	8	1	10	8
FRANCISCO PALLAVICINI	10	10	10	8	8	10	6	10	10	10	1	10	1	10	6
SERGIO VADO	10			10	10	4		8	6	4		8		2	
DONALD ORDEÑANA	10	10	10	10	10	10	6	10	10	10	1	10	1	10	4
HUASCAR PEREIRA	10			6	6	4		10	10	10		10		4	
ALVARO OBREGON	8	1	1	2	2	2	4	8	6	10		8			
VICTOR PALMA	6	2	2	4	4	10	6	10	4	4	1	10	1	6	2
RAFAEL CASTILLO	4					4		2	10	10		2			
JUAN JOSE PEREZ R.	8	1	1	4	4	10	6	4	10	10					
ROGER GARCIA	1					4		2	4	8		1			
VIANA CARAZO BRENES	6	2	2	6	4	10	6	10	6	4	1	10		10	
ESPERANZA DE MAYR	4	1	1	2	4	8	4	8	1	1		8		8	
ANA ARTOLA DE RIVAS						2		4	2			4			
SOCORRO ROJAS DE PALMA	2			2	2	10	4	4	2			4		2	
MARDY A BURTO	2			2	2			8	6	6		8		2	
ROGER BARBERENA L.	10	10	6				6				6		5	10	4
HARRY PORTA A.	10	10	10				10				6		10	6	4
JOSE ABARCA M.	6	8	8				9				4		6	4	1
LILIAM L. DE BORGE	4	3	1				4				8		8	2	
GUILLERMINA O. DE ARCE	4	10	10				10						10	4	1
JOSEFA N. DE SAENZ	6	4	6				6				10			1	

DRAFTING DIVISION - TRAINING

B-7

	RURAL ACTIVITIES						URBAN ACTIVITIES					
	EDIT	PHOTO PREPARATION	DELINEATION	INVESTIGATION	FIELD CHECK	SUPERVISORY	EDIT	PHOTO PREPARATION	DELINEATION	INVESTIGATION	FIELD CHECK	SUPERVISORY
TOMMY LAGOS B.	10	10	10	10	10	10	10	10	10	10	10	10
SALOMON PANIAGUA O.	10	10	10	10	10	10			10	10	10	10
ENRIQUE AMADOR C.							10	5	10	10	10	10
LUIS H. PINEDA M.		10	10	5	10	5			5			5
WILLIAM MIRANDA P.	10	10	10	5	10		5		5			
PEDRO MURILLO A.			10	10	10	5				5		
MARIO CORDOBA Z.							10		10			
DOMINGO HERRERA E.									10		10	
FRANCISCO SILES M.									10		5	
ROGER PRADO O.									10		5	
MARCELINO BLANDON B.									10		5	
WLADIMIR ESPINOZA M.									10		5	
SOCRATES MALESPIN V.	10		10	10	10	10						
PEDRO CASTELLON Q.	10		10	10	10	10						
FREDDY ANDRADE O.	10		10	10	10	10						
RIGOBERTO LOPEZ S.	10		10	10	10	10						
FRANCISCO LOPEZ R.			10	5	5				10			
OSCAR NORORI G.			10	5	5				10			
RUBEN MOLINA F.			10	5	10							
MARIO CONTRADO Z.			10	5	10							
SILVIO FLORES M.			10							5		
RONALD GUIDO L.			10							5		
VICENTE RIOS G.			10	5	5							
FRANCISCO LECHADO A.			10	5	5							
FRANCISCO SEQUEIRA C.			10	5	5							
HUMBERTO LOPEZ S.			10	5	5							

	RURAL ACTIVITIES					URBAN ACTIVITIES						
	EDIT	PHOTO PREPARATION	DELINEATION	INVESTIGATION	FIELD CHECK	SUPERVISORY	EDIT	PHOTO PREPARATION	DELINEATION	INVESTIGATION	FIELD CHECK	SUPERVISORY
CARLOS LEIVA J.			10	5	5							
RAMON CARDOZE P.			10	5	5							
JOSE M. HANON A.			10	5	5							
HERMOGENES VANEGAS M-			10	5	5							
LEONEL BOZA R.			10	5	5							
JOSE M. PEREZ A.			10	5	5							
JORGE GUILLEN G.			10	5	5							
MANUEL MALESPIN S.			10	5	5							
DENIS BLANCO E.			10	5	5							
FIDEL UBEDA U.			10	5	5							
RAMON ZELAYA O.			10	5	5							
EVENOR REYES N.			10	5	5							
ADOLFO CABRERA A.			10	5	5							
FREDDY MEDRANO U.			10	5	5							
RAMON MEJIA D.			10	5	5							
JAIIME RIVAS M.			10	5	5							
BISMARCK PEREZ C.			10	5	5							
MARIO MOYA R.			10	5	5							
JULIO CRUZ P.			10									
* DANIEL CASTELLON B.			10									
* ENRIQUE PASQUIER G.			10									
* HARVY AGURTO V.									10		10	
* CARLOS GARCIA M.									10			
RAFAEL ABURTO V.									10			
* JUAN J. SANDOVAL C.									10			
* ALEJANDRO MARTINEZ Q.									10			

DELINEATION SECTION - TRAINING

	FLIGHT LINE PLANNING	AERIAL FILM PROCESSING	FILM NUMBERING & CHECK	PHOTO INDEXING	CONTACT PRINTING	ENLARGEMENTS	RECTIFICATIONS	COPY CAMERA	DIAPOSITIVES	CONTACT-NEGATIVES	MICROFILM DEVELOPING	OFFSET PRINTING	COLOR PROOFING	STRIPPING & LAYOUT	PRESS PLATES	SUPERVISORY
JOSE A. MORALES S.	10	8	10	10	10	10	10	10	8	10	10	8	10	10	10	10
SALVADOR MELENDEZ P.		10	7		10	10	3	10	5	10	10		8	5	10	5
CESAR VELAZQUEZ M.												10	8	8	10	5
RAMON BLANDON T.												8	10	5	10	
ARMANDO BALTODANO M.	7	2	9	3	5	5	3		10	5	10			8	2	5
* OCTAVIO CENTENO	5		5													
* ROGER FAJARDO	7															
* HELIODORO TALENO	7		5	10												
EMILIO ALANIZ Z.		4	3		10	10	2	7	6	10	10		5	3	5	
GUILLERMO GARCIA	2	10	10	3	10	10	5		5	5	5		5	5	5	
ROLANDO MANFUT B.		2	5		10	5					5		5	2	5	
PEDRO RAMIREZ M.	1	1	7	3	5	3					10	7	5	5	10	
JUAN BRENES A.				3		2	7							8		
JULIO FARIÑA C.		1			5	3		4		2	2		2		3	
EDGAR CURTIS D. h.													5		5	
RAUL MARTINEZ A.											10					
MARVIN MIRANDA P.													3		2	

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	POINT TRANSFER-MANUAL	POINT TRANSFER-PUG 3	EMPIRICAL ORIENTATION	NUMERICAL ORIENTATION	INDEPENDENT MODEL	AEROTRIANGULATION C-8	GRAPHICAL ADJUSTMENT	SCANNING	ORTHO PROJECTION	COORDINATOGRAPH	MOSAICS	STEREOCOMPILATION C-8	" MULTIPLEX, KELSH, M-2	MENSURATION	PLANNING	SUPERVISORY
* J. LEONEL SALAZAR C.	10	10	10	10	10	8	10	5	8	10	10	2	10	10	10	10
RODOLFO BACA R.	10	10	10	10	10	10	10	10	3	10	8	10	10	10	7	6
RODOLFO ESPINOZA	10	10	10	10	10	10	10	10	3	10	8	10	10	10	5	
* FELIX ASCHER G.	10	10	10	10	10	10	10	10	3	10	5	10	10	10	5	
SERGIO SALAZAR C.	10	10	10	5	10	10	10	10	3	10	5	10	10	10		
ROLANDO VELAZQUEZ C.	10		10		10		10		10		5		10	10		
BENJAMIN GARCIA Z.	10	10	10	10	10	10	10	10	5	5	5	10	10	10	5	
LUIS BALLADARES C.	5	5	10	5	10	10	5	10		3	5	10	10	10	5	
IGNACIO AREAS I.	10	10	10	10	10	10	10	10		5	5	10	10	10	6	
GUILLERMO PEREZ P.	5	5	10	6	10	8		5	10	5	5	5	10	10		
RAMIRO ROMERO M.	10	4	10	5	10	10	10	10		3	5	10	10	10		
FRANCISCO AYALA G.	10	6	10			4	5		10		5		10	10		
REYNALDO MARTINEZ M.			10							10			10	10		
HUMBERTO MURILLO A.	10		10										10	10	5	
* EVENOR PEREZ R.			10										10	10		
URIEL HERRERA G.			10										10	10		
* EDUARDO MONTEALEGRE M.			10										10	10		
* ROGER FAJARDO B.	10		10										10	10	6	
ORLANDO MENDOZA S.	10		10				5						10	10		
MANUEL PALMA B.			10	7	10	10		10				10	10	10		
SERGIO CALDERA U.			10										10	10		
JOSE PALACIOS R.	10		10				5						10	10		
ALIAN RIVAS M.			10										10	10		
EDDY NAVAS N.			10										10	10	6	
ROBERTO ROSTRAN F.			10										10	10		
OSCAR VELAZQUEZ H.			10										10	10		

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APPENDIX C

PERSONNEL EVALUATION

The following charts indicate the evaluation of personnel. Personnel were evaluated by their immediate superiors. Thus, lower tier employees were evaluated by their supervisor, supervisors by section chiefs, section chiefs by department heads and department heads by the Director. All evaluations were reviewed by the next superior to the evaluator.

The following scale was used in each of the evaluation categories:

1. Excellent
2. Above average
3. Average
4. Below average
5. Unsatisfactory

	QUALITY OF WORK	PRODUCTIVITY	KNOWLEDGE OF WORK	INITIATIVE	ATTITUDE TOWARDS WORK	ATTITUDE CO-WORKERS														
TOMMY LAGOS B.	2	2	2	2	2	2														
SALOMON PANIAGUA O.	2	2	2	2	2	2														
ENRIQUE AMADOR C.	3	3	2	4	3	3														
LUIS H. PINEDA M.	3	3	2	4	3	3														
WILLIAM MIRANDA P.	1	1	1	1	1	2														
PEDRO MURILLO A.	2	2	2	1	2	2														
MARIO CORDOBA Z.	3	3	2	4	3	3														
DOMINGO HERRERA E.	2	2	2	1	2	2														
FRANCISCO SILES M.	3	3	2	4	3	3														
ROGER PRADO O.	2	2	2	2	2	2														
MARCELINO BLANDON B.	3	3	2	2	2	2														
WLADIMIR ESPINOZA M.	3	3	2	4	3	3														
SOCRATES MALESPIN V.	1	1	1	1	1	1														
PEDRO CASTELLON Q.	1	1	1	1	1	1														
FREDDY ANDRADE O.	1	1	1	1	1	1														
RIGOBERTO LOPEZ S.	3	3	2	4	3	3														
FRANCISCO LOPEZ R.	3	3	2	3	3	2														
OSCAR NORORI G.	3	3	2	4	3	3														
RUBEN MOLINA F.	1	1	1	1	1	1														
MARIO CONRADO Z.	1	1	1	1	1	1														
SILVIO FLORES L.	3	3	2	3	3	3														
RONALD GUIDO L.	3	3	2	3	3	3														
VICENTE RIOS G.	3	3	2	3	3	2														
FRANCISCO LECHADO A.	3	3	2	4	4	4														
FRANCISCO SEQUEIRA C.	3	3	2	3	2	4														
HUMBERTO LOPEZ S.	3	3	2	3	3	2														

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	QUALITY OF WORK	PRODUCTIVITY	KNOWLEDGE OF WORK	INITIATIVE	ATTITUDE TOWARDS WORK	ATTITUDE CO-WORKERS														
GEORGE EDGAR CURTIS	2	2	2	2	2	2														
FERNANDO SANTAMARIA L.	2	2	1	2	2	2														
JORGE IBARRA R.	2	2	1	1	2	2														
RAFAEL ABURTO v.	1	1	1	2	2	2														
JOSE BENAVIDES M.	2	2	2	2	2	2														
SILVIA DE DURAN	2	2	2	2	2	3														
CARLOS BALTODANO M.	3	3	2	4	3	3														
RICARDO ARGUELLO B.	2	2	2	1	2	2														
LORENZO MANZANO G.	2	2	2	2	2	2														
MIRTHA DE BUSTOS	2	2	2	3	2	2														
MELBA MADRIZ M.	3	3	2	2	1	2														
JOSE MADRIZ M.	2	2	2	2	2	2														
MARICELA GALO S.	2	2	1	1	2	2														
CARLOS LEZAMA C.	3	2	2	3	3	2														
JOSE R. SANDINO	3	3	2	2	3	3														
CARLOS ESCOBAR G.	2	2	2	2	2	3														
JAIME ARAUZ D.	2	1	1	1	2	1														
JOAQUIN PALMA Z.	4	4	2	4	4	4														
PEDRO RAYO L.	3	3	2	2	2	3														
DOLORES ESTRADA P.	1	1	1	2	1	2														
RUTH A. DE BERMUDEZ	3	3	3	4	3	3														

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	QUALITY OF WORK		PRODUCTIVITY		KNOWLEDGE OF WORK		INITIATIVE	ATTITUDE TOWARDS WORK	ATTITUDE CO-WORKERS											
J. LEONEL SALAZAR C.	3	3	2	3	3	2														
RODOLFO BACA R.	3	3	2	3	3	3														
RODOLFO ESPINOZA F.	2	3	2	3	2	2														
FELIX ASCHER G.	2	3	2	2	2	2														
SERGIO SALAZAR C.																				
ROLANDO VELAZQUEZ C.	2	2	1	1	2	2														
BENJAMIN GARCIA Z.	2	3	2	2	2	2														
LUIS BALLADARES C.	3	3	2	3	2	2														
IGNACIO AREAS I.	2	3	2	2	2	2														
GUILLELMO PEREZ P.	3	3	2	2	3	3														
RAMIRO ROMERO M.	2	2	2	2	2	2														
FRANCISCO AYALA G.	3	3	2	3	3	2														
REYNALDO MARTINEZ M.	3	2	2	2	2	2														
HUMBERTO MURILLO A.	2	1	1	2	2	2														
EVENOR PEREZ R.	3	3	2	2	2	2														
URIEL HERRERA G.	3	3	2	2	2	2														
EDUARDO MONTEALEGRE M.	3	2	2	2	2	2														
ROGER FAJARDO B.	2	3	2	2	2	2														
ORLANDO MENDOZA S.	3	3	2	4	2	2														
MANUEL PALMA B.	2	2	2	3	2	2														
SERGIO CALDERA U.	3	3	2	2	2	2														
JOSE PALACIOS R.	3	3	2	2	2	2														
ALLAN RIVAS M.	3	3	2	3	2	2														
EDDY NAVAS N.	2	2	2	2	2	2														
ROBERTO ROSTRAN F.	3	3	2	2	2	2														
OSCAR VELAZQUEZ H.	3	3	2	2	2	2														

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	QUALITY OF WORK	PRODUCTIVITY	KNOWLEDGE OF WORK	INITIATIVE	ATTITUDE TOWARDS WORK	ATTITUDE CO-WORKERS														
GUILLERMO NAVARRO M.	2	2	2	3	2	2														
DANIEL SACASA C.	2	2	2	1	1	2														
RAUL LARGAESPADA M.	1	1	1	5	3	3														
JUAN HERNANDEZ F.	2	2	2	4	2	3														
MODESTO BENAVIDES L.	2	2	2	3	2	2														
LORENZO HUETE B.	2	2	3	3	2	2														
ANTONIO LAW C.	2	2	2	2	2	2														
HOMERO MIRANDA	4	4	4	3	2	2														
RILEY ENGLEHARD G.	3	3	2	5	4	4														
OSCAR BLANDINO M.	3	3	2	3	3	3														
ROBERTO GARCIA	3	3	3	5	3	2														
JUAN GARCIA C.	2	2	3	5	2	2														
JOSE BELISARIO	3	3	4	3	3	4														
MANUEL BENAVIDES L.	3	3	2	5	2	3														
MANUEL VEGA R.	3	3	2	5	3	3														
OCTAVIO SANCHEZ R.	2	2	2	4	2	2														
JUAN SUAREZ A.	3	3	2	3	2	2														
ADALID CARBALLO S.	2	2	2	4	2	3														
EDMUNDO SABALLOS M.	3	3	3	5	3	3														
RAUL GALEANO L.	3	3	3	5	2	2														

RURAL FIELD CONTROL SECTION - EVALUATION

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	QUALITY OF WORK	PRODUCTIVITY	KNOWLEDGE OF WORK	INITIATIVE	ATTITUDE TOWARDS WORK	ATTITUDE CO-WORKERS														
JUAN JOSE BUSTOS C.	2	2	2	3	3	3														
JOSE GAMBOA R.	2	2	2	2	1	2														
REYNALDO VARGAS A.	3	3	2	2	2	2														
SANDRO RAMIREZ Z.	3	3	2	2	2	3														
GILMER GUTIERREZ M.	4	3	2	3	5	5														
RODOLFO MULLER O.	1	1	1	2	2	4														
CRISTOBAL LIZANO R.	3	3	2	2	3	2														
GONZALO MEDINA P.	1	1	1	1	1	1														
EVARISTO ARGUELLO N.	1	1	1	1	1	2														
BARNEY ARANA G.	2	2	2	2	2	3														
JOSE ROSALES V.	4	4	3	5	3	3														
ALBERTO CASTRO L.	3	3	3	5	4	3														
ALEJANDRO MARTINEZ	3	3	2	3	3	3														
SEBASTIAN GARCIA N.	1	2	1	2	2	2														
LORENZO ALEMAN J.	3	3	3	5	4	3														
MODESTO GARCIA A.	3	3	2	5	5	3														
JORGE GONZALEZ L.	3	3	2	5	4	3														
ANTONIO ALVARADO M.	2	3	2	3	5	5														
NOEL GOMEZ O.	3	3	2	2	3	2														
RAMON BENAVIDES L.	3	3	3	5	4	3														

URBAN FIELD CONTROL SECTION - EVALUATION

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	QUALITY OF WORK		PRODUCTIVITY		KNOWLEDGE OF WORK		INITIATIVE	ATTITUDE TOWARDS WORK	ATTITUDE CO-WORKERS											
ERNESTO ORTEGA MORA	4	4	2	4	4	2														
F. CASIMIRO PALMA L.	1	1	1	2	1	2														
FIDELMO MAYORGA	1	1	1	2	2	2														
FRANCISCO PALLAVICINI	1	1	1	2	1	2														
SERGIO VADO	2	2	2	2	2	2														
DONALD ORDEÑANA	2	1	2	2	2	3														
HUASCAR PEREIRA	1	2	2	1	1	2														
ALVARO OBREGON	3	3	2	4	3	3														
VICTOR PALMA	2	2	2	3	3	3														
RAFAEL CASTILLO	2	2	3	2	2	2														
JUAN JOSE PEREZ R.	2	2	2	2	2	4														
ROGER GARCIA	3	4	3	3	3	3														
VIANA CARAZO BRENES	2	2	3	2	2	2														
ESPERANZA DE MAYR	3	3	2	4	3	3														
ANA ARTOLA DE RIVAS	3	3	3	4	4	4														
SOCORRO ROJAS DE PALMA	3	2	3	3	3	4														
MARDY ABURTO	2	2	3	2	2	2														
ROGER BARBERENA L.	1	1	1	2	2	2														
HARRY PORTA A.	1	1	1	1	1	2														
JOSE ABARCA M.	3	3	2	2	2	2														
LILIAN L. DE BORGE	3	3	2	2	1	2														
GUILLERMINA O. DE ARCE	1	1	2	2	1	2														
JOSEFA N. DE SAENZ	1	1	1	2	1	2														

DRAFTING DIVISION - EVALUATION

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	QUALITY OF WORK	PRODUCTIVITY	KNOWLEDGE OF WORK	INITIATIVE	ATTITUDE TOWARDS WORK	ATTITUDE CO-WORKERS														
DIB ESLAQUIT	3	3	2	2	2	2														
ENRIQUE LACAYO S.	1	2	1	2	1	1														
JOSE CISNE M.	1	3	1	1	1	1														
RAQUEL M. DE ROMAN	1	2	1	1	2	1														
LORENZO PARIS PORRAS	2	1	1	1	1	1														
ADAN TALAVERA I.	1	2	2	1	1	4														
FERMIN QUANT W.	2	2	1	2	2	2														
ADRIAN SILVA D.	3	4	3	4	3	3														
ORION ZAMBRANA T.	3	4	2	4	4	3														
JOSE VALDES V.	3	3	2	2	3	3														
DAVID GONZALEZ M.	3	3	2	4	3	3														
ROGER SARA VIA B.	3	3	2	2	2	2														
ROGER BARBERENA F.	3	3	2	4	3	2														
AMADEO CASTILLO M.	4	4	3	3	4	3														
ROBERTO HUETE H.	2	1	2	1	2	2														
CLAUDIO SARA VIA C.	2	2	2	1	2	2														
RENE GUEVARA S.	2	3	2	2	2	2														
ALEJANDRO ZAMORA R.	3	3	3	4	3	2														
ALEJANDRO DIAZ P.	2	2	2	1	2	2														
Ma. EUGENIA N. DE RUBI	3	2	2	2	2	2														
NUBIA H. DE MIXCO	3	3	2	2	3	2														
MANUEL AROSTEGUI M.	3	3	2	1	2	2														
SILVIO FITORIA S.	3	2	2	3	2	3														
GERARDO GUTIERREZ F.	3	3	3	3	3	2														
FELIX CASTRILLO R.	3	3	2	2	2	2														
FERNANDO CABEZAS L.	3	4	2	4	3	3														

VERIFICATION SECTION - EVALUATION

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	QUALITY OF WORK		PRODUCTIVITY		KNOWLEDGE OF WORK		INITIATIVE	A TTITUDE TOWARDS WORK	A TTITUDE CO-WORKERS										
AZUCENA S. DE GUIDO	2	2	1	2	1	2													
GLORIA N. DE HERRERA	3	3	3	3	3	4													
SATURNINO ESPINALES C.	3	2	3	2	1	2													
ELISEO NUÑEZ H.	3	3	1	2	1	2													
RONALD SANDOVAL B.	3	3	2	1	2	2													
CARLOS GARCIA M.	4	3	4	4	2	2													
ALEJANDRO VEGA V.	4	3	4	4	2	3													
EDMUNDO MALTEZ H.	3	2	3	3	2	2													
ARNOLDO MEDINA H.	3	3	2	3	3	2													
MIRTA MENDOZA S	2	2	2	3	3	2													
ELIZABETH M. DE JARQUIN	3	3	2	3	3	3													

VERIFICATION SECTION - EVALUATION

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