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A Proposal to Modernize the Agricultural Health Services of Beli

CENTRO DE PROGRAMAS Y PROYECTOS DE INVERSION (CEPPI)

A Proposal to Modernize the Agricultural Health Services of Belize

Division of Pre-Investment, DIPRAT, HCA
Ministry of Agriculture and Fisheries, Belize
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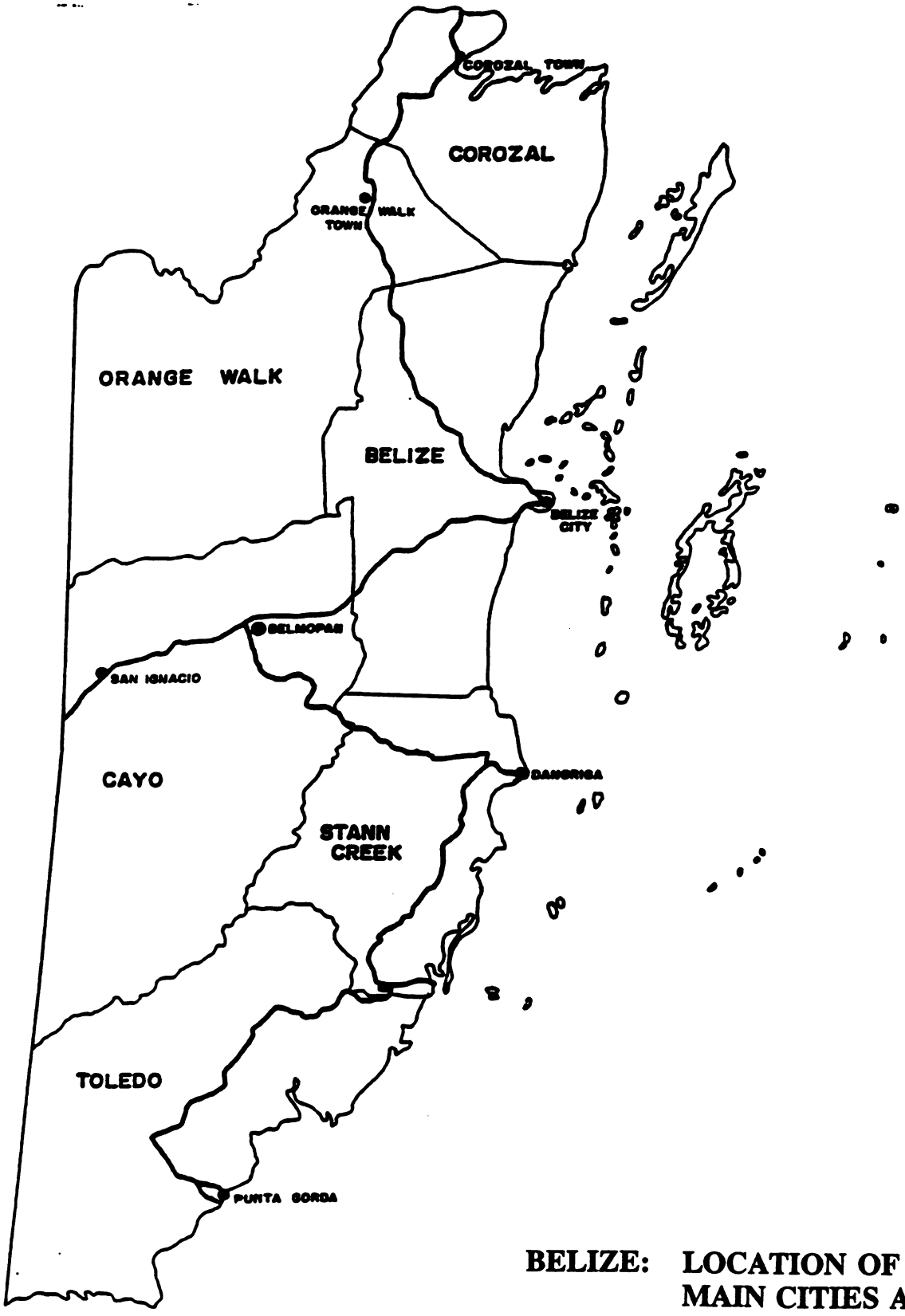
ACRONYMS

AGHS	Agricultural Health Service
AHA	Animal Health Assistance
AHD	Animal Health Division
AHS	Animal Health Services
AI	Artificial Insemination
APHIS	Animal and Plant Health Inspection Service
BCA	Belize College of Agriculture
BEST	Belize Enterprise for Sustained Development
BGA	Banana Growers Associations
BLDP	Belize Livestock Development Project
BLPA	Belize Livestock Producers Associations
BMB	Belize Marketing Board
BOS	Bureau of Standards
CAHO	Chief Agricultural Health Officer
CARAPHIN	Caribbean Animal and Plant Health Information Natural
CARDI	Caribbean Agricultural Research and Development Institute
CARICOM	Caribbean Community
CF	Central Farm
CGA	Citrus Growers Associations
CIL	Central Investigatory Laboratory
CPPC	Caribbean Plant Protection Commission
CREI	Citrus Research and Education Institute
CTV	Citrus Tristeza Virus
CVL	Central Veterinary Laboratory
DAO	District Agricultural Officer
EC	European Community
EEC	European Economic Community
EO	Extension Officer
FAO	Food and Agricultural Organization
FD	Fisheries Division
FDA	Food and Drugs Act
FTA	Free Trade Association
GDP	Gross Domestic Product
GGA	Grain Growers Associations
GOB	Goverment of Belize
HACCP	Hazard Analysis Critical Control Point
HELP	Help for Progress Limited
IPM	Integrated Pest Management
IQID	International Quarantine and Inspection Division
MAF	Ministry of Agricultural and Fisheries
MOF	Ministry of Finance
MOH	Ministry of Health
MOT	Ministry of Trade

MT	Metric Tons
NAFTA	North American Free Trade Agreement
NAGHS	National Agricultural Health Service
NARMAP	Natural Resource Management and Protection Project
NFS	Non-Factor Services
NGO	Non Government Organizations
NRI	Natural Resources Institute
ODA	Overseas Development Administration
OIC	Officer in Charge
OIE	Office of International Epizootics
OIRSA	Regional Organization for Plant and Animal Health
PAEU	Policy Analysis and Economics Unit
PAHO	Principal Animal Health Officer
PAHS	Plant and Animal Health Services
PAO	Principal Agricultural Officer
PCB	Pesticide Control Board
PFD	Premature Fruit Drop
PHB	Public Health Bureau
PHD	Plant Health Division
PHI	Public Health Inspectors
PHS	Plant Health Services
PPA	Poultry Producers Association
PPU	Plant Protection Unit
PVO	Principal Veterinary Officer
QI	Quarantine Inspector
QS	Quarantine Services
RCD	Regional Control Division
RPPO	Regional Plant Protection Organization
SI	Statutory Instruments
SIB	Sugar Industry Board
TB	Tubercolsis
USDA	United States Department of Agriculture
VAB	Veterinary Association of Belize
VAT	Value-Added Tax
VO	Veterinary Officer
VSD	Veterinary Services Division
WTO	World Trade Organization



BELIZE: LOCATION OF DISTRICTS, MAIN CITIES AND TOWNS

LOCATION OF BELIZE

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EXECUTIVE SUMMARY

Background: In terms of sectoral contribution to GDP, Belize's economy is based on mainly services, and to a lesser extent on manufacturing and agriculture. Economic growth has been impressive in the last decade but the average rate was lower in the last five years, about 4.4% per year. The economy rebounded in 1995 after slower growth in 1994 with a 3.8% growth rate due to increases in mainly agricultural production, tourism and manufacturing. Other macroeconomic indicators also reflected a relatively strong recovery of the economy last year. However, the Government's fiscal situation deteriorated in the last three years and several steps were taken during the last year to strengthen it. The economy remains heavily dependent on external trade on a narrow range of exports (sugar, citrus concentrates, bananas and marine products) and on special marketing arrangements with the U.S., EC, and CARICOM. The Government recently embarked on a medium term economic strategy of structural adjustment to achieve sustained economic growth, increase competitiveness and expand diversification of the production base.

The agricultural sector (including fishing and forestry) has been an important sector of the economy, and a major source of growth, employment and foreign exchange earnings. Its share in GDP remained relatively stable in the last decade, averaging about 20%. In 1995, the sector accounted for almost 26% of the total labor force and contributed approximately 94% of the country's foreign exchange earnings. Growth of the sector has also been impressive, averaging about 5.9% per year since 1990. The production of sugar, citrus, bananas and marine products are major activities, contributing more than one-half of agricultural GDP and more than 75% of foreign exchange earnings. Agricultural diversification, expansion of non-traditional exports and increased competitiveness of the sector are the major goals of the Government's strategy for the sector.

Agricultural Health Service: Belize's agricultural health service (AGHS) comprise plant health services, animal health services, quarantine services, special programs, other regulatory services such as those provided by the Pesticide Control Board (PCB) and various support activities. Most services are supplied by the public sector, primarily the Ministry of Agriculture and Fisheries (MAF). The private sector's role is confined to the provision of specific plant health services and some laboratory services for the major export crops - sugar, bananas and citrus, limited advisory services by CARDI and NGO's in plant health, and animal health services by private and public veterinarians (having a private service) for small animals. The total expenditure to provide agricultural health services in the country ranges from BZ$2.0 million to BZ$3.0 million per year.

The MAF executes the Government's agricultural health policy and programs. This is done through its Veterinary Services Division (VSD), Plant Protection Unit (PPU), the Central Veterinary Laboratory (CVL), the Special Projects Unit, the Fisheries Department (FD) and the Pesticide Control Board (PCB). In general, the services provided by the MAF are limited and inefficient. They include diagnosis and surveillance, quarantine inspection, control and

eradication of pests and diseases, laboratory testing, pesticides registration, ambulatory services to livestock farmers, and support services to the fisheries sector. The services are provided free and are totally financed through annual budgetary allocations from the GOB. In recent years, the resources allocated have declined due to financial constraints of the GOB. In the last five years allocations for recurrent and capital expenditures averaged about $1.0 million/year and $0.48 million respectively, while actual expenditures averaged approximately $0.86 million and $0.45 million respectively. Personnel costs absorbed in excess of 75% of the total recurrent allocation and fewer resources have been available for operations each year. In 1996, actual expenditure on agricultural health personnel in the MAF (based on the current number of staff) is estimated to be BZ$1.02 million or 96% of the total recurrent estimates for the service (based on the budgetary estimates) and approximately 29% of the total personnel costs of the MAF (BZ$3.57 million). Of the total personnel costs allocated to agricultural health in the MAF, 42% is spent on animal health services; 21% on quarantine; 18% on plant health services; and 16% on special activities such as Medfly and screwworm.

In plant health, the Plant Protection Unit (PPU) of the MAF provides five types of services in varying degrees of scope and efficiency. The major field activities are in the areas of inspection, diagnosis, quarantine, surveillance and training but these are not done frequently and their geographic coverage is very limited. Laboratory activities focus mainly on samples diagnosis and pest identification and no fees are charged for the tests. In recent years, the number of tests averaged less than 100/year. Given the present staff of the PPU, the laboratory could test a minimum of 2,000 samples per year if it can obtain more equipment, reagents and other supplies. Database management is a recent activity and it includes documentation of information from a recent study on the annual estimated potential crop losses due to pests and diseases, a partial list of crop pests and diseases found in Belize and a data base on samples tested in the laboratory, in which all the relevant information is recorded. The PPU supports other activities related to the control and/or eradication of various pests and diseases in the sector such as the Medfly program, citrus leaf minor program, citrus tristeza surveys and a Varroa mite program. Personnel also participate in various technical committees to provide advisory support.

Besides the Head of the PPU, there are four professional and technical personnel who work in technical areas such as plant pathology, entomology, biological control, integrated pest management, other field and laboratory diagnostic services, and documentation and data management. The PPU's budget is part of the overall budget allocated for research and development activities at Central Farm. Allocations in the last three years averaged about $140,000/year, but actual expenditures averaged less than $100,000/year and funds for operations declined steadily.

Belize has a good animal health status, free of the major animal diseases that cause economic losses in other countries within the region. Animal health services are provided mainly by the public sector through the MAF, which executes animal health policies and programs through the VSD. Limited animal health services are also provided by the MAF. The VSD is headed by the Principal Veterinary Office (PVO) and its other staff include 7 veterinary officers (of a total of 15 veterinarians in Belize), animal health assistants, laboratory technicians, livestock officers and livestock technicians with support from the extension support.

The principal field services are clinical and preventive and these are provided by two main clinics in Cayo and Orange Walk and a satellite clinic in the Toledo. Few services are provided in the Stann Creek district because of limited livestock activities there, but there is a high demand for services from the Cayo district clinic because of the concentration of livestock production in this area. The clinical service is designed to attend sick farm animals on a demand basis and it services small farmers on the whole. In April 1996, the MAF terminated the provision of clinical services for small animals and transferred these to the private sector. The preventive service includes vaccinations, deworming, breeding soundness evaluations, reproductive programs and herd health programs.

Laboratory services are provided by the MAF's Central Investigatory Laboratory (CVL) and the Central Farm laboratory. Previously, these had good diagnostic capabilities in the Central American region, but their services declined due to insufficient resources, organizational problems and the lack of field support to attract users of the service. Its facilities are underutilized and its diagnostic capabilities are limited to meet present demands. In 1995, the CVL did about 200 test which is approximately one-tenth of the number of tests it should be doing, given present demands.

Since 1989/90, budgetary allocations by the MAF for its animal health services averaged just over BZ$0.5 million per year, of which personnel costs absorbed more than 75% of the total. Resources allocated for operations in recent years have been insufficient and capital expenditures also declined, resulting in a reduction in many activities and services including routine ones critical to animal health and production.

The private sector offers few services in animal health. The BLPA, private animal health clinics and one NGO provide the only services. The BLPA (with some collaboration from the MAF) provides technical support and credit to its members. Despite the important role of the BLPA in the sector, it is constrained by weak organization and management capabilities and insufficient funding to support livestock development activities. There are also nine private clinics that mainly cater to small animals, but only three provide services on a fulltime basis. A new small laboratory was recently opened in Belize City and it may have the capability of providing some veterinary diagnostic services. There are other private pathology laboratories but these do not process samples of animal origin. Of the NGO's, only one provides veterinary services to its clients in the Toledo area. A Veterinary Association of Belize was formed in December 1995 with a membership of 15 veterinarians. Its Veterinary Board comprises a selected group of veterinarians from the public and private sector with responsibility for monitoring and improving the quality of veterinary medicine and surgery in Belize.

All quarantine services are provided by the MAF through its Special Projects Unit. The service has six quarantine stations at various ports of entry and is staffed by 11 quarantine inspectors (QIs). Its primary responsibility is to monitor and control all imports and exports of plant and animal products into Belize as specified by the regulations of the Quarantine and Inspection Service. QIs work in close collaboration with customs officers who are directly responsible for inspecting all imports and exports at the ports of entry. The Principal Agricultural Officer (PAO) responsible for Special Projects has no direct technical but some

administrative supervision of all QIs. Day-to-day administrative supervision of QIs is done by the DAO of the district in which the quarantine stations are located.

QIs execute their duties based on the quarantine laws and regulations of the quarantine and inspection services of Belize. Based on these regulations, certain imported plant and animal products are classified as restricted or prohibited to enter the country, depending on their country of origin. Products that are prohibited from entry due to the possibility of contamination or introduction of pests and/or diseases are confiscated and destroyed at ports of entry. Certain products which are considered restricted are allowed to enter the country in limited quantities. Generally, import permits should be obtained from the appropriate authorities prior to their arrival in Belize. All imported agricultural products require an import permit and 26 categories of products require an import license. Depending on whether products are of animal or plant origin, permits and phytosanitary certificates are issued by the Chief Agricultural Officer, the Head of the PPU, the PVO and the PAO for Special Projects. Permits are also required for the import of pesticides and these are issued to importers by the Pesticide Control Board (PCB) prior to the arrival of the products in the country.

QIs also inspect commercial exports of agricultural products. For plant and plant-processed products, visual inspections are done prior to the issuance of the phytosanitary certificate to verify that the product is free from pests and diseases that could be harmful to the importing country. No fees are charged for the services provided by QIs, except at the Benque Viejo Border where a BZ$5.00 fee is collected for vehicles which are fumigated before crossing the border. In 1993 the MAF received seven incinerators under an ODA project to be used as disposal facilities at quarantine stations and at Central farm. Only two were installed and one is presently functioning at the Benque Viejo border while the others have not been installed due to insufficient financial resources.

The MAF also executes several other agricultural health activities in the sector. The Fisheries Department (FD) of the MAF provides diagnostic and inspection services to the fisheries sector. The Department has a small laboratory for sample analysis; only one staff member is devoted to diagnostic work and few tests are done. Tests include the standard plate count, potable water, MPN of coliform organisms and differentiation. The reliability of these tests is about 60% and other tests which are done are few and far apart.

Through its Special Projects Unit, the MAF executes a Medfly service, a screwworm monitoring program and a vampire bat control program. The Medfly service works closely with the local USDA/APHIS Representative in Belize, who usually checks and inspects the activities and ensures that the Medfly protocol is correctly executed. It focuses on the control and eradication of the Medfly so as to protect fruit crops, particularly export crops such as citrus and papayas and peppers. Seven technicians are employed with responsibilities for routine servicing of Medfly traps located along highways and access roads in each district. The estimated cost of a Medfly outbreak campaign is about $250,000, while the cost of the regular operation is approximately $150,000/year of which, personnel emoluments and salaries cost is $89,000/year or almost 60 percent.

A Screwworm Eradication Project was launched in 1989 and executed jointly by the MAF and the Mexico-United States Commission for the Eradication of Screwworm. The success of the screwworm project resulted in a complete eradication of the screwworm, so that Belize is now officially declared screwworm free. There is no project presently but the MAF spends about $0.1 million/year only for monitoring. Four field inspectors are employed for this and they provide livestock farmers with sampling kits and insecticide, as well as support to extension staff and other activities. It is estimated that the cattle industry experiences losses of up to $1.5 million dollars per year from damaged hides, poor weight gain and time spent inspecting for screwworm infestation.

There is an ongoing vampire bat control program funded by the GOB and executed within the extension service of the MAF. The program employs only one technician who is stationed in the Cayo District but who is responsible for servicing the entire country. In the area of beekeeping, an apiaries inspection unit was established to administer a special program within the MAF to provide adequate and timely extension services to an expanding beekeeping industry in the 1970's and 1980's. However, due to a shortage of personnel, the beekeeping program is no longer a national one and apiaries are concentrated in the Cayo, Orange Walk and Corozal districts. Belize produces a high quality honey that is exported to the EC but the sector is affected by several diseases and technical support was provided by Mexico and USDA to control the Varroa mite. Presently, no monitoring or surveillance is done of the disease situation and beekeeping staff was further reduced in 1995 when the MAF retrenched three apiaries inspectors as part of the GOB's retrenchment exercise.

Other Agricultural Health Services: The PHB is responsible for public health issues, notably maintenance of standards and the quality of food processing facilities, water quality monitoring and inspection of restaurants and animal slaughter house facilities. Its activities are enforced through the Food and Drugs Act which provides for diagnosis, epidemiological surveillance and inspection services. However, these are limited in geographic scope. Its laboratory capabilities are weak and it does not conduct routine diagnosis and tests of basic food products due to limited resources.

The BOS is a unit established to maintain and encourage codes of practice, specifications and standards, provision of advisory services to the private sector on quality control for products and personnel training. Although legislation exists for it to work in the area of quality control, it has done little to execute this mandate due to a severe lack of resources.

Deficiencies and Weaknesses of the Agricultural Health Service: The MAF's AGHS is very weak and is incapable of providing the necessary services to meet the needs of producers, to facilitate trade, basic human health and safety standards and international trade and health agreements. It is affected by policy, institutional and resource constraints and these contribute to production and income losses by farmers and the economy. The services are not as effective as they should be, due to the lack of policy priorities for the sector, weak administration, poor planning, insufficient resources to support basic field and laboratory activities, inadequate infrastructure and legislation, lack of sufficient expertise in key technical areas, as well as institutional weaknesses in other parts of the MAF. The present public agricultural health service is fragmented and services are provided by several public sector institutions, but

coordination is weak and there is much overlapping of activities.

Knowledge of the actual health status of the sector is very limited and the MAF has little knowledge of existing pests and diseases or new ones. There are no regular monitoring or surveillance activities besides those related to Medfly, screwworm and vampire bats. There are no standard quality control tests done to determine quality assurance for feed and other inputs, and no registration of drugs. Laboratory activities have declined reflected by the fractional number of tests done by the PPU's lab. and the CVL. Routine diagnosis and tests which should have been done by the Fisheries Department, the PHB and the BOS to meet certain standards and requirements are not done because of severe resource limitations. Infrastructural facilities (buildings and furnishings) are in a state of disrepair in most buildings and there are several non-functional equipment which need repair. These together with the absence of verification of safety standards in food produced and consumed and the absence of effective quality assurance mechanisms pose a serious threat to production and high health risks for the population and tourists.

The quarantine service has several deficiencies which need to be addressed if Belize's trading arrangements are not to be jeopardized. Presently, Belize cannot adequately monitor the smuggling situation at both borders. The risks of diseases being introduced into the country are very high. The service has very little operating funds for routine activities or to maintain existing facilities and it exists at a very low level, providing minimum routine services.

In general, Belize's agricultural health situation is much worse than it appears, primarily because the underlying factors and support activities of the MAF's agricultural health service indicate a situation that has reached an almost crisis point. With the exception of the plant protection services of the sugar, citrus and banana sub-sectors, the service is deficient in most aspects to meet present needs and the future demands of the country. Although the situation has not exhibited major problems so far, the risks of potential economic losses to the country are high if the service continues to operate as it is presently. Belize's agricultural sector faces several major challenges that include retention of existing markets, diversification into new areas, expansion of non-traditional exports, greater self sufficiency in food supplies, harmonization of agricultural health measures with other countries and meeting international health and other requirements in agricultural trade. In particular, the new regulations of WTO, OIE, NAFTA, etc., mandate that the countries engaging in trade meet particular standards and requirements to safeguard human health and safety.

The above problems indicate an urgent need to strengthen the service, improve monitoring and surveillance and implement adequate legislation. A more independent service (both institutionally and financially) is needed if the AGHS is to function efficiently. The current institutional and financing arrangements in the public sector severely limits the effectiveness and sustainability of the service. The GOB's budgetary constraints increasingly reduce the scope of the service, and adequate cost recovery mechanisms and strong links with the private sector and other major stakeholders have not been developed to access alternative sources of financing. Any institutional alternative that consolidates Belize's agricultural health services in a single entity and provide them in a decentralized manner will allocate the MAF's resources more efficiently.

Description of the Project: The proposed project would help to improve the scope and quality of Belize's AGHS, consistent with the standards and requirements that are being imposed on agricultural production and international trade by international and trade agreements. It will reorganize and streamline operations and strengthen the public agricultural health service, thereby contributing to reduced economic losses in production in the agricultural sector due to pests and diseases, improve decision making in agricultural production, and provide adequate safeguards to human health. Besides rationalizing the public sector's agricultural health services, the project will rehabilitate existing infrastructure and construct new buildings and laboratories for the new AGHS, strengthen institutional capabilities to diagnose problems that affect agricultural production and trade, strengthen the information system, review and recommend changes in the relevant laws and regulations, and facilitate harmonization of Belize's policies and measures with other countries in the region in the areas of plant and animal health. The project will have two components: (a) institutional reorganization, streamlining and strengthening; and (b) repairs, upgrading and rehabilitation of infrastructure and facilities.

In the first component, a new institutional framework will be created by streamlining the organizational and other institutional arrangements related to the MAF's agricultural health service; strengthen capabilities to provide such services more effectively and efficiently; design and operationalize an effective information system; upgrade and enact legal instruments and strengthen the regulatory framework; and develop guidelines, improve operational procedures and norms for the service. Technical assistance and training will be provided to support these activities.

The project will create a **National Agricultural Health Service (NAGHS)** which will be the primary public institution providing agricultural health services. This will involve a reorganization of the present service in which the NAGHS will absorb all the personnel and most of the infrastructure and facilities, as well as the roles, responsibilities and functions of those units of the MAF that currently provide plant, animal, quarantine laboratory and fish laboratory services, and laboratory services provided by the PHB. The NAGHS will absorb the veterinary clinics; veterinary field and veterinary public health activities; the CVL: agricultural chemistry (soils laboratory); Medfly service; Screwworm service; the PPU; beekeeping; fish diagnostic laboratory of the FD and the quarantine service of the MAF. In addition, the PCB will be incorporated in the new structure and the NAGHS would have the capacity to provide laboratory services to meet the basic needs of the PHB, the BOS and to the traditional export sector.

Two alternative institutional arrangements within which the service will operate are considered in the proposal. The first alternative is to create the NAGHS within the MAF's institutional framework but provide it with the legal backing and wherewithal to operate with greater autonomy, generate revenue and allocate resources independently of the current practices in the MAF. The second is to have a NAGHS that is similar to a non-governmental public sector corporation or entity (such as the BMB) with close ties to the MAF. In both alternatives, administration, coordination and liaison with the MAF will be similar, but personnel costs and overall reporting will be different. In the first alternative, the NAGHS will report directly to the Permanent Secretary and it will have the same status in the MAR's hierarchy as the Agriculture and Fisheries Departments respectively. In the second alternative, the relationship of the service with the MAF will be similar to that of the Belize Marketing Board in which the

Head of the service will report directly to the Minister or the Permanent Secretary. Legislation will be required to create the NAGHS and to facilitate absorption of those units of the MAF in the new structure.

The NAGHS will be more focused on resolving priority problems and issues of the sector, be flexible and responsive to demands, have a greater degree of autonomy to allocate resources more efficiently and implement cost recovery mechanisms. It will be demand-driven, focusing on the provision of services to various groups of clients and stakeholders and meeting international trade requirements. It will facilitate the development of strong links with the private sector and other institutions in the public sector to provide inputs regarding agricultural health policy, identification of priorities, coordination and sourcing finance. In the first institutional alternative, the service will have an Advisory Board comprising representatives of the MAF, the other public sector institutions such as the Ministries, the Public Health Bureau and the Bureau of Standards. The private sector will be represented on the Board by individuals from the Commodity Association, the BLPA, Veterinary Association and other groups from the private sector and NGOs. In the second alternative, there will be a Board of Directors comprising representatives of the same institutions. Legislation creating the NAGHS will designate the composition of either Board and identify its term of reference.

The NAGHS will be headed by a Chief Agricultural Health Officer (CAHO) who will be responsible for the day-to-day administration of the service. Under the CAHO, there will be five major Divisions - Plant Health, Animal Health, International Quarantine and Inspection, the Central Investigatory Laboratory and Registration and Control, and a small Finance/Accounting unit.

Under the second component, the project will construct additional facilities; repair and rehabilitate the existing infrastructure and facilities; and equip the existing laboratories. It will expand the existing animal clinic building to become a two-floor structure which will house the management and administrative offices of the NAGHS including those of the CAHO, the Finance and Accounting Unit and the Heads of Animal Health and Quarantine. The three veterinary clinics will be upgraded, refurbished and equipped, and existing laboratories will be upgraded in both plant and animal health through repairs to non-functional equipment, and the provision of improved technology, equipment and supplies and remodelling of the existing infrastructure. The soils lab. will be operationalized and the CVL will be reorganized to become the Central Investigatory Laboratory (CIL) which will provide a comprehensive range of laboratory services to meet the needs of both plant and animal health, the fisheries sector, the PHB and the BOS.

Project Costs and Benefits: The project will be executed over a four-year period. Under both institutional alternatives considered, the total investment cost to be covered by external funding is estimated to be BZ$5.94 million or US$2.97 million. Almost 40% will be spent in the first year primarily on construction and repairs to buildings, establishment of a revolving fund and some technical assistance and training. Of the various costs, those for rehabilitation of infrastructure, repairs and construction of new facilities will be the highest (BZ$1.62m). Expenditures on laboratory equipment and supplies comprise the second largest category of costs, totalling BZ$1.22m to repair equipment, for new equipment and laboratory supplies and

to upgrade the plant health lab., the CIL and to make the soils lab. functional. The total cost for other equipment and supplies is estimated to be BZ$0.79m and these include expenditures on computer equipment and accessories (BZ$0.25 million); office equipment and supplies (BZ$0.36 million) and other equipment and supplies ($0.18 million).

Expenditures on technical assistance and training will cost BZ$1.11m for technical assistance and internal and external training to strengthen administration and management of all units of the NAGHS, preparation of operating manuals and guidelines of operation, design and installation of an integrated information system, strengthening of the legal framework and upgrading the technical capabilities of the service. The project will supply only three vehicles but will establish a revolving fund of BZ$0.5 million to provide loans to eligible staff members of the NAGHS to purchase vehicles. Incentives will be provided to staff to purchase their own vehicles and the costs will be met by the NAGHS. This alternative will be less costly and contribute to higher productivity compared to that of the service providing vehicles.

All personnel costs will be covered by the GOB. The new service will absorb the present 67 personnel currently employed in the MAF's plant and animal health service and the PCB and it will require an additional 31 employees. Most of these will be employed in the CIL as technical staff, in the central administration of the NAGHS and in the PHD. Under institutional alternative one, the total personnel costs will be $1.21 million in year 1 and it increases to an average of $1.62m per year, including an increase in the average salary of 2% per year. Under institutional alternative two personnel costs will be higher by an average of 8.8% over the first alternative because the staff of the new service will not be eligible to receive a pension and other benefits provided by the public service and a gratuity will be paid equivalent to 20% of the basic annual salary for professional and technical personnel and 10% of the annual salary for support staff.

The service will continue to depend on public funding. It is proposed that the current total allocation for agricultural health services by the MAF (BZ$1.48 million) be provided as an annual subvention or block allocation to the NAGHS. This contribution together with user fees on selected services particularly in the export sector will generate a surplus of almost $0.7 million under alternative one and $0.5 million/year under alternative two. The cash flow becomes negative after the project has been executed (from year 5). However, the revenue estimates are conservative as additional revenues can be generated from the sale of other services including fees for laboratory tests and analyses, field diagnosis, registration and sale of drugs, cost for issuing various permits, etc. Exporters of products such as bananas, marine products, papayas and other non-traditionals can contribute to cover at least the operating costs of certain services as they benefit the most from programs to control and eliminate pests and diseases.

The project is economically viable as it will contribute to reduced production losses, higher productivity and more efficient use of inputs in production. The quantifiable benefits to the agricultural sector from an improved AGHS is estimated to be between $16.6 million to $54.0 million/year, or between 6.1% and 20% of the 1995 output level for the sector. A realistic scenario would be that of $16.6 million in economic benefits which could be attributed to an improved service in the short to medium term. Under a best scenario $54 million would be attributed to future benefits to be derived which could come from three sources: increased

gross output in crops of $12.8 million or 7% of production and animal products ($3.9 million or 8.5% of 1995 production) for a sub-total of $16.6 million or 7% of the 1995 output level; from ensuring that all fish exports from Belize would continue to be accepted in international markets (exports of $31 million in 1995); and ensuring that Belize remains free from screwworm and Medfly which could translate into potential export earnings of $4 million for papayas and $1 million in potential gross output of animal products from being screwworm free.

The benefits with the project will be higher in the non-traditional cropping sector in the longer run due to higher productivity from reduced pests and diseases - from present level of $25.5 million to nearly $4.4 million. For marine products output losses in the short to the long run can be significant, estimated to be all or part of the present total export earnings of $31 million. The major benefit will be in the form of retaining export markets based on product quality, reliability and consistency.

Through strengthening the diagnostic and laboratory capabilities, the PCB and improvements in the regulatory framework, the project will facilitate improved application of inputs, lower imports of these inputs, reduced costs of production, higher productivity for many non-traditional crops, as well as positive impacts on the environment. Besides the incremental changes in total output, an improved AGHS will contribute to reduced health risks and improving safety of the population and of tourists, through testing and validating food product quality, providing quality assurance systems and ensuring minimum health standards and requirements are met. At the international level, the status of the country's agricultural health image will be enhanced and Belize will be able to meet the trade requirements and standards imposed by institutions such as the WTO, NAFTA, etc., regional economic groupings and countries importing Belizean products. This is critical for the country because of its high dependence on external trade in agricultural products and the need in the future to be competitive in both internal and external markets.

Institutional alternative one is the most economically and politically feasible alternative. It is less costly but it involves a trade-off of having less autonomy compared to alternative two. Nevertheless, the longer term objectives and success of the project will depend on a large number of factors. The major ones include: (a) the political will to create the NAGHS and provide it with the necessary legal backing to operate with greater autonomy, particularly in the areas of decision-making, generation of revenues, and management and allocation of its resources; (b) a systematic planning process is established in the MAF in which priorities are set and the necessary resources allocated for their achievements; (c) a comprehensive review and update of the laws and regulations governing the agricultural health service; (d) involvement of various stakeholders in the service - as sources of revenues and advice as well as in the planning and prioritization of activities; (e) strengthening of the MAF in several critical areas, particularly the extension staff with whom the NAGHS will need to work closely; and (f) the extent to which the appropriate mechanisms and collaborative relationships are developed between the NAGHS and institutions such as the PHB and the BOS.

CHAPTER I

BACKGROUND

1.1 Overview of the Economy

In terms of the sectoral contribution to GDP, Belize's economy is mainly based on services, and to a lesser extent on manufacturing and agriculture. The services sector accounted for just over one-half of the total GDP, while the secondary sector (including manufacturing) contributed almost 26% and the primary sector 20%. In the services sector, trade, tourism and public administration are dominant, while in agriculture, the production of sugarcane, citrus, banana, marine products and livestock are the major activities. Manufacturing and construction are the most important activities in the secondary sector, but there are also relatively small mining and quarrying operations. In recent years, tourism expanded significantly and it has become a major foreign exchange earner, and there has been a resurgence in forestry activities and a significant expansion in fishing due to growing demands of the tourism sector and favorable export markets.

The economy grew steadily at an average rate of almost 5.7% per year during the 1980's and 1990's (Table A.1). Except for 1994, growth in the last five years (1991-95 period) averaged about 4.4% per year compared to an impressive expansion of 8.9% in the previous five-year period. In 1995, real GDP expanded by 3.8%, doubling the 1.5% growth experienced in 1994 due to increases in agricultural production (7.7%), tourism (5.7%), manufacturing (4.4%), the services sector (3.4%) and public utilities (3.2%). Other macroeconomic indicators also reflected a relatively strong recovery of the economy last year - an expansion in exports, a US$4.0m overall surplus in the balance of payments compared to a US$3.7m deficit in 1994, a decline in the trade deficit and an increase in foreign reserves. However, per capita income increased marginally, from BZ$3,265 to BZ$3,272, while inflation (which has generally been low) increased to almost 3% due to the higher costs of utilities[1].

Although output increased in 1995, there were major concerns about the Government of Belize's (GOB) fiscal situation which deteriorated in the last three years. The GOB's operations in 1995 resulted in an overall deficit of BZ$46.9m as a result of a decline in current revenue and an expansion in current expenditure. Several steps were taken to strengthen the fiscal situation at the end of the year that included a retrenchment of 860 public sector workers, a two-year wage freeze and increases in excise taxes on tobacco and alcohol.

The economy has been and remains heavily dependent on external trade. It is vulnerable to external shocks because of its dependence on a narrow range of exports (sugar, citrus concentrates, bananas and marine products) and special trading arrangements with the European

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[1] Belizean dollars (BZ$) will be the currency used in this document unless otherwise stated.

Community (EC), the United States (U.S.) and the Caribbean Community (CARICOM)[2]. Between 1980 and 1995, the share of exports of goods and non-factor services (NFS) in total GDP ranged between 70% and 95%, while the proportion of imports and NFS varied between 80% and 110% of the national income.

In the last two decades, Belize's employment situation experienced a gradual change, primarily due to migration (both internal and external) and changes in the economic structure. Regarding the sectoral contribution to employment, the services and agricultural sectors are the most important. The services sector accounts for more than one-half of the total employment, with the government employing about 17% and the wholesale and retail sub-sector about 16% of the labor force. The agricultural sector (including fishing and forestry) employs 26% and the manufacturing sector about 12%.

The GOB recently embarked on a medium-term economic strategy of structural adjustment for sustained economic growth and a more competitive economy, including policies to reduce the deficit, public sector reform, enhancement of government revenue, promote efficiency in resource allocation and diversification of the production base. The economy is projected to improve in 1996 with a growth rate of 4.5%, with an expansion in the productive sectors and a strengthening of the GOB's fiscal situation due to measures taken in 1995 and the implementation of the value-added tax (VAT) in April of this year. Output of citrus, bananas and marine products are expected to expand and tourist arrivals are projected to increase by between 6% and 8% due to marketing initiatives launched in the U.S. and Europe.

1.2 The Agricultural Sector

Historically, Belize's agricultural sector (which includes fishing and forestry) has been an important sector of the economy, and a major source of growth, employment and foreign exchange earnings[3]. The sector's share in the GDP remained relatively stable in the last decade, averaging about 20%. However, this contribution which is limited to primary agricultural production does not adequately reflect the sector's real contribution to the economy. Production and trade of agricultural commodities and by-products have played a much more

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[2] Belize's exports of sugar and bananas go mainly to the United Kingdom under this agreement. The main products exported to the preferential markets include sugar, bananas, citrus and garments. Sugar and bananas are exported to the EC market under the EC-ACP Lome agreement.

[3] In general, a large part of the agricultural labor force, estimated to range between 15% and 25% includes illegal aliens and refugees. In view of labor shortages in the sector, the government allows the use of foreign "guest workers" to supplement local labor. In addition, seasonal variations in agricultural labor demand provide the opportunity to hire migrant-temporary workers.

significant role[4]. In 1995, the sector accounted for almost 26% of the total labor force and contributed approximately 94% to the country's foreign exchange earnings.

The sector steadily expanded during the 1980's with fishing and forestry almost doubling their value-added to GDP. In the 1990-95 period, it expanded by 5.9% per year with most of the growth coming from the fishing sub-sector. In the same period, the share of forestry in GDP increased marginally while those of the crop and livestock sub-sectors declined. In 1995, although agricultural output expanded by 7.7% primarily due to a 52% increase in the delivery of citrus fruits, the overall growth in crop and livestock production slowed to 1.1%. Adverse weather conditions contributed to a decline in the production of sugarcane and banana by 14.5% and 7.2% respectively. However, the fishing sub-sector expanded by nearly 20% and there were increases in rice paddy production (by 48%), corn (21%), honey (35%) and poultry (3.3%), but a decline in the output of cattle (6%), pigs (12%), red kidney beans (3%) as well as of the forestry sub-sector.

Crop production includes the production of the three major export crops (sugarcane, banana, citrus), cacao which is also exported and various staple crops for domestic consumption (corn, beans, rice, root crops, vegetables and fruits). Sugarcane is the most important crop cultivated; it is the largest employer in the sector and sugar production is the largest contributor to GDP and foreign exchange earnings. Since 1990, annual sugarcane output has exceeded one million metric tons (MT), and contributed an average of almost one-third to total crop production and 36% to total agricultural exports[5].

After sugar, citrus is the second most important crop (in terms of export earnings). Although it contributed approximately 15% to total crop production in 1995, its foreign exchange earnings accounted for 22% of total agricultural exports. Banana is the third major export crop, accounting for 22% of total crop production and 16% of the agricultural export earnings. In recent years, output declined due to unfavorable weather conditions and labor problems. Its production is not as competitive as that in other Latin American countries where yields are higher by an average of between 40% and 50% and production costs are 60% to 70% of those of Belize. The industry is also affected by low yields, insufficient drainage and irrigation, the constant threat of the Black Sigatoka disease and an uncertain future guaranteed market.

Corn, rice and beans are the most important domestic food crops and their output increased steadily in the last ten years (Table A.2). Belize has become almost self-sufficient in corn which is used mainly for feed consumption (poultry and pigs) and for food by the Maya

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[4] Agriculture contributes to other sectors of the economy (included in the national accounts under Secondary Activities and Services) such as manufacturing, trade, transport, finance, communication and other services), due to its needs for financial services, import, manufacturing and delivery of production inputs, and transformation, packaging, storage and transportation of primary as well as processed agricultural products for local consumption and/or exports.

[5] In 1995, export earnings totalled almost BZ$96 million, an amount not earned since 1980.

Indians. Rice production expanded continuously since 1986, reaching 9,600 metric tons (mt) in 1995, almost twice the 1986 level. However, production is characterized by low paddy yields and poor grain quality. Edible beans, mainly red kidney (RK beans) are a staple crop cultivated throughout the country by both milpa and mechanized farmers. Although production fluctuated between 1,100 mt and 3,600 mt in the last decade, Belize is considered to be self-sufficient in RK beans. The production of other crops such as fresh vegetables (tomatoes, cabbages, peppers, cucumbers, lettuce, carrots and the like) is limited and seasonal and the country also produces small amounts of oilseed crops such as soybean, peanuts and sesame.

The livestock sector consists of beef, pork, poultry, and egg production. In general, the total output had an upward trend in the last decade. Of these, the poultry subsector has been the most successful due to an expansion in intensive production by the Mennonite communities. Presently, total output has quadrupled the 1980-level and the country is considered to be self-sufficient in poultry meat. Output of beef, pork, eggs and milk also expanded in the last decade to meet the needs of the local market.

The fishing sector provides employment for a large number of people, generates a substantial amount of foreign exchange and is an important source of protein for the population. Although the sector contributes only about 3% to GDP, it accounts for 11% of the total agricultural exports and total exports respectively. Except for 1994, the real output expanded more than 10% per annum in the last five years. Forestry makes a small contribution (2.5%) to the GDP. The sector experienced a downward trend in the first half of the 1980s, but it reversed dramatically afterwards to record a growth rate of almost 15% per annum between 1986 and 1995. In the last year, output declined primarily due to a continued reduction in mahogany production and lower demand for wood products by Mexico.

Agro-industrial activities comprise primarily of the production of sugar and molasses, citrus concentrates, fertilizers, dairy processing, flour milling, various beverages, wood processing, dehydrated fruits and small food processing operations. The dominant activity is sugarcane processing which accounted for an average of 24% of the industrial output in recent years. Citrus processing contributed between 10 and 12%. In the last decade, there has been an expansion in the number of small processors involved in the production of a variety of products such as pepper sauce, jams, peanut butter, fresh-squeezed juices and yogurt.

The economy is heavily dependent on agricultural trade. The value of agricultural exports nearly tripled from $88 million in 1985 to $269 million in 1995, while the export value of non-agricultural exports increased marginally in the same time period (Table A.3). As a result of the expansion in agricultural exports, the contribution of agricultural exports to total domestic exports increased from 69% to 85%. The country's major domestic exports are agricultural-based (sugar, citrus concentrate, marine products, bananas and forestry products) and the share of these products in total foreign exchange earnings remained fairly stable, averaging about 78%/year in the last five years. Non-traditional agricultural exports (such as molasses, papayas and peppers) increased significantly since the late 1980's, partly due to policy support for agricultural diversification. Despite the country's agricultural potential, it is

dependent on imported food, particularly processed products. Total food imports increased by almost 50% in the last decade and the most important of these have been meat products, dairy, cereal products, fats and oil and fruits and vegetables.

Of the support services for agricultural production and trade, the country's agricultural health service (AGHS) is perhaps the most critical. National agricultural health programs are the responsibility of the Ministry of Agriculture and Fisheries (MAF) but these are generally weak to meet the present and future needs of the sector (see Chapter II). The GOB's development strategy for agriculture is to diversify the production and export bases into non-traditional areas and make the sector's outputs more competitive in national and international markets. The success of this strategy will depend largely on, among other things, having a more efficient and effective AGHS.

CHAPTER II

AGRICULTURAL HEALTH SERVICES

2.1 Institutional Framework

Belize's agricultural health services (AGHS) comprise plant health services (PHS), animal health services (AHS), quarantine services (QS), special programs, other regulatory services such as those provided by the Pesticide Control Board (PCB) and various support activities. Most of these are provided by the public sector, mainly the MAF (**Figure 2.1**). The Ministry of Trade (MOT) and its Bureau of Standards (BOS), and the Ministry of Health (MOH) through its Public Health Bureau (PHB) also provide support services. The private sector's role in the AGHS is confined to the provision of specific plant health services and limited laboratory services for the major export crops - sugar, bananas and citrus (details provided below). In addition, the Caribbean Agricultural Research and Development Institute (CARDI) and NGO's provide limited advisory services in plant health for certain crops, in animal health (in the case of one NGO) and public veterinarians have been allowed recently to supply a private service for small animals.

Based on information available, the total expenditure to provide agricultural health services in the country ranges from BZ$2.0 million to BZ$3.0 million per year[6]. This includes actual expenditures by both the public and private sectors on all their programs and activities to support agricultural health - expenditures by the MAF on its plant and animal health services (PAHS), expenditures by other public institutions such as the MOT, BOS, and the PHB, the commodity associations, CARDI and NGO's.

2.1.1 Ministry of Agriculture and Fisheries

The MAF is responsible for planning, designing and executing policies and programs for the country's plant and animal health service through its Veterinary Services Division (VSD), Plant Protection Unit (PPU), the Central Veterinary Laboratory (CVL), the quarantine service, special programs and projects (such as Medfly and screwworm) and the PCB. **Figure 2.1** shows components of the MAF's agricultural health services within the Ministry's organizational structure. Presently, the major services provided by the MAF include organization and administration of and information about the services, diagnosis and surveillance, quarantine and inspection, control and eradication of pests and diseases, laboratory testing, pesticides registration and ambulatory services to livestock farmers. The Fisheries Division (FD) of the Ministry provides support health services to the fisheries sector. It has a small laboratory which provides very few diagnostic services.

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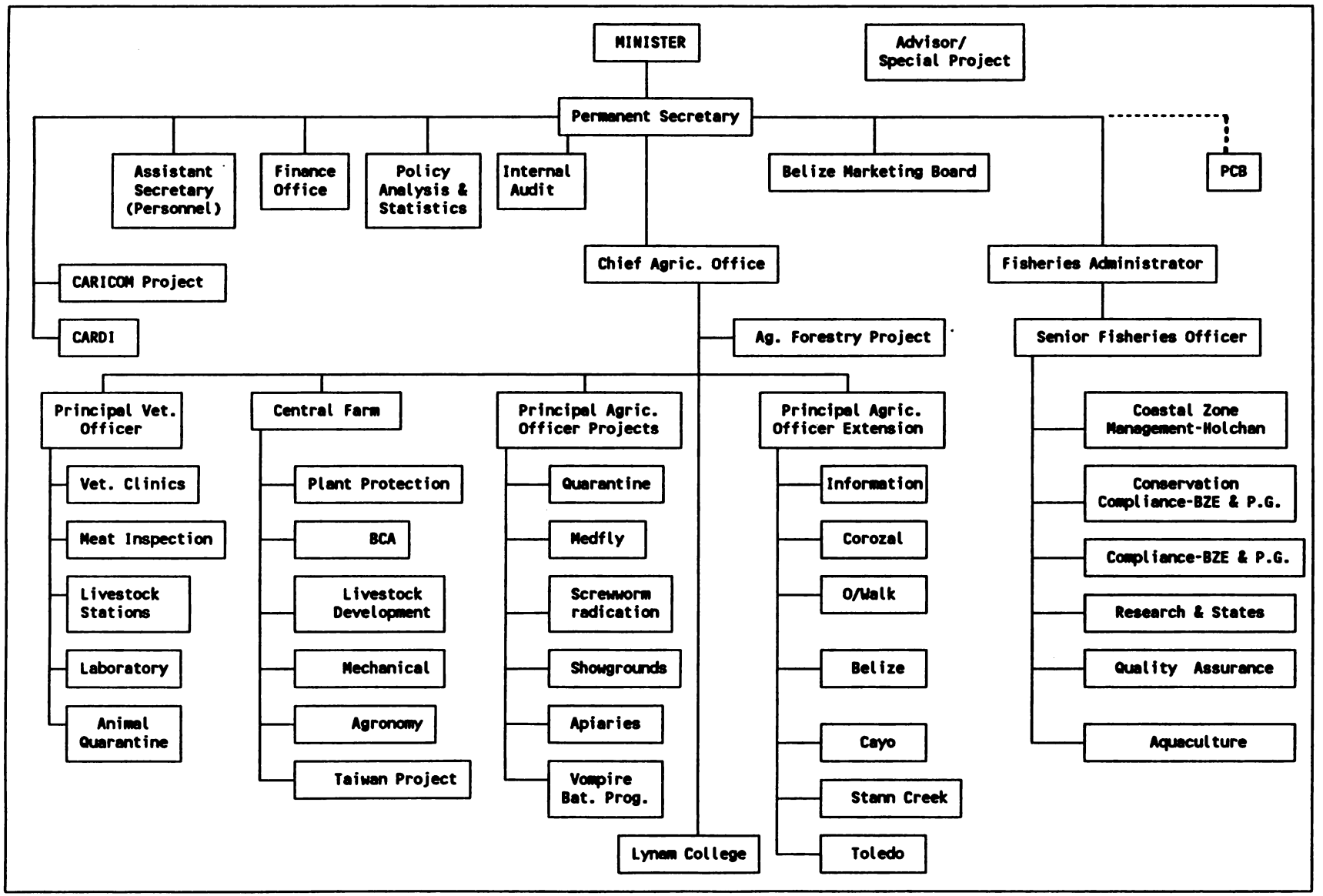
[6] This is an estimate based on actual expenditures on various programs and activities by the public and private sector. The cost is much higher than this because this estimate is only based on budget information available. It does not include several additional costs such as expenditures for technical assistance provided to Belize from abroad, diagnostic services that are done abroad, costs of intervention, negotiations, etc. to deal with occasional special problems.

Figure 2.1
Organogram of Ministry of Agriculture and Fisheries



Source: MAF

The services are totally financed through annual budgetary allocations from the GOB. In recent years, there has been a continuous downward trend in budgetary resources allocated to the service by the MAF due to financial constraints of the GOB (Tables A.4 to A.7). In the last five years allocations for recurrent and capital expenditures averaged about $1.0 million/year and $0.48 million respectively, while actual expenditures averaged approximately $0.86 million and $0.45 million respectively[7]. Although the total recurrent estimates for the MAF's agricultural health service as a proportion of the total Ministry's recurrent budget increased, a larger percentage was allocated to personnel costs and to special activities. As a result, the service's efficiency and effectiveness has been severely affected by less resources allocated to operations and maintenance activities.

In 1996, actual expenditure on agricultural health personnel in the MAF (based on the current number of staff) is estimated to be BZ$1.02 million or 96% of the total recurrent estimates for the service and approximately 29% of the total personnel costs of the MAF (BZ$3.57 million)[8]. Personnel costs for the various services are: animal health (42%); quarantine (21%); plant health (18%); and special projects such as Medfly and screwworm (16%).

2.1.2 Pesticides Control Board

The Pesticides Control Board (PCB) is one component of the regulatory framework governing Belize's agricultural health services. It is a "quasi" government institution established under the Pesticide Control Act of December 1985 and it's work has been facilitated by several statutory instruments (SI) of which the main one was enacted in 1995. These regulatory documents specify guidelines for importation, registration, control, sale, storage and use of pesticides and fees to be charged. Its main functions are: (a) registration of pesticides; (b) licensing people to sell restricted pesticides; (c) search on premises where restricted pesticides are being sold; (d) authorize the use of restricted pesticides; (e) analyze registration requests; (f) train pesticide applicators; and (f) establish labelling and packaging guidelines which should be in accordance with FAO's Standards.

Presently, the PCB's Board comprises fourteen members from public and private sector institutions including the MAF and the commodity associations (Citrus, Bananas and Sugar), the Belize Livestock Producers Association (BLPA) and the Grain Growers Association (GGA). Its day-to-day operations are executed by five permanent employees and three temporary technicians under contract. In 1995, its total budget was approximately $0.18 million of which

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[7] Actual expenditures are lower than budgeted estimates due in large part to reductions in resource availability during the year.

[8] The personnel cost is based on the actual salaries and wages of the current staff employed by the MAF in agricultural health. It exceeds the amount shown in the budgetary estimates because it covers the cost of a large number of personnel who are not on the permanent establishment.

almost 80% was for personnel costs.

From 1989, the Board was financed by a subvention of $54,000 from the MAF which was reduced to $40.000 in 1994. It raises revenue from fees such as a charge of BZ$25.00 to each retail outlet selling pesticides for home use and $100.00 per year for the sale of pesticides for agricultural use. In April 1996 a new Statutory Instrument (SI) was passed which levied a 2% charge on the CIF value (Belize port) of imports of pesticides (for values greater than $2,000) that are registered. Up to the end of July, the Board had collected about BZ$23,000 from this fee and about $3.355.00 in registration fee. Pesticides are registered for a period of five years.

2.1.3 Ministry of Health

The MOH's Public Health Bureau (PHB) is a regulatory unit of the MOH with responsibilities on public health issues, particularly maintenance of standards and quality in food processing facilities, restaurants, water quality and slaughter facilities. Its activities are enforced through the Food and Drugs Act which provides for diagnosis, epidemiological surveillance and inspection services.

To execute its programs and activities, the PHB divided the country into three major geographic areas - Northern Belize (Orange Walk and Corozal districts), Southern Belize (Stann Creek, Toledo and Cayo districts) and Belize City with a north and south sub-division. One Senior Public Health Inspector is responsible for Northern Belize and the southern section of Belize City while another is responsible for Southern Belize and the northern section of Belize City. These officers have responsibilities for executing certain programs such as rabies control and water quality. Of the seventeen (17) public health inspectors (PHI's) the majority (11) are based in Belize City while the remainder serve the other districts (Cayo 2; Stann Creek 1; Toledo 1; Orange Walk 1; and Corozal 1).

The PHB's activities are limited in scope due to limited resources. It conducts tests for water quality, microbiological testing to examine for food contaminants, does waste water monitoring and inspects food production establishments. However, resource constraints have restricted the frequency and the geographic scope of tests done by the Bureau. In addition, its laboratory capabilities are very limited and it does not conduct routine diagnosis and tests of basic food products due to these constraints.

2.1.4 Ministry of Trade

The MOT and its Bureau of Standards (BOS) provide inputs into the AGHS through the implementation of trade regulations (such as approving import licenses), monitoring and coordinating Belize's trade protocol and agreements and establishing and monitoring standards for products. Established under the Standards Act of 1992, the BOS is a small unit of the Ministry of Trade that is located in Belize City. It has an important complementary role to the MAF by maintaining and encouraging "codes of practice, specifications and standards",

provision of advisory services to the private sector on quality control for products and personnel training. Although legislation exists for it to work in the area of quality control of animal products and by-products, it has done little to execute this mandate due to a severe lack of resources. However, as animal and public health issues surface and there is an increasing demand for safety, this unit will need to become more pro-active and develop a strong working relationship with the MAF and the Ministry of Health.

2.1.5 Regulatory Framework

There are several laws and regulations governing Belize's agricultural health services - plant and animal health, quarantine and inspection, slaughtering of animals, meat processing, registration and use of pesticides, etc.[9]. Some of these have existed for more than 30 years and urgently need modification and updating. Mention is made in various sections below of some of the relevant laws and regulations which provide the legal basis for specific agricultural health services. A review of the regulatory framework and specific regulations are provided in **Appendix B.1.**

2.1.6 Information System

A review of the information system of the agricultural health service, particularly that of the MAF is provided in **Appendix B.2.**

2.2 Plant Health Services

Belize's plant health service (PHS) comprises plant protection activities, diagnostic, laboratory testing, plant quarantine and advisory services undertaken by the MAF, the Sugar Industry Board (SIB), the Citrus Growers Association (CGA) and its research arm, the Citrus Research and Education Institute (CREI), the Banana Growers Association (BGA). Plant health services are provided also by the Caribbean Agricultural Research and Development Institute (CARDI) and a few NGO's (**Figure 2.2**).

2.2.1 Public Sector

The MAF's plant health service is provided by its Plant Protection Unit (PPU) headquartered at the Ministry's Central Farm facility in the Cayo District. The Officer-in-charge (OIC) of Central Farm has overall administrative responsibility for the PPU, while the day-to-day management, technical, supervisory and liaison responsibilities are discharged by the Head of the Unit (**Figure 2.2**)[10]. The PPU provides five main services in varying degrees of scope

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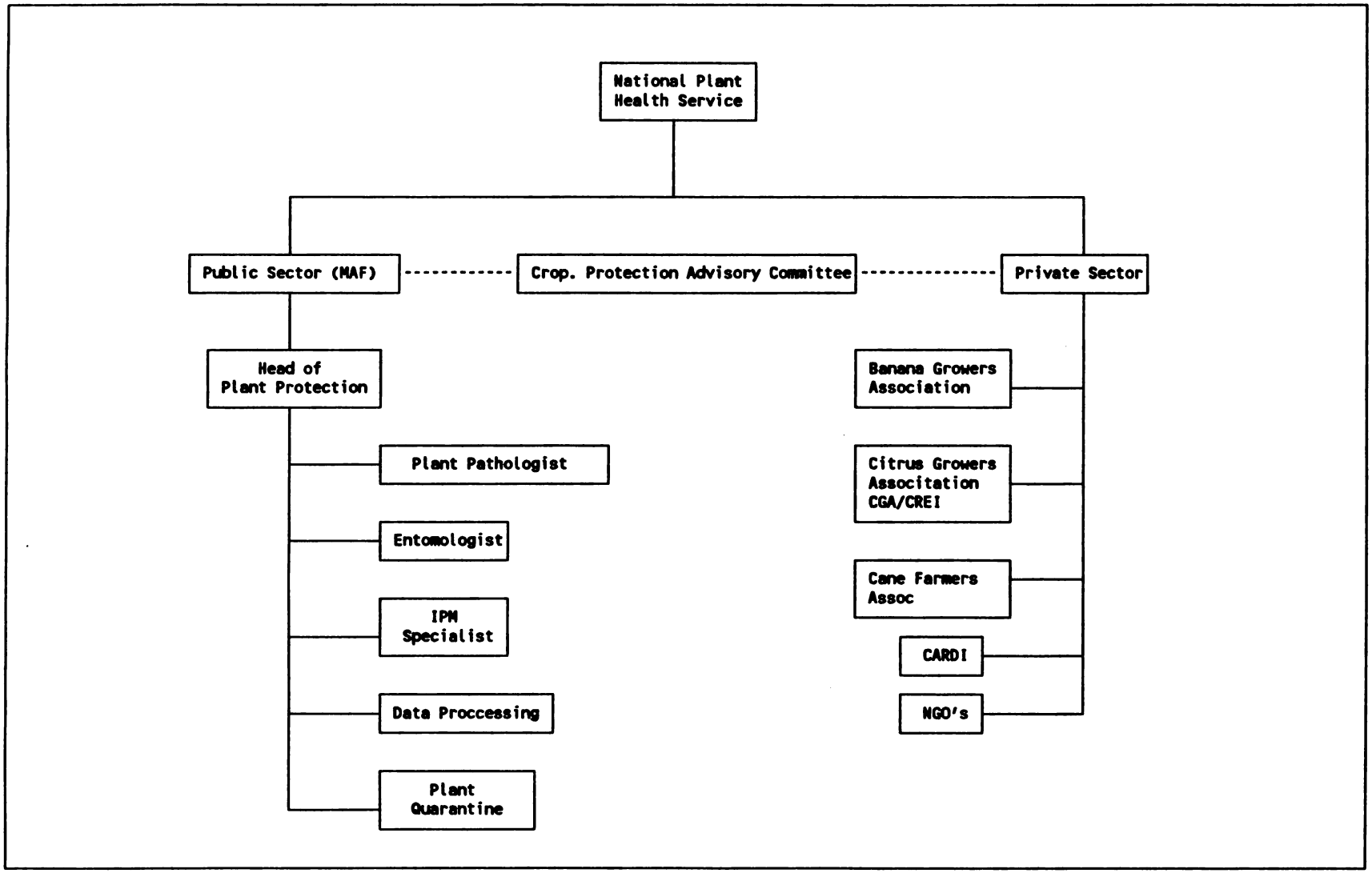
[9] The PCB falls within the regulatory framework of the agricultural health services.

[10] There is no position established in the budgetary estimates for a Principal Plant Protection Officer or the Head of Plant Protection. The senior plant pathologist has been given the responsibility of managing the PPU.

Figure 2.2
Organization of the Plant Health Service (PHS)



Source: MAF

and efficiency - field services, plant quarantine, laboratory services, data management and other support activities. The major technical areas of work are in plant pathology, entomology, biological control, integrated pest management, other field and laboratory diagnostic services, and documentation and data management (Table A.8).

Besides the Head of the PPU (who is also a Plant Pathologist), there are four professional and technical personnel that includes a Pathologist (Virology), an Entomologist, an Integrated Plant Protection Specialist (Entomologist) and a general plant protection technician who has responsibilities for documentation and data base management. Besides the specific responsibilities of individual technicians (in areas such as pathology, biological control, etc.) all five technicians are involved in diagnostics, training (of students, farmers and extension agents) and provide support to quarantine activities. The Head of the PPU also collaborates with local, regional and international organizations in pathology research and data collection. In the area of Integrated Pest Management (IPM), there is collaboration with the other speciality areas (such as entomology and pathology) of the Unit in the design and testing of integrated control measures for pests and diseases in plants. The documentation section organizes and computerizes data in the various technical areas (pathology, entomology and IPM) that are generated by the MAF and the private sector[11]. Besides documentation and information management, the Unit supports citrus tristeza surveys.

Budget: The PPU's budget is part of the overall budget allocated for research and development activities at Central Farm. Budgetary allocations in the last three years averaged about $140,000/year, while actual expenditures averaged less than $100,000/year (Tables A.4 and A.5). Despite the upward trend in both the amount allocated and actual expenditure in the last five years, the PPU's budget has been the lowest compared to that of the other major agricultural health services provided by the MAF. Personnel costs absorbed an average of between 60% and 80% in recent years, a variation due to changes in the number of personnel and support from the ODA project[12]. In the last two years, a pathologist and an entomologist were added to the service. Capital expenditures in the last five years were those of the joint ODA-MAF project which provided among other things, improved facilities at the plant protection building, training and vehicles. For the 1996/97 fiscal year, the sum of $95,000 was budgeted for operations but this was reduced to $65,000 due to financial constraints. The PPU's personnel costs are three times this amount which is approximately 18% of the total costs for personnel in the MAF's agricultural health service.

Field Activities: The major field activities are in the areas of inspection, diagnosis, quarantine, surveillance and training but these are not done frequently and their geographic coverage is very limited. Inspection includes field and container inspection of mainly non-traditional products for export to check for field pests and/or diseases. In the event that the PPU's technicians are

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[11] The documentation unit was recently established with support from the ODA/NRI plant health project.

[12] The ODA project was completed in February 1996. The project provided three new vehicles. In 1995/96, the reduction in personnel costs was due to the VSO leaving the service. The MAF paid contributed 50% of the VSO's salary.

unable to reach the production or assembly site, a sample of the commodity being exported is brought to the PPU's laboratory for inspection[13]. The Unit does a little monitoring, surveying and diagnosis of pests but very limited pest risk analysis is done to determine their impact on crop production. There is no seed testing done to monitor for the presence of any seed-borne pathogens such as virus and bacteria.

Entomological field activities follow the same procedures of diagnosis and identification and resistance management. In the case of the Medfly program, fertility testing is routinely carried out in the event of a capture and an eradication campaign is then initiated by the MAF. Post-entry quarantine at the Central Farm facility is done when necessary. In addition germplasm evaluation is undertaken as a part of post-entry evaluation for newly introduced material. Other field activities done on a very limited scale include assessment of biological control agents, on-farm trials to demonstrate IPM techniques and other control measures for pests and diseases[14].

A plant health project (which ended in 1995) financed by the Overseas Development Administration (ODA) and the MAF made a considerable contribution to the strengthening of the PPU[15]. The project rehabilitated the plant pathology laboratory and screen house for quarantine capability, provided three vehicles, computers and higher graduate-level training for two staff members to study Plant Pathology and Entomology and established a data management unit. Additional support was provided by NARMAP for the training of one staff member in Integrated Pest Management. The project also provided seven incinerators, of which two were installed, one at the quarantine check point at Benque (Guatemala-Belize border) and the other at St. Elena (Belize-Mexican) border check point[16].

Laboratory activities: The PHS's laboratory is relatively small and the range of tests and diagnosis done are limited. The laboratory has the technical capability and it can test for most organisms except viruses but it lacks the required chemicals, other supplies and equipment to do tests that should be done on a routine basis.

Laboratory activities focus mainly on samples diagnosis and pest identification. From 1989 to 1991, the laboratory tested an annual average of 300 samples, mainly for mycological

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[13] This is done only when the shipper has had a previous history of inspection.

[14] The Agronomy Section of the MAF was involved in the Lethal Yellowing Control Program for coconuts which started in 1982. Seed hybridization for genetic resistance to this disease was started costing Belize $40,000/year. Seedlings were supplied between 1991 and 1995 and stopped and the project was discontinued due to cuts in Government budgetary allocation. Presently there is a high demand for coconut seeds but these cannot be provided. The revival of this project has just been started by private initiative.

[15] Due to this project, the PPU's facilities are the improved ones in the MAF's agricultural health service.

[16] After three years only the incinerator at the Benque border is functioning. Another will be installed soon at St. Elena and there are still five others at Central Farm to be installed but the MAF lacks the resources to do this.

analysis (80%), followed by bacteriology (10%), virology and nematology (5%). No fee was (and is not) charged for these diagnostic tests. The average cost per sample for analysis ranged from $5.00 per sample (for common samples) to $100/sample for insect dissection and identification. During the last four years, the number of tests increased for plant pathogens only (58 in 1992, 79 in 1993 and 120 in 1994) before declining to 87 in 1995 due to construction activities in the renovation of the laboratory. Given the present staff of the PPU, the laboratory can test a minimum of 2,000 samples per year if it has more equipment, reagents and other supplies.

To provide a more comprehensive diagnostic coverage to farmers, the lab. collaborates with the Medfly eradication team which provides fruit samples for analysis. The district Extension Officer (EO) is provided with cooling boxes and given instructions on sample collection and preparation methods, so as to encourage farmers to supply samples periodically for diagnosis. The laboratory also has a screen house facility used for quarantine purposes and indexing for known diseases and maintain a small reference collection on plant pests. The facility is also used by teachers and students of BCA.

A data base has been developed for samples tested in the laboratory. For each sample tested, the following information is recorded: date of arrival; source of the sample (name of farmer and location of farm); type of crop sample brought; method of analysis (visual inspection, microscopic analysis); date of analysis; lab. technician responsible for diagnosis; result of diagnosis and recommendation; form of reporting (verbal, written); and any remarks and the possibility for biological control.

Database Management: This is a recent activity initiated by the PPU. In addition to the information base developed from sample testing, the Unit developed a list of crop pests and diseases found in Belize (**Table A.9**)[17]. In addition, a herbarium collection was started together with a reference slide collection for various diseases and pests in Belize which are used to support teaching and seminar activities. Presently, data management is still weak and there is underutilization of the overall existing facility. Data from a recent study on the annual estimated potential crop losses in Belize due to pests and diseases has also been added. Further training in computer skills and data analysis and management are required.

Other Support Activities: The PPU supports other activities related to the control and/or eradication of various pests and diseases in the sector. These include the Medfly program, citrus leaf minor program and Varroa mite program. For the citrus leaf miner, the PPU collaborates with CREI in the rearing of parasitoids for its biological control, information gathering and seeking resistant stock and ways for biologically controlling the Varroa mite. Personnel also participate in various technical committees to provide advisory support.

Two additional areas in which the PPU provides support are quarantine and training. The

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[17] See "A Partial List of Plant Diseases and Pests Including Insects, Nematodes and Slugs Recorded on Belizean Crops," Nerie Sanz 1996.

plant protection laboratory provides technical support to the quarantine service at pre-entry (at border point or at place of origin), entry (within Belize borders) and post-entry (imported products held in secure and isolated location for observation to ensure that items are free of diseases and insects). While the quarantine service is technically under the supervision and control of the Head of Quarantine, the PPU is responsible to keep imported plant materials isolated for observation and treatment (if needed). For post-entry quarantine, the Unit has an insect-proof screen house for observation and indexing if necessary. In the area of training, the PPU is supposed to provide regular training to inspectors and EO's to update them on the status of pests and diseases of quarantine importance but such activities have declined. Other institutions such as CARDI generally collaborate by providing resource persons in these activities, especially when there is an emphasis on specific crops or activities such as rice, peanuts or soybean.

The field services include diagnosis, field quarantine, training of farmers and extension agents about plant health and transfer of technology. At the national level, the PPU collaborates with the private sector in the area of plant health, provides the legal requisites in terms of phytosanitary certificates and import permits for imports of germplasm material and imports of fruit or plant products for processing. It also supports the MAF in monitoring and surveillance and disease eradication for fruit flies and other diseases and pests in the country. At the regional and international level, the PPU shares information and experiences with international and regional organizations called regional plant protection organizations (RPPO) that include the International, Regional Organization for Plant and Animal Health (OIRSA), Caribbean Plant Protection Commission (CPPC), CREI, CARAPHIN, CARINET (Table A.10)[18].

Constraints and Weaknesses: Based on existing information, Belize does not have major plant diseases and pest problems, yet preliminary estimates of crop losses due to pests and diseases indicate these to be in excess of BZ$40.0 million per year. The MAF's plant health service suffers from several weaknesses due to policy, institutional and resource constraints and these contribute to production and income losses by farmers and the economy. Although the ODA-MAF project provided considerable support to upgrade the PPU's technical capabilities and facilities, the scope of plant health services provided are limited and they are not effective as they should be. This could limit Belize's participation in international trade which could severely affect the economy. The major problems and weaknesses of the service are outline below.

(a) Policy priorities for the sector are lacking, the overall planning process in the MAF is weak and these affect the work of the plant health service. While the PPU is involved in several on-going activities (such as plant quarantine, the Medfly program, etc.), the absence of clear policy objectives and guidelines affect the setting of priorities by the Unit and the focusing of its activities on specific crops and plant health issues and planning for the medium and longer term. For 1996, the Unit decided to focus on

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[18] The PAO for Projects is the MAF's coordinator for all OIRSA activities in Belize.

certain problems such as the broad mite and Varroa mite, and to address health problems of three major crops - cabbage, tomatoes and peppers. These priorities were not determined through deliberate planning but on the basis of requests from the district agricultural officer (DAO) and from farmers' demand in the Cayo district to address pest and diseases problems and the income potential of the three crops. In addition, a large proportion of the Unit's time is spent on "fire fighting" activities which do not contribute to a longer term development of the plant health service nor does it meet the challenges of the sector.

(b) In general, the PPU depends much on the MAF's extension field staff to identify pest and disease problems of farmers and their needs and priority issues to be addressed. However, there is poor coordination and inadequate communication between the extension staff and the PPU, and there are no system and procedures clearly outlined of how problems are identified and this information is to be filtered to the PPU's staff. Regular contacts with Extension Officers (EOs) are non-existent and therefore their needs for support from the PPU are unknown. As a result, the PPU's impression is that "everything is O.K." in the field. This situation is also due in part to the lack of policy direction provided to extension staff by the MAF, the shortage of resources and other weaknesses in the extension service. EO's have many responsibilities and are unable to work closely with the PPU's staff to conduct field trials and collect samples. Each district is divided into 5 or 6 zones but due to a staff shortage, EOs are required to cover a larger area. Presently, there is a proposal for the PPU to develop a coordinated work schedule and system with the extension staff across the country. This is needed and EOs could be a more effective vehicle to channel information to the PPU on farmers' needs and problems.

(c) Linkages and coordination between the PPU and other units of the MAF are also weak. Some of the problems of the plant health service are a result of weaknesses in other parts of the MAF. Lack of adequate planning, absence of well defined priorities for the sector and of the Ministry, absence of well defined job responsibilities and guidelines on communication and operational aspects at each unit level, together with insufficient resources contribute to the limited effectiveness of the service. Besides inadequate communication and poor coordination with the extension service, strong linkages which should have existed with the policy analysis and economics unit (PAEU) and the agronomy section are non-existent. Regarding linkages with the PCB, the PPU should ideally be involved in the testing of pesticides before these are registered, but the Board's decision is currently not based on this procedure and no testing is done in the country before recommendations on their use are made.

(d) There is very limited monitoring but no surveillance on the plant health situation in the country. Presently, the PPU does not know exactly what pests and diseases exist beyond those in which it has had some experience. The Unit only deals with issues with which it has previous experience (s) and it does not venture into areas in which it has no information or prior experience. It has a list of pests and diseases of the Caribbean

region but no work is done on monitoring (except on Medfly) to see if these are present in Belize. For example, Palm Trips is a serious pest in the Caribbean that affects vegetables but the Unit does not know if it exists in Belize. Similarly, there is no knowledge of the avocado seed weevil. Recently, the Pink Mealy Bug severely affected crop production in a few Caribbean countries but the MAF does not have the capability to deal with this pest. As a result of the above situation, both the PPU and the MAF do not have sufficient information on the plant health status of the sector and this could have serious implications on policy decisions being made and restrictions could be placed on exports due to the existence of pest and/or diseases.

(e) Regular collection of samples around the country are not done by the PPU due to inadequate resources. Samples are collected in a haphazard manner and there are no clear guidelines as to how this should be done. Ideally, the extension staff and farmers should be trained to collect samples and submit these regularly to the Unit for testing.

(f) The lack of operational resources has also severely limit the scope and the diagnostic work of the PPU. Due to inadequate resources (and the lack of communications with the EO's in other districts) the PPU concentrates much of its work in the Cayo district to minimize travel costs. In the area of diagnosis, the Unit is unable to identify exactly the various viruses that exist due to a lack of materials for diagnosing them. Similarly, for bacterial diseases, it is unable to verify the various ones. New viruses and bacterial diseases could exist but the Unit is unable to check these. For example, there are diseases affecting coconuts but these are unknown. Due to the closure of the soils laboratory, the Unit is unable to test soils to verify whether bacteria exist or not and no soil testing has been done by the MAF for a few years. The Unit is also supposed to do routine visits to districts, but none has been done since 1995. In the area of dissemination of technical information, there is no publication to disseminate information on the pest and disease situation. Presently, the PPU has much technical information that could be published and disseminated to various clients but no resources are available for this. In addition, the PPU lacks appropriate equipment which could facilitate its field work with extension officers and farmers. Its service could be more effective and it could cover a larger geographic area if small technical kits are made available for field visits.

(g) The PPU does not have sufficient expertise in certain key technical areas and its training activities declined due to a resource shortage. Updating of skills and specific training is needed for its staff in areas such as nematology, data management, risk analysis, weed science, biological controls, sampling, monitoring and evaluation, etc. Besides the limited technical experiences of the staff in certain areas, most of its personnel have limited experience in their respective fields. The head of unit is the only person with many years of experience and he has been retained on a contract basis. The Unit also needs urgent assistance from an economist to assist in monitoring its activities and to evaluate the impact of its pest and disease control measures on the sector but the MAF's staff has very limited experience and technical capabilities to work on such problems in

agricultural health. Attempts were made by the Unit to schedule training activities with EOs, Medfly technicians, etc. to facilitate its field work but few were implemented. Adequate training is not provided to farmers and EOs to provide information and improve techniques on husbandry practices, and resolve critical pest and disease problems. Presently, no training is done of field staff and farmers on plant health problems.

(h) In addition to the weak extension service, the PPU's field activities are limited by the lack of organized groups of producers. As a result, the PPU's staff stretches itself too much to resolve farmers problems over large geographic areas.

(i) The GOB's regulations restrict government departments from generating revenue from their services and having easy access to such resources. There are no charges for the PPU's services and the Unit is totally dependent on the MAF's budget for resources. Presently, exporters of peppers are willing to pay for monitoring to be done of their field production and packing sheds, but the MAF cannot accept payment for this service.

(j) The PPU has only three vehicles to respond to requests and resolve farmers problems across the country. Very often however, requests are made too late to address emergency problems and the channels to communicate such requests are weak. The Unit's effectiveness and work schedule is also affected by frequent ad hoc requests from senior officials of the MAF. Presently, instructions are given to address isolated cases and problems in various areas which often disrupt the regular work schedule of the Unit as well as absorbing much of its limited resources.

(k) Given the increasing trend towards globalization of economic activities, changes in trade regulations and laws, rapid advances in communications technology and technical "know how", it is critical that the information and knowledge base of the PPU be constantly updated to keep abreast of regional and international developments in agricultural health. However, the AGHS's communications technology is inadequate to facilitate such linkages. In addition, the Unit has insufficient technical reference materials, manuals and other relevant literature to facilitate its work, and limited communication linkages with other plant health services and research institutes in Central America and Mexico.

(l) Presently, the PPU's staff is involved in teaching at the Belize College of Agriculture. Although the time devoted to teaching varies throughout the year, it absorbs much time and this affects their regular work in the Unit.

2.2.2 Private Sector

Plant health services are provided in varying degrees by several non-public institutions working in specific production areas or sub-sectors. The sugar, citrus and banana industries have the most active plant health services in the private sector. Through their respective growers association (commodity associations), resources are allocated for plant protection

(routine pests and disease management, monitoring and surveillance) and their staff is devoted to pest control activities with occasional support from the MAF's PPU when this is requested. The relationship between the PPU and these organizations ranges from policy and regulatory matters to collaboration in research, quarantine and pesticide usage, training, addressing specific problems and information sharing. The commodity associations have a long history of providing their own support services to deal with various aspects of disease and pest control for their respective crops. Table A.11 shows their current programs and activities. Each has a small laboratory to support diagnosis and pest control activities. It is estimated that the total value of crop losses in the banana, citrus and sugar industries due to pests and diseases is about $11.8m, $20.4m and $8.3 million per year respectively.

Banana Growers Association: There are 26 banana farms comprising about 5,175 acres, yielding an average of about 600 boxes (40-lb. boxes) per acre. The main health problem in banana production are fungi, of which the principal one is the black sigatoka disease fungus. Although the farms are managed individually, the BGA has a team of 10 technicians working in routine monitoring of the pest and disease situation. These technicians attend training courses periodically and they also have on-farm training on disease control and protection measures. On each farm there is a system in place to control ripeness and harvesting and to meet quality requirements. After harvest, bananas are cleaned in the packing shed, go through a rigid inspection process, then sprayed with a solution of fungicide (for anthracnose treatment) before they are packed and trucked to the port[19].

The BGA also has a laboratory to provide diagnostic support on the Black Sigatoka and nematodes. Due to limited laboratory services in Belize, the BGA often sends samples to Guatemala for testing. These comprise two leaf and one soil samples done per year, costing an average of US$20/per sample[20]. The Association charges its members fifty cents per box for plant health/disease control and other services, and it also supplies the chemicals for control of sigatoka and nematodes. Chemicals for the control of the Black Sigatoka is done through aerial spraying on a contractual basis, while the application of nematicide is done by the suppliers. The cost of these control measures to the industry averages about BZ$650 per acre per year.

At the port, the BGA has a small monitoring facility to check on fruit quality. There is also a quarantine inspector (QI) from the MAF to inspect each shipment and to issue a Phytosanitary Certificate (permit). The MAF has a full-time QI at Big Creek but the facilities are poor and there is little regular supervision. The Ministry of Health (MOH) has a part time officer to check in-coming ships also. The BGA covers all the overtime costs of the QI, the

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[19] The BGA ships between 40,000 to 80,000 boxes per week from Big Creek. The annual quota/year is 40,000 metric tons (MT) in the EC market. An extra 15,000 MT has been given to Belize but this gets a lower price than that for the regular quota. If all the quality standards are met, the average quota price is US $10.00/box; of this US$4.00 is the first payment. For the extra 15,000 MT, the average price received is US $5.00/box. The average cost of production varies but the BGA aims to keep costs at US$7.50/box. Ecuador can produce bananas for the export market at about US $3.00/box.

[20] There is a proposal that the soils lab. at Central Farm which has not been functioning for the last two years will be taken over by the citrus and banana producers (CGA and BGA).

customs officer and the public health officer[21].

For additional technical assistance, support is provided by the MAF only when there is an unusual problem related to pests and diseases[22]. The BGA also has good access to technical assistance outside of Belize and it usually covers some costs. Fyffes pays for some costs for any technical assistance provided as well as the cost for any input it provides into quality control[23].

Citrus Growers Association: The Citrus Growers Association (CGA) headquartered in the Stann Creek district provides plant health services (among other services) to its 719 active producers in the citrus industry[24]. The main pest and disease control programs in the industry include the following[25]:

(a) The Medfly program is presently a monitoring program executed by the MAF[26]. The Medfly is a major threat and a principal concern because of its potential economic damage to the industry and other fruits (Table A.12). There is also a Mexican Fruit Fly control program. The basic objectives of these are to control the flies and to reduce/prevent fruits from falling off the trees. Monitoring is done over a ten month period and it involves the use of bait and insecticide.

(b) A control program for wee wee ants on most farms. The ants strip the tree of leaves and eventually damage the trees. This program is a continuous one throughout the year.

(c) A program to protect young plants from drunken baymen (leaf eating bees) which destroys the leaves of mainly young plants.

(d) A program to prevent premature fruit drop (PFD). This is a disease caused by fungus and fungicide is used for its control. Expansion of this problem could have a major economic impact on the citrus industry.

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[21] This cost is usually paid for by the purchaser and its agent charges this cost to ship.

[22] The BGA does no periodic reporting to the MAF on the industry's health status unless there is an unusual problem related to pests and diseases.

[23] Through Fyffes, the BGA has access to good technical assistance outside of the MAF.

[24] The CGA charges a cess for supplying various services. Presently, it is BZ$0.16/box for oranges and 0.11 cents/box for grapefruit. Of the total cess charged, 0.6 cents/box goes to cover the costs for research and 0.5 cents/box for finances and administration.

[25] Not all these programs or measures are implemented on all the citrus farms.

[26] Belize is presently Medfly free.

(e) Monitoring and control measures to increase leaf life such as those that address the removal of green spot and leaf molds.

In addition to the above, the industry is under the constant threat of the citrus tristeza virus (CTV) which has been detected in some trees[27]. In recent years, it has been using tolerant root stocks to replace those affected by tristeza. A certification program is being proposed for the entire industry in which the Citrus Research and Education Institute (CREI), the research arm of the CGA will be the certifying body. This program will cover all root stocks and nurseries. Recently, CREI received a grant of $250,000 from FAO to execute a certification program on planting material for the citrus industry.

Most of the personnel involved in the execution of the disease and pest control programs and measures comprise farm managers, field supervisors and regular laborers. The MAF provides support to the industry through its PPU only if there are specific requests which are related to unusual pests and diseases. No regular reporting is given to the Ministry on the health status of the industry. Regarding the cost of pest and disease programs, this varies between $100,000 and $250,000 per year[28]. Due to limited laboratory capabilities in Belize, the industry sends soil and leaf samples abroad, mainly to Guatemala for analysis. The cost for these is about US$15.00/sample for soil analysis and US$20.00 or more for leaf analysis. One processing company, the Belize Foods Limited sends about 300 samples/year for analysis and it plans to do this every two years instead of every three as is presently done.

CREI is becoming increasingly active in disease monitoring and control in the industry due to the estimated high economic losses that can result if certain diseases and pests are not controlled or eliminated. It has the mandate for citrus research and is now in the process of executing the bud wood and nurseries certification program. It also does test on root stock-scion compatibility test and is currently involved in a survey on the citrus tristeza virus. Presently, its major activity is to have disease-free plants in order to produce a healthy fruit by ensuring that clean root stocks are available to producers. It buys seeds from commercial nurseries in U.S. and all imported root stocks are placed first in quarantine by the MAF before they are available for use. In addition, CREI has a number of programs in the area of plant protection that includes addressing the citrus leaf miner, aphid, etc.

CREI's annual budget is approximately $250,000 per year and this is financed by the cess. It has nine staff members including a plant biologist, plant pathologist and two extension officers. The Institute liaises and maintains close links with external institutions for technical information and assistance such as the Universities of Florida and California and technical institutions in Brazil.

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[27] Its efficient vector is not present as yet in Belize; however, if it does affect the industry, the estimated total losses to the sector is around $13 million.

[28] It is difficult to estimate the total costs of all the plant health measures executed in the citrus industry. The pest control program for one citrus processor, Belize Foods Limited is estimated at about BZ$50,000 per year.

Sugarcane Farmers Association: Sugar is the most important agricultural export and the largest earner of foreign exchange. Therefore, keeping the industry free of pests and diseases is a high priority of the sugar industry as well as the GOB. There are more than 70,000 acres under sugarcane and plant protection measures are executed by the Sugar Industry Board (SIB). The SIB has a research team comprising agronomists and extension officers, whose primary responsibility is to demonstrate technological packages dealing with production and plant health measures. The activities cover 100 demonstration farms in each of two districts of Corozal and Orange Walk. These demonstration trials cover varietal testing of imported breeding lines and the control of weeds and pests. Weeds and froghoppers (*Aeneolamia postica jugata)* are the two most important pests of the industry. The SIB levies a cess on sugarcane farmers for plant protection and other support services. Regarding improved breeding stock, Belize obtains these from Barbados through a special program to which the country contributes $40,000 annually.

Caribbean Agricultural Research and Development Institute (CARDI): CARDI contributes to Belize's agriculture and to the activities of the MAF by developing technological packages for rice, peanuts, soybean, cowpea and pigeon pea[29]. Plant health issues are not dealt with as a separate activity but it provides information and technology packages to deal with pests and diseases on those products with which it is experimenting. The biggest direct impact of CARDI's activities in plant health is in the selection, introduction and release of germplasm resistant to disease and pests.

CARDI also offers training courses and demonstrations on the management and general agronomic practices for the crops mentioned above, provides extension services for monitoring and surveillance at the farm level and technical advice and assistance in the area of plant protection (use of herbicides, fungicides, etc.) and it does joint work with CREI on citrus. If there are problems related to diseases, CARDI assesses the situation and sends samples to the PPU for analysis. Most of its laboratory needs are met by the PPU but it also sends soil samples occasionally to the U.S. for analysis.

CARDI has the technical capability to deal with a range of pests and diseases in crop agriculture but it requires critical support from the PPU's laboratory for analysis of samples. Its personnel also has a strong capability in IPM. If there is a serious pest and disease problem or there are new ones, only then is this reported to the MAF[30]. Presently, its professional and technical staff comprises two professionals - an Entomologist and an Agronomist/Seed Specialist), supported by a field technician. Its internal network for generating information and

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[29] There is no seed certification system in Belize and the CARDI is the principal source of soybean, other beans and peanut seeds. Besides those seeds not produced from its own operations and from farmers, CARDI imports its seeds from international centers. With regards to seed certification, Belize does not have the required infrastructure for storage, cleaning, grading and treating seeds.

[30] There is no official requirement by the GOB to report pests and diseases discovered.

providing support services include the MAF, NGOs, other institutions and farming groups in Belize. As a regional institution, it is able to generate information from its wider network with other offices and research centers in the Caribbean and elsewhere.

Non-Government Organizations: There are a few Non-Government Organizations (NGOs) that provide limited plant and animal health services as part of their overall support to specific client groups of farmers. The main ones that provide such services are the Belize Enterprise for Sustained Development (BEST) and Help for Progress Limited (HELP). Both NGOs provide advisory services in plant health through their extension activities and depend heavily on support from the MAF and CARDI to resolve specific problems. BEST has a veterinarian and two agronomists that provide technical support in the agricultural health area[31]. These personnel can service the basic needs of BEST's clients; similarly, the technical personnel of HELP provides basic assistance to its client farmers.

The experiences of the NGOs indicate that farmers are in urgent need for technical assistance to address their plant and animal health problems if they are to produce quality products for the internal and export markets. In addition, there is a lack of information on what the trade regulations are regarding the use of chemicals. BEST is focusing on the use of IPM techniques to address pest and disease problems. Besides the MAF personnel and CARDI as a source of information, the NGOs depend on an informal network in Belize for technical information.

2.3 Animal Health Service

2.3.1 Animal Health Status

Belize has a good animal health status, free of major animal diseases that cause much economic losses in other countries in the region. This status is a result of past and present animal health programs of the MAF and its on-going collaboration with international organizations. Since 1993, the MAF has computerized much information on the animal health disease status in the country[32].

The Office of International Epizootics (OIE) reports that Belize is free of "List A" diseases such as Foot and Mouth, Newcastle and Avian Influenza. The country is also free of "List B" diseases such as Heartwater, Malignant Catarrhal Fever and Spongiform Encephalopathy. Hog Cholera was a national problem up to the 1980's; since 1988 the country has not reported any further outbreak of this disease. However, there is always a serious threat

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[31] The total cost for these personnel is about BZ$140,000 per year.

[32] Initially, records on animal disease were kept using the Panacea computer program but this was replaced by Epi-info.

of its incursion from the neighboring countries of Mexico and Guatemala[33]. Brucellosis has never been reported. Annual blood testing of dairy herds in the Cayo District is conducted and every reported case of abortion in the country is tested for Brucellosis. The prevalence of tuberculosis has not been documented[34]. In 1991 testing disclosed 5 reactor cases and the animals were destroyed; since then no new case of tuberculosis has been detected.

Malnutrition and parasitism are important constraints to animal production in Belize. Despite adequate rainfall malnutrition is a problem because of overstocking and little supplemental feeding in the dry season. Ticks and beefworms cause losses in animal production. The loss from beefworm became more visible after the eradication of the screwworm in 1994. Internal parasites are a problem throughout the country but especially in the Cayo District where rainfall is high (average of 60 inches/year) and herds are more concentrated. Sheep, in particular, suffer much from internal parasites and this sometimes requires farmers to deworm as often as once a month. Belize is also free of liverfluke. In 1994 liverfluke was detected in goats under quarantine from El Salvador.

The animal disease status of the country is outlined in **Appendix B.3.** Belize has a list of notifiable diseases that have been under legislation since 1958. There are certain exotic diseases in the region that pose a threat to Belize. In addition, the country: has both urban and wildlife rabies; Blackleg is endemic throughout the country; Vesicular Stomatitis (New Jersey strain) is endemic in four districts (Belize, Cayo, Stann Creek and Toledo); Equine Encephalomyelitis is of low sporadic occurrence; Contagious Ecthyma is endemic but not of economic importance; and there are sporadic outbreaks of Avian Diseases.

2.3.2 Public Sector

2.3.2.1 Ministry of Agriculture and Fisheries

Belize's animal health service is provided largely by the public sector through the MAF. Private sector services are very limited, comprising a small support service provided by the Belize Livestock Producers Association (BLPA) to its members, by BEST to its clients and by the country's Veterinary Association for small animals.

The MAF executes the GOB's policies and programs in animal health through its Veterinary Services Division (VSD). The services include: (a) organization and administration of field and laboratory services; (b) animal quarantine; (c) disease surveillance and veterinary public health; and (d) prevention, control and eradication of diseases. The VSD coordinates all

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[33] Mexico has embarked on a national Hog Cholera Eradication campaign.

[34] Simultaneous testing for Tuberculosis is done when dairy herds are tested for Brucellosis. Live cattle exported are also tested for tuberculosis and no animal has ever tested positive. Moreover, meat inspection at slaughter plants has never found a tuberculous lesion.

animal health activities throughout the country from its headquarters in Belmopan (Figure 2.3). The Principal Veterinary Officer (PVO) has responsibilities (both administrative and technical) for livestock production, animal health, animal quarantine and laboratory services. Support is provided by veterinary officers, animal health assistants, laboratory technicians, livestock officers and livestock technicians (Table A.13). The MAF employs eight (8) of the 15 veterinarians in Belize[35].

Since 1989/90, budgetary allocations by the MAF for its Animal Health Service (AHS) averaged just over BZ$0.5 million per year, of which personnel costs absorbed more than 75% of the total (Tables A.4 and A.5). Despite a reduction in operating costs, actual expenditures by the service exceeded BZ$0.5 million since 1993 due to higher costs for personnel. Capital expenditures also declined resulting in a reduction in many activities including routine ones critical to the service (see below). In general, resources allocated for operations in recent years have been insufficient and this has severely limited the service's effectiveness.

Veterinary field services[36]: The principal field services are clinical, preventative and extension aspects of veterinary medicine and surgery. Recently, field service staff has been required to supervise meat plants desiring to export dressed carcasses and processed meats. These services are provided from two main clinics in the Cayo and Orange Walk districts and a smaller satellite clinic in the Toledo district. The Belize district has a clinic attached to the Central Veterinary Laboratory (CVL) but it provides very few services. The Orange Walk clinic is responsible for the Corozal district while the Stann Creek district is covered by the Cayo clinic or the Toledo district clinic. The Corozal district has a private clinic and as a result, little demand is placed on the government's clinic in the Orange Walk district. Minor services are provided in the Stann Creek district because citrus production is the major activity there and livestock activities are few, but there is a heavy demand for services from the Cayo district clinic (located at Central Farm) because of the concentration of livestock production in this area[37].

The clinical service is designed to attend sick farm animals on a demand basis and it services mostly small farmers. Charges for services are levied at the discretion of the veterinary officer but they should cover the cost of drugs plus a 30% surcharge which is deposited in a revolving fund controlled by the Ministry of Finance (MOF)[38]. In April 1996, the MAF terminated provision of clinical services for small animals and transferred these to the private

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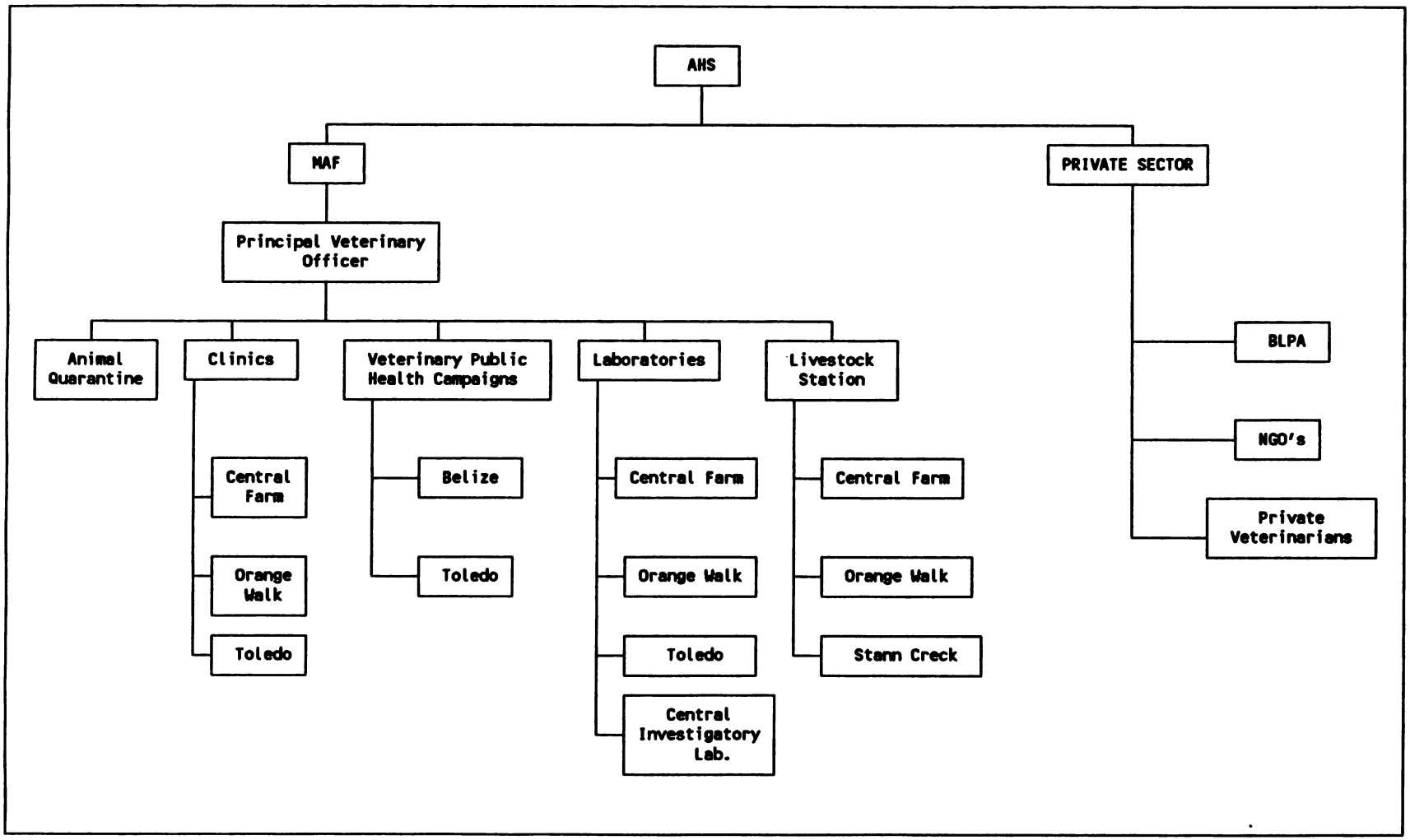
[35] Presently, one Veterinarian has been interdicted from duty pending investigations.

[36] Until 1988, the veterinary field services were carried out by British veterinarians. By then Belize had a full complement of national veterinarians trained abroad.

[37] In addition, this is a central clinic that provide supplies and support to the other clinics.

[38] The Fund was approximately BZ$214,000 at the and of July 1996. The revolving fund is not easily accessible and an application for its use may take as much as four months to be processed and approved by the MOF. Basically, the animal health service has little control over this fund.

Figure 2.3
Structure of National Animal Health Service (AHS)



Source: MAF

sector. While this service provided much revenue to the government, it absorbed much time from the veterinary officers which affected their work in other areas of the service.

The preventative service includes vaccinations, deworming, breeding soundness evaluations, reproductive programs and herd health programs. It is usually provided on a demand basis and no charges are levied for services except the cost of drug(s) plus a mark-up of 25 percent[39]. The extension service comprises technical support to the district extension staff in matters pertaining to animal health and production. The Central Farm clinic also provides training in the form of clinic attachments to students of the Belize College of Agriculture (BCA). In addition a semester course in "Veterinary Science" is offered by the Veterinary Section to second year students of this institution.

The animal health section also has the responsibility for meat inspection of any processing plant exporting meat[40]. With the closure of "Belize Meats" in the Belize district in the late 1980's no inspection was done until May 1996. Two meat plants in the Cayo district have expressed interest to export beef and inspection is being done of these plants.

Veterinary diagnostic laboratory: The Central Veterinary Laboratory (CVL) and the Central Farm Laboratory of the MAF had good diagnostic capabilities in the Central America region, but their services declined due to insufficient resources, organizational problems and the inability to attract users of the service. The CVL has an excellent location in Belize City, within the area of the Belize General Hospital, Nursing School, Medical Laboratory and various private medical clinics. It houses a veterinary clinic previously used for companion animal medicine and surgery but provides very few services presently and is in a state of disrepair. It has a veterinary officer (VO) in-charge and one senior laboratory technician while the Central Farm laboratory has one laboratory technician. The number of samples tested per year at the CVL decreased from more than 2,000 in the 1980's to less than 200 presently. Given the severe financial and staffing constraints of the CVL in recent years, its services are few and the majority of tests are for parasitology, hematology and serology (Table A.14). No fees are levied for samples submitted, but there is a charge for certain tests done at the Central Farm laboratory (Table A. 15). Some tests are done by the Medical Laboratory in Belize City for the CVL. This working relationship also allows for limited exchange of reagents and materials when these are in short supply at either facility. Some assistance is also provided to the Fisheries Department laboratory by the CVL. The Orange Walk Veterinary Clinic has a small laboratory but its work is limited to parasitology and hematology. It cannot serve the Mennonite communities (poultry producers) in the north and it has done no survey work among these.

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[39] The effective cost of supplying veterinary field services is unknown.

[40] Presently, no processing plant is exporting meat but support is being provided to one plant (Running W) to enter the export market.

The CVL's facility is underutilized and its diagnostic capabilities are limited to meet the demands of the AHS. There is need to expand its capabilities to conduct tests for certain diseases such as Hog Cholera, Infectious Bursal Disease and leptospirosis.

Tuberculosis testing is the only field test done by the MAF although the poultry industry conducts it own field test for Salmonella (S. pullorum and S. gallinarum). The majority of samples from both companion and food animal sources for testing is submitted by Veterinary Officers with occasional submission by farmers or field workers in the agricultural sector (such as screwworm field officers).

Surveillance: This service is designed to monitor the animal health status within the country in order to deal with emergencies, control focus of diseases and to keep track of important health conditions. The surveillance system has two components: monitoring of a given vector or disease situation, clinical cases and meat plants; and monitoring during disease outbreaks. The scope of surveillance activities by the MAF is very limited presently. Those that are done are carried out for important exotic, endemic and zoonotic diseases. It includes:

(a) Vesicular disease surveillance which records and follows all outbreaks of vesicular diseases in Belize. Epithelia from all vesicular cases are sent to Panama for analysis. A positive diagnosis for Vesicular Stomatitis requires the implementation of a 50-mile radius quarantine area which is maintained in force until one month after the last case reported.

(b) The threat of Avian Influenza in Mexico instigated the formation of a poultry health team with particular responsibilities for Avian Influenza surveillance. This program requires all farms reporting poultry health problems to be tested for the disease.

(c) African Swine Fever and Hog Cholera surveillance. Suspect cases of classical swine fever are submitted to the USDA laboratory in Ames, Iowa. The most recent samples (June 1996) were negative. It is hoped that Belize could conduct its own testing for CSF since it is critical that the country be declared free of this disease.

(d) Equine Encephalomyelitis. The USDA assists Belize in the diagnosis of equine encephalomyelitis. In July 1996, an outbreak occurred in Shipyard, Orange Walk and affected 8 farms (a total of 14 out of 1,200 horses). The disease was also reported in the Belize and Cayo districts.

(e) Rabies. All suspect rabies cases (wildlife, domestic animals and pets) are investigated and where deemed necessary, brain samples are sent for analysis to the Ministry of Agriculture's laboratory in Panama.

Other surveillance activities include support to the Vampire Bat Control Program (see section below on quarantine). However, this program has been affected by insufficient resources. There is a plan to decentralize it by having it executed by the EO's in the various

districts. Nevertheless, to be more effective the program will require: (a) additional funds, equipment and vehicles at each extension center; (b) all persons involved with it will need to be vaccinated for rabies; and (c) resources to cover additional costs since overtime work will be incurred include night shifts.

Relationships with Other Organizations: At the national level, the AHS of the MAF liaises with the BLPA, the Poultry Producers Association (PPA), the Veterinary Board, the Veterinary Association of Belize (VAB), the Bureau of Standards (BOS) and the Ministry of Health (MOH).

The BLPA is the only association of livestock producers in Belize (apart from the Poultry Producers Association (PPA)). Close ties are maintained with the BLPA in imports/exports of live animals and their products and in animal husbandry practices in general. The PPA was recently revitalized as a result of the threat of Avian Influenza from Mexico. VO's provide technical support to address poultry health problems experienced by members of the association. The Poultry Animal Health Committee was formed for the surveillance of Avian Influenza. This collaboration between the MAF and the association has facilitated timely diagnosis and treatment of some poultry diseases.

The Veterinary Board comprises a selected group of veterinarians from the public and private sector with responsibility for monitoring and improving the quality of veterinary medicine and surgery in Belize. Legislation supporting the Board was enacted recently (March 1996) and the Board was made a legal entity in May of this year. The Veterinary Association of Belize was formed in December 1995 with a membership of 15 veterinarians. It is now developing a closer working relationship with the MAF, a cooperation that was instrumental in the diagnosis of aflatoxin that contaminated animal feed which affected poultry and pets recently.

The AHS of the MAF maintains relations with several regional and international organizations on sharing information, training and other collaborative activities in animal health. These include LADIVES/PANAMA, MIDA/PANAMA, PAHO/BELIZE, IICA, OIRSA AND PARSA and USDA/APHIS.

Deficiencies and Weaknesses: In general, the MAF's AHS has deteriorated in the past few years, in large part due to the similar constraints of the PHS - resource shortages, inadequate prioritization of policy objectives and lack of planning. The situation has been compounded by outdated as well as inadequate supporting legislation. Although no serious animal health problems have arisen, the country's situation is much more serious than it appears. A large number of routine activities which should be executed are not done by the MAF, resulting in substantial weaknesses in the service that could severely affect Belize's economy and trade situation (through production losses and loss of markets) and the health of the population. A review of some of the service's problems (outlined below) suggests that urgent remedial measures need to be taken to improve the situation.

(a) No regular monitoring or surveillance is done of the animal health status or of particular diseases in the country and the MAF doesn't know what the exact situation is regarding

existing diseases or new ones. Regarding the aflatoxin problem that was recently discovered, there is no regular surveillance or testing for this in the country. Only after animals died were efforts made to diagnose and contain the problem. In the poultry industry, the MAF suspects that it is affected by many diseases such as IB, IBD, Merk, etc. because there is no testing being done by the laboratory, it has been difficult to verify the situation. Belize has new castle disease but there is very little information on the situation with pigs. In communities such as Cayo and Orange Walk where dairy cows are concentrated, no TB testing is done. There are also several diseases and fungi that affect marine products and aquaculture activities but very little testing is done of these. Honey production is a viable economic activity given the strong export market for this product and Belize produces good quality honey. However, several diseases affect bees and the MAF has not developed the appropriate technological packages for the honey industry.

(b) Although Belize is self sufficient in poultry meat, the chicken industry has been affected by many health problems which have only been addressed after outbreaks have occurred. Resource shortages result in no regular monitoring of the industry and prevalence of unknown diseases that cannot be officially recognized. For example, there is little information on the disease status of the poultry industry. Accessibility to the Mennonite communities was very limited and although this is improving, the existing legislation does not provide the MAF with the necessary support to allow inspection of their operations. The industry relies on excessive antibiotic use and there is slaughtering and processing of flocks that fail to respond to medication. Producers keep shifting in the use of antibiotics in order to reduce the mortality rate because they are unable to determine the true cause of death of chickens. There is one hatchery that supplies the country which has an above average mortality rate but no surveillance and monitoring of it is done. There are several problems related to various diseases such as salmonella, etc., but no screening is done of the eggs produced and of the layer and broiler breeder flocks which should be screened regularly (before 21 weeks old). Furthermore, there is misuse of antibiotics in the and no testing or monitoring of drug use is done on this. Nothing is being done on the registration and control of veterinary drugs and biologicals in the sector. Not only is the disease status unknown but little is also known generally about residues in meats, milk and eggs and the wholesomeness of food of animal origin.

(c) There are certain diseases that affect cattle in all countries. Several of these diseases are common to large countries but they are not considered as barriers to trade in meat. Despite this, Belize needs to do its own monitoring and testing for these diseases because they have never existed in the country. For example, there is need to test and do surveys on diseases such as IBR, and Bovine Viral Diarrhoea. The incidence of these diseases are high in developed countries but they do not exist in Belize. Even though the larger countries may consider beef or products to be safe for trade Belize needs to establish its own system to monitor and prevent certain diseases from entering the country. Similarly, the same applies to pork. The U.S. exports pork but that country has Aujeskey and PRR diseases which Belize does not have. There is a need for Belize to do its own testing if

it is to remain free of certain diseases. Presently, such tests or monitoring activities are not done which could potentially result in new diseases being introduced into the country.

(d) There are constant complaints from people who buy feeds that the animals don't respond as they are supposed to. There is inconsistency in the feed quality produced in Belize in terms of protein content, calcium, phosphorous, and vitamins A and E. There is no standard quality control, no test is done to determine quality assurance, especially for grain-based feed and no test has been done for aflatoxin for several years. The above problem is the same for natural pasture which needs to be tested for nutrition status and content. The need for quality assurance is even more critical for exports, particularly non-traditional products or both existing and potential markets can be lost. Importers of Belize's products need verification on the residue and safety status of exports but the quality assurance system is ineffective and the government is unable to provide scientifically based guarantees of product quality, except for the traditional exports.

(e) Belize has a low reproductive efficiency in cattle, a result of many factors including diseases, poor nutrition, etc. and the country is the only one in the region without brucellosis. Information on other diseases affecting the reproductive rate of cattle are not available and no effort is made to generate such information. There is need to test the forage of the country and make appropriate recommendations, and verify the existing health and nutrition status of the animal stock but the MAF is unable to do this because of laboratory deficiencies. Presently, the veterinary service does not have a tech. pack. to offer to farmers to help address disease problems, mineral status of forages, animal nutrition, etc. Furthermore, given that Belize will participate in an increased trade liberalization framework and the possibility exists that cheaper imports of meat will likely enter the country, the MAF will need to develop natural forage feed to compete with cheaper imports. Proper diagnosis of natural forage is needed and appropriate tech. packs. developed and tested. The AHS has an important role to develop the tech. packs but these have not been considered as high priority and resources have not been allocated.

(f) For residues, antibiotics, food safety and zoonoses control, no tests or monitoring is done except in the urban rabies control program with PHB. There are a large number of zoonotic diseases (TB, Venezuelan Equine Encephalitis, Leptospirosis, Brucellosis, etc.) which affect human beings but the MAF does no work in this area. Toxoplasmosis is a parasite in raw meat but there is no information whether or not it exists in the country. In Guatemala, 60% of the pork that reaches the city is contaminated with tapeworm. In the Toledo area (close to Guatemala), people live under the same conditions as those in Guatemala but there is testing or monitoring of the health situation in that area.

(g) There is no monitoring or government oversight of activities related to certification and licensing of AI and embryo centers. Several diseases such as gumbora in chicken and pasteurella in cattle (which Belize did not have before) were imported to Belize through

vaccines because of lack of monitoring. In addition, no testing and certification of the genetic stock for animals is done.

(h) The regulations governing private practices of veterinary medicine needs to be strengthened and an effective control system must be established. Private veterinarians can provide ambulatory services but there is usually a conflict of interest when public veterinarians also have private practices. When requests are made at government clinics for certain services, clients are referred by the veterinarians to their private services, either because of shortage of supplies or the opportunity to make additional money. Since government veterinarians also have private practices, a system of proper control, certification and appropriate regulations are needed to reduce or minimize this conflict of interest. In this regard, a regulatory system needs to be developed similar to that of medical doctors in the public sector who also have private practices. Some private practitioners with animal health training provide private veterinary services but there are problems related to their training and the quality of services provided. A certification system is needed to ensure that quality services are provided and to prevent malpractices.

(i) Perhaps the weakest area of the AHS is its laboratory services. The CVL functions at a very low level providing only a few services only. The current facility is in a state of disrepair, without resources such as adequate staffing, instruments and equipment, reagents and finance to carry out basic surveillance and diagnostic work needed in the livestock sector. In 1995, the CVL did about 200 tests but it should be doing at least 10 times this amount and other diagnostic work given the demand for the services. No testing of food is done for disease agents and the only food tested was milk and this stopped in 1987. These tests were previously done by the VSO veterinarians but the activity stopped after they left. The requests to test milk was also stopped by the milk cooperative and no test is done for milk produced by the Mennonites. Although there is legislation under the Foods and Drugs Act for such tests to be done regularly, it is not enforced and the laboratory lacks resources to do this. Recently, the laboratory began testing milk again but only for total colony counts, somatic cell count, etc. Tests for contaminants, acid phosphatase (to check if milk is pasteurized), drug residues, for toxins, specific agents such as coliforms, etc. are not done. Similar tests for meat are also not done. Certain tests such as species identification, general antibiotic tests, pesticide tests were done up to 1989 but these stopped because meats were no longer exported. There are no materials and supplies to do such tests even for meat consumed locally.

(j) Rabies is endemic in Belize but the CVL needs to fix a few pieces of equipment which are not operational to test for rabies. The building that houses the CVL is not bio-secure to conduct rabies tests - it needs repair and improved security to prevent people from being exposed to the disease. Presently, the brains of dogs are sent to Panama for analysis but the CVL can do this if it is adequately equipped. Although Panama provides this service free there are certain costs which they would like to be covered by the MAF.

(k) Food testing is a very deficient area in Belize but this can be improved if the CVL can be equipped and its technical capabilities upgraded. Presently, the CVL cannot conduct international standard tests for antibiotics, pesticide and aflatoxin residues in meat, milk, eggs, fish, and feeds[41]. It has the capability and kits to do aflatoxin tests but it does not have equipment for adequate testing of milk, meat, etc. The BOS should be doing several tests on food products but these are not done. It should test processed foods for certain contents like protein content, ash content, minerals, contaminants, antioxidants and preservatives, etc. That Bureau does not have a laboratory and if it wishes to have a test done, the sample is sent overseas. In addition, the BOS needs to provide a seal (for verification) on exports but it is unable to do this because it cannot scientifically verify the quality of the product(s). Additional areas that should normally have been addressed by the BOS but are not include tests for food poisoning, quality assurance, diagnostic tests to identify diseases and regular monitoring of the food production-consumption system. For marine products, routine laboratory tests (which are not currently done) should be done for drug residues, pesticides and a number of specific bacteria such as Vibrio, coliforms and yersinia.

(l) The CVL (like many other departments of the MAF) has been affected by inadequate human and financial resources. The high cost items for the laboratory include equipment for confirmation of pesticides (GC and HPLC) which it is unable to purchase. In addition, it is constrained by insufficient vehicles for transport, regular visits and sample collection, lack of reagents, other equipment and operational resources, etc. There were no operational funds for 1995 and 1994 except resources to pay for stationery and gas. Although $20,000 was approved for operations for 1996, the CVL does not have ready access to this due to it being controlled from the MAF's headquarters in Belmopan (operational funds are for laboratory equipment maintenance, collection of samples, field visits etc.)[42]. Syringes and a few medicines for the clinic are the only supplies bought with the resources available and it is supplied with a few basic drugs and local medicines from Central Farm through use of the revolving fund. Since April 1995, the Laboratory received only about $40/month for maintenance of the building and the grounds. Its generator has not worked for 6 years because a part costing about $1,500 was not purchased. The USAID (under BLDP) made efforts in 1985 to develop laboratory capabilities to test for biological and chemical residues in meat. Some equipment was bought but the laboratory did not become operational due to various reasons, including departure of the supervisory chemist contracted by the MAF to operate the laboratory The equipment remain partially installed in the CVL or are in a detached storehouse. Regarding personnel, there is no personnel for testing of residues and the CVL lost 8

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[41] The recent problem of aflatoxin in feeds and its implications is a small reflection of the problems (and potential problems) which exist due to the absence of regular monitoring, surveillance and tests done in the sector.

[42] The MAF's headquarters in Belmopan usually controls expenditure of the budget despite the prior approval of funds to be spent by the various units. The heads of the units do not have effective access and control of the resources allocated.

positions after 1994 (4 lab. technicians, 3 assistant lab. technicians, and 1 assistant AHA) due to reduced funding. These personnel existed in the 1980's until 1988 when surveys, monitoring and other regular diagnostic work was done.

(m) A major problem is in the area of health regulation and protection. There is need for preventive measures to ensure adequate health protection against contaminated food. The country's regulations and quality assurance system(s) are weak and these could have serious implications for the tourist industry. In the area of animal slaughter and processing, there are no standards available for local production or for exports. As a result, there no verification of the quality of products. There should be standards and procedures established for slaughtering plants, hatcheries, milk plants, etc. If these do exist, there is no monitoring or enforcement done. Food need to be tested on a regular basis for there are organisms which include staphylococcus aureus, Salmonella, Clostridium perfringens (pathogens in food) which need to be tested for but this is not presently done. Both marine products and meats need to be tested regularly and an effective quality assurance program for food is needed.

2.3.2.2 Public Health Bureau

Meat inspection: PHI's are responsible for meat inspection at slaughter plants and for inspection of food processing facilities while the MAF's veterinarians are responsible for export meat plant inspection[43]. Meat inspection is done at each of the district abattoirs in Toledo, Stann Creek, Orange Walk and Corozal and at the four abattoirs in the Cayo District[44]. Unregulated small-scale slaughtering occurs in rural areas throughout Belize but these are not monitored effectively. The PHIs also collect a cess on behalf of the BLPA for all livestock slaughtered at any of the public or private slaughter plants[45]. A commission of $1.00 per every cattle cess and $0.25 per every swine cess collected is paid to them for this service.

Rabies control: This is a mandatory activity of the PHB. The Bureau runs a two-month countrywide campaign annually that includes public education, free vaccination of dogs and cats and elimination of stray dogs. Following this the Bureau continues rabies control activities throughout the year by vaccinating animals at specified times and places and by cleaning up areas missed during the campaign.

A tripartite agreement was signed in the 1980's at the diplomatic and technical level by Belize, Guatemala and Mexico that includes sharing information and materials on rabies and other health disciplines. Recent proposals from technicians in these countries include plans for

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[43] Public Health Inspectors are trained in Jamaica at the West Indies School of Public health in a program that includes meat inspection techniques.

[44] Belize district has no official abattoir; the USDA certified abattoir was closed in 1992.

[45] The cess is $8.00 per head of cattle and $1.00 per head of swine. The BLPA actually receives $7.50 for each head of cattle and $0.75/head for swine. $0.50 and $0.25 respectively are paid as commission.

joint campaigns at border towns and for cross-checking diagnoses of suspect rabid cases[46].

Laboratory services: The PHB does not have a functional laboratory but has the capability for water quality testing. Food samples are tested at the Central Medical Laboratory for basic microbiological pathogens. Training was provided through the FAO to a number of laboratory technicians and field officers in laboratory techniques and analysis following detection of the first case of cholera in 1992 in the Toledo district. Basic equipment and reagents were purchased (with FAO's assistance) and recommendations were made on regionalisation of food safety issues[47].

2.3.3 Private Sector

The private sector offers few services in animal health. The BLPA, private animal health clinics and one NGO provide the only services. The BLPA (with some collaboration with the MAF) provides technical support and credit to its members. The Association obtains an income of about BZ$70,000 per year from a cess levied on animals slaughtered and exported plus a smaller amount from brand registration and renewal. Sources of additional income include a 3.5% fee on the value of the animals it auctions, a BZ$2.00/head per day yardage fee, and a fee of BZ$3.50/head per month to manage the cattle fund[48]. The fund provides credit to cattle farmers through loans to purchase steers, minerals and veterinary supplies and to transport these animals. Despite the important role of the BLPA in the sector, it is constrained by weak organization and management capabilities and insufficient funding to support livestock development activities.

There are nine private clinics in Belize with three of them providing services on a fulltime basis. Most of these clinics cater for companion animals (dogs, cats and other small animals). One clinic in the Corozal District has been submitting a regular monthly report to the MAF since 1988 which has provided invaluable information on the disease status of animals in the area. It is expected that similar reporting will be submitted by the other clinics. Regarding private labs., a new small laboratory (Laboratory of Analytical Services) was recently opened in Belize City and it may have the capability of providing some veterinary diagnostic services. There are other private pathology laboratories in the country but these do not process samples of animal origin. Of the NGO's, BEST is the only one that provides veterinary services to its clients through its vet. officer located in the Toledo area.

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[46] All suspect rabid cases are referred to the nearest government veterinary clinic which then conducts postmortem examination and forwards the brain to the Central Veterinary Lab. for submission to Panama.

[47] Due to the demands for its services, the PHB strongly supports the creation, equipping and maintenance of a national reference laboratory for Belize.

[48] The cattle fund was established in 1991 by the GOB and the BLPA as a financial facility to provide production and marketing credit to livestock farmers. The fund started with a government loan of BZ$600,000 and a yearly subsidy of BZ$40,000 to cover operating costs.

2.4 Other Health Services

Besides the agricultural health services indicated above the Fisheries Department (FD) of the MAF provides diagnostic and inspection services to the fisheries sector. The Department has a small laboratory for sample analysis but its capabilities are extremely limited. Presently, the FD has only one staff member devoted to diagnostic work[49]. Lack of resources has severely reduced the Department's capability in inspection, diagnostic laboratory services and monitoring and controlling the disease situation in the sector.

The Department does inspection of fish processing facilities to ensure quality control and selected testing of samples. Among others, the tests include: the standard plate count to determine bacteria level; potable water in processing plants for sanitary and hygienic standards (chlorine test); MPN of coliform organisms in processing water; differentiation; and salmonella. Other tests are few and done far apart. Of the present tests done by the Department, the reliability is about 60 percent.

Belize exports a large amount of marine products and there is an increasing demand for higher quality marine exports. Importing countries such as the U.S., Japan and France have requested that specific tests be done to ensure the safety of imported marine products. For example, countries exporting to the U.S. are required to apply the Hazard Analysis Critical Control Point (HACCP) system while Japan and France require that Belize conduct toxicity tests. However, the FD lacks the necessary resources and Belize does not have the capability (technical and infrastructure) to meet the current and future demands of importing countries which are becoming increasingly concerned about the safety standards of food imports. In addition, the country's fisheries sector, particularly inland fish and shrimp farming is constantly under threat of various diseases but the FD is unable to effectively resolve these problems and monitor the health status of the sector. Presently, the FD can only monitor but not control diseases such as Ciguaterra (a major disease in the Caribbean) and Red Tide which kills fish and produces toxins.

2.5 Quarantine Services

2.5.1 Overview

Belize's plant and animal quarantine service is provided entirely by the public sector. It was established in October 1981 with the posting of Quarantine Inspectors (QIs) at Belize International Airport (later renamed Phillip Goldson International Airport) in response to the discovery of the Mediterranean Fruitfly in the states of Florida and California. Shortly, thereafter, QIs were posted at the country's borders with Mexico (at Santa Elena) and with Guatemala (at Benque Viejo) respectively. Later, quarantine stations were established at Punta Gorda, Big Creek and the Belize Port Authority. At the time of its establishment, the Agriculture

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[49] Another staff member with diagnostic and laboratory capabilities recently became the head of the Department.

Department of the Ministry of Agriculture and Natural Resources had direct responsibility for the service. The major responsibility of the service was to monitor and control all imports and exports of plant and animal products into Belize as specified by the regulations of the Quarantine and Inspection Service.

Presently, the quarantine and inspection service is within the Agriculture Department of the MAF (**Figure 2.4**). It is headed by the Principal Agricultural Officer (PAO) responsible for Special Projects who has no direct technical but some administrative supervision of all QIs[50]. The PAO is also responsible for preparing a periodic report of the service based on a monthly report submitted by QIs. Day-to-day administrative supervision of QIs is done by the DAO of the district in which the quarantine stations are located.

The service has six quarantine stations at various ports of entry and is staffed by eleven (11) QIs. The principal responsibility of QIs is to enforce quarantine regulations designed to: (a) prevent the introduction and dissemination of plant and animal pests and diseases from foreign countries, by prohibiting and/or restricting the entry or movement of plants and animal products; and (b) inspect plants and animals (veterinarians are responsible for domestically produced animal products) for export and inspect and quarantine (if required) imported plants, animals and their products. QIs work in close collaboration with customs officers who are directly responsible for inspecting all imports and exports at the ports of entry.

The Quarantine Inspectors are appointed by law through notices published in the Gazette and local newspapers, and function under Chapter 122 and 167 of the laws of Belize for plant and animal disease control respectively (**Appendix B.4**). Regulations made under these two parent ordinances also define the responsibilities and powers of these officers who are referred to as Quarantine Inspectors or Plant Protection Officers. They are required to be thoroughly familiar with the plant protection ordinance of Belize and all supplemental regulations. In addition, they should possess a general knowledge on entomology, pathology, and related sciences and should be able to identify important plant and animal pests and diseases that are known to occur in Belize. However, all QIs do not have the basic academic and technical skills. Some were employed possessing only a high school diploma, while most obtained an Associate degree in Agriculture (this is considered the basis qualification needed) from the Belize College of Agriculture (BCA) while in the service[51]. After being employed QIs are offered short in-service training courses on quarantine procedures. Previous courses were conducted by USDA/APHIS personnel. Details on qualifications, training and experience of all QIs are provided in **Table A.16.**

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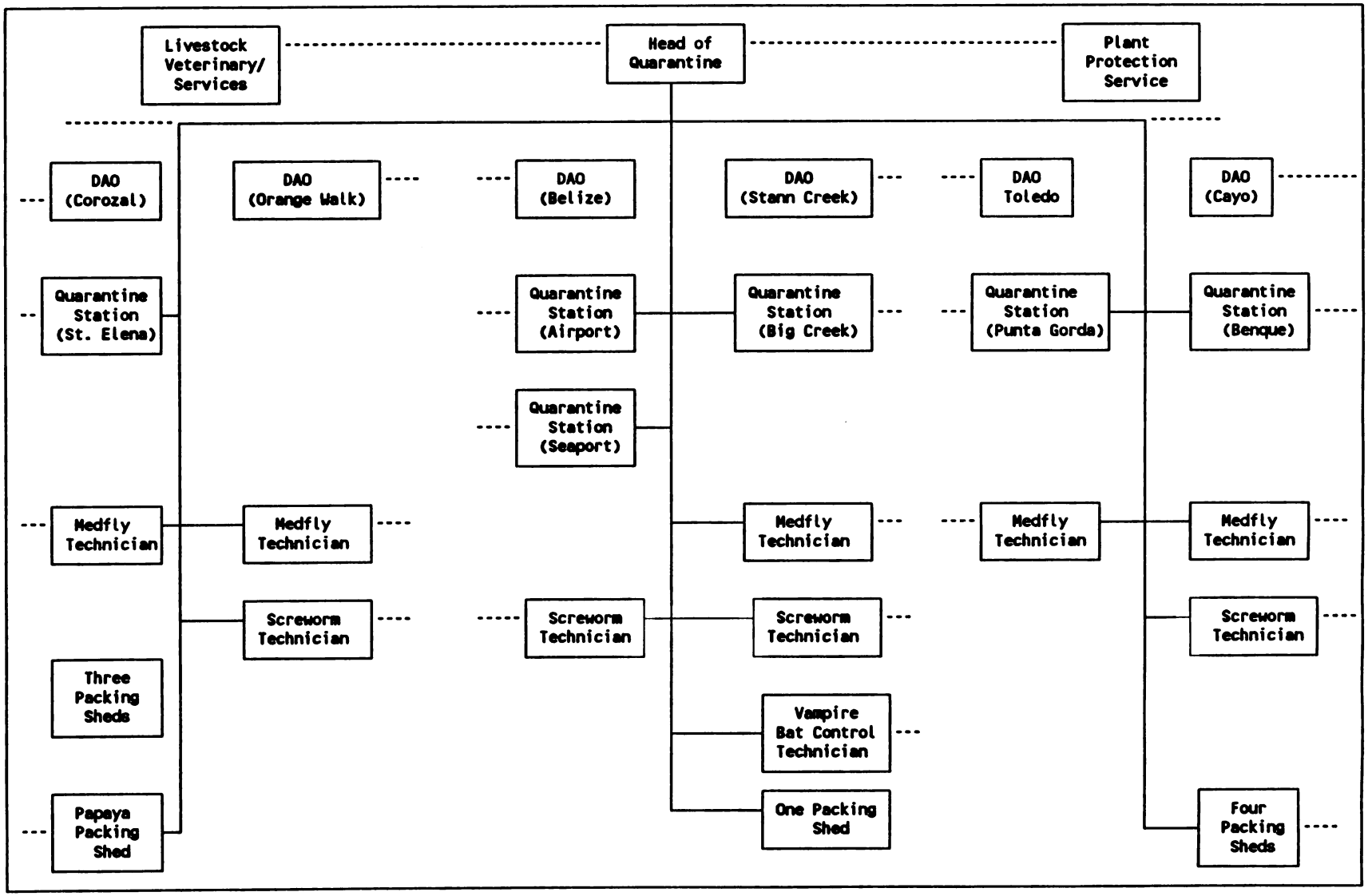
[50] In 1996, one veterinary officer became the head of the quarantine service. Recently, this responsibility was taken over by the PAO for Projects again but a technician from the PPU was appointed as the new national supervisor for all QIs.

[51] This is the basic qualification that should be possessed by QIs. Those with a high school diploma are awarded scholarships by the quarantine service to complete the Associate Degree course offered at the BCA. This program is executed by the MAF to upgrade all the QIs to possess the basic qualification.

Figure 2.4
Organogram of the Quarantine Service of the MAF



Source: MAF

Facilities and Equipment: Each port of entry has a quarantine station which is usually a small office space that has been assigned in buildings owned and/or occupied by the Customs Department[52]. In general, the space occupied by QIs is quite insufficient and the offices are sparsely furnished, with only a desk, chair and filing cabinet (**Table A.17**). Only a few offices have telephones and air conditioning units. Regular communication with the head of the service and adequate supervision is lacking. Transport facilities are non-existent in the service and this severely affects adequate supervision of all quarantine stations around the country.

In 1993 the MAF received seven incinerators under an ODA project to be used as disposal facilities. Two were installed, but only one is presently functioning at the Benque Viejo border while the others have not been installed due to insufficient financial resources.

Inspection Procedures: The QIs execute their duties based on the quarantine laws and regulations of the quarantine and inspection services of Belize. Based on these regulations, certain imported plant and animal products are classified as restricted or prohibited to enter the country, depending on their country of origin. Updated lists of restricted and prohibited products are provided to QIs, but some of this information is posted at the airport only to inform travelers and importers on their status in Belize. Products that are prohibited from entry due to the possibility of contamination or introduction of pests and/or diseases are confiscated and destroyed at ports of entry. Certain products which are considered restricted are allowed to enter the country in limited quantities. Such products are produced locally and may be imported when local supply is not sufficient to meet demand[53]. These products require a trade license from the Ministry of Trade and a special import health permit from the MAF.

Generally, import permits should be obtained from the appropriate authorities prior to their arrival in Belize[54]. All imported agricultural products require an import permit and 26 categories of products require an import license. This is presented to the QI by the importer upon the product's arrival at the port of entry and a quarantine inspection is done of the product(s). The QI makes a visual inspection to verify that the imported product is exactly as stated on the import permit and the conditions of that permit are complied with by the product, then issues a landing permit, stamps and signs the customs entry form which is then presented by the importer to clear the product through customs. A copy of the import and landing permits is kept at the quarantine station for records.

Importation of fresh plant products requires a certificate of origin, a phytosanitary certificate and an import permit issued in Belize prior to the product's arrival (QIs have the

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[52] This is the case of the Port Authority, the international airport, the border ports with Guatemala (Benque Viejo) and Mexico (St. Elena), Big Creek and Toledo.

[53] At the discretion of the QIs some restricted products are allowed entry without an import permit provided these are brought into the country in small quantities for home use by travelers. Some imports are also allowed during the Christmas period. However, the control system to monitor entry of products is weak, particularly at the border points of entry.

[54] However, there are cases in which import permits are sought after the product(s) has arrived in the country.

authority to issue this certificate for exports). QIs inspect fresh plant imports to check for insects, diseases or other pests that can be detected visually. Confiscated plants are usually destroyed[55].

Health certificates and import permits are required for all imports of live animals[56]. A landing permit is issued after the animal(s) have been inspected by a veterinarian at the port of entry, and after satisfactory inspection and verification of the import permit and health certificate. The animal(s) is then transferred to a holding facility there they are quarantined for one month with periodic inspection by the veterinarian prior to its release. Visitors carrying animals such as dogs and cats are required to present a health certificate for pets at port of entry. The QI makes a visual inspection for insects and diseases prior to issuance of a landing permit. Pet owners not in possession of an import permit are cleared with a health certificate on agreement that they would contact a veterinarian for issuance of the required import permit.

Permits are also required for the import of pesticides. These are issued to importers by the Pesticide Control Board (PCB) prior to the arrival of the products in the country. The QIs check for the import permit and verify that the imports are as stated on this document, then issue a landing permit which is used by the importer to clear the products through customs. QIs have a list of pesticides that are prohibited from entry into Belize.

A ledger is used by the QIs for record keeping of all plant and animal products and pesticides entering the country. The information recorded include; date of entry, importer, quantity of product, type of product, origin, estimated cost, reasons for entry, condition of material, landing permit number, confiscations and mode of transport. This information is compiled in a monthly report and sent to the Head of Quarantine (and copied to the DAO) by all stations[57].

QIs also inspect commercial exports of agricultural products. For plant and plant-processed products, visual inspections are done prior to the issuance of the phytosanitary certificate which verifies that the product is free from pests and diseases that could be harmful to the importing country. For live animals, zoosanitary certificates are issued by the Veterinary Section of the MAF.

The MAF does not charge fees for the services provided by QIs, except at the Benque Viejo Border where a BZ$5.00 fee is collected for vehicles which are fumigated before crossing

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[55] Due to non-existent incinerators to destroy confiscated products at most ports of entry, such products are usually dumped in a hole (pit) or in a nearby site. Pits are sprayed with malathion and disinfected with lime.

[56] These include livestock for breeding purposes and pets such as dogs and cats.

[57] Hand-written monthly reports are submitted by those QIs who do not have access to secretarial services.

the border[58]. Vehicles which are fumigated include those coming from beyond Melchor, the border town in Mexico.

The quarantine service also has several areas of weakness and deficiencies which need to be addressed if Belize's trading arrangements are not to be jeopardized, markets lost and the agricultural health status affected through the introduction of pests and diseases. Presently, Belize cannot adequately monitor the smuggling situation at both borders. No patrols are done by the quarantine service at the Mexican and Guatemala borders (only the Customs Dept. does monitoring). New quarantine stations are needed at Jalacte and La Union to monitor and inspect the cross border trade which expanded rapidly in recent years. Trade estimated at about $1.0 million/month occurs at Jalacte and live animals (and other goods) cross both border points without inspection. The risks of diseases being introduced into the country without the GOB or MAF's knowledge are very high.

Without adequate facilities, equipment, training and supervision, QIs have limited capabilities to function effectively. No basic equipment, instruments and supplies (refrigerator for storage, magnifying glass, microscope, gloves, etc) are available to support diagnosis and inspection at the border points of entry. QIs diagnose products with naked eyes since no instruments are available for this. Storage and disposal facilities for products seized are inadequate and proper ones are needed to safeguard personnel and potential health hazards. The quarantine service has no computers and monthly reports are hand-written (except for the Benque office which has a typewriter) before they are typed at the DAO's office.

Presently, there is no supervision of QI's because the PAO for Projects has several other responsibilities. There are two supervisors for the service, with no clear definition of the role of each. In the last two months only those stations at Benque, the airport and seaport were visited by the Head of Quarantine and no visit was made to the Corozal station in the past year nor to the Toledo station in the last two years. In general, QIs are unable to communicate with their supervisor, with senior officers of the MAF or share information due to limited facilities and limited supervision. There is poor communication within the service which affects updated information on quarantine matters from being forwarded to inspection stations in a timely manner. The service's capability to respond to emergency situations is almost non-existent. A minimum of one visit/month is needed for monitoring and more effective management.

Equipment to prepare regular monthly reports are not available in most offices and direct communication to share data and information on a regular basis is non-existent. The monthly reports provided by the QIs to the MAF are not analyzed, monitored nor the information stored.

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[58] The International Regional Organization for Plant and Animal Health (OIRSA) has assumed the responsibility for fumigations of all vehicles, aircrafts and boats at Belize's border stations, airport and seaports as from August 1, 1996. It is being implemented on a phased basis and OIRSA started at the Port Authority, airport and the Corozal border. The spraying will be effective for a period up to twelve hours. The fees charged are: BZ$30.00 for large aircrafts (international flights); $20.00 for smaller local aircrafts that cross the borders; $30.00 for large commercial ships and $20.00 for smaller vessels; $4.00 for passenger boats (30 - 50 persons); $6.00 for trailers, $4.00 for buses, $4.50 for trucks, $3.00 for taxis, and $2.50 for pickups. The revenue collected will go to OIRSA.

Inspection procedures, data collection and reporting systems are not standardized; therefore QI's are "forced" to use personal judgement rather than referring to a fixed set of rules or guidelines.

QI's also lack authority or sufficient powers in the execution of their duties. Due to the technical nature of the job, QIs need to consult with their superiors in Belmopan and even with other countries to check on pest and disease situation. There is poor communication and no information system to facilitate such a need. They do not have the authority to make important on the job decisions in comparison with their colleagues of the customs department. The working hours of QIs are not consistent with those of customs officers and the MAF stopped paying overtime last year. As a result inspection is not effective. Although they have authority to confiscate products of quarantine importance, QI's are generally not respected by the public and sufficient support and information are not provided on the importance of their activities.

Only 25% of QI's are well trained (based on years of service) which is a serious deficiency. QI's have a basic idea of their work and the needs of the service but there is no systematic training. Regular training is needed if only the BCA diploma is obtained. Specialized training is needed in several areas such as entomology, exotic animal diseases, pathology (viruses and fungi), risk analysis, quarantine systems etc., but QI's have no training in these areas. In 1996, a two-day training was provided to QIs but it was mainly theoretical with no hands-on training.

The service has very little operating funds for routine activities and to maintain existing facilities and it exists at a very low level, providing minimum routine services. After three years, only one incinerator has been installed and another is expected to be installed soon at St. Elena. Five are still stored at Central Farm to be installed in various locations but the MAF lacks the resources for this (the approximate cost of installation is $6,000). Resources were reduced drastically in recent years. A cattle inspection station facility (a dip for cattle, pens, etc.) costing approximately $80,000 was established at St. Elena in 1992 on 5 acres of land for exporting cattle to Mexico. The facility was funded by USAID to meet Mexican import requirements. However, the facility is not presently utilized fully and it needs electricity and resources for maintenance.

2.5.2 Special Projects

Medfly Services: The Mediterranean Fruitfly program started in 1981 when it was implemented by the USDA in response to a Medfly outbreak in California[59]. In 1986, the Government of Belize (GOB) took responsibility for the service. Presently, the service employs seven technicians who are responsible for routine servicing of Medfly traps which are located along

[59] The Medfly usually attacks it's host by drilling holes in the flesh of ripe fruits. These holes facilitate entry of other insects and pests which eventually results in rotting of the fruit.

highways and access roads in each district throughout the country[60]. The service works closely with the local USDA/APHIS Representative in Belize, who usually checks and inspects the activities and ensures that the Medfly protocol is correctly executed. It focuses mainly on protecting fruit crops that are exported such as papayas.

Traps are inspected weekly to check for Medfly catches and to replenish pheromone bait used to attract flies to the trap. Each trapper is assigned a vehicle along with the basic equipment required to execute his duties. Trappers are employed and paid at the same level as Extension Officers (EOs). Like the QIs, the DAOs have administrative responsibility for trappers while technical responsibility is that of the Head of Special Projects.

An outbreak is identified when both sexes of the Medfly are identified. If an outbreak occurs an eradication campaign is executed and this can last up to 70 days (the reproduction cycle is 35 days)[61]. The campaign would comprise several activities, including ground spraying, destruction of fruits, compensation to farmers and constant monitoring of checkpoints. The estimated cost of an outbreak campaign is about $250,000, while the cost of the regular operation is approximately $150,000/year of which, personnel emoluments and salaries cost is $89,000/year or almost 60 percent.

Screwworm Eradication Project: In 1988, an agreement for Technical and Scientific Cooperation was signed between the GOB and the Mexico-United States Commission for the Eradication of Screwworms from Belize. The project was officially launched in 1989 and executed jointly by the MAF and the Mexico-United States Commission for the Eradication of Screwworms.

The screwworm does considerable damage to animals if not controlled. It is estimated that the Belizean cattle industry experiences losses of up to $1.5 million dollars per year from damaged hides, poor weight gain and time spent inspecting for screwworm infestation[62]. Its eradication works on the principle of biological control. Millions of screwworms are reared artificially and as they approach adulthood, they are exposed to radiation which makes them sterile, but leaves them normal in all other respects. These sterile flies are then packaged and distributed by aeroplane throughout the countryside, where they mate with local fertile or normal screwworm flies. Either no eggs or sterile egg masses are produced from these matings, thus reducing the local populations of screwworms to extinction over a period of time.

Presently, there is no screwworm project but the MAF spends about $0.1 million/year only for monitoring. Four field inspectors are employed for this and they provide livestock

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[60] The distribution of Medfly technicians are as follows: 3 in Stann Creek district and one each in the Toledo, Cayo, Orange Walk and Corozal districts. The Belize district is serviced jointly by the technician based in Cayo and Orange Walk.

[61] The eradication campaign is a 24-hour a day operation.

[62] Screwworms are a voracious or greedy pest of warm-blooded animals that feed on the living flesh of infested animals.

farmers with sampling kits and insecticide as well as support to extension staff and other activities[63]. Farmers are encouraged to cure all wounds on their animals. However, if an animal is infested with worms, samples should be collected and sent to the local field inspector. The success of the screwworm project resulted in a complete eradication of the screwworm such that Belize is now officially declared as screwworm free. The present activities of the service focus mainly on monitoring the situation.

Vampire Bat Control Program: This is an ongoing program funded by the GOB and it is executed within the extension service. The program currently employs only one technician who is stationed in the Cayo District but who is responsible for servicing the entire country. There are two reasons for the program - the bats are hosts for spreading rabies and the wounds they create on livestock are ideal feeding grounds for screwworms.

Whenever vampire bats are suspected as transmitters of rabies or creators of wounds, activities are initiated to control the bat. Trapping is done for several days or until the population of vampire bats has declined to a safe level. Nets are set up at night to catch all types of bats in the area. All other bats except vampire bats are released untreated while the vampire bats are selected and treated with an anticoagulant paste before they are released. The ingested paste leads to hemorrhaging and subsequent death.

Beekeeping Activities: An apiaries inspection unit was established to administer a special program within the MAF to provide adequate and timely extension services to an expanding beekeeping industry in the 1970's and 1980's. During this period, apiary inspectors were stationed in Toledo, Cayo, Orange Walk and Corozal Districts. Belize and Stann Creek were serviced by apiary inspectors stationed in neighboring districts. The apiaries inspectors were responsible for raising queens that were distributed to beekeepers and they also provided training in beekeeping skills and management. The industry has declined considerably in recent years, partly because of the arrival of Africanized Bees and partly because of the reduction in feeding zones caused by aerial spraying of marijuana plantations in the 1980's. The responsibilities of this program are now executed by extension officers.

Due to a shortage of personnel, the beekeeping program is not longer a national one and apiaries are concentrated in the Cayo, Orange Walk and Corozal districts. Belize produces a high quality honey which is exported to the EEC. The industry is affected by several diseases and technical support was provided by Mexico and USDA to control the Varroa mite. Presently, no monitoring or surveillance is done of the disease situation and beekeeping staff was further reduced in 1995 when the MAF retrenched three apiaries inspectors as part of the GOB's retrenchment exercise.

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[63] There is one inspector for the Toledo and Stann Creek districts, one for Orange Walk and Corozal districts, and one each for Cayo and Belize districts.

2.6 Other Major Weaknesses and Deficiencies

Although Belize's agricultural health situation has not exhibited major problems so far, the AGHS is very weak and the risks of potential economic losses to the country are high if the service continues to operate as it is presently. So far, the country has not been affected by major problems and disruptions in agricultural production and trade due to pest and disease problems. The commodity associations have well-organized and fairly efficient plant protection programs to address problems in the traditional sector, resulting in sugar, bananas and citrus playing a major developmental role in the economy. In the public sector, the ODA project and relatively well-trained technical personnel in both the plant protection and animal health services have contributed significantly to maintaining certain agricultural health programs and activities, and resolving occasional outbreaks of pest and disease problems. However, there are other weaknesses and deficiencies in the service and the country's agricultural health status is much weaker than it appears. In several areas, the situation has reached a crisis proportion because nothing (or very little) is done in basic activities such as regular diagnosis and testing, monitoring and surveillance. Some additional major areas to be addressed through an improved service are outlined below.

(a) Agricultural health policy: Belize's agricultural sector faces several major challenges that include retention of existing markets, diversification into new areas, expansion of non-traditional exports, greater self sufficiency in food supplies, harmonization of agricultural health measures with other countries and meeting international health and other requirements in agricultural trade. However, the country lacks an overall agricultural health policy to meet these challenges. As a result, agricultural health priorities are not identified, systematic planning is not done adequately and agricultural health policy direction is missing. These problems are compounded by a severe shortage of resources. The GOB and the MAF need to clearly define its agricultural health policy which should be integrated in an overall development strategy for the sector and identification of the role of the MAF within this framework.

(b) Inadequate resources: This is perhaps the most important problem of the public agricultural health service which is totally dependent on the GOB for financial support, since most of its services are provided for free. Although the MAF has increased its allocation of funds for certain animal and plant activities over the years, the amount is insufficient given the volume of work to be done. In the last five years, no major investment in the service was done by the MAF except for the ODA-MAF project that strengthened plant protection activities. A large proportion (more 70%) of the MAF's budgetary resources are absorbed by personnel costs while expenditures on operations have continuously declined. Presently, the MAF can only maintain selected activities in order to facilitate certain critical areas of production. Among these are the Medfly service which is critical to production and export of non-traditional products to the U.S., support to banana and citrus production and "fire-fighting" activities to control selected pest and disease problems.

In plant health, the ODA project has facilitated the PPS to provide and maintain several activities relative to other agricultural health services supplied by the MAF. However, its

activities are concentrated largely in the Cayo district. Insufficient resources limit its capability to service other districts adequately and diagnose and resolve pest and disease problems in a wider array of crops. Continuous support to traditional cropping activities is a major responsibility because of their importance to the sector.

In the area of animal health, the staff declined over the years and this has affected both the scope and quality of services provided to the livestock sector. Critical positions were not created while others have been vacant for several years, including that of the veterinary officer for Public Health, a veterinary officer to manage the diagnostic laboratory and a livestock Officer for animal breeding and genetics. The clinics have been severely affected due to the shortage of adequate facilities, equipment, drugs and chemicals. No funds were available to purchase reactives in the last five years, resulting in a reduction in the number of laboratory tests. In the past, an average of 9,000 tests were done per year (costing approximately BZ$60,000); in recent years, less than 200 have been possible. Presently, the CVL is almost non-functional despite it having several pieces of equipment and some drugs. Several critical tests and analysis (such as risk analysis, residue testing, etc.) which are increasingly becoming standard activities in agricultural health services in many countries are not done (see **Annex B.5** on the importance of risk analysis).

In the past there were strong linkages between the field staff in animal health and the diagnostic laboratory but these have deteriorated to the extent that few samples are submitted. This is a reflection of both the inadequacy of the laboratory facilities and weak linkages with field staff of the MAF. The overall situation has deteriorated and there is a general malaise in which no samples are collected for laboratory analysis (for both plant and animal health). The service also has an acute shortage of professional and technical staff to support the service. Besides the PVO, there are only four established Veterinary Officer post in the Ministry. In addition, of the six pre-existing Animal Health Assistant (AHA) posts, three are occupied by qualified veterinarians who work as Veterinary Officers. Of the remaining three AHA posts, one AHA does field service in Orange Walk District, one has been transferred to the Livestock Station (Dairy Section) in Central Farm and one AHA (Belize District) was retrenched in 1995.

In general, the lab. capabilities to support diagnosis and analysis in the service are very weak. The soils lab. at Central Farm has been non-functional for almost two years due to the unavailability of funds to repair some equipment. The facility exists with some equipment and perhaps expired chemicals but its staff has been reassigned elsewhere. Samples are sent occasionally to the U.S. and Guatemala by the commodity associations for analysis and these are costly. No similar tests are done for non-traditional crops. For fish health, the FD lab. is almost non-functional also because of insufficient equipment and limited technical capabilities. Other institutions such as the PHB and the BOS have also been affected by budgetary problems. The PHB is unable to do lab. testing and its coverage to resolve public health problems both in agriculture and elsewhere is very limited. The BOS is still to implement its program of activities, given its mandate and responsibilities.

There is insufficient personnel to operate a national alert system, with periodical collection of samples at the field level, and determination of pests detected at the country's ports of entry. The plant health service does not have sufficient support in the entomology and nematology areas. Moreover, none of the quarantine inspection stations has pre-diagnostic equipment to make a quick identification of pests found in imported vegetables, or in the vehicles or crates in which those imports are transported[64]. Samples of suspected pests have to be sent to the Central Farm office for analysis, thus delaying the movement of plant material.

Due to the resource shortage, there is a deficiency of veterinary supervision of existing slaughterhouses, with no collection or analysis of samples from infected animals. In addition, public health inspectors who perform this function do not have the necessary training in veterinary medicine. As a result of these and other deficiencies, no slaughterhouse meets the standard required for exporting meats to the U.S. market[65]. The export market requires a USDA certified meat plant which, despite attempts by the BLPA to secure financing for a new USDA approved meat plant has not been possible. The present policy is to upgrade existing meat plants to a level that passes inspection from importing countries such as the Caribbean and Mexico. The depressed livestock industry presently has few incentives to finance animal health services. In the past the MAF depended on the small animal clinical services to inject money into its revolving drug fund. With the loss of this service in April of this year, it is expected that the drug fund will suffer considerably.

There is no animal epidemiology unit to support animal health and quarantine, and the PPS does not perform adequate surveillance and monitoring, in order to promptly control or eradicate endemic and or exotic sanitary problems. Surveillance activities do not include the detection of changes in the endemic stability of diseases and pests and introduction of new ones. Without this information, it is not possible to perform adequate economic or risk analyses of these problems, which are needed for decision-making on control and/or eradication.

The shortage of resources has also limited the scope of surveillance and monitoring of agricultural health activities. Presently, the MAF is unable to have systematic monitoring of the agricultural sector and no evaluation is done. Although the country's agricultural health situation is considered to be fair, there is limited information on the various pests and diseases which may be present and the "real" agricultural health status of the country. For example, almost no surveillance is done on the animal health situation. For brucellosis and leptospirosis, extensive surveillance and testing is needed to provide the true situation in the country. In the case of hog cholera, although Belize has not experienced any case in the last six years, the country needs a program to declare it as free of this disease, or it cannot export any pork or pork products or it can not deny imports from countries having the hog cholera disease.

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[64] The quarantine stations lack basic facilities and office equipment. Most are equipped with only a chair and a desk and no support equipment or supplies.

[65] Even if Belize had a pesticide residue laboratory service, these deficiencies would prevent it from exporting meat.

(c) Weak structure and organization: Agricultural health services are provided by several public institutions. The overall service is fragmented and with policy direction lacking, adequate planning, management and coordination are limited. There is unnecessary overlapping of responsibilities given the resource constraints of the public sector and the size of the Belize's agricultural health service. Ideally, the service would be more efficient in the areas of legislation, information and quarantine if it operates under a single structure, as this would improve efficiency and coordination.

The private sector is the major client of the service but their participation in overall planning and coordination is limited due to the weak organizational structure and absence of mechanisms to forge adequate linkages with this group of stakeholders. The present institutional framework needs modification to facilitate private sector participation in all aspects of the service - planning, monitoring, coordination, provision of advisory services and resource mobilization.

The quarantine service in particular is adversely affected by it's present organizational and administrative structure. The position of the agricultural health services within the organogram of the MAF creates fragmentation between the different components of the service (plant health, animal health and quarantine). This structure isolates the quarantine service and does not exhibit a clear management system that facilitates administrative efficiency.

(d) Institutional Rigidities: Public service regulations impose considerable rigidities for public sector institutions to provide services effectively and efficiently. The agricultural health service (as well as many other services) needs to be decentralized and attain greater flexibility and autonomy to respond to clients' needs and demands, both internally and externally. Government regulations restrict the service's ability to charge fees for services rendered and utilize the revenue when and where appropriate. Although there is a revolving fund for animal drugs, the Vet. Division does not have easy access and autonomy in its use. In general, there are many options for the agricultural health service to implement cost recovery mechanisms and achieve more sustainability but regulations limit the pursuit of these options.

The regulations and budgetary constraints together have worsened the staff situation in the service. Presently, there are restrictions on hiring personnel. The process of filling certain vacancies is extremely time consuming and this affects the service from having adequate staff. Presently, several positions are filled by persons transferred from other units with little training or relevant technical experience in the positions to which they are assigned. Opportunities for promotion are limited and upward mobility in the public service is only through the assignment to a position of higher grade or classification irrespective of the experience and qualifications required. For example, there is only one category of employees in quarantine and their is no possibility for a QI to be promoted unless he is transferred out of the quarantine unit. The quarantine service has also "borrowed" a few extension officers to work as QI's. Promotion and securing a pension from the public service are often the overriding factors for personnel.

Due to the number of positions established in the budget estimates, additional positions cannot be created[66]. To fill positions, personnel are transferred within the Ministry to fill existing vacancies or facilitate their promotion. This has been a practice in the MAF for some time, resulting in no consistency between the official title of several employees, their current job responsibilities and their salary. The shortage of resources in recent years and a freeze on hiring has compounded this problem. Lack of opportunities for advancement, a freeze in salary increases and increments together with limited training have reduced morale and efficiency. In the long run, the personnel situation is likely to deteriorate as opportunities for promotion become increasingly limited and the Ministry is unable to attract capable personnel.

(e) Inadequate information system: The absence of a computerized information system to facilitate storage and easy retrieval seriously affects the efficiency of all aspects of the agricultural health service. For example, the information system to keep records of diseases detected at the field level, and that generated at the slaughterhouse level is inadequate. As a consequence, surveillance is only problem-oriented. Information generated by the quarantine stations at border points are recorded only and no use is made of these for planning and policy decisions. Several persons in the MAF issue phytosanitary certificates and import permits but there is no system of control and record of how many of these were issued over the years. In the plant health area, a data base on pests and diseases was started by the ODA project but experience in database management, analysis, interpretation and supplying information to policy makers and the public in general are lacking. Furthermore, there are insufficient inputs from the districts and a formal linkage that involves data collection and monitoring is needed. The quick response to small farmer's needs in the district is a continuous challenge, hence the importance of an effective linkage and feedback mechanism.

The service also has a limited capacity to share information to external institutions as well as to access data bases and other agricultural health information easily. The need to strengthen this linkage will become critical in the future as the country becomes increasingly integrated in the regional and hemispheric trade arrangements and more accurate information is required of its health status. Information on international agreements, new regulations (such as those of the WTO) and health requirements and standards are limited in the MAF and there are no training activities to diffuse these to the staff. Non-compliance with such regulations due to information and training deficiency could adversely affect the country.

(f) Absence of training programs: Besides the occasional attendance by senior officers to seminars and meetings abroad, there is no systematic in-service training of technicians. Since the service lacks a structured training program, its quality continues to decline and the staff's morale has been affected. Some technicians (such as AHA's and QI's) are locked into a position which offers very little upward mobility or refresher training.

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[66] In animal health, three vets. occupy the position of animal health assistants (AHA) because the budget estimates have no provision for additional vets. As a result, the Vet. service is unable to employ additional AHA's since all the positions allocated by the budget are filled.

The majority of veterinary and extension staff do not have training in farming systems, and are unable to provide an effective service to small farmers involved in subsistence-type livestock production. Given farmers' constraints, most technicians are unable to adequately diagnose and provide the appropriate advice. The veterinary section estimates that a major deficiency in two of its eight field veterinarians in animal production or clinical laboratory medicine reduces the existing supervisory staff's effectiveness by about 25%, and affects almost 50% of the area covered in the country. The veterinary service has no input into slaughterhouse or dairy plant inspection. Although veterinarians do have the necessary training to function in these areas, they do not have legislation to mandate them in these activities (since they are under the responsibility of the Ministry of Health)[67].

Previously, linkages between the field staff and the diagnostic laboratory were strong, but they have deteriorated from a voluntary participation of veterinary officers to make accurate diagnoses to a situation where the response to treatment is the "norm." This is a reflection of both the inadequacy of laboratory facilities and a trained, experienced laboratory supervisor to provide sufficient support to improving the performance of the field staff.

(g) Inadequate legislation: The legislation to support an effective agricultural service is inadequate. Most of the laws and regulations governing the service were executed almost three decades ago and several have not been updated to incorporate the new roles and responsibilities of the service, new information, and changes in technology, the economy, health standards and in international trading requirements and standards.

For example, the current legislation does not enable the animal health service to act on diseases not so defined in the Laws of Belize. Thus, the animal health service is forced to wait on other Ministries for legal action. Sometimes, this causes inadequate control of diseases and the service suffers from the consequences of such control. Examples of this are: the rabies outbreak of 1995 in the Cayo District and the aflatoxin contamination of locally manufactured dog food. Most of the regulations for quarantine are in SIs and the old quarantine legislation refers only to human diseases (such as cholera) and makes little provision for dealing with the wide range of plant and animal diseases. In the case of animal diseases, the Minister of Agriculture is required to declare an area infected before quarantine activities can be implemented. There is a law governing exported products (such as meat) but there are no laws that support testing for certain standards for meat consumption locally. In addition, there is insufficient legal basis for quarantine officers for searching and seizure, and for the imposition of fines or service charges to raise revenue for the service[68].

There are some laws regulating the service but these are not enforced and the MAF does not have the resources for monitoring the situation. The MAF's technicians have no legal training and little knowledge of the process of taking people to courts. The MAF does not have

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[67] Legislation places the responsibility for inspecting slaughterhouses under the MOH.

[68] Assistance was provided by the ODA to the PPS and Animal Health Section to improve the respective legislation.

any legal technician or lawyer for this. Technicians are now required to develop a case when someone is taken to court. The process is a lengthy one, it cumbersome and costly and sometimes subject to political manipulation. The service must be given the authority to charge fines on the spot for violations such as at quarantine posts. In addition, the regulations of the service are scattered in various legislations and SIs. These need to be packaged into a comprehensive collection to facilitate easy reference.

There is need for greater decentralization in the use of legislative authority, more transparency, a quick response mechanism, legal training of technicians in the agricultural health service. Presently, the Minister of the MAF has much leverage in the use of the law. A technical/advisory committee is needed to make recommendations to the Minister on all legal aspects of the service.

There is a manual of regulations for the region (PROPLEX) but these have not been adopted as law by Belize. These regulations need to be incorporated into Belize legislation and regulations. A legal committee will be needed to incorporate these into the animal health regulations. A disaster preparedness approach is also needed that is backed by the necessary regulations.

In several other areas, the regulatory framework needs to be strengthened and legislation updated to: (i) give improved access to technicians for inspection and surveillance; (ii) provide for adequate registration and use of drugs; (iii) provide the necessary framework for the private sector to supply essential health services if the GOB is unable to implement them; (iv) support harmonization of measures and procedures consistent with WTO regulations and those of other countries in the region; and (v) provide for a dispute settlement system.

These areas need to be urgently addressed if: (a) the goals of Belize's medium and long term economic and agricultural development strategy are to be achieved; (b) the sector is to be more competitive and sustainable within a trade liberalization framework; (c) the challenges being imposed by new international trade regulations and phytosanitary requirements are to be met; (d) the country is to retain current export markets and penetrate new markets; and (e) the health risks of the population are to be reduced and potential damages to the tourism sector is to avoided.

CHAPTER III

THE PROJECT, ITS OBJECTIVES AND DESCRIPTION

3.1 Origin and Rationale

The proposed project originated from the agricultural sector study completed by IICA in 1995. That study indicated that Belize's agricultural sector is facing many challenges both within and without the country. Among these, trade liberalization, the emergence of regional trading blocs in the hemisphere such as NAFTA, CARICOM and FTA (in the future), bilateral trade protocols, WTO regulations, the declining importance of traditional exports and the need to expand production and exports of non-traditional products, together, are placing enormous pressure on Belize to compete in external markets. In particular, the new regulations of WTO, OIE, NAFTA, etc., mandate that countries engaging in trade meet particular standards and requirements to safeguard human health and safety. Given these trade requirements, the role of agricultural trade as a critical source of GDP, employment and foreign exchange earnings in Belize (as well as social and political stability), and the need to accelerate agricultural diversification and exports, the country needs to have an effective and efficient agricultural health service to sustain achievement of these goals. More importantly, however, the Belizean economy depends heavily on exports which makes the country very vulnerable to any disruptions in trade. Therefore, the economic risks of a weak agricultural health service are very high - lower production, loss of existing and potential export markets and foreign exchange earnings and the high possibility of the entry of new pests and diseases.

In general, Belize's agricultural health situation is much worse than appears, primarily because the underlying factors and support activities of the MAF's agricultural health service (AGHS) indicate a situation that has reached an almost crisis point. Except for the plant protection services of the sugar, citrus and banana sub-sectors, the service is deficient in most aspects to meet present needs and future demands of the country. As indicated in the Chapter II, the service suffers from several major weaknesses including weak policy design and support, no priority setting, inadequate organizational and administrative structure, inadequate legislation, lack of basic infrastructure and support facilities (information system, laboratories, equipment, etc.) and insufficiently trained professional and technical personnel. Coordination between the service and other components of the MAF is presently non-existent. Several basic but critical diagnostic work are not being done in the existing laboratories while field services are limited to addressing emergency situations. The reduction in the government's budgetary support to the service and institutional rigidities and practices have largely contributed to its weaknesses. The number of incidents and emergency situations in the agricultural health area have been increasing in recent years which indicate an urgent need to strengthen the service, improve monitoring and surveillance, and implement adequate legislation. There are major deficiencies in the MAF's human resource capability which need to be addressed urgently in order to bring the service's level to an acceptable standard. Furthermore, the MAF's response capability to address routine problems is very limited; the situation is worse in the case of emergencies. Knowledge of the pest and disease situation in the sector is very limited also and the country's borders are not

adequately monitored. These together with the absence of testing and verification of safety standards in food produced and consumed and effective quality assurance mechanisms pose a serious threat to Belize's agricultural production and trade and high health risks for its population and tourists.

Besides the need to strengthen, upgrade and improve both the scope and quality of services provided by the AGHS, greater independence is needed of the service (both institutionally and financially) if it is to function efficiently and effectively. Due to the nature of its activities, the service needs to have greater flexibility in response and be less constrained by the cumbersome and bureaucratic regulations and practices of the traditional public service. The current institutional and financing arrangements in the public sector severely limits the effectiveness and sustainability of the service. The GOB's budgetary constraints increasingly reduce the scope of services offered, and adequate cost recovery mechanisms and strong linkages with the private sector and other major stakeholders are non-existent to access alternative sources of financing and provide client-based support. Any appropriate alternative that consolidates Belize's agricultural health services in a single entity and provide them in a decentralized manner will allocate the MAF's resources more efficiently.

In recent years, Belize's public sector has been undergoing institutional reform, in response to the need for greater efficiency and effectiveness, budget deficits and financial constraints, and o meet the country's new challenges in the areas of economic integration in the hemisphere, trade liberalization, competitiveness and sustainability. This project will improve the scope and quality of agricultural health services, thereby contributing to reduced losses, higher production and a more competitive and sustainable agriculture. It will also contribute to the lowering of the health risks of the population, reduction of the risks to retain and penetrate export markets, and to much needed institutional reform in the public sector by reorganizing, streamlining and strengthening the MAF's AGHS, forge stronger linkages with the private sector and other stakeholders and develop alternative sources for the financing of public agricultural health services through the implementation of cost recovery mechanisms.

3.2 Goals and Objectives

The proposed project would help to improve the scope and quality of Belize's plant and animal health and quarantine services, consistent with the standards and requirements being imposed on agricultural production and trade, human health and safety by regional and international trade and health agreements. By reorganizing and streamlining operations and strengthening the services, the project will reduce economic losses in production in the agricultural sector due to pests and diseases, improved decision making on resource use in agricultural production and provide improved safeguards to human health.

The general objective of the project is to strengthen and upgrade the public AGHS of Belize for the support of agricultural production and trade, consistent with international agricultural trade and human health standards and requirements advocated by Belize's trading

partners and international institutions such as the WTO, OIE, etc. The specific objectives are to:

(a) Reorganize and streamline the agricultural health services of the public sector including quarantine and veterinary public health, particularly those of the MAF.

(b) Rehabilitate existing infrastructure and construct new ones (buildings and laboratories) for the reorganized AGHS.

(c) Strengthen institutional capabilities to diagnose and treat pests and diseases and to have a more efficient response mechanism to address agricultural health problems that affect production and trade.

(d) Strengthen the information system to support an effective agricultural health service.

(e) Review and recommend appropriate changes in the relevant laws and regulations governing the agricultural health service, consistent with improving production and human health and with regional and international requirements.

(f) Facilitate harmonization of Belize's policies and measures with other countries in the region in the areas of plant and animal health.

3.3 Description of the Project

The project will have two components: (a) institutional reorganization, streamlining and strengthening; and (b) repairs, upgrading and rehabilitation of infrastructure and facilities (Table 3.1).

3.3.1 Institutional Reorganization, Streamlining and Strengthening

In order for the MAF to effectively develop and implement comprehensive agricultural health policy and programs, a more effective institutional framework needs to be established and strengthened in every operational aspect. The overall objective of this component is to reorganize and streamline the present institutional arrangements in the MAF's agricultural health service so that it can improve the quality of the current services provided, as well as expand the scope of services and activities which it should have been providing. This objective will be achieved by: (a) developing a new institutional framework by streamlining the organizational, management, administrative and other institutional arrangements related to the MAF's agricultural health service; (b) strengthening organizational, managerial, administrative and technical capabilities to provide such the services more effectively and efficiently; (c) designing and operationalizing an effective information system; (d) upgrading and enacting legal

Table 3.1
Summary of Project Component

Component	Objective	Activitive
1. Institutional Reorganization, Streamlining and Strengthening	- Create a National Agricultural Health Service (NAGHS) to incorporate the Plant, Animal Health, the Quarantine Services, the Soils Laboratory and Fish Laboratory Unit of the MAF and the Pesticide Control Board. - Reorganize and decentralize the services provided by the Plant, Animal Health and Quarantine Units. - Rationalise the laboratory services. - Improve the efficiency, scope and coordination in the provision of PAH services. - Strengthen public and private sector participation in the provision of PAH services. - Strengthen the NAGHS to become economically viable and sustainable. - Create capacity building for the longer run.	- Review, modify and enact appropiate legislation to create the NAGHS. - Reorganizing of the plant health service to include the Soils Laboratory and internal plant quarantine activities. - Reorganizing and streamlining of the Animal Health Service. - Reorganizing of the quarantine service to focus on external quarantine and inspection (border and entry points). - Incorporating the Pesticide Control Board in the new NAGHS. - Reorganizing and streamlining the CVL in Belize Citiy to become the Central Investigatory Laboratory. - Design and operationalize an information system. - Establish advisory bodies for the NAGHS. - Training and technical assistance. - Establish norms, procedures, operational guidelines and regulations for the service.
2. Upgrading and rehabilitation of infrastructure and facilities	- Provide adequate infrastructure facilities for the NAGHS to function efficiently and effectively.	- Construct and rehabilitate buildings and other infrastructure facilities at Central Farm, Belize City and border points of entry. - Equip laboratories, clinics and field services.

instruments and strengthening the regulatory framework; and (e) developing guidelines, improving procedures and norms for the service's operations.

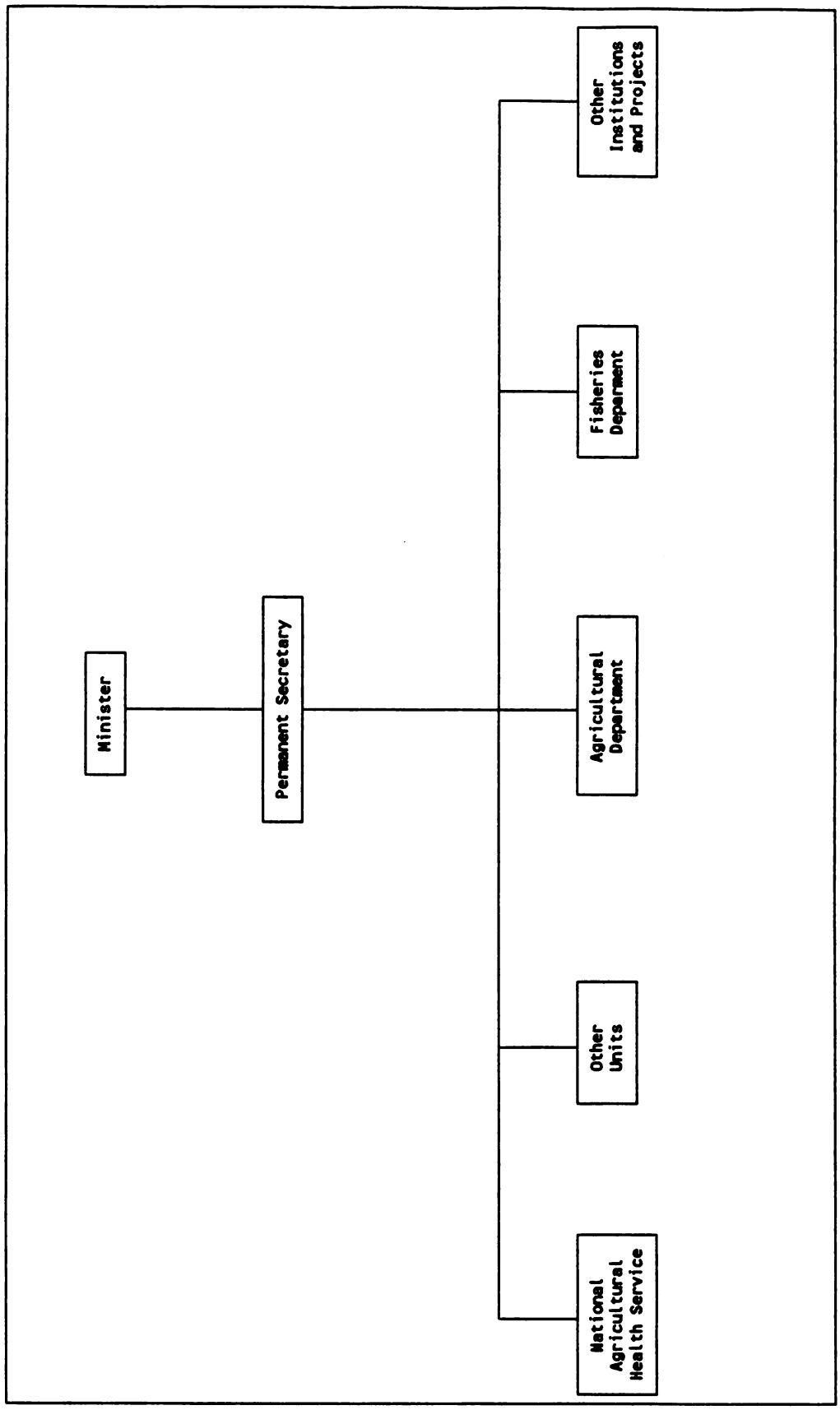
The present public agricultural health service is fragmented and services are provided by several public sector institutions but coordination is weak and there is much overlapping of activities. The project proposes to rationalize this situation by creating a National Agricultural Health Service (NAGHS) which will be the primary institution providing public agricultural health services. This will involve a reorganization of the present service in which the NAGHS will absorb all the personnel and most of the infrastructure and facilities, as well as the roles, responsibilities and functions of those units of the MAF that currently provide plant, animal, quarantine laboratory and fish laboratory services, and laboratory services provided by the Public Health Bureau. Those units and activities of the MAF that will be absorbed by the NAGHS include: the veterinary clinics; veterinary field and veterinary public health activities; the CVL: agricultural chemistry (soils laboratory); Medfly service; Screwworm service; Plant Protection Unit; beekeeping; fish diagnostic laboratory of the Fisheries Department; and the quarantine units located at all the ports of entry (international airport, seaport and border entry points). In addition, the Pesticide Control Board will be incorporated in the new structure because of its close linkages to both plant and animal health and the NAGHS would have the capacity to provide laboratory services to meet the basic needs of the Public Health Bureau and the Bureau of Standards.

Institutional Structure: Major characteristics of the NAGHS include the need for it to be more focused on resolving priority problems and issues of the sector, be flexible and responsive to client's demands, have a greater degree of autonomy to allocate resources more efficiently and generate revenue. Given the present structure of the MAF's AGHS and institutional practices, upgrading and strengthening the various units that provide agricultural health services will have partial success in the short run but will not address the problems of flexibility, efficiency and sustainability in the longer term. Therefore, alternative institutional arrangements are needed for the NAGHS. In this regard, **the project will consider two alternative institutional arrangements under which the service will operate in the public sector.** Both will require autonomy and flexibility in operations but will have different cost implications.

The first alternative is to create the NAGHS within the MAF's institutional framework but provide it with the necessary legal backing and wherewithal to operate with greater autonomy, generate revenue and allocate resources independently of the current practices in the MAF. **The second alternative** is to create the NAGHS as a quasi public institution that is similar to a public sector corporation or entity (such as the BMB) but with strong ties to the MAF. In both alternatives, administration of the services and coordination and liaison with the MAF will be similar, but personnel costs and overall reporting will be different. In the first alternative, the NAGHS will report directly to the Permanent Secretary and it will have the same status in the MAF's hierarchy as the Agriculture and Fisheries Departments respectively (**Figure 3.1**). In the second alternative, the relationship of the service with the MAF will be similar to that of the Belize Marketing Board in which the Head of the service will report directly to the Minister or to the Permanent Secretary. The major differences between both institutional

Figure 3.1

Proposed Institutional Arrangement of the NAGHS Within the MAF



arrangements will be the extent to which each provides greater autonomy in management and operations and the costs of personnel. The second alternative provides greater autonomy than the first.

Legislation will be required to create the NAGHS and to facilitate absorption of those units of the MAF in the new structure. The rational for creating a more consolidated service is based on: (a) the present institutional weaknesses of the MAF which affects the effectiveness of the present service; (b) regulations of the public service which create various rigidities in operations and limit implementation of cost recovery measures and flexibility in resource use; and (c) the limited capability of the present institutional structure to develop strong linkages with the private sector and other stakeholders of the service.

The proposed NAGHS will have four major characteristics that differ from the existing plant and animal health service of the MAF.

(a) It will need to be a semi-autonomous structure with much fiexibility and effectiveness to respond to demands and clients' needs. In this regard, the NAGHS will be demand-driven, focusing on the provision of services to various groups of clients and stakeholders - producers, exporters, importers, as well as addressing public health concerns and meeting international trade requirements and standards. The services will have greater integration and in the case of the second alternative, it will be a coherent public sector institution that will operate outside of much of the scope and institutional rigidities of the traditional public service.

(b) Strong links and mechanisms will be developed with the private sector and other institutions in the public sector to provide inputs regarding agricultural health policy, identification of priorities, coordination and sourcing finance.

(c) A cost recovery mechanism will be developed so that fees will be charged for certain services, particularly those having private good characteristics. These include laboratory analysis, specific field services, issuance of phyto and zoosanitary certificates, import permits, registration and certification of agricultural drugs and chemicals.

(d) Strong links will be developed with regional and international organizations such as the WTO and OIE to access information on new agricultural health standards and requirements, and to coordinate with trading partners on regulations governing trade and their health status.

The NAGHS will be headquartered at Central Farm where it will utilize the present facilities of the Plant Protection Unit, the Veterinary Clinic and the Soils Laboratory. A Board of representatives will oversee the service and its Chairman will be the Minister of the MAF or his representative. In the first institutional alternative, the service will have an Advisory Board

comprising representatives of the MAF, other public sector institutions such as the Ministries of Trade, Finance, Foreign Affairs, Public Health Bureau and the Bureau of Standards[69]. The private sector will be represented on the Board by individuals from the Commodity Associations (sugar, citrus and bananas), the BLPA, Veterinary Association, other groups from the private sector and NGOs. In the second alternative, there will be a Board of Directors instead of an Advisory Board comprising representatives of the same institutions as in the first alternative. Among other responsibilities, the Board will oversee policy design and execution, planning, mobilization of financial resources including identification of self-financing activities, appointment of professional and technical staff. Legislation creating the NAGHS will designate the composition of either Board and identify its terms of reference.

The composition of the Board is based on: (a) the need for the service to be integrally linked to the MAF (in the case of the second alternative) in terms of policy development and execution, accreditation by external institutions and countries, continued dependence on public funding and providing support to other activities of the MAF such as teaching, research and extension; and (b) the need to develop strong public and private sector links so that various stakeholders and client groups will be involved in active planning and participating in the operation of the service. At the operational level, the NAGHS will be supported by special technical advisory bodies in the areas of plant health, animal health, quarantine and registration and control to provide technical advice and information.

The NAGHS will be headed by a Chief Agricultural Health Officer (CAHO) who will be responsible for the day-to-day administration and management of the service. Under the CAHO, there will be five major Divisions and a smaller supporting unit (Figure 3.2). The five Divisions will be the Plant Health Division (PHD), Animal Health Division (AHD), International Quarantine and Inspection Division (IQID), the Central Investigatory Laboratory (CIL) and Registration and Control Division (RCD). The smaller support unit will be a Finance/Accounting Unit.

(i) **Plant Health:** This division will remain headquartered at Central Farm and it will be headed by a Principal Plant Health Officer. The project will build on the accomplishments of the ODA project by expanding the scope and efficiency of the PHS to execute programs to eliminate and/or reduce crop production losses due to pests and diseases. The project's general objective in this area will be to broaden and strengthen the technical capability of the Plant Health Division (PHD) for diagnosing and addressing pest and disease problems (both existing and new ones), update the information base on the plant health status of Belize and create stronger linkages with external plant health and research institutions to share information and experiences. Specifically, the project will: (a) strengthen the PHD to provide more specialized field services in areas such as nematology, commercial production of biological agents, rapid and accurate diagnostics, post-harvest disorders and risk assessment; (b) enhance the existing

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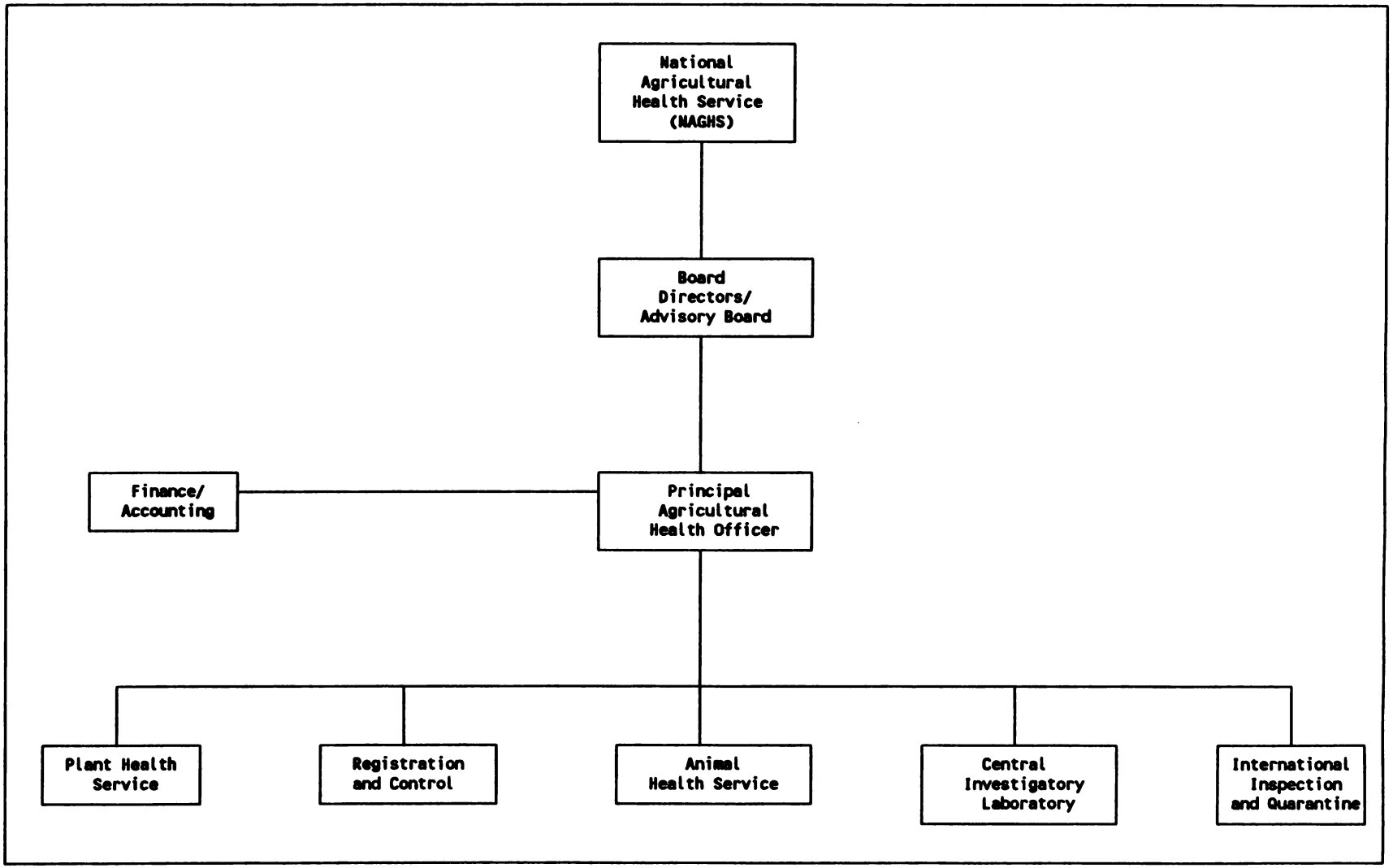
69 The Foreign Affairs Ministry has a critical role in the areas of Protocol and external relations when there are international trade problems, emergency situations disputes between Belize and other countries. For this reason, this Ministry is to be represented on the Board.

Figure 3.2
Proposed Structure of the National Agricultural Health Service of Belize (NAGHS)



capacity of the laboratory to diagnose, test and develop new integrated technological control measures for priority crops; (c) contribute to the development of mechanisms to share responsibility and facilities on plant research such as with CREI and on surveillance activities (such as Medfly) in order to minimize duplication; (d) expand the PHD's capacity of intelligence gathering and data management to facilitate identification of pests and diseases and provide easily accessible information; (e) strengthen the capabilities of the supporting units of the MAF, particularly the extension staff through training in areas such as sample collection, diagnosis of basic problems, etc. (so as to reduce dependence on the PHD to diagnose pest and disease problems); (f) develop mechanisms for greater sustainability through the use of user fees and attracting support through collaborative activities with the private sector; and (g) improve the PHD's capability to provide services that meet both client needs and those of international requirements and standards.

The project will provide technical assistance and training to the PHD to design and operationalize a plant health policy, management and organization of plant health services, design of pest and disease control programs, an internal quarantine system, a programming, monitoring and evaluation system and produce manuals to define the role of the PHD, job responsibilities and operating procedures. The PHD will provide four basic groups of services - field services, laboratory services, data analysis and information management and regional/international collaborative network services.

Field services. The project will rationalize the field services in plant health that are provided by various units in the MAF by consolidating these in the PHD, and provide equipment and supplies, technical assistance and training in specific areas to improve the provision of such services. The services to be provided will be those currently supplied by the Plant Protection Unit including diagnosis of and research on pests and diseases, eradication, training, Medfly service, bio-safety, pest risk analysis, quality control, special programs such as on-going monitoring, surveillance and eradication of pests and diseases, other plant protection services, etc.). The field services will also include all internal plant quarantine activities and special programs such as the Medfly program (currently executed by the Special Projects Unit of the MAF).

Laboratory services. Considerable strengthening of the plant laboratory capabilities was done by the ODA project. However, these need to be further strengthened if Belize is to become more competitive in crop production and exports, and meet the standards and requirements that are being imposed on international trade. The present laboratory capabilities will be strengthened to provide wider and more effective services including analysis of seeds and plant pathology, entomology, post entry quarantine and assessment of biological agents.

The current soils laboratory which has been non-functional for two years at Central Farm will be equipped and become operational, and will be part of the laboratory services to be provided by the PHD. The activities of the soils lab. will include soil tests (for chemical and physical characteristics and for fertilizer application), plant leaf testing for nutrient quality, water quality testing, animal feed testing and fertilizer analysis. These tests will facilitate more

efficient input use in crops and in livestock production. A small facility will be attached to this lab. to facilitate chemical residue testing so that there will be no need to send samples abroad for quality analysis of foods as currently done by firms such as Belize Food Products, etc. Some equipment for such tests that are presently at the CVL location in Belize City will be transferred to the soils lab. By becoming operational, this lab. will support the diagnostic work of the PCB, reduce the need for farm producers such as the commodity associations (sugar, bananas and citrus) to send samples abroad for analysis, provide such services at a cheaper cost and facilitate more frequent testing. Non-functional equipment will be repaired and additional equipment and supplies provided, as well as technical assistance and training to supply a wider array of laboratory services.

The project will strengthen administration and management of both labs. and facilitate the development of strong linkages with other units of the MAF and private sector institutions to maximize the use of scarce resources in plant health activities, through the exchange of experiences and execution of joint plant protection programs and research. In particular, equipment and training will be provided to the extension staff of the MAF and farmers to diagnose and resolve pest and disease problems.

Information. The project will consolidate and expand the data base and information management capability (intelligence gathering, biogeographical data collection, data analysis, information dissemination) that was developed by the ODA project. Training, technical assistance and improved technology will be provided by the project to strengthen the unit's capabilities in data gathering, information management and easy accessibility to plant health information and data bases outside of Belize.

(ii) Animal Health: The overall objective of the project in the area of animal health is to modernize Belize's AHS so that it can: (a) reduce animal production losses through more effective diagnosis and treatment of animal diseases; (b) support disease prevention; (c) facilitate and promote international agricultural trade in animal products; (d) promote veterinary public health; and (e) protect animal health and welfare. This is to be done by: upgrading the human resource capability, infrastructure, legislation, information system, quarantine, laboratory and field services; establishing the registration of veterinary chemicals, pharmaceuticals and biologics; and executing veterinary public health campaigns and programs.

The animal health service will be headquartered at Central Farm and all its activities will be executed through the AHD. As in the case of plant health, the project will rationalize all animal health services and special programs (currently provided by various units of the MAF) and the provision of these will be the responsibility of the AHD. These include field diagnostic services, laboratory services, epidemiology services, meat inspection, animal quarantine, the Screwworm Eradication Program the Vampire Bat Control Program and beekeeping activities. The AHD will also have responsibilities for all internal animal quarantine activities, as well as the design, execution and monitoring of policies and programs related to animal health but not animal production.

Streamlining will also be done to the staffing in the animal health service, particularly of the positions occupied by animal health assistants (AHAs). Like qurantine inspectors, AHAs have a "dead-end" job, because there is no classification system, no incentives and no promotion system for this group of staff. Regarding collaboration and coordination and regular monitoring of the animal health situation, the AHD will work closely with the MAF's extension staff and the BLPA.

The project will strengthen the animal health service to provide four sets of services more effectively: field diagnostic, ambulatory, laboratory and epidemiology services. In addition, the project will facilitate improved liaison and alliances between Belize's AHS and regional and international institutions.

Field diagnostic and ambulatory services. These will include the services presently provided by the Vet. Services Division of the MAF such as the surveillance and eradication of diseases, regular monitoring and various other ambulatory services. The AHD will also have responsibilities for all internal animal quarantine activities, the screwworm program, the vampire bat control activities, provide technical support for apiaries, and the execution of all other special programs and campaigns in the animal health area. Training will be provided to and coordinating mechanisms strengthened with the MAF's extension staff in various areas to facilitate and support the AHD's field and laboratory tasks.

Regarding diseases in the sector, the project will strengthen the technical capabilities and provide the AHD with the necessary facilities to address a range of priority diseases and health problems in Belize, some of which exist in the livestock sector. These include: various cattle diseases (vesicular diseases, rabies, brucellosis, TB, screwworm, anthrax, BSE, EBL, cystercercosis and liver flu); poultry diseases (Avian influenza, Newcastle disease, Pullorum, Fowl typhoid, Merks disease, infectious bronchitis and IBD); diseases of pigs (hog cholera; aujeskey disease, PRRS, TGE, Trichinella, parvo virus and cystercercosis); sheep and goat diseases (scrape, CAE virus, brucella, blue tongue, liver flu and Orf); diseases of horses (rabies, equine encephalitis, VS, equine infectious anaemia and infectious viral arteritis); and diseases affecting bees (varroa mite, acariasis, nosema and fowl brood).

Laboratory services. The project will also rationalize all laboratory services in animal health provided by the MAF, as well as related services provided by other public sector institutions. The CVL will become an individual entity within the NAGHS and its services expanded but it will continue to provide support services to the AHD (see below). The veterinary clinics (at Central Farm, Orange and Toledo) will be repaired, upgraded and refurbished through improvements in the physical infrastructure, provision of additional equipment and supplies so that they can provide a more efficient service to the livestock sector.

Epidemiology services. These will strengthened through training and the provision of improved technology and facilities. The services include monitoring the status of diseases, surveillance of disease outbreaks, risk analysis and management of animal health information. These services will be provided from Central Farm.

The project will facilitate harmonization of health and zoosanitary measures with other Central American and Caribbean countries and other trading partners. This harmonization will be achieved through a review and modification of existing legislation and regulations, and the establishment of policies, norms and guidelines in the area of animal health. The project will also provide technical assistance to facilitate harmonization of measures and standards. Complementary to harmonization, the project will facilitate access to information bases, sharing of information and stronger collaborative mechanisms and links with institutions such as FAO, Codex Alimentarius, International Office of Epizootics (OIE), OIRSA and IICA through an upgrading of the information system.

(iii) **Central Investigatory Laboratory:** Due to the small size of the country, limited demand for laboratory services, limited resources and the provision of inefficient and insufficient services presently by the CVL, the Fisheries Department and the Public Health Bureau, it is economically advantageous to centralize these laboratory services in Belize City in a single entity. Moreover, there is an increased recognition for the need to expand and diversify existing laboratory work to include the promotion of human health by providing laboratory support on food safety issues. Public sector agencies currently involved in different aspects in food safety matters in Belize are largely ineffective, lacking the facilities and the necessary legal, administrative and financial support for the effective promotion of food safety in human health. There is a general recommendation among these institutions that the resources be brought together under a single laboratory structure that consolidates activities, utilize the resources more efficiently, supported by the necessary mandate to execute specific actions. Such a laboratory should have the necessary administrative, legal, financial, technical and other wherewithal including an advisory board to provide guidance and coordination at the national level, to meet the needs for timely, reliable and accurate analytic and diagnostic test results for food and agricultural products in Belize.

In this regard, the CVL which is presently underutilized and has the best potential to provide a wide array of laboratory services (relative to other existing agencies) will become the **Central Investigatory Laboratory (CIL).** Its services will include various tests and diagnosis of animal diseases, clinical treatment, meat residue analysis, the provision of laboratory services for the fisheries sector (testing for diseases, water quality, HACCP, toxicity tests, etc.) and services for the PHB (water quality testing, microbiology tests of food, etc.). These services can be provided more efficiently by a single lab. since the activities are inter-related and the costs of provision of the additional services are marginal. The project will upgrade and expand the current facilities of the CVL, repair equipment and provide improved technology, equipment and facilities, strengthen lab. management and administration and the technical capabilities to provide a more efficient service.

(iv) **International Quarantine and Inspection:** Despite the introduction of few pests and diseases from external sources (based on official information), Belize's quarantine service is not efficient because of inadequate infrastructure and facilities, low technical capabilities and morale, and poor supervision and communication. In addition, being a signatory to regulations that govern international trade, the quality of the service needs to be upgraded to meet these new

requirements. Although these regulations are designed to facilitate fair trade across international borders, all countries must have basic protective structures in place to safeguard human, plant and animal health, and to protect their borders from unfair trade practices and from the entry of pests and diseases. The project will reorganize the quarantine service of the MAF and strengthen its capability to address these issues more effectively.

The International Quarantine and Inspection Division (IQID) will be headed by a Principal Quarantine Officer stationed at Central Farm. This Division will be responsible for all external quarantine and inspection activities currently executed at all the border inspection stations with Guatemala and Mexico, the airport and seaports and other entry points. These stations include the six existing facilities at Santa Elena-Corozal (Belize/Mexican border), Benque Viejo in Cayo (Belize/Guatemalan border), Phillip Goldson International Airport and Port Authority in the Belize district, Big Creek in Stann Creek and Punta Gorda in Toledo. There is a need for additional stations to monitor the flow of traffic which has been increasing in recent years at other border points. In this regard, the project will install three additional quarantine stations at Dangriga in the Stann Creek district, La Union in Orange Walk (Belize/Mexican border) and at Jalacte respectively in Toledo (Belize/Guatemalan border).

The IQID's principal role will be to monitor all agricultural exports and imports in order to safeguard the country's borders from entry of pests and diseases that could be harmful to humans or jeopardize production in the agricultural sector. Under this component of the project, technical assistance will be provided among others, to strengthen quarantine administration and management, streamline the role, functions, responsibilities and operating procedures of the IQID, streamline quarantine and inspection activities in accordance with international practices and upgrade technical capabilities in various areas through training.

Four new QI's will be appointed, one of whom will fill the vacant position at Punta Gorda, and the remaining three will be assigned to new stations at La Union, Dangriga and Jalacte. All QI's will be upgraded to have the basic qualification at the level of Associate Degree in Agriculture from the BCA. Additionally, all QI's will receive a three-month intensive training course on quarantine and inspection procedures, as well as an annual in-service training on quarantine systems analysis and risk analysis.

Presently, the job of a QI is a "dead-end" one, in which all QI's are in one employment category with no incentives for job promotion and increments in salary. The project will reorganize the staffing situation by creating three categories (Grades I, II and III) quarantine inspectors based on qualifications and experience. Mechanisms for promotion will be designed and an annual personnel evaluation and review system will be established.

(v) **Registration and Control:** An efficient and effective PAHS needs to be complemented by an effective regulatory framework. Besides the need for adequate legislation to support the provision of agricultural health services, certain day-to-day services are needed in several areas to control and monitor the use of products that could be harmful to health, life and the

environment. The Registration and Control Division (RCD) of the NAGHS will provide such services in support of agricultural health standards and regulations.

The project will create the RCD by incorporating the PCB in the new framework and widen the scope of services presently offered. The RCD will be headed by a Principal Regulatory Officer and will be based at Central Farm, utilizing the current facilities of the PCB. It will absorb the present staff of the PCB and its activities will be closely linked and complementary to those of plant health, animal health, the soils lab., the CIL and to the MAF's Extension Division. The major services that this Division will provide include: (a) registration of all veterinary drugs; (b) registration of pesticides and biological products; (c) validation of chemicals and other inputs in agricultural production (with the soils lab. and the CIL); (d) inspection of farms and other premises in the use of banned chemicals, hazardous products and substances; (e) apply international labelling standards for all registered products (in joint collaboration with the Bureau of Standards); (f) educate and sensitize farmers, consumers and the general public on the use of pesticides, chemicals and hazardous products; and (g) train and accredit the public and private sector personnel on chemical use.

Basically, the RCD will be responsible for designing, implementing and monitoring of some of the GOB's regulatory policies and programs in agricultural health. Therefore, it will need to have appropriate technical capabilities, work closely with other units of the NAGHS, the MAF, the PHB, the BOS and other institutions in both the public and private sector to coordinate and monitor regulatory services. Links will also need to be established with regional and international organizations to monitor international agreements, new requirements and standards and exchange information in those areas in which the RCD is involved.

The project will strengthen the RCD by providing the required technical assistance for its organization and management and to: streamline its functions and responsibilities; review and recommend appropriate legislation and mechanisms for its enforcement in support of its activities; establish a dispute settlement process and sanctioning system; and develop an information system. In addition, training will be provided to the current staff of the PCB to upgrade their skills and capabilities in legal, as well as areas related to inspection, analysis and international standards and regulations.

(vi) Finance and Accounting: This will be a small unit which will provide a support service through the execution, control and monitoring of all income, expenditures and other financial transactions by the NAGHS. The CAHO will supervise all its operations and activities.

Presently, the GOB through the MAF provides budgetary allocations to its agricultural health service through the accounting unit of the Ministry. With establishment of the NAGHS, an independent accounting unit will be needed to oversee its financial operations. In addition to public funding, user fees and other charges will be levied for certain services, bank accounts established in order to provide flexibility in the use of its financial resources and provisions will be made for periodic financial auditing of the NAGHS. The project will establish this unit and

provide technical assistance to design an accounting system and mechanisms for financial control, revenue and expenditure management.

(vii) Information System: An efficient information system is needed if the agricultural health service is to meet the demands of its clients and international requirements and to support the service's response capability to emergency situations. The project will strengthen the information system to operate more efficiently at two levels: (a) at the NAGHS level to facilitate policy decisions, planning and coordination; and (b) facilitate access to data bases and agricultural health information abroad and supplying better quality information to regional and international organizations such as WTO, OIE, etc. and Belize's trading partners. This will be achieved through the design of an efficient system and modernizing it with improved information technology (computers and other equipment) and networking capabilities. This will allow more effective communication between all units of the NAGHS and between the service and organizations abroad. The design and installation of the information system will be supported by training activities on its use and general upgrading of information management skills of technicians in the service.

At Central Farm, an integrated system will be designed through technical assistance to provide intra and inter linkages. The system will manage all the data and information of the PHD, AHD, the soils laboratory and including general administration, the quarantine stations and the district vet. clinics. The system will be also be connected to the CIL in Belize City and to the quarantine stations and the District Clinics to facilitate sending and receiving information instantaneously. It will also be connected to the internet to link the service with countries and institutions abroad.

A large server with a back-up tape unit will be installed at Central Farm to manage all information in the service and to create daily back-up of information. Adequate equipment will be also provided to link different units of the service, as well as to protect it from power failures, ensure a constant level of electricity throughout the system and provide for future expansion of the information system. Each building at Central Farm will be wired appropriately for the system and installed with a UTP Port Hub (with capacity for eight computers).

At the CIL, a server will be installed with modems to facilitate linkages with the server at Central Farm and with the internet. The system will also be protected from power failures and uneven flow of electricity with appropriate wiring and a UPS installed that can manage at least 16 workstations. To reduce the risk of losing data, a back-up tape unit will also be installed on the server to create daily back-up of all information stored. Peripheral computers will be installed in the district veterinary clinics and in the quarantine stations at the airport, seaport, at the Guatemala and Mexico borders respectively and these will be linked to the Central Farm information network.

(viii) Legal and Regulatory Framework: Most laws and regulations governing Belize's agricultural health services were implemented several years ago. Presently, some of these do not provide a sufficient legal basis for the services to be effective. In addition, there are new

rules and regulations supporting international trade which need to be incorporated in Belize's legal framework. In general, the existing laws and regulations need to be modified and updated as part of the process of modernizing the agricultural health services.

The project will provide technical assistance to review, modify and update all existing laws and regulations governing the provision of agricultural health services. The objective is to provide the NAGHS and the MAF the necessary legal basis to design and implement appropriate agricultural health policies and enforce and monitor the laws and regulations. In addition, assistance will be provided to strengthen the NAGHS's capability in international rules governing trade, standards and requirements such as phitozoosanitary, and the harmonization of the country's agricultural health policies and measures with regional and international. There will also be training activities for technicians of the service with the objective of sensitizing and improving their knowledge of the regulations and other legal aspects of the service.

3.3.2 Infrastructure Rehabilitation

The NAGHS will absorb the infrastructure facilities (buildings and laboratories) that are presently utilized by the agricultural health service of the MAF. These include the Plant Protection building and its lab., the animal health clinic and the Soils lab. at Central Farm, the CVL in Belize City, the vet. clinics in Toledo and Orange Walk and the quarantine stations at various border points of entry. This component of the project will: (a) repair, expand and rehabilitate the existing infrastructure and facilities; (b) construct additional facilities; and (c) refurbish the buildings. Information on the location of the various infrastructure facilities is provided in **Figure 3.3**, while their design and layout and other details are provided in **Appendix C.1 and C.2.**

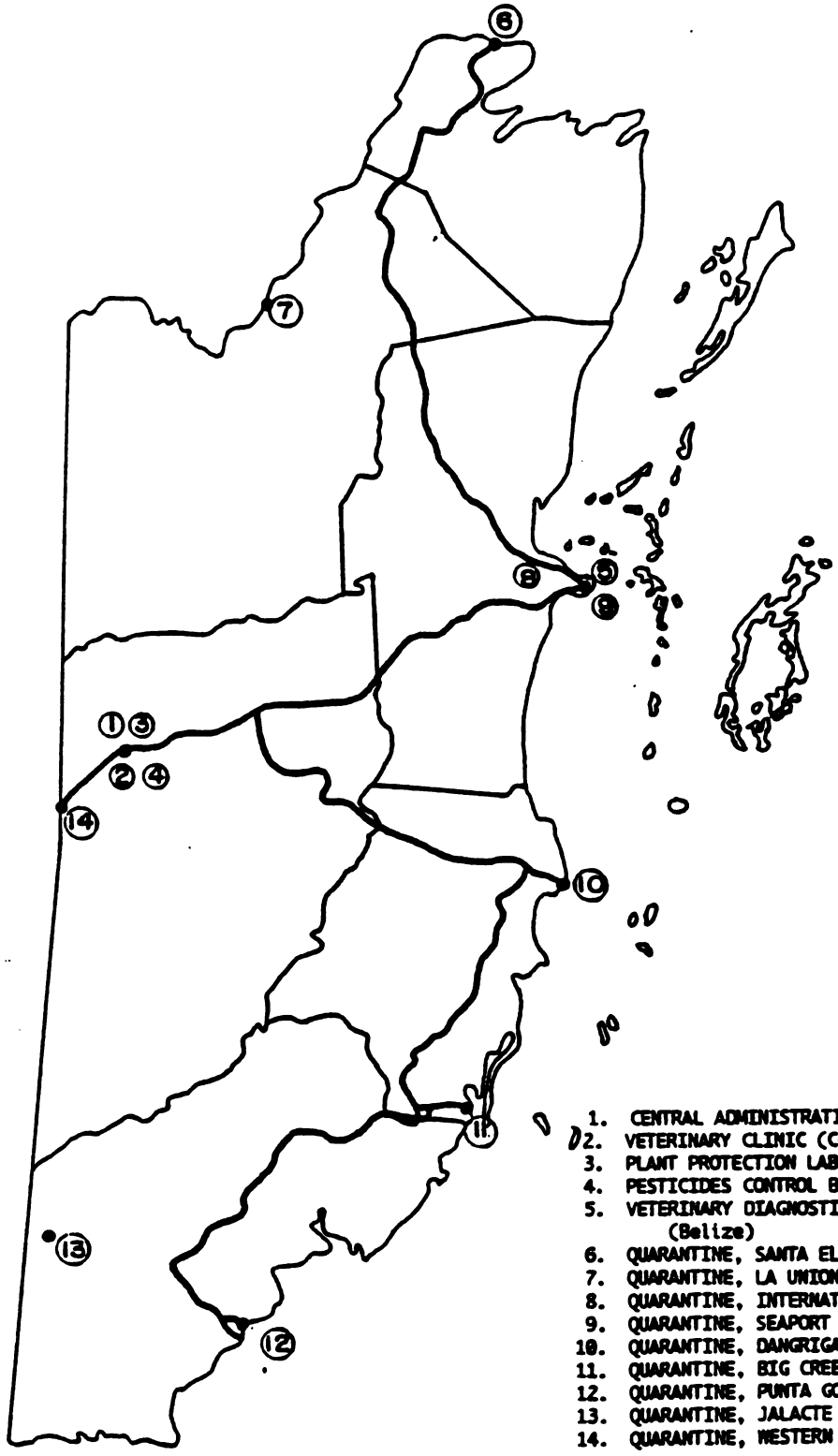
(i) Repairs, Rehabilitation and Refurbishment: The project will repair and refurbish several existing facilities that provide plant health services. These are a remodelling of the ground floor of the Plant Protection Building, expansion of the screen house and quarantine facilities presently used by the Plant Protection Service at Central Farm and attach an extended facility in the soils lab. for chemical residue testing.

Rehabilitation and remodelling will also be done to the existing quarantine stations located at the international airport, Benque (border with Guatemala), St. Elena (border with Mexico) and Punta Gorda. The present stations are grossly inadequate to provide the working space needed for international quarantine and inspection, since most of them are provided "gratis" and located in marginal areas in buildings owned by the Customs Department. The remodelled quarantine stations will provide sufficient office space for QI's, as well as contain a storage room, bathroom facility and an incinerator.

(ii) Laboratories: The project will upgrade the present laboratory facilities in both plant and animal health through the provision of improved technology, equipment and supplies and remodelling of the existing infrastructure. The major activity will be a remodelling and expansion of the CVL in Belize City to become the Central Investigatory Laboratory which will

Figure 3.3

LOCATIONS OF PROPOSED PLANT AND ANIMAL HEALTH FACILITIES



1. CENTRAL ADMINISTRATION OFFICES (Central Farm)
2. VETERINARY CLINIC (Central Farm)
3. PLANT PROTECTION LABORATORY (Central Farm)
4. PESTICIDES CONTROL BOARD (Central Farm)
5. VETERINARY DIAGNOSTIC INVESTIGATIONS LABORATORY (Belize)
6. QUARANTINE, SANTA ELENA BORDER (Corozal)
7. QUARANTINE, LA UNION (Orange Walk)
8. QUARANTINE, INTERNATIONAL AIRPORT (Ladyville)
9. QUARANTINE, SEAPORT (Belize)
10. QUARANTINE, DANGRIGA (Stann Creek)
11. QUARANTINE, BIG CREEK (Stann Creek)
12. QUARANTINE, PUNTA GORDA (Toledo)
13. QUARANTINE, JALACTE (Toledo)
14. QUARANTINE, WESTERN BORDER (Benque Viejo)

provide a range of laboratory services. As indicated before, in addition to having diagnostic capabilities for addressing animal health problems, this lab. will provide services to the fisheries sector, the PHB and the Bureau of Standards. Details on the remodelling of the CVL and its support facilities are provided in **Appendix C.1 and C.2.**

(iii) Construction of New Facilities: The NAGHS will be headquartered at Central Farm. The project will expand the existing animal clinic building to become a two-floor structure. The upper floor of this structure will house the management and administrative offices of the NAGHS including those of the CAHO, the Finance and Accounting Unit, the office of the Principal Quarantine Officer, offices of other support staff and a conference room. The lower floor of this structure will house the office of the Principal Animal Health Officer, offices of vet. officers, other offices of the AHD, an expanded vet. clinic and an incinerator facility.

Four new quarantine stations will be constructed under the project. A station-cum-dwelling facility will be constructed at Big Creek to replace the existing quarantine office which has been "borrowed" from the Customs Department and which is grossly inadequate to meet the basic needs of a functional office. The QI will need a dwelling facility since his continuous presence is required at Big Creek to inspect ships that arrive at irregular hours. Three new stations will also be constructed at La Union in Orange Walk (where a Customs inspection facility already exists), in Dangriga and in Jalacte in the Toledo district which have become regular points of entry into Belize in recent years. These stations will contain basic facilities for QI's to discharge their day-to-day responsibilities - office space, a work area for inspection of products, storage room, bathroom and an incinerator facility to dispose of products which are seized.

CHAPTER IV

PROJECT COSTS AND BENEFITS

4.1 Financial Costs and Benefits

4.1.1 Costs

The project will be executed over a four-year period. Summaries of the investment, personnel and technical assistance and training costs of the project are presented in Appendix E. Detail costs for equipment, materials, supplies and other inputs are presented in Appendix F.

The total costs of the project under the two institutional alternatives are presented in Tables 4.1 and 4.2 respectively. Under both alternatives, the total investment cost to be covered by external funding is estimated to be BZ$5.94 million or US$2.97 million. In terms of allocation of expenditure over the four-year period, almost 40% will be spent in the first year primarily on construction and repairs to buildings, establishment of a revolving fund and some technical assistance and training.

Rehabilitation of Infrastructure and Facilities: This item will be a major expenditure with a total cost of BZ$1.62m for repairs and rehabilitation of existing buildings and laboratories, and construction of new facilities. This activity will: (a) expand the vet. clinic building at Central Farm to house the administrative and support offices of the NAGHS, offices of the PQO, a vet. clinic and other facilities; (b) remodel the offices of the Plant Protection Building and laboratory and expand the quarantine facilities for the plant health service; (c) remodel and expand the CIL to increase its diagnostic, testing and analytical facilities; (d) remodel the buildings of the vet. clinics in Orange Walk and Toledo; (e) provide additional rooms to the soils laboratory at Central Farm as part of the overall strategy to make this lab. functional; (f) expand quarantine offices and facilities at the international airport, Punta Gorda, Benque border and St. Elena border; (g) provide a new housing and office facility for quarantine at Big Creek; and (h) construct additional quarantine stations at Dangriga, La Union and Jalacte.

Laboratory Equipment and Supplies[70]: These comprise the second largest category of expenditures, totalling $1.22m for upgrading the laboratories by repairing existing equipment and providing additional equipment and supplies. Expenditures will be incurred to: (a) improve the plant health lab.'s capabilities in Entomology, Plant Pathology and related activities; (b) repairs to equipment and provision of supplies to make the soils lab. functional; (c) provide supplies to improve internal quarantine activities in plant and animal health; (d) repair equipment and provide additional equipment, reagents and other supplies to upgrade and expand the CIL's

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[70] The prices of all equipment, supplies, materials and other inputs that are imported for the project are CIF Belize port. The prices include a 15% mark-up of all U.S. prices to cover the cost of transportation, insurance, etc.

Table 4.1

Investment and Personnel Cost Under Institutional Alternative One (BZ$)

	External Contribution	GOB Contribution	Year 1	Year 2	Year 3	Year 4	Total
1. Investment Cost							
- Construction, Repairs and Rehabilitation of Infrastructure and	X		1.172.796	331.424	111.520	-	1.615.739
- Laboratory Equipment and Supplies	X		-	570.262	653.240	-	1.223.502
- Computer Equipment and Supplies	X		-	254.063	-	-	254.063
- Office Equipment and Supplies	X		-	356.746	-	-	356.746
- Other Equipment and Supplies	X		-	181.531	-	-	181.531
- Vehicles	X		58.000	100.000	-	-	158.000
- Revolving Fund to Purchase Vehicles	X		500.000	-	-	-	500.000
- Technical Assistance and Training	X		416.000	525.000	122.000	50.000	1.113.000
- Miscelaneous 10%	X		214.680	231.902	88.676	5.000	540.258
Total Investment Cost			**2.361.475**	**2.550.927**	**975.436**	**55.000**	**5.942.838**
2. Personal Cost							
- Current Personnel		X	1.125.544	1.147.525	1.169.947	1.192.817	4.635.833
- Incremental Personnel		X	80.796	366.583	373.695	380.950	1.202.024
- Vehicle Allowance		X		96.000	96.000	96.000	288.000
Total Personnel Cost			**1.206.340**	**1.610.108**	**1.639.642**	**1.669.767**	**6.125.856**

Table 4.2

Investment and Personnel Cost Under Institutional Alternative Two (BZ$)

	External Contribution	GOB Contribution	Year 1	Year 2	Year 3	Year 4	Total
1. Investment Cost							
- Construction, Repairs and Rehabilitation of Infrastructure and	X		1.172.796	331.424	111.520	-	1.615.739
- Laboratory Equipment and Supplies	X		-	570.262	653.240	-	1.223.502
- Computer Equipment and Supplies	X		-	254.063	-	-	254.063
- Office Equipment and Supplies	X		-	356.746	-	-	356.746
- Other Equipment and Supplies	X		-	181.531	-	-	181.531
- Vehicles	X		58.000	100.000	-	-	158.000
- Revolving Fund to Puerchase Vehicles	X		500.000	-	-	-	500.000
- Technical Assistance and Training	X		416.000	525.000	122.000	50.000	1.113.000
- Miscelaneous 10%	X		214.680	231.902	88.676	5.000	540.258
Total Investment Cost			**2.361.475**	**2.550.927**	**975.436**	**55.000**	**5.942.838**
2. Personal Cost							
- Current Personnel		X	1.287.214	1.312.430	1.338.149	1.364.383	5.302.177
- Incremental Personnel		X	94.073	409.502	417.474	425.604	1.346.653
- Vehicle Allowance		X		96.000	96.000	96.000	288.000
Total Personnel Cost			**1.381.287**	**1.817.932**	**1.851.623**	**1.885.987**	**6.936.830**

diagnostic and testing capabilities to provide a wider range of services including meeting the laboratory needs of the fisheries sector, the PHB and the BOS.

Equipment and Supplies: The total cost of these is estimated to be $0.79m. They include expenditures on: (a) computer equipment and accessories (BZ$0.25 million); (b) office equipment and supplies for all the offices (BZ$0.36 million); and (c) other equipment and supplies ($0.18 million).

All expenditures have been programmed for the second year of the project. An integrated information system will be installed in the NAGHS to facilitate intra exchange of information and data, and for easy access to data and information bases through the internet. This is to be done by providing new information technology such as more efficient computers, modems and other accessories.

Technical Assistance and Training: This is also a major category of expenditure in the project. The total cost is estimated to be $1.11m which will cover technical assistance to be provided in several areas and both internal and external training. Technical assistance will be provided to strengthen administration and management of the individual units of the NAGHS, preparation of operating manuals and guidelines of operation, design and installation of an information system and strengthening of the legal framework. Training will be provided to upgrade the technical capabilities of the service, to address and resolve pest and disease problems more effectively and efficiently. In addition, training will be provided for capacity building in the longer run.

Vehicles: The project proposes an alternative approach to addressing the perennial problem of providing adequate transport facilities in the public sector. In this approach, a limited number of vehicles will be supplied by the service and staff will be given incentives to purchase their own vehicles for use in their work. The alternative is less costly to the government because it reduces the costs of maintaining vehicles and the costs to hire drivers. More important however, it improves efficiency and productivity by resolving the usual problem of having a large number of idle vehicles over a long time period because the Ministries do not have sufficient resources to repair and maintain them. By providing incentives to the staff to purchase their own vehicles, the problem of transport will be resolved, the staff is likely to maintain their vehicles more efficiently resulting in less immobility, reduced delays in the delivery of services and higher overall productivity.

Given the current vehicles in the service, the project will purchase three vehicles costing a total of BZ$158,000. It will also provide $0.5m to be used in a revolving loan fund for loans to staff members of the NGAHS for the purpose of purchasing vehicles. The criteria and conditions to borrow from the revolving fund will need to be clearly defined. Among these, only eligible staff members that require vehicles in their work will be eligible to borrow from the fund and all loans will be provided at market interest rates. The CAHO and Minister or the Permanent Secretary of the MAF will have to give prior approval for staff to borrow from the fund. The fund could be managed by the NAGHS or by another institution such as the

Development Finance Corporation.

Sufficient incentives will need to be provided for staff members to purchase and use their private vehicles for their regular work. Three of them are proposed here[71]. The first is the availability of finance which will be provided by the revolving loan fund. The second is staff members could purchase vehicles duty free or tax free and be allowed to keep them for a minimum period, say five years before they are allowed to sell them at a market rate[72]. The third is provide a monthly vehicle allowance to those using their vehicles for official work. This allowance will comprise two components - a fixed amount and a variable amount to be based on distance travelled. Given the work responsibilities of personnel in the NAGHS and based on the estimated costs of vehicle maintenance, an average monthly allowance of BZ$400 will be provided. The GOB will cover the annual cost of the vehicle allowance which is estimated to be $96,000 per year based on 20 vehicles being eligible for the allowance.

Personnel Costs: All personnel costs will be covered by the GOB. The new service will absorb all the present personnel of the MAF's plant and animal health service including plant protection, veterinary services, quarantine, Medfly services, Screwworm project, personnel involved in apiaries activities, the Fisheries Department and the PCB. Presently, a total of 67 professional, technical and support staff is employed by the AGHS of the MAF including that of the PCB. More than one-half is employed in the plant and animal health services. With the project, 31 additional personnel will be required to make the NAGHS fully operational. Most of the incremental personnel will be technicians. The CIL will absorb almost one-third of the additional staff because it has a serious shortage of staff and it will be providing a wide range of laboratory services. Additional staff (8) will be needed for the PHD and five will be needed for the administration and management unit of the NAGHS. The AHD will need the least incremental staff because its current staff size is the largest in the MAF's AGHS. Most of the incremental personnel will be hired from the second year, after the physical infrastructure has been put in place. The new service assumes the current pay scales and rates for all professional, technical and support staff.

Unlike the investment costs, personnel costs differ between the institutional alternatives considered. Under institutional alternative one, the total personnel costs will be $1.21 million in year 1 and it increases to an average of $1.62m per year, including an increase in the average salary of 2% per year. Incremental personnel costs will be marginal in year 1, but will be 32% higher than the current personnel costs covered by the MAF.

Under institutional alternative two in which the NAGHS will be a semi-autonomous public sector institution, the staff of the new service will not be eligible to receive a pension and

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[71] These incentives were applied in several countries and have been successful in resolving the problem of transport in the public sector.

[72] Details will have to be worked out for used vehicles purchased, for vehicles kept for a shorter period due to a member leaving the service, etc.

other benefits provided by the public service and there is no provision made for contribution to a pension scheme. In lieu of these benefits, a gratuity will be paid that amounts to 20% of the basic annual salary for professional and technical personnel and 10% of the annual salary for support staff. Personnel costs will be higher by an average of 8.8% under alternative two.

4.1.2 Financial Benefits

Public agricultural health services are provided free by the MAF in Belize and the absence of user charges makes it difficult to estimate the financial benefits which can accrue to the service as a result of this project. In the private sector, the financial benefits of the plant health programs executed by the various commodity associations are internalized and are reflected in their output and earnings.

Some agricultural health services have private good characteristics while others are considered to be public goods. As such, it is not possible, at least in Belize in the short run to cover the total costs of providing the services from user fees. The AGHS will continue to depend on public sector funding due to the high cost of supplying them, the inability of certain users particularly small farmers to pay for them, and the need for government intervention in agricultural services due to the importance of the sector in agricultural trade and its overall contribution to growth.

Presently, the MAF allocates approximately BZ$1.48 million per year (recurrent and capital estimates) for its agricultural health service. Assuming that the MAF continues to support the service by making an annual subvention of this amount (adjusted for inflation) to the NAGHS, Tables 4.3 and 4.4 provide a rough approximation over a 10-year period of the net financial situation of the service under the two institutional alternatives. The assumptions are that the costs of operations and maintenance of the NAGHS are a proportion of 35% of the total costs, the GOB through the MAF will continue to provide public funding for the services through a subvention given to the NAGHS, and user fees and charges are levied on exports of marine products, bananas, non-traditional exports, and for the issuance of import permits and phytosanitary certificates. Funding by the MAF will be equivalent to the 1995 total budgetary allocation of recurrent and capital expenditures for the service. User fees are based on a 1% value of the 1995 level of exports of bananas, marine products and other non-traditional agricultural products, and fees (BZ$10.00 each) are charged for issuing an estimated 758 phytosanitary certificates and 2,000 animal import permits and these are adjusted annually for a 2% inflation rate[73]. Assuming that operational costs occur after the project is completed in year 4, there are positive cash flows under both alternatives until year 4. The negative cash flows under alternative two are almost four times the annual estimate of approximately $0.1 million in alternative one.

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[73] This is a rough estimate of permits issued. No records are kept on how many phytosanitary certificates and other permits are issued each year by the MAF because several persons provide these.

Table 4.3

Estimates of Recurrent Costs and Revenue Under Institutional Alternative One (BZ$'000)

Recurrent Costs	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Personnel Costs:*	1,206.3	1,514.1	1,543.6	1,573.8	1,604.5	1,635.8	1,667.8	1,700.5	1,733.7	1,767.6
- Current Personnel	1,125.5	1,147.5	1,169.9	1,192.8	1,216.1	1,239.9	1,264.2	1,289.0	1,314.2	1,340.0
- Incremental Personnel	80.8	366.6	373.7	381.0	388.4	395.9	403.6	411.5	419.5	427.6
Vehicle Allowance	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0
Estimate of Operational and Maintenance Costs**					864.0	880.8	898.0	915.7	933.5	951.8
Total Recurrent Costs	1,302.3	1,610.1	1,639.6	1,669.8	2,564.5	2,612.6	2,661.8	2,712.2	2,763.2	2,815.4
GOB's Contribution#	1,480.0	1,509.6	1,539.8	1,570.6	1,602.0	1,634.0	1,666.7	1,700.1	1,734.1	1,768.7
Revenue from Services##	834.7	843.0	851.5	860.0	868.6	877.3	886.1	894.9	903.9	912.9
Net Situation	1,012.4	742.5	751.7	760.8	(93.9)	(101.3)	(109.1)	(117.2)	(125.3)	(133.7)

* This is based on the total costs of personnel for 1996 adjusted annually for an inflation rate of 2%.

** Operations and Maintenance Costs is computed as a ratio of 35% to total costs.

Based on the total recurrent and capital allocations for the 1995/96 fiscal year by the MAF and adjusted annually by an inflation rate of 2%.

This is derived from a 1% fee on the level of exports of bananas, marine products, papayas and other non-traditional agricultural exports, phytosanitary certificates and import permits for 1995.

Table 4.4

Estimates of Recurrent Costs and Revenue Under Institutional Alternative Two (BZ$'000)

Recurrent Costs	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Personnel Costs:*	1,381.3	1,721.9	1,755.6	1,790.0	1,825.0	1,860.8	1,897.2	1,934.5	1,972.4	2,011.1
- Current Personnel	1,287.2	1,312.4	1,338.1	1,364.4	1,391.1	1,418.4	1,446.3	1,474.7	1,503.6	1,533.2
- Incremental Personnel	94.1	409.5	417.5	425.6	433.9	442.4	450.9	459.8	468.8	477.9
Vehicle Allowance	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0
Estimate of Operational and Maintenance Costs**					982.7	1,002.0	1,021.6	1,041.7	1,062.1	1,082.9
Total Costs	1,477.3	1,817.9	1,851.6	1,886.0	2,903.7	2,958.8	3,014.8	3,072.2	3,130.5	3,190.0
GOB's Contribution#	1,480.0	1,509.6	1,539.8	1,570.6	1,602.0	1,634.0	1,666.7	1,700.1	1,734.1	1,768.7
Revenue from Services##	834.7	843.0	851.5	860.0	868.6	877.3	886.1	894.9	903.9	912.9
Net Situation	837.4	534.7	539.7	544.6	(433.1)	(447.5)	(462.0)	(477.2)	(492.5)	(508.4)

* This is based on the total costs of personnel for 1996 adjusted annually for an inflation rate of 2%.

** Operations and Maintenance Costs is computed as a ratio of 35% to total costs.

Based on the total recurrent and capital allocations for the 1995/96 fiscal year by the MAF and adjusted annually by an inflation rate of 2%.

This is derived from a 1% fee on the level of exports of bananas, marine products, papayas and other non-traditional agricultural exports, phytosanitary certificates and import permits for 1995.

The above scenarios are an approximation of revenues that could be generated fairly easily if certain user fees are charged. The lack of data and the non-existence of user fees make it difficult to estimate revenues that could be earned from various services. Nevertheless, there are several possibilities to generate additional revenues from agricultural health services, particularly those which have private good characteristics (see **Appendix D** for an elaboration of this). Revenues could be higher than those indicated in Tables 4.3 and 4.4, if fees could be charged for laboratory tests and analyses, field diagnosis, registration and the sale of drugs, cost for issuing various permits, etc. Exporters of products such as bananas, marine products, papayas and other non-traditionals can contribute to cover at least the operating costs of certain services (such as the Medfly program) since they benefit the most from efforts to control and eliminate pests and diseases. In addition, the participation of various stakeholders in the NAGHS provide the possibility of seeking alternative source of capital investment. These include the fishermens' cooperatives, the commodity associations and the BLPA who will be the major beneficiaries of improvements in the service.

The continued funding by the GOB through the MAF will be critical for the provision of agricultural health services. The benefits of the services are both tangible and intangible and the services have certain public good characteristics that limit the extent to which their operations can be privatized. The concern for sanitary and public health standards, control and elimination of pests and diseases, the economic risks of non-compliance to international standards and requirements are all important overriding factors for some public intervention in the supply of such services. In the case of Belize, the small market size for agricultural health services, characteristics of the agricultural sector and the large number of subsistent and non-commercial small farmers who cannot pay for such services also limit the extent to which these can be provided by the private sector. In addition, the externalities and spread effects of a more effective service are sufficient conditions also for public sector intervention.

4.2 Justification and Viability

4.2.1 Economic Analysis

The lack of data has limited the economic analysis and justification for the project. Nevertheless, a simple cost/benefit model of the present agricultural health service of the MAF with 1995 as a base year is used to estimate the economic impacts of the project. **Tables 4.7 to 4.8** present estimates of present and potential gross output losses due to pests and diseases under the existing AGHS. These tables also indicate the incremental gross output that could be achieved if the various services were improved.

An estimate of the total losses of the major crops from pests, diseases and post-harvest practices is BZ$45.3 million, comprising a loss of $25.5 million for non-traditional crops and

Table 4.5
Estimates of Present and Potential Losses from Various Pests and Diseases Under the Present Plant Health Service - Crops Sector (1995)

Crop, Pest and Disease	Present Loss (BZ $'000) *	Potential Loss (BZ $'000) **
1. Banana:		
Black Leaf Streak	7,500.00	12,000.00
Anthracnose & Peel Rots	1,467.00	2,500.00
Nematodes	750.00	1,500.00
Moko, Bacterial Wilt	1.00	2,000.00
Borer	500.00	1,500.00
Sub-Total	10,218.00	19,500.00
2. Beans:		
Web Blight	1,500.00	3,000.00
Leaf & Pod Insects	2,300.00	3,000.00
Sub-Total	3,800.00	6,000.00
3. Cabbage:		
Diamond Back Moth	72.00	200.00
Bacterial Black Rot	40.00	80.00
Sub-Total	112.00	280.00
4. Citrus:		
Tristeza Virus (CTV)	30.00	60,000.00 #
Leaf Miner		3,000.00
Drunken Baymen	2,500.00	3,000.00
Leaf Cutting Ants	2,500.00	3,000.00
Phytophthora Foot $ Root Rots	500.00	1,000.00
Other Graft-Transmissible Viruses	10.00	3,000.00
Scales + Leaf Feeding Insects	50.00	500.00
Sub-Total	5,590.00	73,500.00
5. Coconuts:		
Lethal Yellowing	100.00	6,500.00 #
Red Ring/Palm Weevil	200.00	400.00
Sub-Total	300.00	6,900.00
6. Corn:		
Army Worm & Other Insects	2,500.00	5,000.00
7. Cucurbits:		
Beetles & Pickleworms	20.00	40.00
Downy Mildew	20.00	30.00
Sub-Total	40.00	70.00
8. Papayas:		
Bunchy Top	2.00	1,500.00
Ringspot Virus	5.00	1,500.00
Bacteriosis	0.00	1,500.00
Foliar Insects & mites	350.00	700.00
Sub-Total	357.00	5,200.00

Crop, Pest and Disease	Present Loss (BZ $'000) *	Potential Loss (BZ $'000) **
9. Peppers:		
Gemini + Other Viruses	500.00	1,000.00
Bacterial Wilt	75.00	150.00
Leaf Spots	75.00	150.00
Pepper Weevil	400.00	500.00
Sub-Total	1,050.00	1,900.00
10. Rice:		
Hoppers	250.00	500.00
Army Worm	142.00	284.00
Stinkbug	354.00	708.00
Sub-Total	746.00	1,492.00
11. Sugar Cane:		
Frog Hopper	2,900.00	5,000.00
Smut	1,500.00	2,900.00
Sub-Total	4,000.00	7,900.00
12. Tomatoes:		
Gemini + Other Viruses	308.00	616.00
Bacterial Wilt	44.00	88.00
Leaf Spots	100.00	200.00
Leaf Miners	161.00	250.00
Sub-Total	613.00	1,154.00
Weeds	7,000.00	7,000.00
Other Pests/Fruit Flies	4,000.00	4,000.00
Post-Harvest Losses	5,000.00	5,000.00
Output Loss for Non-Traditional Crops	25,516.00	43,996.00
Output Loss forTraditional Crops	19,900.00	100,900.00
Total	46,328.00	144,488.00
Additional Potential Output Loss ##		70,870.00
Optimal Output Loss (1)	32,567.00	
Increased Gross output	12,759.00	

* Gross output loss under the present Plant Health System

** Refers to "maximum likely value if there is no control and it includes only those pests/diseases already present or could affect Belize. It is unlikely that more than two or three of these pests would near their potential losses at any one time; therefore, the total amount has little real significance" (Peter Hunt).

\# "It is calculated on the basis of one-off loss of all susceptible sour orange rootstock citrus to CTV and of all local tall variety coconut palms to lethal yellowing" (Peter Hunt).

Refers to maximum additional output loss if the three largest potential pests reach their maximum.

(1) Gross output loss attributuyed to pests/diseases under a fairly functional Plant Health System; in this case gross output loss attributed to non-traditional crops will decrease by 50.0% while gross output loss attributed to traditional crops will not change significantly.

Source: National Plant Protection Service, NRI/ODA Plant Project (Peter Hunt, August 1995).

Table 4.6
Estimates of Present and Potential Losses from Various Diseases Under the Present Animal Health Service - Animal Sector (1995)

Disease	Estimate of Control Cost ($)	Nominal Gross Output Loss ($)	Total Production Loss ($)	Potential Output Loss ($) *
Bovine (Cattle):				
1. Black Leg	173,805.00	417,060.00	590,865.00	590,865.00
2. Parasitism	347,550.00	634,700.00	982,250.00	982,250.00
3. Malnutrition	570,925.00	634,700.00	1,205,625.00	1,205,625.00
4. Vesicular Stomatitis **				2,300,000.00
Sub-Total	1,092,280.00	1,269,400.00	2,361,680.00	4,661,680.00
Swine (Pigs):				
1. Parasitism	70,256.25	963,200.00	1,033,456.20	1,033,465.00
2. Malnutrition		481,600.00	481,600.00	481,600.00
3. Hog Cholera	N/A	N/A		
Sub-Total	70,280.25	1,444,800.00	1,515,065.20	1,515,065.00
Avian (Chicken Broilers):				
1. Infectious Bursal Disease # (Gumboro)		2,565,400.00	2,565,400.00	** 3,848,100.00
Sub-Total		2,565,400.00	2,565,400.00	6,413,500.00
Total	1,162,536.20	5,666,660.00	6,859,196.20	10,441,905.00
Optimal Gross Output Loss (1)			2,969,236.20	

* Potential output loss is equal to output loss under present animal health system unless otherwise stated

** Potential output loss is based on previous annual export sales of beef to Martinique;

\# Potential output loss is based on 15-0% mortality rate for broilers;

Source: Dr. Victor Gongora, Dr. Ivor Burns / Statistics Unit, Ministry of Agriculture & Fisheries

(1) This was generated by subtracting increased gross output under fuctional Animal Health Systems from total production loss under present Animal Health System.

Table 4.7

Estimates of Present and Potential Losses from Various Diseases Under the Present Animal Health Service - Animal Sector (1995)

Disease	Estimated Output (BZ$'000) (1)	Rate of Output Loss (2)	Nominal Gross Output Loss (BZ$'000) (3)	Optimal Rate of Output Loss (4)	Optimal Output Loss (BZ$'000) (5)
Bovine (Cattle):	6,347.00				
1. Black Leg (6)		1.0% Motality	417.06	1.0%	417.06
2. Parasitism		10.0% Output	634.70	2.0%	126.94
3. Malnutrition		10.0% output	634.70	0.0%	0.00
Sub-Total			1,269.40		126.94
Swine (Pigs):	9,362.00				
1. Parasitism		10.0% output	963.20	0.0%	0.00
2. Malnutrition		5.0% output	481.60	0.0%	0.00
Sub-Total			1,444.80		0.00
Avian (Chicken Broilers):	25,654.00				
1. Infectious Bursal Disease		10.0%	2,565.40	5.0%	1,282.70
Total	41,633.00		5,696.66		1,826.70
Increased Gross Output (7)					3,869.96

(1) Refers to nominal gross output for respective industries.
(2) Refers to rate of output loss under the present animal health system.
(3) Refers to gross output loss under the present animal health system.
(4) Refers to rate of output loss under a functional animal health system.
(5) Refers to gross output loss under a functional animal health system.
(6) Mortality rate refers to death rate of cattle population attributed to black leg; Gross output loss = 1994 census X 1.0% X $800 lbs/Animal X 0.90/lb.
(7) Refers to potential increased gross output attributed to a functional Animal Health System.

Table 4.8

Estimates of Present and Potential Losses from Various Diseases Under the Present Animal Health Service - Animal Sector (1995)

Disease	1994 Census *	Rate of Control Cost ($/Animal) **	Nominal Control Cost ($) #
Bovine (Cattle):	57,925.00		
1. Black Leg.		3.00	173,805.00
2. Parasitism		6.00	347,550.00
3. Malnutrition		10.00	570,925.00
Sub-Total			1,092,280.00
Swine (Pigs):	18,753.00		
1. Parasitism		3.75	70,256.25
2. Malnutrition			
Sub-Total			
Avian (Chicken - Broilers):			
1. Infectious Bursal Disease			
Total			1,162,536.20

Source: Dr. Victor Gongora and Statistics Unit. Ministry of Agriculture and Fisheries

* Refers to Livestock census for 1994 (Belize Livestock producers Association)

** Refers to average expenditure/Animal done by the private sector in controlling the corresponding diseases.

\# Refers to the total expenditure done by the private sector in controlling the corresponding diseases.

$19.8 million for traditional crops (Table 4.5)[74]. The highest losses are estimated to have occurred for bananas, citrus, sugarcane (traditional crops) and peppers (non-traditional). If there were no control measures or programs for pests and diseases and given the present pests and diseases in Belize, the potential crop output loss is estimated to be $144.5 million. Additional losses could reach $70.9 million. This estimate is based on the assumption that the three most significant pests in terms of potential damage exist simultaneously in Belize, in addition to the current losses already being incurred from other pests and diseases.

Based on existing information on disease, parasites and malnutrition in the animal sector, the total production loss is estimated to be $6.9 million (Table 4.6). The low losses in the livestock sector relative to crops is a reflection of its small size, its relatively good health status and that its output is sold mainly in the domestic market while the crops sector is heavily dependent on the export market. The potential loss is more than $3.6 million and could reach $10.4 million, in addition to the current production loss of $6.9 million. The potential loss estimate is based on the assumption that the present losses remain and that diseases (such as vesicular stomatitis, hog cholera & gumboro) that occurred during the past 10 years would re-occur. For instance, the positive testing for vesicular stomatitis in the past prevented Belize from exporting beef to the Caribbean. In addition, during the 1980's Belize successfully exported in excess of $2.3 million/annum worth of live cattle to Martinique for 1.5 years until the presence of equine infectious anaemia affected this export. For lack of information on the cost of control and eradication and present output loss, no estimate on potential output loss due to hog cholera is provided. However, this should not affect the analysis as hog cholera seems to be more related/restricted to border areas where there are imports of pigs from neighboring countries in times of deficit production in Belize.

The estimated nominal cost of controlling the more common diseases and animal health problems is $1.16 million (Table 4.6). However, in estimating the total output loss in the animal sector no account is taken for the total cost of controlling diseases due to the lack of data. For instance, it was not possible to disaggregate drug imports into veterinary drugs (vaccines, antibiotics etc.) and other drug imports. In addition, information on the costs to control outbreaks of hog cholera, vesicular stomatitis, Newcastle disease, gumboro and equine infectious anaemia is lacking. Additional losses which need to be taken into account are costs incurred by various institutions (such as internal quarantine, the Ministries of Health and National Security) related to sporadic disruptions when there are outbreaks of diseases and there is a temporary halt to processing of meats. Furthermore, the current strategy to control outbreaks for poultry and pigs is through vaccination where possible, which is effective but prevents Belize from entering export markets. An additional cost to the economy of the present animal health service is its weak credibility to certify and test for diseases to ensure that export sales are not disrupted similar to the 1980's.

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[74] These losses are based on estimates using the methodology developed by the ODA project on pests and diseases in Belize. Some estimates of crop losses go beyond $50.0 million per year.

The fisheries industry is extremely dependent on international trade for its survival, given that about 95% of its total output ($31 million in 1995) is exported. Even though the services related to quality assurance and inspection have deteriorated, the quality of fish products exported has so far remained acceptable, and the output loss due to poor fish health status remained low (Table 4.9). In instances where one or two containers of exports were returned, these were not due to any serious virus or bacteria but rather to harmless bacteria such as those found in the air (because of poor standards on temperature requirements for fish processing)[75]. However, the risk from potential output loss to the industry and to the economy in the future if the present quality assurance system stays in place could be significant because: (a) the fisheries sector is expanding at the rate of 20.0%/annum with a large proportion of the output going to export markets; (b) the resources allocated to fish health services continue to decline; and (c) exports could be affected in terms of price and quality if health requirements are not addressed, particularly given the increasing demands of importing countries to have several tests done and quality assurance systems (such as HACCP) in place.

Table 4.10 shows the present and potential losses under the current quarantine service, mainly internal quarantine[76]. Information on the output loss due to the Medfly and vampire bats is not available but it is estimated that the present loss from Medfly is the cause for zero exports of fresh produce from the southern part of Belize. The potential loss from Medfly, however, could easily surpass more than $4.7 million in export sales of only papayas and habanero peppers (based on exports of papayas and habanero pepper) to the U.S. market, if the Medfly zone extends to the northern part of Belize. Although Belize was certified screwworm free since June of 1992, data from 1989 to 1992 indicate that the output loss in the livestock sector from infestation by screwworm was approximately $1.5 million/annum. Based on this, the minimum economic benefit from having an effective internal quarantine service is estimated to be about $6.2 million - if Belize remains free of screwworm and exports of fresh produce from northern Belize are not affected.

Evaluation: In general, a decision to improve the AGHS should be based on the following criteria:

(a) the financial costs of the proposed new service minus increased revenue to be generated from the provision of services;

(b) the incremental output resulting from the new service; and

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[75] The low estimate of loss is based only on the low rate of rejection of exports. However, the total output loss should be much higher than indicated because inland aquaculture activities have been affected by various disease and virus problems but no estimation has been done on this.

[76] It is difficult to estimate the loss due to the introduction of pests and diseases from outside. Very little work has been done in the past on estimating the output loss due to pests and diseases coming into the country from external sources.

Table 4.9
Estimates of Present and Potential Output Loss in the Fisheries Sector (1995)

Exports (BZ$'000)	Domestic Sales (BZ$'000)	Total Output (BZ$'000)	Output Loss Under to the Present Health Service	Potential Output Loss Due to Non-Improvement of Diagnostic Capability
31,142.00	1,742.00	32,884.00	Very Small & Insignificant	Runs Risk of Increasing and Adversey Affecting Export Earnings & the Fisheries Sector

Source: Fisheries Department, MAF.

Table 4.10
Estimate of Present and Potential Losses Under the Present Quarantine Service

Quarantine	Industry	Present Output Loss ($)	Potential Gross Output Cost ($)
1. Medfly	Fresh produce - Papaya, Habanero Peppers; Citrus; Passion ruis; Mangoes, Canteloupe; Tomatoes; Almond; Watermelon; Breadfruit, etc.	Not available-small due to small exports of fresh produce from Medfly zone of Stann Creek & Toledo; no opportunity to export fresh produce to the US market from Southern Belize	4,700,000 Lose US market for fresh produce if Medfly zone extends to Northern Belize (1)
2. Screw-Worm	Livestock	None Certified Screw-Worm Free on June, 1992	1,500,000
3. Vampire Bat	Livestock	Not available	Malnutrition & Higher Mortality Rate
TOTAL		Small	6,200,000

Source: Belize Screew-Worm Eradication Program: 1993 Annual Report; Statistics Unit, MAF; Medfly File, MAF; An Alternative Cash Crop (the Papaya Industry) to Progressive Farmers.

(1) This refers to potential export income loss due to inability to export Papayas & Habanero Peppers to the USA market if the Medfly Zone were to be extanded to the whole country; this quantitative estimate was based on ampirical evidence of maximum exports/annum of Papayas & Habanero Peppers to the USA over the previous 5 years and on expected exports for this coming year.

(c) the economic and political risks to the agricultural sector and the economy, in terms of losses in output and export earnings and the country being perceived as having a low agricultural health status internationally should the current service not be strengthened.

Other factors which determine whether or not it is economically feasible to invest in modernizing the service are: (a) the effects on health; (b) the service's role as a facilitator for exports of animal and plant products; (c) the implications for Belize's agricultural trade under WTO and other trading agreements if the present service remains as is; and (d) the extent to which certain plant and animal pests and diseases are exclusively independent of the plant and animal health infrastructure but are more related to other factors.

Table 4.11 summarizes the estimated total economic benefits by improving Belize's AGHS. Basically, output losses currently experienced by the agricultural sector will be reduced, potential production losses will be avoided, acceptance of products in export markets will continue and the potential to export additional products exists.

Table 4.11
Estimated Economic Benefits of An Improved AGHS, 1995 (BZ$'000)

Health System	Incremental Gross Output*	Exports**	Risks of Pests and Diseases#	Quality	Total
Quarantine		(+)	6,200.00	(+)	6,200.00
Plant	12,759.00	(+)	(-)	(+)	12,759.00
Animal	3,869.96	(+)	(-)	(+)	3,869.96
Fish	(+)	31,142##	(-)	(+)	31,142.00
Total	16,628.96	31,142.00	6,200.00	(+)	53,970.96

* Refers to increased gross output that will be generated once a functional plant/animal health system is established.
** Refers to export earning that are dependent on strengthening the capacity of the current plant/animal health systems.
# Refers to potential output/export earnings loss by maintaining the current service.
Refers to nominal fish exports for 1995; exports for 1997 will require that HACCP standards be implemented.

The quantifiable benefits to the agricultural sector from an improved AGHS is estimated to be between $16.6 million to $54.0 million per year, or between 6.1% and 20% of the 1995 output level for this sector. It could be argued that under a best-case scenario $54 million would

be attributed to a future service which could come from three sources: (a) from increased gross output in crops ($12.8 million) or 7% of production and animal products ($3.9 million or 8.5% of 1995 production) for a sub-total of $16.6 million or 7% of the 1995 output level; (b) from ensuring that all fish exports from Belize would continue to be accepted in international markets (given exports of $31 million in 1995); and (c) ensuring that Belize remains free from screwworm and Medfly which could translate into potential export earnings of $4 million for papayas and $1 million in potential gross output of animal products that are screwworm free.

However, a more likely case scenario would be that of only $16.6 million in terms of economic benefits which could be attributed to an improved service in the short to medium term. In this case the main economic incentive for strengthening the service are benefits of increased gross output from crops and animal products totalling this amount. Limiting benefits to this figure is based on the following assumptions: (a) that the present service would be able to keep the certification status of Belize free of screwworm and Medfly; and (b) the FD in conjunction with the private sector would implement the HACCP system to meet export market requirements for marine products.

The benefits from the project will be higher in the non-traditional cropping sector in the longer run due to higher productivity from reduced pests and diseases - from present level of $25.5 million to nearly $4.4 million. Improvements in productivity in the traditional cropping sector will be low in the short run since this sector already has a strong plant health system. However, in the medium to the longer run, output losses will be reduced because of improved diagnostic, testing and more efficient response capabilities of the AGHS. For marine products output losses in the short to the long run can be significant, estimated to be all or part of the present total export earnings of $31 million. The major benefits will be in the form of retaining export markets based on product quality, reliability and consistency.

In general, the impact of the project will result in higher incomes for farmers, a level of self-sufficiency in some crops and lower foreign exchange expenditure on imports. Furthermore, keeping the health status of major activities free of pests and diseases, particularly the traditional crops, poultry and marine products is critical for the agricultural sector and the economy. In the crops sector total gross output was more than $192 million in 1995, of which the three traditional commodities (bananas, citrus and sugarcane) contributed more than 73% and more than 70% of foreign exchange earnings. In the livestock sector, total animal output for 1995 was $47.6 million with more than 53% coming from the poultry industry. Belize is self-sufficient in poultry products; therefore, maintaining a healthy industry contributes significant economic benefits to the economy.

The project will provide benefits by facilitating more efficient use of inputs in agricultural production. Agricultural chemicals used by farmers are generally regarded as being abusive, resulting in excessive imports of pesticide and fertilizer. In 1995 total imports of such chemicals was $18.5 million. Through strengthening the diagnostic and laboratory capabilities, the PCB and improvements in the regulatory framework, the project will facilitate improved application of fertilizers and other chemicals and assure higher quality of feeds. The economic benefits will

be lower imports of these inputs and costs of production and higher productivity for many non-traditional crops, as well as positive impacts on the environment.

Besides the incremental changes in total output, an improved AGHS will provide other tangible and intangible benefits to Belize. The project will contribute to lowering the health risks and improving safety for the population and tourists, through testing and validating food product quality by the CIL, providing quality assurance systems and ensuring minimum health standards and requirements are met.

At the international level, Belize will be able to provide more accurate information to its trading partners and to regional and international organizations of its health status and access data bases to support its agricultural health programs[77]. As indicated before, the contemporary structure of Belizean agriculture reflects a high dependence on international trade for its growth and sustainability. Even for animal products, it is important that export markets be penetrated, otherwise, lower economies of scale will continue to impede efficiency in animal production resulting in high domestic prices and little incentive for entrepreneurs to improve standards to meet export market requirements. With trade liberalization and a weak and inefficient AGHS, domestic production will not be able to compete with cheaper imports. Belize also needs to diversify its production and agricultural export base in the medium and longer run if an expanding, sustainable and a competitive agriculture is to be assured. Furthermore, it needs to project and maintain an image of a country free of certain diseases and pests and having a reputable inspection, diagnostic and quality assurance system in place, etc., so that its accreditation could be easily assured.

Within the past decade, Latin American and Caribbean countries have been engaged in a number of regional trading blocks, multilateral trade agreements and bilateral trade accords which promise economic various benefits. While free trade is being promoted in these frameworks, non-tariff barriers such as phytozoosanitary measures and more stringent health and safety standards are being imposed for products traded. Under NAFTA the U.S. is allowed to prohibit all imports that do not meet U.S. standards. The project will provide Belize with the necessary wherewithal for its products to meet the trade and health safety requirements to participate in a more competitive trading environment.

4.2.2 Technical and Institutional Viability

Without the project, the quality of Belize's public agricultural health services will continue to deteriorate. Under the present institutional arrangements, budget constraints of the GOB and public service regulations, resources (both human and financial) are insufficient and are allocated inefficiently, and cost recovery measures are non-existent. Investments in the public agricultural health service has been declining continuously for several years, and the present and foreseeable future of the financial situation of the GOB do not indicate that this trend

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[77] The experiences of the U.K. recently regarding the existence of mad-cow disease is an excellent example of the implications which pest and disease problems can create for a country in international trade.

is likely to reverse. In addition, the service is fragmented as they are provided by several institutions with little coordination. Furthermore, the perception that the GOB is obligated to provide services "free" is one that is synonymous with the traditional public sector. This perception will continue if the services remain as they are..

Belize is a small country with a relatively small agricultural health service and limited financial resources. Therefore, there is need to consolidate the various services into a more integrated framework that facilitates complementarily, coordination and information sharing with ease. With the project, a new institutional arrangement will result in the provision of more efficient and cost effective services. The creation of the NAGHS is a viable institutional option that satisfies these criteria. Mechanisms will be established that will allow the NAGHS to provide services in close coordination with the private sector. Various stakeholders - public sector, commodity groups, private producers and other users in the planning, policy-making, provision of technical and other advisory inputs as well as securing alternative sources of financing.

With the NAGHS, agricultural health activities will be more concentrated and cost recovery mechanisms will be executed to ensure long term sustainability. The NAGHS will have greater autonomy, access and flexibility in the use of financial resources, and institutional flexibility to respond to internal and external demands. Creating the C/L will provide economies of scale in the provision of a wider range of laboratory and diagnostic services.

The NAGHS will execute the GOB's agricultural health policies and retain its critical linkages with units of the MAF without compromising the standards that are needed for an efficient service. In addition, creation of the NAGHS will contribute to the process of institutional reform in the public sector, which is much needed for increasing efficiency, reducing the cost of government and spreading the burden of providing critical services to users and beneficiaries. This is a trend that most countries are pursuing in their efforts to provide more efficient public agricultural health and other services.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Belize's economy achieved impressive growth rates in the last decade, primarily due to an expanding agricultural sector and the country's access to preferential markets for its major exports - sugar, bananas and citrus products. The country continues to be highly dependent on these products and the same markets for foreign exchange earnings and overall economic growth. However, rapid changes in the international economy are forcing countries to have more open economies and fewer trade barriers and be more competitive. In addition, international trade agreements, the adoption of global measures to safeguard human health and promote free trade and the emergence of regional integration grouping (NAFTA, CARICOM, etc.) are inducing countries to be more flexible and adjust rapidly to new demands and requirements. These forces also impact Belize and it requires the country to adopt measures and policies to make its economy more open, reduce dependence on the preferential markets which are becoming less important, accelerate the agricultural diversification process and make its agricultural sector more competitive in both the domestic and export markets.

The country's agricultural support services, particularly those provided by the public sector are deficient in many respects to support a more competitive sector. In particular, the agricultural health services provided by the public sector are inefficient and ineffective. Although Belize has not experienced major problems in agricultural health, the situation has reached crisis proportions in several areas and knowledge of the actual status is very limited. The MAF which is the major public sector institution that provides such services has severe resource constraints, and policy priorities for the sector are not adequately defined. The MAF's AGHS is fragmented and there is weak coordination between the various units of the service and with other departments of the MAF. This weakness is also extended to the working relationship the Ministry has with other agencies supplying public agricultural health services.

The MAF has stopped doing routine diagnostic and testing activities and there is no monitoring and surveillance of the pest and disease situation. Except for the facilities of plant protection, its infrastructure and laboratories are in a state of disrepair, lacking several pieces of basic equipment, supplies and other materials and the necessary human and financial resources for operations. The soils lab. has not been functional for a few years and the fisheries lab. at the FD does not have the diagnostic and testing capabilities to meet the needs of the fisheries sector. Due to the deficiencies of the labs. and few services provided, both the country's population and the large tourist sector face high risks from potential pest and disease effects. More important however, the threat of disruptions in agricultural production and trade in the future are high, and the potential economic impacts on the country could be severe.

5.2 Recommendations

The deficiencies in the agricultural health service need to be urgently addressed if Belize's agriculture is to continue to play a major role in economic growth, and the medium and long term goals for the sector are to be achieved. The strategy to address these problems is to reorganize and streamline the services provided, by consolidating the public agricultural health activities and responsibilities in a single integrated entity. This project proposal recommends that a National Agricultural Health Service (NAGHS) be established to assume the responsibilities, functions and activities of those units of the MAF that provide plant and animal health services, quarantine and inspection services, laboratory services and other regulatory activities. The PCB will be an integral part of the NAGHS. In addition, the NAGHS will provide laboratory services for the PHB and the BOS which these agencies should be providing but are unable to. The NAGHS will be headquartered at Central Farm.

Two alternative institutional arrangements are suggested for the NAGHS. In the first alternative, the NAGHS will be a separate unit in the MAF with greater autonomy and flexibility to make decisions, manage its resources and impose user fees and charges for certain services. it will have a status similar to the Agriculture and Fisheries Departments in the MAF. In the second alternative, the proposal is to make the NAGHS a quasi-public sector institution independent of the MAF. Both alternatives require that strong linkages and mechanisms of coordination be developed with various units of the MAF. Mechanisms for stakeholder involvement in the service are also recommended.

Legislation will be required to create the NAGHS and provide it with the necessary legal backing to charge fees for its services, prioritize its activities and manage its human and financial resources with greater flexibility. Even in the first alternative, the NAGHS will not provide services efficiently unless it is able to disengage itself from the institutional rigidities and other constraints which presently affect the MAF and other government ministries.

The project also proposes to streamline the operations of the CVL by creating the CIL which will be responsible for providing a wider range of diagnostic and testing services. Under the CIL, the laboratory activities and needs of the FD, the PHB and the BOS will be consolidated in a single unit which will provide these more cost effectively and avoid duplication and inefficient resource use by several agencies.

Buildings and other physical infrastructure will be repaired and new ones constructed and refurbished to provide adequate facilities for the labs., offices, clinics and quarantine stations. The soils lab. will become operational by repairing existing equipment and provide it with additional equipment and supplies. The CIL, the plant protection lab., animal health clinics and quarantine stations will be provided with the necessary equipment and supplies to provide services more efficiently. Regarding the provision of vehicles, the project proposes an alternative approach to resolve the transport problems of personnel. Instead of supplying vehicles to the service, a revolving fund will be established to provide loans to eligible staff members to purchase vehicles, and a monthly allowance will given for maintenance. This

approach will be more cost effective and it will impose fewer costs in the medium and long run on the service.

The investment costs in the project are the same for either institutional alternative. However, personnel costs are higher in the second alternative due to payment of gratuities in lieu of the benefits of a pension which would be provided under the first alternative. Given the difference in personnel costs, the political and institutional feasibility of both alternatives, it is recommended that the institutional arrangement under alternative one be adopted.

Besides upgrading, strengthening and streamlining the operations of the AGHS, several other issues will need to be addressed if the project is to be successful and the longer term goals of the NAGHS are to be achieved. These are discussed below.

(a) Given that the institutional arrangement under alternative one is recommended, it is critical that both legislation and the MAF provide the necessary autonomy needed for the NAGHS to operate with a greater degree of management and financial independence compared to other departments of the Ministry. Without the supporting legislation and the MAF's provision of greater autonomy, the efficiency of the services of the NAGHS will be affected in a short period of time. Budgetary support to the NAGHS should be done through block allocation rather than the current procedure of providing funds on a monthly basis. In addition, since user fees and revenue will be generated in the new service, it is recommended that the NAGHS have a separate finance and accounting system in order to manage financial resources effectively.

(b) Strong political support is required if the NAGHS is to be created and become successful. The political will be required from the MAF, as well as from the Ministries of Finance, Health and Trade,

(c) The NAGHS should have a similar status such as that of the Agriculture and the Fisheries Departments of the MAF.

(d) The administrative and reporting system should be clearly defined. Although technical assistance will be provided to support the design of operational guidelines, the relationship of the NAGHS to other major offices in the MAF such as those of the Minister, the Permanent Secretary, the CAO and other units/departments of the MAF.

(e) Training in management and administration and in various technical areas is for developing the longer term capability of the service. In addition, technicians of the service should be sensitized and be provided with training in legal aspects of the service. This would contribute to improved efficiency in job performance and impose less burdens on the legal department of the GOB.

(f) Although the service will need to continue to receive public funding, generating revenues from the sale of various services will be critical for increased investments and sustainability. Exclusive dependence on the GOB's resources will eventually lead to deterioration of the service. Various client should be identified and their ability to pay be assessed. Those with the ability to pay for certain services include the export sectors and commercial producers. In addition, revenue could be raised from fees charged to issue permits and licenses.

(g) The success of the service will depend on the linkages it develops with other units of the MAF and with its stakeholders. In this regard, the MAF needs to strengthen its institutional framework, streamline its operations and define policy priorities for the sector. Unless the MAF is strengthened, the NAGHS will have limited success. Mechanisms for private sector participation in the planning, policy development and in the provision of advisory support are also critical for the success of the NAGHS. This is largely because the private sector will be the largest group of direct beneficiaries of the service.

(h) Special linkages and coordination will need to be developed with the extension division of the MAF. Extension staff should undergo training simultaneously with the technical staff of the NAGHS. In addition, support will be needed by the extension staff to organize producer groups and farmers for training activities, etc., to minimize dependence on the service and prevent resources from being spread too thinly.

APPENDIX A
Statistical Tables

Table A.1
Percent Contribution to Gross Domestic Product by Industrial Origin at Factor Cost (Constant 1984 Prices)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Total GDP (BZ$ Million)	365.7	373.2	370.9	365.1	371.5	373.0	384.3	429.8	456.9	517.4	570.6	588.2	644.2	672.2	682.4	706.3
A. Primary Activities	20.7	20.5	21.8	21.0	21.1	21.1	19.7	21.2	20.0	18.8	19.2	19.8	20.4	19.6	19.8	20.3
Agriculture	15.4	15.1	18.3	15.7	15.8	15.6	14.9	15.2	13.8	13.2	14.0	13.2	13.9	13.2	13.4	13.1
Forestry & Logging	2.3	1.8	2.2	1.8	2.0	1.9	1.6	3.0	3.1	2.5	2.3	3.0	2.8	2.5	2.8	2.4
Fishing	2.8	3.3	3.0	3.2	3.1	3.3	2.7	2.6	2.6	2.6	2.3	2.5	2.9	3.1	2.9	3.3
Mining	0.2	0.2	0.2	0.3	0.3	0.4	0.4	0.4	0.5	0.5	0.7	0.9	0.8	0.8	0.7	0.7
B. Secondary Activities	28.4	26.8	28.2	26.0	26.7	26.7	26.7	26.7	25.7	26.1	26.1	26.0	25.9	26.7	25.6	25.5
Manufacturing	21.5	21.9	21.8	21.9	19.7	19.8	19.7	18.8	17.6	17.2	17.2	16.7	16.4	16.4	16.9	17.0
Electricity & Water	1.3	1.4	1.8	1.7	1.7	1.8	1.9	1.8	1.9	1.7	1.8	1.9	1.9	2.0	2.1	2.1
Construction	5.5	5.6	4.8	4.4	5.4	5.2	5.2	8.1	8.3	7.1	7.1	7.4	7.6	8.3	6.5	6.4
C. Service	54.8	54.5	53.6	54.4	55.5	55.7	57.2	55.8	58.2	58.7	58.3	57.9	57.1	57.0	58.0	57.6
Trade, Rest. & Hotels	20.4	19.4	16.1	14.8	15.5	14.5	15.5	15.9	17.2	18.7	19.2	18.3	17.8	17.7	18.2	18.0
Transport & Communications	8.0	6.5	7.6	8.3	8.7	8.9	9.6	9.5	11.2	12.4	12.6	13.3	14.4	14.6	14.6	14.7
Finance & Insurance	5.3	5.4	4.9	4.8	4.7	4.9	5.0	5.2	5.5	5.1	5.1	4.9	4.7	4.7	4.9	4.9
Real Estate & Bus. Serv.	5.9	5.9	5.7	5.8	5.7	5.8	5.8	5.5	5.5	5.3	5.1	5.1	4.9	4.9	5.0	5.1
Public Administration	8.2	8.4	9.9	11.0	11.1	11.4	11.2	10.6	10.0	9.2	8.8	8.8	8.3	8.2	8.4	8.1
Comm. & Other Services	8.9	9.0	9.3	9.7	9.8	10.0	10.0	9.2	8.9	8.0	7.5	7.5	7.0	6.9	7.0	6.9
D. Imputed Bank Service Charges (deduct)	3.8	3.8	3.5	3.4	3.3	3.5	3.6	3.7	3.9	3.6	3.6	3.4	3.4	3.4	3.3	3.3
Per Capita GDP (BZ$)	2,516	2,500	2,420	2,321	2,300	2,249	2,257	2,457	2,545	2,807	3,015	3,027	3,229	3,279	3,265	3,279
Annual Change in GDP (%)		2.1	(0.6)	(1.5)	1.7	0.4	3.0	11.8	6.3	13.2	10.3	3.1	9.5	4.3	1.5	3.8
Annual Change in Per Capita GDP (%)		-0.6	-3.2	-4.1	-0.9	-2.2	0.4	8.9	3.6	10.3	7.4	0.4	6.7	1.5	-0.4	0.4
Implicit Deflator (1984=100)	93.1	91.2	84.8	91.4	100.0	98.2	102.2	111.6	116.3	118.6	118.7	123.7	127.9	134.1	135.8	139.2

Source: Central Statistical Office, Belmopan

Table A.2
Output of Major Crops and Livestock Products, 1980-95

Products	Crop Production and Area Cultivated										
	1980	1982	1984	1986	1988	1990	1991	1992	1993	1994	1995
Sugar Cane ('000 MT)	1,032	1,116	1,040	869	791	1,091	1,134	1,123	1,162	1,217	1,041
Sugar ('000 MT)	105	106	103	94	63	101	103	102	101	107	105
Hectares	24,706	24,706	23,696	23,066	22,681	23,693	24,301	24,301	26,327	24,291	24,300
Banana:											
Output ('000 of 42 lb. boxes)	803	536	568	671	1,457	1,723	1,157	1,545	2,140	2,815	2,742
Hectares	597	648	631	699	1,058	2,506	2,071	2,106	1,763	2,147	1,983
Oranges:											
Output ('000 of 90 lb. boxes)	1,100	1,058	1,124	1,265	1,336	1,606	1,203	2,407	1,793	2,020	3,132
Hectares	N/A	N/A	N/A	N/A	5,939	12,621	16,658	19,191	22,439	8,066	12,047
Grapefruit:											
Output ('000 of 90 lb. boxes)	408	706	317	650	841	1,103	792	1,192	1,015	833	1,214
Hectares	N/A	N/A	N/A	1,266	3,397	3,569	4,832	4,962	5,537	454	516
Corn:											
Output (MT)	18,864	21,227	16,192	18,521	23,170	16,710	31,899	25,563	27,245	23,259	26,200
Hectares	10,531	11,134	11,790	11,290	13,464	9,853	11,195	11,930	13,041	12,114	14,605
Rice:											
Output (MT)	8,636	8,091	5,685	4,415	5,562	4,624	4,802	6,658	9,766	6,489	9,627
Hectares	3,261	3,314	2,521	2,390	2,755	2,061	3,717	2,936	4,457	4,502	4,933
R.K. Beans:											
Output (MT)	1,397	1,773	1,266	1,822	2,260	2,573	3,561	2,506	3,631	3,207	3,140
Hectares	2,491	2,815	1,631	2,306	3,865	3,964	3,362	3,406	4,017	2,902	3,877
Cocoa, Dry Beans (MT)	5	17	55	60	57	167	91	143	72	24	34
	Production of Livestock and Marine Products										
Cattle:											
Nos. Slaughtered	6,600	6,042	6,196	7,091	7,459	7,870	7,157	6,706	8,296	7,636	8,245
Dressed Weight*	1,050	879	1,917	1,110	912	1,465	1,416	1,519	1,367	1,256	1,472
Pigs:											
Nos. Slaughtered	N/A	5,773	6,251	6,411	8,160	11,553	6,627	10,955	11,226	13,506	12,106
Dressed Weight*	221	151	265	300	416	650	460	571	579	774	694
Poultry:											
Nos. Slaughtered	1,405	1,789	1,966	2,250	2,831	3,882	4,160	5,051	5,315	4,606	4,419
Dressed Weight*	1,955	2,755	3,033	3,131	5,055	6,131	6,538	7,831	7,611	6,789	7,051
Milk ('000 kgs)	290	319	531	1,043	1,173	1,243	1,296	1,136	1,304	3,029	1,318
Honey ('000 kgs)	251	227	287	306	220	72	62	62	55	72	97
Eggs ('000 kgs)**	1,747	1,739	1,886	1,926	1,996	2,067	2,144	2,231	2,296	2,370	2,431
Marine Products ('000 lbs)	832	1,021	1,115	1,159	1,412	1,576	1,712	2,497	2,489	2,706	2,785

* Dressed Weight in '000 Kgs. ** Data for 1994 and 1995 are in '000 Dozens Source: CSO, Ministry of Agriculture

Table A.3
Value of Domestic Exports, 1980-95 (BZ$ Million)

Items	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Sugar	95.40	75.12	68.67	70.93	65.07	40.85	62.91	62.62	70.03	68.13	85.53	83.41	75.26	82.91	80.62	95.50
Molasses	4.40	2.40	1.80	1.20	2.30	1.70	1.00	1.10	1.00	1.30	6.50	7.50	4.50	9.60	10.40	5.60
Bananas	7.00	4.30	4.30	4.80	6.30	6.60	9.20	14.30	17.20	18.10	19.70	14.70	20.50	24.20	29.70	34.60
Citrus Concentrates	12.70	13.00	14.00	12.60	19.50	24.20	22.20	32.00	34.60	36.90	44.30	17.90	54.80	27.80	33.60	58.30
Marine Products	8.40	14.40	13.30	15.00	13.40	15.00	14.80	16.90	16.20	13.30	10.40	11.70	22.40	26.00	26.40	31.10
Forestry Products	2.30	2.40	3.70	2.70	2.00	1.00	0.50	4.20	5.40	4.70	3.80	5.90	4.60	4.20	7.60	3.90
Other Agricutlural Exports	5.10	5.60	5.10	6.30	5.90	3.40	5.90	11.50	8.70	8.90	10.20	14.70	16.70	13.20	13.90	18.20
Total Agricultural Exports	135.40	117.20	108.80	113.60	114.50	92.60	116.50	142.60	153.10	153.30	160.50	155.70	199.00	188.00	202.30	247.40
Other Exports	28.70	32.20	12.70	16.70	31.20	36.10	32.40	31.20	37.30	34.70	36.50	41.40	32.10	41.20	52.70	38.40
Total Domestic Exports	164.10	149.50	121.50	130.30	145.70	128.90	149.00	173.80	190.30	188.00	216.90	197.10	231.10	229.20	255.00	285.60

Source: MAF

Table A.4
Recurrent Estimates for the AGHS, Ministry of Agriculture and Fisheries
1989/90 - 1996/97 (BZ$)

Service	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97
Plant Health Service:								
Personal Emoluments	34,579	36,988	43,000	45,000	59,029	78,542	123,891	44,069
Operating Costs	7,820	7,056	15,628	19,609	90,605	64,413	68,240	1,900
Sub-Total	42,399	44,044	58,628	64,609	149,634	142,955	192,131	45,969
Animal Health Service:								
Personal Emoluments	415,327	416,894	415,352	458,564	420,097	504,755	491,438	411,701
Operating Costs	107,242	118,828	112,752	120,842	120,842	93,960	82,334	80,460
Sub-Total	522,569	535,722	528,104	579,406	540,939	598,715	573,772	492,161
Quarantine Services:								
Personal Emoluments	140,710	143,406	147,618	152,990	183,070	192,109	205,772	175,547
Operating Costs	22,100	19,342	35,412	38,940	38,940	29,500	18,270	96,200
Sub-Total	162,810	162,748	183,030	191,930	222,010	221,609	224,042	271,747
Medfly Program:								
Personal Emoluments	-	38,506	39,920	41,159	59,149	79,584	87,860	89,012
Operating Costs	890	41,660	63,268	72,100	72,100	161,100	57,010	41,725
Sub-Total	890	80,166	103,188	113,259	131,249	240,684	144,870	130,737
Screwworm Program:								
Personal Emoluments								99,694
Operating Costs								15,800
Sub-Total								115,494
Total Personal Emoluments	590,616	635,794	645,889	697,713	721,345	854,990	908,961	820,023
Total Operating Costs	138,052	166,886	227,060	251,491	322,487	348,973	225,854	236,085
TOTAL COSTS	728,668	822,680	872,949	949,204	1,043,832	1,203,963	1,134,815	1,056,108
Personal Emoluments as a % of Total Cost	81.1%	77.3%	74.0%	73.5%	69.1%	71.0%	80.1%	77.6%
TOTAL RECURRENT BUDGET FOR MAF	5,076,582	5,387,015	5,842,952	5,773,889	5,831,485	6,058,027	5,848,718	4,654,790
AGHS Budget as a % of Total MAF Budget	14.4%	15.3%	14.9%	16.4%	17.9%	19.9%	19.4%	22.7%

Source: MAF

Table A.5
Actual Expenditures by the AGHS, Ministry of Agriculture and Fisheries
1989/90 - 1994/95 (BZ$)

Service	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95
Plant Health Service: *						
Personal Emoluments	34,579	36,966	40,032	35,966	45,631	78,542
Operating Costs	11,718	12,427	15,117	16,093	12,461	19,416
Sub-Total	46,297	49,415	55,149	52,061	58,092	97,958
Animal Health Service:						
Personal Emoluments	301,696	296,404	318,300	358,100	499,000	505,000
Operating Costs	88,369	106,158	109,100	113,300	102,600	76,000
Sub-Total	390,065	402,562	427,400	471,400	601,600	581,000
Quarantine Service:						
Personal Emoluments	137,297	141,621	153,000	100,600	217,700	208,400
Operating Costs	12,989	15,304	23,200	20,600	16,400	12,700
Sub-Total	150,286	156,925	176,200	121,200	234,100	221,100
Medfly Program:						
Personal Emoluments	12,680	28,286	36,500	41,700	65,600	88,100
Operating Costs	39,551	19,485	64,500	70,500	76,600	65,100
Sub-Total	52,431	47,771	101,000	112,200	142,400	153,200
Chemistry Lab.						
Operating Costs	11,718	12,427	9,542	10,945	7,110	12,343
Total Personal Emoluments	486,452	503,299	547,832	536,366	827,931	880,042
Total Operating Costs	164,366	165,601	221,459	234,436	215,371	165,559
TOTAL COSTS	650,817	669,100	769,291	770,806	1,043,302	1,065,601
Personal Emoluments as a % of Total Cost	74.7%	75.2%	71.2%	69.9%	79.4%	82.6%

* These are approximate estimates. The budget for the Plant Protection Unit is part of the overall budget of Central Farm.

Source: MAF

Table A.6
Estimates for Capital II Subheads for AGHS, Ministry of Agriculture and Fisheries
1989/90 - 1996/97 (BZ$)

Description	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97
Medfly Eradication Programme	0	120,000	120,000	77,474	223,001	200,000	65,000	200,000
Animal Disease Surveillance	0	0	0	0	0	10,000	10,000	35,000
Vet. Section-Central Farm	500	0	0	0	0	0	0	0
Veterinary Clinic	0	0	0	0	25,000	0	0	0
Quarantine Services	0	0	0	21,000	10,060	0	0	0
Central Vet. Lab. Bze. City	51,000	0	0	0	0	0	0	0
Improvements of Vet. Service -OW	0	0	0	5,000	12,684	0	0	0
Agricultural Chemical Laboratory	0	0	0	42,193	0	0	0	0
Plant Protection Lab.	0	0	0	0	10,000	40,000	0	20,000
Animal Health Services	0	41,100	0	0	0	0	0	0
Improvement of Research	0	0	0	0	0	0	0	0
Rehab. of R. Hill Quarantine Station	0	64,127	60,000	0	0	0	0	0
Disease Control - Banana Industry	0	0	50,000	22,000	0	0	0	0
Reloc./Replace of Insinerator - Czl	0	70,000	0	0	0	0	0	0
Citrus Tristeza Virus (CTV)	0	0	0	0	0	50,000	10,000	10,000
Consultany Services (CTV)	0	0	0	0	0	0	0	0
Anti-Brucellosis Campaign	0	0	0	0	0	0	0	0
Pesticide Control Board (PCB)	0	0	0	0	33,942	65,000	30,000	20,000
Vampire Bat Control Project	0	0	90,000	46,140	26,343	30,000	0	0
Livestock Quarantine Station - Cayo	0	0	50,000	50,000	0	0	0	0
Laboratory Renovation Project	0	0	50,000	0	0	0	0	0
Equipment/repairs for Vet. services/clinic	0	0	100,000	50,000	0	0	0	0
Papaya Hot Air Treatment Fac.	0	0	0	0	1,135	0	0	0
Veterinary Lab. Reagents & Supplies	0	168,449	0	0	0	100,000	60,000	10,000
Soil & Tissue Lab. - Central Farm	0	0	0	0	4,939	0	0	0
Screwworm Eradication Programme	341,660	120,000	353,348	250,000	182,503	200,000	150,000	0
TOTAL CAPITAL II OF PAHS	393,160	563,676	873,348	563,807	529,627	695,000	325,000	295,000
TOTAL CAPITAL II FOR MAF	2,493,993	2,987,439	4,169,832	5,521,072	4,045,261	2,612,550	1,735,000	1,140,000
AGHS as a % of Total Capital II for MAF	15.6%	19.7%	20.9%	10.2%	13.1%	26.6%	16.7%	25.9%

Source: MAF

Table A.7

Actual Expenditure under Capital II Subheads for AGHS, Ministry of Agriculture and Fisheries

1989/96 - 1995/96 (BZ$)

Description	1989/96	1990/91	1991/92	1992/93	1993/94	1994/96	1995/96
Medfly Eradication Programme	0	100,000	21,326	98,461	223,001	70,000	240,000
Animal Disease Surveillance	0	0	0	0	0	10,000	34,000
Vet. Section-Central Farm	0	0	0	0	0	0	0
Veterinary Clinic	625	0	0	0	0	0	0
Quarantine Services	0	0	0	0	10,060	0	0
Central Vet. Lab. Bze. City	31,000	0	0	0	0	0	0
Improvements of Vet. Service -OW	0	0	0	0	12,684	0	0
Agricultural Chemical Laboratory	0	0	0	37,767	0	0	0
Plant Protection Lab.	0	0	0	0	10,000	0	50,033
Animal Health Services	0	0	0	0	0	0	0
Improvement of Research	0	0	0	0	0	0	0
Rehab. of R. Hill Quarantine Station	0	0	0	0	0	0	0
Disease Control - Banana Industry	0	0	1,503	560	0	0	0
Reloc./Replace of Insinerator - Czl	0	1,000	0	0	0	0	0
Citrus Tristeza Virus (CTV)	0	0	0	0	0	30,000	0
Consultany Services (CTV)	0	0	0	0	80,000	0	0
Anti-Brucellosis Campaign	0	0	8,746	0	0	0	0
Pesticide Control Board (PCB)	0	0	0	0	33,942	15,000	2,535
Vampire Bat Control Project	0	0	5,724	51,031	26,343	25,000	0
Livestock Quarantine Station - Cayo	0	0	150	15,112	0	0	0
Laboratory Renovation Project	0	0	6,154	0	0	0	0
Equipment/repairs for Vet. services/clinic	0	0	14,252	50,000	0	0	0
Papaya Hot Air Treatment Fac.	0	0	0	0	1,135	0	0
Veterinary Lab. Reagents & Supplies	0	17,000	0	0	0	55,000	271
Soil & Tissue Lab. - Central Farm	0	0	0	0	4,939	0	0
Screwworm Eradication Programme	125,000	100,000	294,142	250,000	182,503	150,000	150,000
TOTAL ESTIMATES FOR PAHS	156,625	218,000	351,997	500,931	584,627	355,000	476,839

Source: MAF

Table A.8

Staff Responsibilities of the Plant Health Service, MAF

Speciality	Responsibility	Considerations	LOT	Years Exp.
Head (Plant Pathologist) Diagnostics	* Lead and manage the service * Participate in training at BCA, extension officers and farmers * Represent Ministry in Control Boards (CGA, BGA, PCB) regional organizations (oirsa, caraphin, carinet) * Advise on matters relating to pesticide use and provide information for policy formation * Contribute to project development	The head is a senior pathologist on a contract, which will end soon. Could be involved in management training.	MSc.	15
Plant Pathologist (General Pathology) Diagnostics & Management	* Conducts diagnostics for virus identification * Leads in virus and bacterial disease diagnostics * Liaise and support IPM services and other NGO's (CCDC, BFAC, Organic farming promoters) * Participate in training at BCA, of farmers and extension	Training was supported by ODA project in UK and for in-service training in IPM at CATIE. Would like additional training in Nematology, virology. Position not established	MSc.	1
Entomoligist Biological control & insect identification	* Diagnostics and identification of insect pests * Provides technical expertise for the Medfly, Africanized bees and Varroa mites program * Contribute to bio-control of Brown Citrus Aphid program with CREI * One of the national coordinator of medfly and contribute to he campaing for control	Training was supported by the ODA project in UK and NARMAP contributed to the in-service training at CATIE. Position not established. Needs training in desktop publishing and management	MSc.	1
Documentation/ data management, diagonostics of disease in vegetables	* Test integrated control measures for pests and diseases * Lead in IPM activities * Research on mite control * Participate in teaching at BCA * Efficacy test for control of broad mite * Development of technical bulletins	Training was supported by NARMPA and did in-service training at CATIE in Biological Control. Needs training in lab. instrumentation	MSc.	6
	* Lead in developing P.H.S. dta-base * Conduct diagnostics in Plant Pathology and resource person in citrus survey * Lead in extension linkage for P.H.S. * Resource person in training	Training supported by MAF at EARTH and currently considering doing an M.Sc. Needs training in DBase management and instrumentation	BSc.	2

Table A.9
Partial List of Plant Diseases and Pests in Belize

Crops	No. of Diseases	No. of Pests
Food Crops:		
Rice	10	11
Beans	16	13
Peanuts	5	5
Corn	12	12
Sorghum	4	3
Tobacco	2	0
Sugarcane	17	5
Soybean	9	9
Cowpea	6	8
Chick pea	3	3
Fava bean	0	0
Lima bean	0	0
Mung bean	1	1
Sweet pea	1	0
Dry pea	1	0
Pigeon pea	1	2
Sesame	2	0
Sunflower	1	0
Tree Crops:		
Avocado	2	2
Musa Sp.	12	12
Citrus	36	17
Coconut	6	5
Coffee	2	0
Mango	5	5
Papaya	6	5
Golden plum	2	1
Ginger	1	1
Yam	0	1
Irish potato	1	1
Sweet potato	0	0
Cassava	0	0

Source: PPU, MAF

Table A.10
PHS's Relationship with Various Organizations

Organization	Function	Nature of relationship
CREI	Citrus research and education, Private sector & Local	- Research collab & board member - Assist with survey - Assist with diagnostics & identification
OIRSA	Regional regulation of plant and animal health	- Member of steering committee (2 meetings attended) - Information up-date on state of the art plant health Belize - Harmonize regional regulation
CARAPHIN	Information network on plant & animal health	- Steering committee member, update quarantine information - Participate in 3 training sessions - In-kind contributions made software, newsletter
CARINET	IPM network	- Steering committee member - Update on quarantine information
CARDI	General plant health	- Participate in training and disease monitoring with special focus on rice and peanuts

Source: PPU, MAF

Table A.11
Major Pest and Disease Control Activities by the Private Sector

Organization	Crop	Control Mechanism Implemented	Pest & Disease Controlled	Potential Value	Cost to Org.
Citrus Growers Association (CREI)	Oranges Grapefruit	- Indexing and monitoring being done by CREI in collaboration with international org. and U.S. universities; there is plan to pest nursery certification in place. - Fruit-flies control is currently being undertaken by the public sector /Anastrepha) and the private sector does its monitoring for Mexican fruit-fly. Use of bait and insecticide (Malatheon). - CREI is currently researching the post bloom drop problem. - Monitoring for parasitoids & using chemical control for CLM. - Trapping program in place to look for BCA.	1. Citrus tristiza virus 2. Fruit-flies (Anastrepha spp) 3. Atta cephalotes we-wee ants 4. Trigona, corvina (drunken baymen) 5. Mexican fruit-fly 6. Post bloom drop (Premature fruit drop) 7. Citrus leaf minor (CLM) 8. Brown Citrus Aphid (BCA)	12.8 2.5 2.5	$250,000/year Current operational budget $287,634
Banana Growers (Quality Control Unit)	Banana	- BGA has a lab. for monitoring and surveillacne for control of black sigatoka. Participate with govt. for mokko disease eradication. - Contract regional experts for nematode and soil analyses and other technologies with aid of Fyffes. - BGA buys chemicals from pest control sellers, who may apply chemical eg nematicide. Association committed to contribute the financing of the rehabilitation of Central Farm soils lab. Approx. cost $100,000 BGA can contribute $20,000	1. Mycosphaerella fijiensis Black sigatoka 2. Post harvest fruit rot anthracnose 3. Trigona corvina 4. Cosmopolites sordidus banana borer 5. Radopholus similis nematode	7.4 1.5 1.5 .7 .7	
Sugarcane Growers	Sugarcane	Chemical control	1. Weeds 2. Aeneolamia postica jugata (froghopper) 3. Ustilago scitaminea smut	4.2 2.5 1.7	
Pepper Growers	Pepper	Use of IPM technology, select clean seeds for planting. Preparation of bulletins and introduction of IPM options, validate technology	1. Gemini curls (virus) 2. Anthonomus eugenii pepper weevil 3. Diabrotica balteata (cucumber beetle) 4. Ceratoma ruficornis leaf beetle	.5 .4 .1 .1	
Pesticide Control Board	Pesticides	Use of chemical control, training for certification of users	1. Training 2. Certification		Current budget $297,990
CARDI	Germ-plasm & Tec. Pack.	Evaluation of germplasm for resistance and adaptation and test of agronomic practice	1. Germplasm release 2. Training 3. Cultural practice		Current budget $350,000

Source: PPU, MAF

Table A.12
Medfly Hosts in Belize

Product	Scientific Name
Breadfruit	Artocarpus communis
Cherry	Prunus Cerasus; p. Avium
Craboo	Byrsonima crassifolia
Plums	Prunus Spp.
Mamey apple	Mamea sp.
Sapodilla	Manilkara sapota
Soursop	Annona Muricata
Papaya	Carica papaya
Cacao	Theobroma cacao
Passion Fruit	Passiflora edulis
Guava	Psidium guajava
Tomato	Lycopersion esculentum
Peppers	Capsicum sp.
Watermelon	Citrullus Vulgaris
Squash	Cucurbita moschata
Cantaloupe	Cucumis melo
Banana	Musa spp.
Almond	Prunus amygdalus
Apple	Malus sylvestris
Ackee	Blightia sapida
Pineapple	Ananas comosus
Mango	Mangifera indica
Cashew	Anacardium occidentale
Coffee	Cofea Cofea spp.
Custard Apple	Annona reticulata
Avocado	Persea Americana
Citrus	Citrus spp.
Eggplant	Solanum melongena
Okra	Hibiscus ecsulentus
Nectarine	Prunus persica
Peach	Prunus persica
Pear	Pyrus communis
Grape	Vitis spp
Strawberry	Frogaria spp
Star apple	Chrysophyllum caimito
Tropical almond	Terminalia catappa
Star fruit	Averrohoa carambola

Source: PPU, MAF

Table A.13
Professional and Technical Staff of the Veterinary Service, MAF

Post	Academic Qualification	Skills & Training	Year of Experience	Responsibilities
Principal Veterinary	B.S.c., DVM	Livestock Specialist	12	Policies for Animal Health & Production
Veterinary Officer	B.S.c., DVM, MSc	Epidemiology Information System	10	Assist PVO Assist Meat Inspection Lectures at BCA
Veterinary Officer	MVZ	Meat Inspection	4	Field Service In charge of Clinic
Veterinary Officer	MV	Meat Inspection Quarantine	8	Chief Quarantine & Fiel work
Veterinary Officer	B.A., BVSc, MSc	Laboratory Vet. Public Health Epidemiology	6	Vet. investigation Officer In charge of Lab. & Climic
Veterinary Officer	MV	Registration of vet. Products	2	Field Work & in charge of Clinic
Veterinary Officer	MVZ	Epidemiology	8	Activities being reviewed
Veterinary Officer	MV	Livestock Specialist Reproduction	3	Field Work
Sr. Lab. Technician	BSc	Diagnostics	4	Runs Central Farm Veterinary Lab.
Lab. Technician	Diploma	Bacteriology Rabies diagnosis	7	Asst. Central Farm Veterinary Lab.
A.H.A.	Diploma		8	Asst. Vet. Officer

Source: Vet. Services Division, MAF

Table A.14
Diagnostic Capabilities of the CVL

Area	Type of Test
Serology	**Brucella abortus:** Plate agglutination test Milk ring test Rivanol test **Avian influenza:** Hemagglutination inhibition **Newcastle disease:** Hemagglutination inhibition **Marek's disease:** Agar gel immunodiffusion test
Elisa	reader functional (to work with kits)
Bacteriology	Isolation, identification and anti-microbial susceptibility testing of common pathogens and anaerobic bacteria Serotyping of Salmonella and E. Coli. Bacteriological examination of water and milk
Haematology	Measurement of the following blood parameters: Packed cell volume Erythrocyte count Leucocyte count Differential leucocyte count Platelet count Total protein
Parasitology (accounts for most of tests done)	Faecal examination: helminth egg and larval count Formal-ether concentration techniques to detect protozoan oocysts. Identification of ectoparasites and haemoparasites

Table A.15
Costs for Laboratory: Tests at the Central Farm Laboratory

Item	Price
Faecal - Farm Animals	2.00
Pets	5.00
Biochemistry	3.00/Test
Haematology & Blood Parasites	
Farm Animals	5.00
Pets	10.00
Heartoworm - Wet Prep. & MKT	8.00
Wet Prep. MKT & Elisa	10.00
Skn Scrapimg	5.00
Urinalysis	10.00
Leishmania Check	5.00
Bacty - Gram Stain Only	5.00
Culture & Sensitivity	20.00
Serology - Brucella	FREE
EBL/Blue Tongue	3.00 e.a.
EIA	10.00

Source: Vet. Services Division, MAF

Table A.16
Qualification and Skills of Staff of the Quarantine Service, MAF

Title	Qualification	Training and Sills	Position	Years of Service
Quarantine inspection (Q1)	Assoc. Degree in Agriculture/BCA	USDA/APHIS in service training on quarantine inspection	Corozal/Santa Elena Border	12
QI	Assoc. Degree in Agriculture/BCA	USDA/APHIS in service training on quarantine inspection	Corozal/Santa Elena Border	13
QI	High School Diploma	USDA/APHIS in service training on quarantine inspection	Corozal/Santa Elena Border	5
QI	High School Diploma	Two-month course in Quarantine, USDA, USA	Belize International Airport/Port Authority	14
QI	One Year School Certificate Course in Agriculture	Two-month course in Quarantine, USDA, USA	Belize International Airport/Port Authority	6
Q1	Associate Degree in Agriculture, BCA Agriculture, BCA	USDA/APHIS in service training on quarantine inspection	Belize International Airport/Port Authority	8
Q1	Diploma in Agriculture	USDA/APHIS in service training on quarantine inspection	Cayo/Benque Border	10
Q1	Diploma in Agriculture	USDA/APHIS in service training on quarantine inspection	Cayo/Benque Border	10
Q1	High School Diploma Sacred Heart College, 1981	USDA/APHIS in service training on quarantine inspection	Stann Creek Independence Border	12
Meat Inspector	High School Diploma	One-month course in Meat inspection in the U.S.	Belize International Airport/Port Authority	14
Extension Officer	High School Diploma Sacred Heart College, 1981	USDA/APHIS in service training on quarantine inspection	Toledo Port Station	4

Table A.17
Status of Quarantine Stations, MAF

Quarantine Station	Office Space	Office Equipment	Condition	Remarks
Corozal/Santa Elena Border	Customs Inspection Area	1 Desk 1 Chair 1 Filing Cabinet 1 Bulletin Board	Fair Good Poor Fair	There is no room available for quarantine inspection, they are located in an open public area used for custom inspections. No refrigerated facility. An incenerator will soon be installed.
Belize International Airport	One room provided by tha airport authorities	2 Desks 2 Chairs 1 Refrigerator 1 Filing Cabinet	Good Good Good Good	The office size does not facilitate storage space for confiscated materials. *One available incenerator that is not functioning.
Belize Port Authority	Office provided in Customs Building	2 Desks 1 Chair 2 Filing Cabinets	Fair Poor Fair	There is no room available as an office space for quarantine inspections. No refrigeration facility. *One available incenerator that is not functioning
Benque Viejo Station	One room available in the Customs Building	1 Desk 3 Chairs 1 Filing Cabinet	Fair Good Poor	There is no refrigerator to store confiscated products. No storage space for confiscated goods. *One available incenerator that is not functioning.
Big Creek Port	None	None	N/A	There is no office, office space of office equipment. No incenerator.
Toledo Port Station	One room in building occupied by customs	1 Desk 1 Cabinet 1 Freezer 2 Chairs 1 Fan	Poor Poor Good Fair Good	The Extension Officer performing quarantine duties, lacks training in quarantine procedures. *One available incenerator that is not functioning.

APPENDIX B

Appendix B.1
Regulatory Framework

Appendix B.1

Regulatory Framework

1. Characteristics of the Legal Framework

Belize's legal system is similar to that of most Commonwealth countries. It has been developed along that of the British system which is different from the other countries of Central America. The process of designing laws, regulations, decrees and their execution depend on the legislative system. The legislature consists of a National Assembly (Parliament) comprising two Houses - a House of Representatives and a Senate. Under this provision "each House may make, amend or revoke Standing Orders for the regulation and orderly conduct of its own proceedings... and the passing... and numbering of Bills and the presentation of the same to the Governor General for assent"[1]. The basic steps for approving an Act in the legislative system are as follows:

a. Within the respective Ministry, a draft of the Act is prepared. It includes the objectives and technical aspects. This process is also for Statutory Instruments.

b. The document goes to the Minister for review and approval.

c. It is then sent to the Solicitor General's Office, where it will be elaborated using the required legal terminology (The Ministries do not have registered attorneys within it's staff for this type of work).

d. The document is discussed at the Cabinet level, after which it is sent to the National Assembly - either to the House or the Senate for debate[2].

e. At the Committee level, the document goes through the process of a "first reading", during which all relevant institutions and individuals are invited to submit comments (public and private).

f. Finally, it is published as a Bill in the Official newspaper, the Gazette.

g. A "Second Reading" is done if additional changes or amendments are necessary.

h. After the "Final Reading" in Parliament, the final draft goes to Governor General's office for his signature into law before its publication as an Act in the Gazette.

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1 Constitution of Belize, Section 70 (1).

2 Constitution of Belize, Section 68.

For approval of **Statutory Instruments:**

a. The draft document is prepared by the interested Department or Division of the Ministry and sent to the Minister for comments.

b. After its amendment, it is sent to the Solicitor General's office to convert the document using legal terminology.

c. Finally, it is sent to the Minister for his signature[3].

2. Overview of Agricultural Health Regulations

Belize has several laws and regulations governing various aspects of agricultural health issues and activities in the country. Several institutions are responsible for executing and ensure compliance of these regulations. However, effective compliance is weak. In addition, some laws and regulations were enacted a long time ago and these need to be reviewed and modified to be consistent with changes that occurred over the years on agricultural health issues, as well as being consistent with regional and international requirements and standards required by countries. A review of some of the major regulations on agricultural health issues in Belize is provided below.

Pest and Disease Control Programs: As indicated in Chapter II, there are several programs implemented by the PAHS of the MAF to eliminate and control pests and diseases. These include the ambulatory clinical veterinary service and plant disease clinics provided on a demand basis and other control programs such as Vesicular Disease Surveillance (FMD, Vesicular Stomatitis, Swine Vesicular Disease and others). In the area of plant health, a major regulation is the Plant Protection Act of 1941 (Chapter 178 of the Laws of Belize) empowers the Minister to make regulations for prohibition, restriction or regulation of imports into Belize of products from countries which are not Medfly free.

Inspection, Surveillance and Quarantine: According to Chapter 178, 1941 of the Laws of Belize, Plant Protection Officers (PPOs) may inspect and/or stop, search, seize, destroy or dispose of planting materials, whether incoming or internal, and disinfect buildings and carriers, suspected of providing any risk to the country's agriculture. The law (Section 15) also provides Inspectors the power of entry in special cases where a written notice is needed to inform the occupier and or it's owner of the prevention of spread, control or eradication of a pest. If there is non-compliance, then the Inspector may enter the premises to implement the measures to be taken.

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[3] For statutory instruments, the Minister responsible determines whether it should be discussed or not at the National Assembly.

All authorized PPO's may impose quarantine at premises, if necessary, without warrant. The Inspector should treat, destroy or remove plant material and shall inform the occupier, if present at the time. Such quarantine may be lifted, only by the Minister, within 21 days after its imposition through a specific certificate declaring the premises no longer under quarantine. In general, QI's are responsible for the movement of plants and animal species and assist in documenting pesticide and fertilizers movement into and out of the country. In addition, they intercept materials of quarantine importance, inspect and approve the entrance of commercial shipments and vegetables. These officers have specific duties which have been established by several laws such as by Chapter 167, Part I, Section 3 for Animal Health, the Plant Protection Act under Chapter 178, Section 9, 1941 of the Laws of Belize and also the Animals International Movement and Disease Act, enacted in 1953. Regarding the need for facilities to support animal health, Chapter 167, Part III, Sections 15 and 16 of the Animal Diseases and Importation Act states the Minister may establish facilities wherever he deems necessary, to place the animals, reptiles or birds to be quarantined for the time specified in regulations and it's respective license. However, these laws were enacted a long time ago and they need updating and modification to meet current and future needs of the agricultural health service. A new proposal for animal health was drafted in 1991 with the specific aim of harmonizing the legislation to meet CARICOM Standards. For plant protection, a draft was prepared with the objective of establishing the service within the framework of WTO-SPS guidelines.

Regarding meat inspection, the Food and Drugs Act, through the Statutory Instrument No. 20 of 1970, named " Meat Post Mortem Inspection" specifies that Public Health Inspectors should inform the Minister of any present disease at slaughtering houses, when meat inspection is done (Section 6). Regulations are also included under Sections 3, 4, 9, 10, and Schedule 1 and 3. The major responsibility for meat inspection is with the PHB of the Ministry of Health.

The Food and Drugs Act, Statutory Instrument No. 18 of 1970, (Slaughter house Hygienic Practices) Regulations contains information on the expected layout of slaughter houses: accommodations, lighting, ventilation, cleanliness, ceilings, floors, necessary water supply and equipment. This instrument also includes provisions for official numbering of each slaughterhouse that has undergone inspection, labelling, misbranding and adulteration. At the end of the year, the PHI's is expected to prepare a report on all inspected slaughter houses and suggest recommendations for improvements.

Current meat inspection laws do not require inspection of slaughterhouses by a Vet. Officer; only by an "Authorized Officer" meaning a medical officer of health or any person authorized in writing by the Minister. However, PHI's do not possess the technical knowledge to provide adequate diagnosis of animals for diseases and health problems. If there is need to dispose of an animal (because of the presence of a disease or residues), the decision is based on the inspector's personal views; a Vet. officer may be present but may not necessarily be needed. Vet. Officers are empowered to act in the control of animal diseases at post mortem stage only.

Laws and Regulations such as the Meat Post Mortem Regulations, Slaughterhouse Hygienic Regulations, Humane Slaughter of Animals Regulations, Fisheries Act and Regulations,

Animal Disease Act, Plant Protection Act and the Bureau of Standards establish inspection services. Such provisions can be found under: Sections 3, 4, 9, 12, Schedule 1, 3 (1); Sections 5, 52 (1,5), 53, 57 (1,2), 58 (1,2, A), 60(12 -16), 61,62; Section 5, 9 (1-11); Section (57, 62, 67); Section 12; Section 3; Sections 5,7, 8, 15, Sections 5, 6 (g,h), 17 (2-A), 18; respectively.

In general, meat inspection (in all stages) in Belize is not executed according to international standards or practices in more developed countries. This is a major constraint in the animal health service - both for providing adequate health standards in the country and for facilitating trade in animal and meat products. Although some legislation exists to support more stringent inspection than is currently practiced, there is also a need to update these and stronger enforcement mechanisms to ensure compliance.

In the **fisheries sector**, the Fisheries Department (FD) of the MAF has responsibilities for fish inspection. Inspection is conducted inland, at sea and in several processing plants. Inland inspection requires special permits for fishermen. At sea, inspectors check that marine products are harvested during the established period(s) of the year and are adequate for human consumption.

Under the Fisheries Regulations No. 66 of 1977, Sections 57, 61, 62, and 67 and Section 12 of Chapter 174 of the laws of Belize, inspection is established for processing plants, quality control measures and labeling are also regulated. Presently, processing plants are inspected periodically but the laws are not effectively enforced due to constraints of the FD. The Department's inspectors also have the power to arrest individuals for unlawful behavior and fees are charged which go into the GOB's Consolidated General Fund and are not available to the Department.

Pesticides control: The Pesticide Control Board (PCB) has the responsibility for executing and monitoring pesticide control measures. It is a "quasi" governmental institution established under the Pesticide Control Act of December 1985 and it's regulation enacted in 1995. Both regulatory documents specify guidelines for importation, registration, control, sale, storage and use of pesticides. The PCB's main functions are: (a) registration of pesticides; (b) licensing people to sell restricted pesticides; (c) search on premises where restricted pesticides are being sold; (d) authorize the use of restricted pesticides; (e) analyze registration requests; (f) train pesticide applicators; and (f) establish labelling and packaging guidelines which should be in accordance with FAO's Standards.

Inspection of pesticides is governed by the Registered and Restricted Pesticides Registration Regulations of 1995. The PCB has responsibilities for this; its Inspectors also provide information to farmers on pesticides application methods and training. These officers are empowered to seize products if they are banned or outdated. The law empowers them to control the use of pesticides in authorized establishments and help prevent introduction of prohibited chemicals by making provisions for their removal or destruction. However, the PCB

lacks appropriate facilities for storage or disposal of such products[4].

Pesticides and toxicological control and inspection are also included under the Statutory Instrument, Number 9 of 1985, on Biological Residues (Control) Regulations, which indicates tolerance levels and appointment of officers to enforce these regulations. These officers have the authority to take samples and conduct routine surveillance of biological residues in animals being slaughtered, as established under the Slaughterhouse Hygienic Practices Regulations of 1969, Section 63 (1,2).

Quality Control: The Statutory Instrument No. 66 of 1977 on Fisheries Regulations provides for Regulations on Quality Assurance (in Section II). Other laws dealing with quality control are: the Slaughterhouse Hygienic Practices Regulations of 1969, under "Products entering Slaughterhouse", S.I. 31 of 1971; 57 (5,6,8); 58 (4); and the Statutory Instrument, No. 9 of 1985 on Biological Residues Control Regulations under Article 4 (b, c, i through v, d, e, f and others).

Belize exports a large amount of fish products and HACCP (a test required by several importing countries) is becoming a critical challenge for the FD. Very little testing is presently done by the Department. Its diagnostic capabilities need considerable improvement, as well as the need for recognition and accreditation based on international standards[5]. A few European countries have provided information indicating the maximum bacteria limits accepted for lobster, for example, but the Fishermen Cooperatives are beginning to have problems to comply with the new requirements because the FD's lab. does not have the capacity for such testing. Besides HACCP requirements, the FD's lab. should be able to do the following tests: Standard Plate Count for recognition of exisitng bacterial quantities in products; water tests; Most Probable Number (MPN) for findings on coliform organisms; searches for the Clostridium bacteria, proteus, a test required by certain countries; salmonella, staphylococcus and toxicity (required by France and Japan).

On the issue of quality control, the private sector also has a very important role since much of this is basically done by them. Private enterprises have the resources and access to technology to support their exporting and importing health requirements. For traditional crops, quality control is provided by the respective commodity associations. For non-traditional crops, quality control is limited to those products exported. In the case of peppers and papayas, two non-traditional products exported, quality control is done by the EO's, the QI's and the USDA-APHIS office in Belize (through protocols between APHIS and the PPS). The BFAC does quality control from farmer to consumer through an agronomist and an extensionist that provide

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[4] Whenever products need to be disposed of, they are thrown or buried in areas where there is little or no population.

[5] The FD's technical capability consists of two people, the Head of the Department and a laboratory technician. Due to limited personnel and equipment and budget, there is only a 60% confidence on the tests presently done by the FD. The Department is currently working on improving its legislation and its enforcement, in order to comply with international standards.

technical assistance (costing approximately BZ$40,000/year) to its clients. With regards to poultry, the Mennonite Community receives technical support from the MAF and from its overseas suppliers and private laboratories. Due to disease problems, this community is permitting MAF's personnel to examine its production facilities and to provide assistance and proper surveillance. CARDI and Prosser (chemical supplier) also provide technical assistance on quality control, and pest and disease information to farmers.

Presently, an information system is being developed at Central Farm, where the majority of research activities are being conducted by plant and animal health personnel and agronomists on validation and germination tests. Support for this activity is being provided by the private sector. The main objective is to compile a complete list of existing pests and diseases in Belize. This will be consistent with the SPS Agreement which require that countries update their pest and disease situation.

Import and Export Certificates: The import licensing system started in 1974 and it currently covers 26 product categories. For some products, duties were abolished due to trade agreements. Approval and proper certification for exports and imports are required from the MAF and the Ministry of Trade. All imported planting materials, soil and live animals require the necessary health certificate (as most countries do), an import permit and the CITES permit. In cases of emergencies, special permits may be issued provided that the material(s) have no pests or diseases of economic importance. Export licenses are provided freely, except for live animals, fish, crustaceans and mollusc, log and lumber, sugar, citrus fruits and beans which require a phytosanitary certificate. These are issued by various units in the MAF.

The OIE provides certification guidelines which have been compiled in an information system named PROPEXAN which was created by a FAO Project. Although it is not included in the laws of Belize it is considered the best method available for MAF's personnel to keep controls.

Public Health Bureau: The PHB's responsibilities and activities are supported by the Laws of Belize. The Public Health Act, Chapter 31 and the Food and Drug Act, Chapter 219 are the main legislations that empower the Bureau. A number of regulations also guide the Department in veterinary public health matters. These include:

* Humane Slaughter of Animals, Regulation 1981 (SI 58 of 1981);
* Meat (Post-mortem) Boneless Meat Inspection Reglation 1985 (SI 14 of 1985); Animals (ante-mortem) Inspection Regulation 1971 (SI 28 of 1971);
* Biological Residues (control) Regulation 1985 (SI 9 of 1985);
* Meat (post-mortem) Inspection Regulation 1970 (SI 20 of 1970);
* Slaughter (Hygienic practices) Regulations 1969.

The Public Health Department also works closely with the Bureau of Standards in the Ministry of Trade and helps to enforce the Standards Act of 1992.

3. Comparison with International Regulations, Standards and Guidelines

Belize is a signatory of the General Agreement on Tariffs and Trade (GATT) and consequently, of the international standards established by the World Trade Organization on agricultural health issues such as Sanitary and Phytosanitary Measures (SPS). Other institutions like the Organization of International Epizooties (OIE), the International Plant Protection Convention (IPPC) and Codex Alimentarius play a relevant role in designing, promoting and monitoring the development of international standards and guidelines in the area of agricultural health.

The SPS Agreement was signed on December 15, 1995. In Section 14, compliance time frames were established. By January 1, 1997 the SPS measures will be obligatory for implementation by all signatories to the GATT; therefore, changes in the national laws of these countries to comply with the new international agreement will be required. The following is an analysis of the Sanitary Laws of Belize vis-a-vis the international regulations and standards mentioned, based on the principles of sovereignty, harmonization, risk assessment, transparency and others.

(a) Sovereignty: In Belize, the Constitution indicates Sovereignty as it's major principle. Section 2.1 of the SPS Agreement states the right of the countries to be sovereign in implementing the necessary measures to protect "human, animal or plant life or health", but such provisions should not be inconsistent with the ones in this Agreement. This same principle is applicable to other international regulations and standards.

Belize's legislation gives much discretionary powers to the Minister. Some of these powers are not consistent with the provisions of the SPS measures. For example Section 13 of the Biological Residues Regulations, state that the Minister may "at his discretion, ban or restrict the use of pesticides ...where such pesticides constitute ... a danger to health and well being of useful animals and man". In order to do this, the SPS Agreement require that such a ruling should be based on scientific justification rather than on discretionary powers. This Section in the Belize's laws does not consider the standards or guidelines on which such a decision is made.

By enforcing the SPS requirements at the national level, countries would provide assurance that their national measures are not arbitrarily applied or discriminative, and that they are based on scientific justifications. Member countries have the right to adopt more stringent measures but these will need to be equally applied to imports as well as domestic production. However, scientific justification must be provided and notifications will need to be sent to the WTO, OIE and IPPC depending whether it is an animal or plant health issue.

Countries will need to adopt or implement equivalent measures with respect to other member countries, so that they can achieve appropriate sanitary levels according to international guidelines. Institutions like the Environmental Protection Agency (EPA) and the Federal Drug Administration (FDA) of the U.S. and FAO provide standards, guidelines and lists of banned

pesticides based on proper scientific investigation. These could be very useful for Belize, once the institutional framework, appropriate legislation, decision-making process and information system are in place to support the agricultural health system.

(b) Harmonization: Harmonization implies the application of common sanitary and phytosanitary measures by different countries. It does not mean that countries need to have the same laws or political systems. Belize's laws should be harmonized with the rest of Central America as they are with the CARICOM, given that it is a member of the International Organization of Plant and Animal Health (OIRSA). Presently, a new regulation on phytozoosanitary issues is being proposed for the Central American countries including Belize which will provide for harmonization.

The SPS Agreement together with the rest of standards and guidelines, authorize countries to keep sanitary measures of a higher protection level, if (as indicated before) there is scientific justification for such action. It also states that international organisms such as the OIE, Codex Alimentarius and IPPC will promote guidelines and recommendations on these matters.

(c) Transparency: This refers to the openness of countries to provide information about their phyto and zoosanitary regulations, norms, standards and guidelines, prevalence of pests and diseases. Certain requisites have to be followed by each Member country under the SPS.

Transparency requires an adequate information system will be needed to provide continuous information to other countries and regional and international organisms about Belize's sanitary and phytozoosanitary situation (and vice versa). Presently, Belize does not have appropriate notification or emergency systems in place nor adequate control of the information on pests and diseases. Although the PHS and AHS of the MAF are making efforts to improve their information base, they lack adequate resources and capability. In addition, phyto and sanitary information should be centralized in one institution and disseminated to various institutions as required.

(d) Risk Assessment: This is the evaluation of the likelihood of entry, establishment or spread of a pest or disease within the territory of an importing member country and the sanitary or phytozoosanitary measures which might be applied. Given this scenario, countries need to have in place the necessary facilities (laboratories, expertise, inspection services) to do risk analysis. Presently, Belize does not have laboratory capabilities to do risk assessment. This constraint will affect the country's agricultural trade because it will lack a scientific basis to put in place appropriate measures to prevent the entry of products or to do the necessary tests for products it exports. Although inspection is established by law, it is not effectively done and sampling and testing is not appropriately done due to limited laboratory facilities. As a result, the prevalence of specific diseases and pests is undetermined and proper controls cannot be implemented. Furthermore, an inadequate pest and disease control system could result in potential economic losses for the country due to the high probability of the entry of pests/diseases and/or the execution of restrictive trade measures.

(e) Control and Inspection Procedures: The SPS Agreement indicates all the steps to be followed for these[6]. Legally, Belize has established inspection and control services for most areas in the agricultural sector but this is not effectively executed. Time frames are to be established and published in order to follow SPS procedures. In general, Belize's legislation does not contain specific periods of time for the compliance of these procedures. A "competent body" will be needed to oversee the execution and monitoring of the required procedures. Presently, Belize has several entities involved in the sanitary and phytozoosanitary process including the MAF, MOT and the PHB, but there is little coordination and effective enforcement of the regulations.

Another problem is the absence of a dispute settlement system for agricultural health. The SPS make reference to a procedure to review complaints and the existence of a mechanism to facilitate settlement of agricultural health issues. Presently, complaints in the agricultural sector are taken to court after a written notice is served and/or a fine is imposed. There is no system for alternative dispute settlement such as arbitrage, for instance; consequently, there is loss of time and high costs incurred as public sector personnel engage in legal disputes over a lengthy time period.

(e) Regional Conditions: This indicates that member countries shall ensure that their measures be adopted in accordance with the phytosanitary characteristics of the region or area, prevalence of specific pests and diseases and the existence of eradication control programs. Epidemiological surveillance and appropriate testing are also mentioned under the SPS. Although Belize has laws to support certain types of surveillance (such as the Biological Residues Regulations under Section 4), the country's diagnostic capabilities are limited to support this.

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[6] Sanitary and Phytozoosanitary Agreement, Annex C.

Appendix B.2
Status of the Agricultural Health Information System

Appendix B.2

Status of the Agricultural Health Information System

1. Introduction

This section describes information needed and generated by various units of the Ministry of Agriculture and Fisheries and other stakeholders involved in agricultural health. It is concerned with sources of information, the flow of information (reports, samples, permits) and dissemination of information. It also describes some of the computer resources (hardware and software) available in the Ministry. The functions of these units are described in greater depth elsewhere.

2. Plant Protection

2.1 Information/Samples from the Field

Each district of Belize has five or six zones, each of which should be serviced by a District Extension Officer (DEO). At the present time, only about 50% of the posts are filled and the DEOs are also required to work on special projects, therefore those remaining may have to service two or three zones. The DEO's job is to visit farms, make recommendations and disseminate information. They are generally graduates of Belize College of Agriculture (BCA), which is a two year program. The DEOs report to the respective District Agricultural Officer (DAO). They submit a monthly report of acreage planted, amounts harvested, etc.; however, there is no standard reporting form. The DAO in turn sends a monthly report to the Principal Agricultural Officer for Extension, PAO (E). No copy is sent to the Plant Protection Service (PPS).

In the case of a disease problem, if it can't be resolved by the DEO, it is referred to the DAO and if necessary to the PPS. Problems are often relayed verbally to the PPS and when necessary they send someone out to the field. Although there is a seasonal variation in the frequency of calls, on average there is about one call per day. The decision as to who goes out to investigate the problem depends on the technical specialty required and who is available at the time. Cayo district gets the most coverage and Toledo the least, as it requires a day to travel each way (minimum trip of three days).

The PPS would like to improve the reporting system and increase the submission of samples, thereby reducing the need for expensive trips to the field. The number of samples submitted per year ranges from 100 to 300. There is a specific reporting form for submission of samples titled "Problem Diagnosis and Advisory Service". The PPS is in the process of redesigning this form and has sent a survey out to the users asking suggestions for improvements. Sometimes the farmer or DEO brings samples directly to the laboratory at the Central Farm, in which case the entry is made in a ledger, rather than filling out the usual form.

The ledger includes the following: a) Date of arrival; b) Source of sample: - farmer, - location of farm; c) Crop sample brought; d) Method of examination: - visual, - microscopic analysis; e) Date of examination; f) Person responsible for diagnosis; g) Result of diagnosis and recommendation; h) Form of reporting: - verbal, - written; i) Remarks and possibility of biological control.

Generally it would be the DEO who would fill the form in triplicate and submit the sample (s). Some problems require a series of visits or a number of sample submissions. Once the PPS has made a diagnosis, they fill in the section on diagnosis and advice. Copy number 1 is retained by the PPS, copy number 2 goes to the DAO (to be shared with the DEO) and copy number 3 goes to the farmer.

For the last three years the PPS was able to send out samples under the ODA/NRI plant health project, which was of considerable benefit. The Commonwealth Agricultural Bureau International (CABI) charges 50 pounds sterling per sample for viral or insect identification and sometimes multiple samples are necessary for a diagnosis.

An extension meeting is held quarterly with the DAOs and one representative from each of Plant Protection and Animal Health to discuss the current situation. The Annual General Meeting is attended by all staff of the Ministry of Agriculture as well as NGOs working in agriculture. Each district makes a presentation and there is a forum for discussion of problems. The Head of the PPS submits quarterly and annual reports to the CAO.

2.2. Public Awareness of Plant Protection Issues

Technical information is disseminated to the public through the Information Unit in Belmopan (see section 7.1 for details about this unit). In the recent past, articles on Citrus Tristeza Virus, Citrus Leaf Miner, Pink Mealybug and Lethal Yellowing have appeared in the monthly publication, Belize Today. The Information Unit used to produce fact sheets by crop with technical input from the PPS, but this hasn't been done for some time as there have been problems with continuity of staffing in the Unit. In the case of an emergency, notices are placed in the newspaper and use is made of call-in radio and television programs. Leaflets and pamphlets are distributed through extension people.

Videos were provided through the Medfly program and one was sent to each district for use at meetings or seminars. In the event of a Medfly outbreak an emergency committee is convened. This committee consists of the Head of PPS, Quarantine, the USDA/APHIS representative in Belize and the DAO from the area where the outbreak occurred. There was one such outbreak in 1995. The committee meets to decide on the best plan of action - whether to quarantine the entire district or an area within the district. They appear on television and radio to advise the public of their actions and ask for cooperation. They also advise the regional plant protection organizations (OIRSA, CPPC).

2.3 Documentation of National Plant Protection Information

The PPS is making an effort to compile an exhaustive list of all plant protection problems that occur in the country. This will be increasingly important for trade purposes, both to gain access to external markets and to justify decisions to exclude importations on a sanitary basis. In addition to their own records the PPS are drawing on local sources such as CREI, BSI, the Banana Growers Association, Ministry of Natural Resources and NGOs as well as specific studies that have been done by outside organizations.

A list of pests and diseases of the major crops of Belize is being maintained in a Word of Windows file. It includes pests and diseases of:

i) Field Crops (rice, beans, peanuts, corn, etc.);
ii) Tree Crops (avocado, banana, citrus, etc.);
iii) Vegetables (cucurbits, crucifers, lettuce, onions, etc.);
iv) Ornamentals (rose, frangipani, heliconia, anthurium); and
v) Root Crops (cocoyam, ginger, yam, irish potato, etc.).

A National Plant Protection Service (NPPS) Resource Database was initiated with support form the ODA/NRI plant health project (1992 - 1995). Dr. Hunt, an ODA/NRI consultant developed a program in dBase III+ for cataloging slides and specimens available at the Central Farm. The section for data entry has been coded, and he indicated that once 1,000 entries had been made (there have been several hundreds to date), he would code the section for information retrieval. The value of the database will not be realized until this function is available. Work has also been done to set up Epi-Info files to record the results of plant protection problem diagnosis, but no data has been entered as yet.

Surveillance and monitoring takes place mostly through the form of special projects, such as the medfly program. This program employs six technicians and involves ongoing trapping according to a USDA/APHIS protocol. It is an example of the magnitude of effort which may be necessary to establish and maintain "free" status for particular pests and diseases for purposes of international trade.

2.4 Information for Decisions and Policy-Making

During the execution of the ODA/NRI project a new draft of plant protection legislation was developed. This draft has been reviewed by Belizean authorities and may be adopted by the end of 1996.

Belize is a member of CARICOM and the OAS and is a signatory to the World Trade Organization (WTO). The various regional trading blocks will need to harmonize their Sanitary and Phytosanitary Measures, which ultimately will need to be in line with the international standards developed under the WTO.

The WTO has charged the Secretariat of the International Plant Protection Convention (IPPC) with organizing efforts to develop international standards for plant quarantine. In 1993, a Coordinator was appointed to the IPPC and the FAO Committee of Experts on Phytosanitary Measures (CEPM) was instituted.

The procedure which was established for the development of international standards, guidelines and recommendations for plant protection is as follows. A Working Group of experts is convened to draft a document, which is circulated through Regional Plant Protection Organizations (RPPOs) for comments and revision prior to consideration by the CEPM. After the standard is reviewed by the CEPM it is submitted to the Committee of Agriculture (COAG) and finally to FAO Council for acceptance. As the entire process can take several years, the only standards that have been finalized to date are: 1) the International Plant Protection Convention; and 2) Principles of Plant Quarantine as Related to International Trade.

Draft and approved standards are supposed to be distributed by the Secretariat of the IPPC to the National Plant Protection Organizations (NPPOs) of all FAO Members, as well as to the Technical Secretariats of the RPPOs. Belize is a member of the Caribbean Plant Protection Commission (CPPC) and has recently also joined the Organismo Internacional Regional de Sanidad Agropecuaria (OIRSA), yet the Chief of the PPS has not been receiving copies of the international standards (copies of the approved standards were provided during this mission). This will be very important in future to ensure that national requirements are compatible with international standards as required by the WTO.

The following databases are available which contain information about the distribution of plant pests and diseases and are consulted by the PPS to assist with import decisions: European Plant Protection (EPPO) Database; the FAO Global Plant Quarantine (PQ) Database; and the Caribbean Plant Protection Commission (CPPC) Database.

2.5 Computer Resources for Plant Protection

Largely by virtue of the ODA/NRI project, the PPS has a 386 notebook, a 486 and a Pentium, the latter two with fax/modems, CD-Roms and printers (see section 9 for Inventory of Computer Equipment). Software available for use with the desktops includes Windows 95, WordPerfect for Windows 5.1, CAB Abstracts, MS Works 4.0, the customized NPPS Resource Database mentioned above (section 2.3) and reference databases on pest and disease distribution (section 2.4). The notebook has Windows 3.11, Word for Windows 2.0 and two pest identification keys: a) CABIKEY for beetles; and b) INTKEY produced by CSIRO for mosquitos.

The Pentium has an Internet connection (see section 8 for details about Internet access in Belize). Funds for the monthly access fee were provided through the ODA/NRI project until February 1996, however, since the PPS finds Internet access extremely useful they would like to be able to maintain their connection. The Internet is used both for e-mail and for accessing technical information.

The PPS is fortunate to have one member who is very computer literate and navigates the Internet with ease. He maintains an index of Internet Resources relevant to the PPS on topics such as beekeeping, biological control, entomology, insect collections, integrated pest management and pesticides/regulations, as well as a catalog of pertinent mailing lists, electronic publications (includes insect fact sheets from various universities), bibliographies, institutions, international organizations and private companies. Other members of the PPS can use specific software packages, but do not have in-depth computer knowledge or training. There are plans to use the Internet connection to update information from one computer to another and also to start a separate database for the insect collection.

3. Pesticides Control Board

The Pesticides Control Board (PCB) maintains databases on: a) registered pesticides; and b) licenses issued for the importation and/or sale of registered pesticides. These databases were set up in Paradox by a Peace Corp Volunteer. The Registration Committee of the PCB meets quarterly to discuss applications and re-applications for the registration of pesticides. Registration is on an annual basis, hence a new application must be filed each year. It contains the same information maintained in the database of registered pesticides. Once an importer is licensed, in order to import pesticides he or she must pay the PCB and obtain a certificate. This is in addition to any custom's duty that may apply. For shipments of BZ$5,000 or more there is a charge of 2% of the value of the shipment (there is a scale for amounts less than BZ$5,000). In Cayo district, payment may be made directly to the PCB and they will issue the certificate. In other districts, payment is made to the District Agricultural Office and the certificate is issued by the Quarantine Inspector at the port of entry, upon presentation of a receipt of payment to the PCB. The certificates are used to keep track of inventory. At the end of the year information is collected from the statistics unit in Belmopan regarding the total amounts of pesticides imported.

4. Animal Health

4.1 Information/Samples from the Field

There are government veterinary clinics in four (Belize, Cayo, Orange Walk, Toledo) of the six districts of Belize. Actually, all seven of the veterinarians employed by the government spend some time servicing field calls, including the Principal Veterinary Officer (PVO). The "Animal Health Services Case Report" is to be filled out for each farm visit, however, compliance by the attending veterinarians has been declining and those reports that are submitted are often incomplete. Although there is no government veterinarian posted in Corozal, as a courtesy, the private veterinarian operating in that district provides a monthly summary of cases seen.

The present case report form was instituted in 1993 and solicits information on the number and types of cases seen, whether laboratory submissions were made, the treatment prescribed and census information about all animals on the farm. The information provided from case reports is collated and entered into Epi-Info at the Central Farm by a veterinarian with additional training in epidemiology and the management of information systems. Information entered into Epi-Info for the years 1994 - 1996, indicate a reduction in the type of information entered in that period.

The "Report on Clinical Field Work: Jul-Dec, 1993" includes graphs that show how the collated case reports can be used to look at workload by month, district, veterinarian and type of animal species. This type of information has potential as a management tool to better organize delivery of animal health services according to demand.

Although there have been efforts to improve and standardize reporting, there doesn't seem to be consensus on the need for reporting or what should be reported. As there is a cost for collection, analysis and dissemination of information, information needs must be more clearly defined in order to answer questions of greatest priority in an efficient manner.

There used to be monthly meetings of the veterinary service which provided an opportunity for continuing education, to share interesting cases and discuss problems. These meetings have been discontinued due to lack of funds and for peer contact. The service has been primed to watch for cases of vesicular stomatitis, hog cholera, rabies poultry problems, such as Newcastle's disease. In the case of an emergency the PVO is called. Due to the limitations for laboratory diagnosis within Belize, samples must be sent to other countries for confirmation of diagnosis.

4.2 Public Awareness of Animal Health Issues

Technical information is disseminated to the public through the Information Unit in Belmopan (see section 7.1 for details about this unit).

One of the greatest current concerns is the introduction into Belize of avian influenza from Mexico. Information on this and other avian diseases has appeared in the monthly publication, Belize Today. It describes how a Poultry Producers Committee, comprised of two veterinarians and two industry representatives, has been established in an attempt to prevent the introduction of new avian diseases and minimize losses to production and trade due to existing diseases. An example of the type of reporting and public awareness campaign launched by the veterinary service in response to a disease outbreak is provided in the "Report on Vesicular Stomatitis Outbreak, April - May, 1994" .

4.3 Documentation of National Animal Health Information

In comparison to the plant protection situation there are considerably fewer animal species and associated diseases and pests to deal with. Belize is in an enviable situation with

regard to the most serious of these. The Office International des Epizooties (OIE) in Paris maintains a list of diseases of importance to international trade or human health, which are assigned to List A or List B according to the potential severity of their impact. Of the eight List A diseases, only one, vesicular stomatitis, is known to occur in Belize.

The veterinary authorities would like to be able to demonstrate freedom from some List B diseases such as brucellosis, tuberculosis, and infectious bovine rhinotracheitis (IBR). These diseases are not known to occur in Belize based on testing to date; however, Belize has been unable to mount the type of active surveillance necessary for international recognition of free status according to stipulations of the OIE.

The data from case reports maintained in Epi-Info, as mentioned in section 4.1 Information/Samples from the Field, documents the national animal health situation according to available information. Due to the lack of laboratory verification of diagnosis, much of the recording is by body system affected (eg. musculoskeletal, reproductive) rather than by disease. The merit of devoting effort to this type of recording must be weighed against the potential gain from targeted active surveillance for specific pests or diseases of concern.

The Screwworm eradication program was an example of an active surveillance and monitoring program to achieve a particular goal. Belize was declared free of Screwworm in 1994, so it is now considered an exotic pest. Any fly larvae found on animals in the field are sent to the Central Veterinary Laboratory for identification and verification that it is not Screwworm. Although these monitoring activities are ongoing they are not documented through any type of reporting system.

Tuberculosis testing is conducted every other year and the cost has been shifted to producers. The dairy cows in the major milk producing districts have all tested negative, however, this is not sufficient for Belize to claim freedom from Tuberculosis.

Although Belize is not a member of the OIE due to the cost of membership, they usually participate in the annual joint FAO/OIE/WHO survey on listed diseases, however, the materials were not received for the 1995 survey. Many countries use OIE information as a resource for making import decisions. In the absence of information, a worst case scenario might be assumed, curtailing export opportunities.

4.4 Information for Decisions and Policy-Making

The Animals (Diseases and Importation) Ordinance has existed, with amendments, since 1958. A new Veterinary Surgeons Act came into force in May 1996.

The OIE has been designated by the WTO as the official organization for the development of international standards for animal health. Since 1924 various Specialist Commissions, Working Groups and ad hoc groups have contributed to the development of international standards which are published as the International Animal Health Code. Experts

contribute draft chapters of the Code, which are presented each year for adoption by the assembly of the Heads of Veterinary Services at the OIE General Session. The Code contains a "detailed definition of the minimum health guarantees to be required of trading partners, so as to avoid the risk of spreading animal disease inherent in such exchanges."

As mentioned above, Belize has not joined the OIE due to the cost of membership and therefore does not receive OIE publications. However, through membership in FAO and IICA, Belize receives the FAO/OIE/WHO Animal Health Yearbook and the database HandiSTATUS, respectively, which contain data on the global distribution of listed diseases as reported by the countries. HandiSTATUS (Help with World Animal Disease Status) also contains the complete text of the International Animal Health Code with recommendations for the safe importation of animals and animal products. As a recent member of OIRSA, Belize received a document developed through the FAO/Propexan project which stipulates conditions for importation from other OIRSA member countries based on their present disease status.

4.5 Computer Resources for Animal Health

There are computers and 24 pin printers in each government veterinary clinic (Orange Walk, Cayo and Toledo), in the office of the PVO in Belmopan and at the Central Veterinary Laboratory in Belize (see entries 5 - 9 respectively in section 9. Inventory of Computer Equipment). Most of the computers are 486s with only 4 MB of RAM, which operate very slowly using Windows. The majority are equipped with fax/modems, but the Ministry of Finance did not approve additional phone lines for their use. It may be possible to utilize a switching device so that the one line could be used either for the telephone or fax/modem use. Internet access would allow efficient communication within the veterinary service, reducing isolation by enabling consultation and collaboration.

The operating system for most computers is Windows 3.11. Software packages in general use include WordPerfect 6.0 for Windows, Quattro Pro for Windows, Lotus 123 version 2.3 and MSWorks. Epi-Info 6.01 and Epi-Map are specialized epidemiology programs for managing, analyzing and displaying field data. HandiSTATUS 3.1 contains information on disease distribution to aid in import decisions. There is a need for training in the use of computers, specific software packages and the Internet.

5. Public Health

The two major areas of overlap between the Ministry of Health and Veterinary Services are zoonotic diseases (diseases that can be transmitted between animals and humans such as rabies, tuberculosis or brucellosis) and meat inspection.

Morbidity data for all outpatients and inpatients are compiled from hospitals and health centres in the districts and submitted monthly to the epidemiology and medical statistics office. The "Communicable Disease Notification Card" should be sent in weekly, but compliance is not good and the information must be cross-checked against the monthly reports. Information from

the weekly and monthly reports are entered into dBase IV in Belize City and are also transferred to Epi-Info. Monthly, quarterly and annual reports are produced using Epi-Info.

External reporting requirements include weekly and Quarterly reports to PAHO/CAREC (Caribbean Epidemiology Centre) on communicable diseases and weekly submission of an "Epidemiological Letter on Priority Diseases" under a tripartite agreement with Mexico and Guatemala. In return, this unit receives the Epidemiology Bulletin from PAHO and a monthly report from CAREC.

The computers available in the epidemiology and medical statistics office include two 386s and two 486s, entries 10-13 in section 9. Inventory of Computer Equipment. The 486s run Windows 3.11 and the 386s are running DOS. Software for word-processing includes Microsoft Word for Windows and WordPerfect (6.2 for Windows and 5.1 for DOS). Spreadsheets in use are Microsoft Excel, Quattro Pro and Lotus. Other programs include Harvard Graphics, Epi-Info, dBase, FoxPro and MEDISIS (a customized database program).

Meat inspection falls under the jurisdiction of Public Health, with the exception of meat for export which falls under Quarantine and must be inspected by veterinarians. The Running W plant is presently gearing up for export (see section 6.3 Export). Each district has a municipal slaughterhouse which is to be inspected by the district Public Health Officer (PHO). Slaughtering often takes place at night when there are no flies. In principal PHOs are to inspect all meat; in reality the frequency of visits may be once per month. There are poultry plants at Spanish Lookout and Blue Creek in Orange Walk which are inspected several times per year. In addition to meat inspection there are listings for water quality, milk plants, tanneries and regarding rabies control.

Public Health is in charge of the rabies campaign which consists of public education, vaccination of cats and dogs, and elimination of stray animals. Vaccine are provided by the Pan-American Health Organization (PAHO) for an annual vaccination campaign. Vaccinations are administered by PHOs, Veterinarians and Animal Health Technicians at several sites that are announced in the media. They used to identify vaccinated animals with tags, but there was a problem with the tags being transferred to different animals, so now a certificate of vaccination is issued identifying the animal and owner. If a person is bitten by a dog, the PHO follows up on the certificate and the dog is confined for 10 days regardless of vaccination status.

6. Quarantine

6.1 Import Decisions

The Quarantine and Inspection Service, initiated in 1981, is responsible for decisions regarding the importation of both animal and plant products. There is a need to check for consistency between the list of goods which require an import license prior to importation and the supporting legislation. It would also be most useful for all parties concerned (quarantine

inspectors, importers, etc.) to have a manual or handbook of regulations which outlines what products are allowed without restrictions, which products require import permits, health or phytosanitary certificates, any additional conditions that must be fulfilled prior to entry and an outline of the procedures to acquire the necessary documentation. Some representatives of the private sector would also like to see requirements regarding expiry date, expressed as a minimum percentage of the shelf-life of the product.

The position of Chief Quarantine Officer was created in January 1996. Technical back-up is provided by the PPS and Veterinary Service. Their primary sources of information with respect to international standards and global distribution of pests and diseases is described above in the respective sections titled Information for Decisions and Policy-Making (plant protection 2.4, animal health 4.4).

There is concern about compliance with the World Trade Organization (WTO) and its new rules, which came into effect January 1st, 1995. It includes a framework of rules regarding sanitary and phytosanitary (SPS) measures, the basic principles being: a) non-discrimination between a country's own and other countries' products; and b) transparency.

In order to implement the concept of non-discrimination it will be necessary to document the national disease and pest situation. For example, it Belize wished to prevent the entry of live animals from another country due to the presence of Hog Cholera, Belize may be called upon to demonstrate that it does not have Hog Cholera. This would require not only resources, but would necessitate knowledge of epidemiological principles for sampling and study design. The same concept applies for plant pests and diseases. In order to fulfill the transparency requirement both Belize's import regulations and the basis on which import decisions were taken would have to be made available to other countries.

According to the WTO agreement on SPS measures, international standards, guidelines and recommendations are to be developed "by the relevant international organizations, including the Codex Alimentarius Commission, the OIE, and the relevant international and regional organizations operating within the framework of the IPPC". If a national measure is based on an international standard it cannot be challenged under the WTO. However, the use of other than an international standard must be scientifically justified. Risk analysis is being promoted as a transparent and science-based method for making import decisions.

The Chief of the PPS and a Veterinary Officer are members of a newly formed regional commission for risk analysis which has been convened by OIRSA. In the future, the capacity to conduct risk analyses will be necessary to justify import restrictions for sanitary or phytosanitary reasons.

6.2 Process of Importation

Although there is a process to be followed for importation of agricultural products it appears that many importers are not familiar with it. Their knowledge of which products require

an import licence or import permit is limited. In the past there has been a rather regular trading pattern with respect to which goods arrive from what country and at which port of entry, however, new situations are likely to arise with the changing world trade environment. Quarantine inspectors at different ports of entry had slightly different interpretations of the procedures and reporting requirements. The following is an amalgamation of information from various sources in an attempt to determine what actually takes place.

The "Permit to Import Plant Material" is generally issued from the office of the Principal Agricultural Officer for Projects, PAO(P), in Belmopan. The PAO for projects, the PVO and the Head of the PPU only have the authority to issue other permits and all phytosanitary certificates. The CAO and QIs can also issue phytos while the Policy Analysis Unit can only issue import permit for vegetables. The consignment must be accompanied by a phytosanitary certificate, must be free from soil, is subject to inspection and other conditions of entry can be specified as necessary. The process to obtain a permit for the importation of pesticides is described under section 3. Pesticides Control Board.

"Import Permit for Animal Products into Belize" is used at present. The importer can purchase it at Angelus Press for B$0.20/copy. It is a one page from, however, up to five copies must be filled out by hand. One copy is kept by the veterinarian who issued the permit, one is kept by the importer, one is provided by the importer to the quarantine inspector (at time of clearance) and one is provided to the Ministry of Trade if a supplies control license is required (this should cease as of January 1997 due to WTO). A new "Permit to Import Animals, their Products and Byproducts, Biologics and Animal Health Products" was developed in 1995, but is not yet available commercially. The veterinary service presently prints it from a computer, then photocopies it to provide to district veterinary officers.

In addition to the import permit, certain conditions for entry must be fulfilled depending on the species and commodity. Importers are asked to make their application for an import permit at the same time that they place their order, however, sometimes the goods arrive without a permit having been issued. There is a need for a review of conditions, standardization of conditions at different sites and for the establishment of authority to sign the permits. The practice of issuing permits after goods have arrived should be discontinued.

In general, the import permit for either plant or animal material or pesticides must be completed, then stamped and signed by the relevant authority. Once the goods have arrived, the importer or importer's agent takes the import permit along with the customs entry form to the Quarantine Inspector. The Quarantine Inspector verifies that the documentation is in order and that the paperwork accompanying the goods that have arrived are in accordance with the import permit. He stamps the customs entry form with a stamp that says "visual inspection" and signs it. If the goods are actually inspected, it is a visual inspection to ensure that they correspond with the documentation. The Quarantine Inspector stamps and signs the permit and enters the information into a ledger. The entries vary from one port to another:

SEAPORT:
Released Date, Arrival Date, Material, Carrier, Origin, BOL (Bill of Lading number), Amount, Consignee (importer's name), Remarks, Officer (initials of person who fills in data).

AIRPORT (separate ledgers for animal health and plant protection): Date, Description, Origin, Amount, Airline, Name of Passenger or Importer, Remarks, Officer responsible.

LAND BORDER:
Date, Owner, Amount, Item, Origin & Transport, Condition, Disposition and Officer.

The Quarantine Inspectors transcribe their ledger entries into monthly reports and attach the import permits. The reports used to be sent to the PAO(P), in Belmopan. There is some confusion as to who should receive the reports since the recent creation of the position of Chief Quarantine Officer.

In the case of commercial shipments at the seaport, once the documentation has been stamped and signed by the Quarantine Inspector, the importer or importer's agent takes it to customs for clearance of the goods. If the shipment contains goods for several importers it is opened at the port, otherwise the sealed container goes to the warehouse or store before it is opened. A customs officer is present, but a Quarantine Inspector is not. Even when the container is opened at the seaport, it is often done by customs at times when there is no Quarantine Inspector on duty.

Live animals must be accompanied by an import permit and a health certificate. A landing permit is issued upon arrival (primarily pets), which notes whether they were allowed in and if any further action was required (eg. a young animal may require a rabies vaccination once it reaches a certain age).

Produce such as limes, mangoes and avocados are sometimes in transit through Belize to be shipped from Big Creek. They must be accompanied by a phytosanitary certificate stating that they are free of pests and diseases and that they come from an area free of fruit flies. The consignment is sealed with a metal belt that goes around the exterior and is accompanied by a customs guard to the point of shipment.

A sample of questionable goods can be taken to the District Agricultural Office to send away for examination. Lack of feedback diminishes incentive to submit samples. There is no penalty for trying to bring in goods without a permit. If they arrived by sea or air, the carrier has already departed. Goods have been seized on past occasions, but the legislative backing for such actions needs to be verified.

There are no technical materials available for the Quarantine Inspectors. The PVO used to send them photocopies of CARAPHIN News, the Newsletter of the Caribbean Animal and Plant Health Information Network, which contains articles about pests and diseases of concern in the region. They receive verbal messages regarding any changes regarding what is allowed

to enter Belize.

At several of the land borders lists of items that were not allowed entry to Belize were posted where persons crossing the border could see them. This type of public awareness should be encouraged and additional materials made available. In addition to immigration and customs forms, there is no declaration form or inclusion of questions related to agricultural health. This is a good way to inform the public and invoke their assistance in protecting domestic agriculture.

6.3 Export

Phytosanitary Certificates can be issued by the Quarantine Inspectors at the border for commonly exported goods such as lumber, peppers, or sugar. Entries such as the following are kept in a ledger:Date/Exporter/Origin/Quantity of Material/Type/Exportation License Number/Exportation License Date Issued/Owner of License/Total Amount Exported/Destination. The exportation license refers to supplies control which falls under the Ministry of Trade and Industry.

With respect to exportation of non-traditional products to the USA, such as papayas and peppers, Ministry of Agriculture officials have worked out a protocol together with the representative of USDA/APHIS. Producers, ministry officials and the PCB work out pesticide use with guidelines provided through CATIE. CATIE is the official institution representing EPA guidelines for Central America. Producers are provided with packing shed requirements and Quarantine Inspectors are trained in the necessary procedures for certification.

No meat products have been exported since 1987; however, there has been a recent excess of beef and potential exists for a resumption of exports. Meat for export must be inspected by veterinarians. Even when the product is available, sometimes it isn't possible to do the laboratory testing necessary for certification. For example, in one year there were excess eggs, but they could not test for poultry diseases such as Newscastle's disease. Residue testing for meat can be done in Honduras.

The Running W plant processes beef and pork on alternate days. It is responsible for 25% of the national output. As of May 1996, there was a veterinarian present on the kill floor on an experimental basis. This cost may eventually be assumed by the processor. The Belize Livestock Producer's Association receives a cess of Belize $8.00 per head which could be used to pay for inspection. Consultants from Florida were providing training and were to prepare a report regarding standards necessary for export to the USA.

6.4 Computer Resources

There are no computers specifically allocated to quarantine. The Chief Quarantine Officer has access to the computer at the Central Veterinary Laboratory.

The Customs Department is computerized in Belize City at the seaport and airport, with information on the type and amount of commodities that enter. At the land borders customs does an inspection and looks for drugs or collects a duty.

7. Other Related Areas

7.1 Information unit

The person assigned to this unit just returned from training in January. Although there is no job description available it is understood that the major function is public relations, including the preparation of press releases related to Ministry functions and travel. Press releases are fed through another government agency, the Belize Information Service. Articles are also supplied to Belize Today, a monthly publication which is distributed free of charge with a circulation of several thousand. The PPS and Veterinary Services assist with technical input for articles on pertinent problems such as Pink Mealybug, Lethal Yellowing or Avian Influenza. A booklet was produced on growing hot peppers with technical assistance from the PPS.

Emergency alerts are done through radio spots, posters or flyers (the newspaper is weekly). For example, during the rabies outbreak in 1995 flyers were distributed at the western border and there was daily information on the radio.

There are plans to do technical bulletins, prepare radio programs and audiovisual materials, but there is a problem with transport, lack of access to a camera or tape recorder and no budget for materials, so recurrent expenditures present a problem. The radio stations are private so there is no free time.

A pentium computer replete with a scanner, laser printer, CD-ROM, speakers and a removable cartridge for tape storage was provided through the NRI/ODA plant protection project (entry 14 in section 9. Inventory of Computer Equipment). The operating system is Windows 95, with software such as WordPerfect 6.1, Lotus and Quattro Pro, as well as specialized programs for publication including Pagemaker 6.1, Photo Shop (for the scanner), Illustrator and Corel Photo-Paint.

7.2 The private sector

Information generated exclusively by and for the private sector is not the subject of this study. However, the private sector has an increasingly important role as a contributor to the public management of its interests. With respect to information, the private sector has a role to play in the development of national standards and can be a contributor to, as well as a recipient of public awareness materials.

Formation of groups such as the Pesticides Control Board and the Poultry Producers Committee show how public/private cooperation can better serve and protect their industries.

There will be a need for additional collaboration as Belize adjusts to the requirement of the WTO and other trade agreements. For example, the fisheries sector is in need of information and assistance to implement HACCP procedures. Between 70% and 80% of the catch is exported, primarily to the US, but some goes to France and Japan. Present sources of HACCP information include the Bureau of Standards, FAO and USDA. Private veterinarians have expressed need for practice management software, which could be employed in government clinics as well.

7.3 Bureau of standards

The Bureau of Standards was established in 1992 under the Ministry of Trade. It has responsibility for standardization for all commodities. This is achieved by overseeing the development of national standards.

Belize is a signatory to the WTO, therefore its national standards must be based on international standards when they are available. This underlines the importance of access to international standards, but the cost of membership has prevented Belize from joining many international standards organizations. When this unit receives a request for an international standard they source it and find its cost. Belize has a limited library of some standards. Other countries who are members of international standards organizations send catalogues of their national standards, which indicate which are the same as the international standard.

With regard to agricultural health, the organizations with responsibility for international standards for animal health, plant protection and food safety are the OIE, FAO/IPPC and Codex, respectively. The first two are discussed under the relevant sections of this document. The Bureau of Standards needs to cooperate more closely with the PPS and Veterinary Services with respect to national standards in these categories. The Bureau of Standards is the point of contact for the Codex Alimentarius Commission. Codex produces international standards for food safety which pertain to both agricultural goods and fisheries. There is no cost membership.

The Standards Advisory Council was appointed in 1995. The process for developing national standards begins by assembling a committee of relevant public and private sector representatives to prepare a draft. The public is notified of the draft. If substantial revisions are necessary the public must be notified again. If the standard is mandatory it is submitted to the Ministry of Trade and Industry. There is a need for public sensitization as to the importance of these standards, as there is presently a very poor response to requests for comments.

The Bureau of Standards has one 486 computer which is used primarily for word-processing (WordPerfect 5.1 for DOS) and spreadsheet calculations (Lotus 123). See entry 15 in section 9. Inventory of Computer Equipment for details.

7.4 Policy Analysis and Statistics

Information on imports and exports is gathered by the Ministry of Trade and Industry. Relevant information on agricultural products is available in this unit both as a hard copy and on diskette (Lotus spreadsheet). Production data for major export crops is provided by the producers (eg. citrus, banana, sugar, papayas). Extension Officers report on local production, both acreage under cultivation and yields. The quarterly reports provided by the District Agricultural Officers are collated for the six districts and serve as a basis for the annual report which includes production totals. This unit also does market price collection for each district on a weekly basis. A number of farmers are sampled at each market.

Since 1995 information on the number of import permits, amount and type of product has been extracted from the import permits submitted through the Quarantine Inspectors. It is used to calculate how much of what commodity is imported from where. It also gives some idea of the production of lesser commodities such as cabbages and cucumbers. The amount imported off season to meet consumption needs is used to estimate in-season production. The unit provides agricultural statistics to the Central Statistical Office where they are refined and published annually as the "Abstract of Statistics".

One statistical officer has self-taught knowledge of computers is responsible for managing the computers in the unit (see entries 16 - 18 in section 9. Inventory of Computer Equipment). This includes three 486s (one actually belongs to NARMAP) which run under Windows for Workgroups 3.11. Software includes WordPerfect 6.0 and Lotus for DOS, Microsoft Word 6.0, Harvard Graphics and Quattro Pro for Windows and an antivirus program, F-PROT. He also oversees the computers of the Chief Agricultural Officer, the Finance Officer and the secretary to the Minister of Agriculture (entries 19 -21 in section 9. Inventory of Computer Equipment) which are primarily used for word processing. Hardware problems require outside help.

8. The Internet in Belize

Internet access in Belize is provided through Belize Telecommunications Ltd (BTL). The service is named BTL.NET. There is a one-time activation charge of Belize $30.00 to set up a BTL.NET account. The monthly access fee is Belize $60.00/month for either shell access (text only) or SLIP/PPP access (graphical capability). This includes 10 hours of access per month and 2 MB of disk space. The next 10 hours cost Belize $8.00/hour and additional hours are billed at Belize $4.00/hour. Each additional MB of disk space costs Belize $10.00.

BTL suggests that minimum hardware requirements to access their service are a personal computer with 4 MB of RAM, 4 MB of space on the hard disk and a modem for a shell account, plus Windows 3.1 and at least a 386 for a SLIP/PPP account. It would be advisable to be running Windows and to have SLIP/PPP access, as graphical browsers make it much easier to navigate the Internet. A faster machine and higher speed modem (preferably 486, 66MHz, 14,400 bps or more) will reduce connect time.

Once an account has been established with BTL.NET, they provide the necessary userids and passwords. BTL provides WorldGroup and BTL.NET software, however, other commercially available software packages can be used as browsers (eg. Netscape Navigator, Mosaic). For a SLIP or PPP account the user must be running Windows 95 or must obtain additional software such as "Internet in a Box" or Trumpet Winsock to provide TCP/IP connectivity. BTL does not provide assistance with software installation or training in using the Internet; however, there is a list of local companies which provide these services.

9. Inventory of Computer Equipment

No.	Make	CPU	MHz	RAM	HD (MB)	Disk Drive	Other/Printer/Comments
1 PPS	Tech-media	486	66	8	540	3.5 CDROM	14.4 fax/modem HP Laserjet IIIP
2 PPS	Micron Electronics	586	90	8	1200	3.5 CDROM	14.4 fax/modem HP Deskjet 600c Internet
3 PPS	Desktop	386	40	4	60		not working
4 PPS	Compaq notebk	386	25	4	60	35	problems with monitor
5 VSO/W		386		1	500	35	Epson LX 810 fax/modem
6 VSCF	Dell Optiplex 425 S/L	486	25	4	250	3.5 5.25	Okidata Microline 380 24 pin printer fax/modem
7 VS TOL	IBM PS/2 50z	286		1	30	3.5 5.25	Epson FX-1050 24 pin printer
8 VS PVO	Dell Optiplex 425 S/L	486	25	4	250	3.5 5.25	pin printer fax/modem
9 CVL	Dell Optiplex 425 S/L	486	25	4	250	3.5 5.25	pin printer fax/modem
10 MED	Gateway 2000	486	33?	8	250	3.5 5.25	Epson LQ-1170 CD-ROM not working
11 MED	THC	486	33?	8	405	3.5	14.4 fax/modem
12 MED	AST	386	33	2	118	3.5	Epson FX-1170 not working
13 MED	Colorado 350	386	33?		250	3.5 5.25	Citizen GSX 145 tape drive

No.	Make	CPU	MHz	RAM	HD (MB)	Disk Drive	Other/Printer/Comments
14 INF	Smile	586	133	32	1000	3.5 5.25 ROM	HP Deskjet 1600CM HP Scanjet 4C 270MB tape storage
15 STD		486	66	7	250	3.5	Printer
16 STA	Compaq	486	33	12	210 500	3.5	HP Laserjet 4 (shared with #11)
17 STA	Edison	486	33	4	200	3.5	HP Laserjet 4 (shared with #10)
18 NAR	Compaq	486	33	4	210	3.5	Epson FX1050
19 CAO		386	33	4	80	3.5	No printer
20 FIN		386	33	8	120	3.5	HP Laserjet II
21 MIN		386	33	4	80	3.5	HP Laserjet 4L

Appendix B.3
Overview of the Animal Disease Status in Belize

Appendix B.3

Overview of the Animal Disease Status in Belize

1. Prevalence of Main Animal Diseases

(i) Rabies: Belize has both urban and wildlife rabies. The last human death due to rabies was in 1989. In August 1995 urban rabies resurfaced in the Cayo District after an absence of 5 years in the country. This outbreak occurred in the Cayo District (6 dogs and 1 cat) and in the Corozal District (1 cat). The reservoir for sylvatic rabies is the vampire bat. The last reported wildlife rabies case was in 1992 in two foxes. The Ministry of Health is responsible for urban rabies and they conduct annual vaccination of dogs and cats. The MAF is responsible for sylvatic rabies and for submissions of all suspect rabies cases to the reference laboratory in Panama (the Veterinary Laboratory of the Ministry of Agriculture). Under sylvatic rabies the MAF maintains a vampire bat control and eradication program which is attached to the Screwworm surveillance unit.

(ii) Blackleg: Blackleg is endemic throughout the country since its introduction in the early seventies in the Cayo District. Farmers are encouraged to vaccinate their cattle annually with a seven way clostridial vaccine. Most cases are reported in the dry season.

(iii) Vesicular Stomatitis: Vesicular Stomatitis, New Jersey strain, is endemic in four districts in Belize: Belize, Cayo, Stann Creek and Toledo. Epidemics occur on a six to seven-year cycle in the dry season. The Cayo district suffers the most from this disease since it is a major livestock producing area. The last outbreak was in 1994. It affected 36 farms in the Belize, Cayo and Stann Creek districts. A total of 23 equine cases and 43 bovine cases were reported. Epithelia of all suspect vesicular cases are submitted to the regional reference laboratory (LADIVES) in Panama. Since the closure of LADIVES all suspect vesicular samples are submitted to the USDA laboratory in Plum Island, New York.

(iv) Equine Encephalomyelitis: Equine Encephalomyelitis is of low sporadic occurrence throughout Belize. In 1994 there were five cases reported in the Cayo District. In 1996 a case reported in the Cayo District was diagnosed in the U.S. (Ames, Iowa) as Eastern Equine Encephalomyelitis. It is believed that this disease is under-reported in other districts. Vaccination using a three-way vaccine (Eastern, Western and Venezuelan) is recommended.

(v) Contagious Ecthyma: Contagious Ecthyma is endemic in Belize but it is not of economic importance as sheep production is minimal and the production system is largely small scale and extensive. Some farmers do vaccinate.

(vi) Avian Diseases: The major diseases affecting poultry in Belize include Mycoplasmosis, Fowl Pox, Infectious Bursal Disease, Aflatoxiosis and parasitism. There are periodic outbreaks of aflatoxicosis when old corn is used in feed formulation. Farmers vaccinate against the following diseases: (a) Broilers - Infectious Bursal Disease, Coccidiosis (recently); and (b)

Layers - Marek's Disease, Avian Encephalomyelitis, Infectious Bronchitis, Newcastle Disease, Fowl Pox and Infectious Bursal Disease.

The Mennonite Community produces almost 100% of the poultry products in Belize. All the major poultry producing areas are Mennonite Communities such as Spanish Lookout in the Cayo district and Blue Creek in the Orange Walk district. Until recently entry into these communities to inspect poultry production has been difficult.

2. Notifiable Diseases:

Belize has a list of notifiable diseases that have been under legislation since 1958. Anyone having any animal with a notifiable disease must keep such animal separate from animals not so diseased and report the disease within 24 hours. The notifiable diseases are: Anthrax, Brucellosis, Contagious Bovine Pleuropneumonia, Equine Encephalomyelitis, Equine Infectious Anaemia, Epizootic Lymphangitis, Epizootic Abortion, Foot and Mouth Disease, Glanders, Farcy, Hemorrhagic Septicaemia, Infectious Laryngotracheitis Mange (ovine, commonly called sheep scab), Melitensis infection (commonly called Malta Fever), Newcastle Disease, Paralytic Rabies (bat transmitted), Psittacosis, Rabies, Rinderpest, Sarcoptic mange in horse, Swine Erysipelas, Swine Fever (Hog Cholera and African Swine Fever), Tuberculosis, Trypanosomiasis (including dourine, mal de caderas, surra and trypanosama vivax infections), variola ovina and variola vaccinia.

3. Exotic Diseases

Animal diseases in the region that pose a threat to Belize include the following: Anthrax, Aujesky's Disease, Avian Influenza, Avian Laryngotracheitis, Brucellosis, Heartwater, Hog Cholera, Infectious Bovine Rhinotracheitis, Screw worm and Tuberculosis. The threat of these diseases require that Belize maintains a strong quarantine (including pre entry, entry and post entry) and an active surveillance system especially along its borders with Mexico and Guatemala.

4. AHS's Relationship with Regional and International Organizations

(i) **LADIVES/PANAMA:** This is the reference laboratory for vesicular diseases.

(ii) **MIDA/PANAMA:** This is the veterinary laboratory for the Ministry of Agriculture in Panama. This laboratory provides courtesy rabies diagnostic service for Belize.

(iii) **PAHO/BELIZE:** This organization has been largely underutilized by the animal health services. Only recently have formal agreements been made with PAHO and this was due in large measure to the urban rabies outbreak in the Cayo District in August of 1995.

(iv) **IICA:** A Belize office was recently inaugurated (January 1996). Animal health programs include a broad-based sectorial study (1993-1994), funding of training activities within

the region and the preparation of the current project proposal for the modernization of animal and plant health services.

(v) **OIRSA:** Belize recently became a member of OIRSA and a country office was opened in July 1996. As a member country Belize benefits from all the animal (and plant) health programs executed by OIRSA. OIRSA membership has enabled Belize to benefit from another regional program (PARSA) sponsored by the European Union.

(vi) **USDA/APHIS**: Belize has an excellent collaboration with the USDA/APHIS of the U.S. USDA veterinarians visit Belize periodically offering training in-country and in the U.S. The USDA also provides assistance in the diagnoses of diseases in their laboratories in Ames, Iowa and in PLum Island, New York.

Appendix B.4
General Regulations of the Quarantine and Inspection Service

Appendix B.4

General Regulations of the Quarantine and Inspection Service

The operations of the Quarantine and Inspection Service are regulated under Chapters 178 and 167 of the laws of Belize for plant and animal disease control respectively. These are outlined below.

I. Regulations controlling the importation of animals, etc.

1. The Minister may, for the purpose of preventing the introduction or spread of any disease into Belize, make regulations prohibiting, restricting, controlling or regulating the importation of animals or any specific kind thereof, or of carcasses, fodder, litter, dung or other similar things.

2. Regulations made under subsection (i) may without prejudice to the generality of such power make provision with regard to:

   (a) Specifying and defining the ports at which animals or carcasses, fodder, litter, dung or other similar things may be landed;

   (b) controlling, prohibiting or regulating the movement of animals or carcasses, fodder, litter, dung or similar things, into, within, or out of, any defined port;

   (c) controlling the examination, cleansing, destruction, disposal, seizure and detention of any animal, or of carcasses, fodder, litter, dung or other similar things, in a port;

   (d) the fees and expenses incurred for any purposes for which regulations may be made under this section and the person to whom they are to be paid and the manner in which they may be recovered.

II. Regulations controlling the importation of plant and plant products.

1. The Minister may make regulations for all or any of the following purposes:

   (a) prohibiting, restricting or regulating the importation into Belize of:

      (i) any plant, vegetable organism or package;
      (ii) any article or class of articles whether of a nature similar to plants or not;
      (iii) any animal or animal organism, likely to cause infection by any animal or vegetable organism or other agent which is or believed to be inimical to the growth of plants;

(b) requiring that any plant, article, matter or thing specified in paragraph (a) of this subsection shall be imported into Belize only on the advice of and with the concurrence of the Plant Quarantine Committee previously obtained and subject to such conditions as the Committee may impose;

(c) authorizing or requiring the inspection before import of any plant or article likely to infect any plant with any animal organism or vegetable organism or other agent which is or is believed to be inimical to the growth of plants;

(d) prohibiting, restricting or regulating the transport, cultivation or harvesting of any diseased or controlled plant ordered by the Minister to be such section 4.

(e) authorizing or requiring the disinfection, treatment, destruction and disposal without compensation of any diseased plant or article likely to infect any plant with any pest or disease or of any plant appearing to be infected with any animal or vegetable organism or other agent which is or is believed to be inimical to the growth of plants, or of anything whatever, whether of a nature similar to a plant or not, likely to infect any plant with any animal or vegetable or organism or other agent which is believed to be inimical to the growth of plants;

(f) authorizing or requiring the precautions to be taken to prevent the spread of plant disease or pests, including the quarantine of infected plant areas;

(g) directing or authorizing the disinfection, treatment and fumigation of buildings, vehicles, vessels or aircraft suspected of harboring any pest or article likely to infect any plant with disease;

(h) authorizing or requiring the inspection before import or export of any plant or article likely to infect any plant with any pest or disease, and providing for the grant of a certificate certifying the results of any such inspection;

(i) prohibiting the importation of any plant or plants except at specified ports or places of entry;

(j) directing or authorizing the detention of any imported plant or plants or classes of imported plants in any specified place and prescribing the precautions to be observed during such detention;

(k) authorizing or requiring the issue and revocation of licenses for the inspection of nurseries in which plants are reared for the purpose of sale, and the imposition of fees for such licenses, and the regulation of the sale or removal of plants whether reared in nurseries or not;

(l) regulating or prohibiting the removal from any land or building, or the transference or conveyance from any part of Belize to any other part thereof, of any plant, soil, manure, straw, package, vegetable organism or animal organism;

(m) fixing the payment of fees for disinfection or treatment or any other services rendered by officers under this Ordinance;

(n) defining the duties of Plant Protection Officers under this Ordinance;

(o) regulating the manner in which applications are to be made to a Plant Protection Officer; and

(p) generally for carrying into effect the provisions of this Ordinance.

Additional Information

Its major problems is the lack of resources and capacity to meet the basic demands of the sector as well as the new international health standards, norms and requirements of exporters such as Hazard Analysis Critical Control Point (HACCP) where testing on plate counts, fecal coliforms, fecal streptococcus, fecal staphylococcus anaerobics, salmonella, listeria and TBVN are required[1].

THe VSD places emphasis on ambulatory clinical services and the adoption of critical practices such as vaccination against diseases, deworming, utilization of mineral supplements, use of plant breeding programs and commercialization of livestock farming. The PPS is responsible for diagnosis and surveillance, eradication and control campaigns, information gathering and dissemination, liaison and advisory services. The Quarantine Department (QD) supports both plant and animal health. It has quarantine inspectors (QIs) stationed at the five official entry points into Belize.

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[1] The HACCP is a test required by U.S. and some European countries, specially France, since 1995. It requires that a country has an accredited laboratory to meet international standards.

Appendix B.5
Risk Analysis

Appendix B.5

Risk Analysis

1. What is Risk Analysis[1]

Almost every decision involves a risk analysis, whether or not it is undertaken consciously. There is nothing new about it, other than the efforts being made to formalize and document the process. In general, it consists of identifying a source of danger and estimating the likelihood of its occurrence and the potential impact. It is crucial that both of these components be included. For example, when deciding whether or not to buy a lottery ticket, there is a high likelihood of losing the investment, but the impact would be negligible. In contrast, when deciding whether to sky dive, with proper technical controls there may be a very small chance that the parachute will not open, but the consequence would be devastating. Thus the risk depends not only on the probability of an event occurring, but also on the foreseen outcome.

The above are very simple qualitative examples. A quantitative risk analysis would require estimation of probabilities in numeric terms. In the parachute example, this would include estimating the likelihood that both the primary and back-up release mechanisms fail and the likelihood of possible outcomes. Quantitative analysis can be very demanding of time and resources and are usually reserved for situations where either the trade revenues or potential impact are great.

The introduction and establishment of a pest or disease in an importing country requires that a number of conditions be fulfilled: the organization must be present in the commodity of interest in the exporting country or have the opportunity to be introduced in transit, it must avoid detection and elimination by inspection, quarantine, testing or treatment, it must be able to contact a suitable host in a favorable environment and be in sufficient numbers/dosage to establish infestation or infection.

Regardless of the complexity of the analysis, the careful identification on the steps in the process and documentation of the evidence means that the reasoning behind the decision is available, can be understood by others, and can be altered in light of changes or new information.

2. Relevance of Risk Analysis?

International trade agreements are setting the stage for freer trade in a more global economy. In the agricultural sector, freedom from particular pests or diseases can impart an

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1 Although there have been attempts to harmonize terminology and approaches to risk analysis in the SPS realm, there are still a variety of techniques employed in animal health, plant protection and food safety. It is beyond the scope of this document to deal with these differences and an effort has been made to use generic descriptions to avoid conflict.

advantage in terms of production costs and trade opportunities. Sanitary and phytosanitary (SPS) measures must be balanced to protect human and agricultural health in the importing country, without unnecessarily impeding trade.

In the past, a "zero risk" policy was often applied, whereby the mere presence of a disease in a country was sufficient to bar importation of that country's products. This may have been defensible earlier in the century when observation of clinical signs or gross abnormalities may have been the only means of detection. However, there have been tremendous improvements in the availability of scientific information, diagnostic tests and measures to mitigate the risks presented by pests and disease.

Risk analysis is being promoted as a science-based tool that can help introduce elements of impartiality, repeatability and transparency to import/export decisions. It can lead to improved decision-making, taking into consideration mitigating measures such as testing, quarantine, treatment, processing or the establishment of free areas or zones.

The historic focus on the use of SPS measures for purposes of protection are being redirected toward facilitation of trade. This redirection implies cultural changes and improved cooperation between the public and private sectors, both nationally and internationally. The adoption of risk analysis is one step in this direction.

3. Risk Analysis, SPS Measures and the WTO

Under the World Trade Organization (WTO), the only legitimate remaining non-tariff barrier to agricultural trade is the application of SPS measures. Development of the SPS agreement was necessary to ensure that sanitary barriers were not used to replace tariffs or other non-tariff barriers. One of the basic principles is non-discrimination between a country's won and other countries' agricultural products.

According to the WTO agreement on SPS measures, international standards, guidelines and recommendations are to be developed "by the relevant international organizations, including the Codex Alimentarius Commission, the International Office of Epizootics (OIE), and the relevant international and regional organizations operating within the framework of the International Plant Protection Convention (IPPC)." This extends to the development of international standards for risk analysis.

The Secretariat of the IPPC is in the process of developing a standard for risk analysis for plant quarantine. Expert have prepared draft documents on the subject. However , there is a lengthy process of review and approval that generally takes several years to complete. Similarly, experts contribute, draft chapters for the International Animal Health Code, which is updated annually by the OIE. In recent years a chapter has been added on Import Risk Analysis, which provides general guidelines, but states that countries "should design their own methodology for carrying out the exercise". An edition of the OIE Scientific and Technical

Review (Vol. 12, No. 4, December 1993) entitled "Risk analysis, animal health and trade" provides examples developed by some countries.

If a national SPS measure is based on an international standard, it cannot be challenged under the WTO. However, countries have the sovereign right to protect their national agricultural sector and may elect to apply measures that are more strict than the international standard. The use of such measures must be scientifically justified and should be bases on risk analysis. Thus, there is rapidly increasing demand for risk analysis for import decisions; however, a standardized methodology and structured set of procedures for the conduct of risk analysis have not yet been established.

4. Why it Is Necessary to Implement Risk Analysis?

Evaluation of the infrastructure of an exporting country is considered a valid element of risk analysis and is key to establishing credibility with potential trading partners. A favorable assessment will help instill confidence in subsequent information provided by that country. Some of the factors considered are structure and organization, human and financial resources, legislative support, operational programs and technical back-up (laboratory, inspection, quarantine).

The conduct of risk analysis will impose demands on the exporting country to provide specific and detailed information on the disease and pest situation. This increase in national surveillance and monitoring will entail knowledge of epidemiologic methods and analytic capabilities. There is increasing pressure to scientifically verify claims of freedom from particular diseases and pests and for ongoing surveillance to ensure continued free status. The same principles will apply to the recognition of disease and pest free zones or areas.

Access to appropriate technology and information is necessary to be able to conduct import risk analysis or evaluate risk analysis completed by others. Even the most sophisticated quantitative analysis can be conducted on a personal computer with the appropriate software. More limiting factors are knowledge of how to construct the analysis and access to the necessary information inputs. Risk analysis has been likened to "organized uncertainty" in that it can proceed in the absence of perfect information.

Important differences remain between countries that will affect their ability to implement risk analysis, particularly with regard to the availability of funds, technically trained personnel and access to appropriate information and technology. In many cases developing countries would have to make significant investments in order to comply with global and regional SPS agreements.

APPENDIX C

Appendix C.1
Construction and Rehabilitation of Infrastructure of the NAGHS

Appendix C.1

Construction and Rehabilitation of Infrastructure of the NAGHS

1. Central Administration Offices of the NAGHS, Central Farm, Cayo District

Location: First Floor of an expanded Veterinary Clinic and Laboratory Building at Central Farm

(a). Cashier and Reception
(b). Conference Room
(c). Head of Health Services
(d). International Regional Liaison
(e). Quarantine Office
(f). Accountant's Office
(g). Storage
(h). Male Bathrooms
(i). Female Bathrooms

The Central Administration Offices of the NAGHS will be located above the proposed extension to the Veterinary Laboratory. These will occupy and Area of 2200 square feet of a totally new Building Structure.

2. Veterinary Clinic, Central Farm, Cayo District

Rooms: Ground Floor

(a). Secretary/Receptionist
(b). Waiting area
(c). Medication general storage room
(d). Small medication storage room
(e). X-Ray room
(f). Dark room
(g). Surgery room
(h). Surgery bath room
(i). Storekeepers office
(j). Veterinary assistant office
(k). Laboratory
(l). Storage for laboratory
(m). Autopsy room
(n). Incinerator room
(o). Veterinary doctor's office
(p). Epidemiologist's office
(q). Head of Animal Health's office
(r). Public and personnel bath rooms

(s). Utility room
(t). Laundry room
(u). Patio
(v). Kennels

The building of the existing veterinary clinic will continue to be used in this proposal with the remodeling of rooms as specified in drawings. Windows will be replaced, existing burglar bars should only be adjusted to suit the new windows. The ceiling will be changed and a vinyl floor will be installed.

The existing building has an area of 1881 square feet and an additional 1806 square feet will be built to house the other rooms that will complement the project, on a Ground Floor. The entrance to the building has now been relocated to face the proposed parking area to the west side of the building.

3. Plant Protection Laboratory Building, Central Farm, Cayo District

Ground Floor:

1. Head of Plant Health Services
2. Secretary/Receptionist
3. Meeting room and library
4. Computer room
5. Quarantine officer
6. Bath rooms

First Floor:

1. Plant Protection Officer and sample reception
2. Plant pathology laboratory
3. I P M Officer and Entomologist's office
4. Bath rooms
5. Store room

Plant Health Laboratory Building has an existing area of 1232 square feet, all of which was recently refurbished. The proposed 388 square feet of new construction is to be built in two floors to house additional bathrooms, storage and quarantine office. In addition to this, the soils laboratory, which is adjacent to this building, will have its storeroom extended by 180 square feet and a new drying area will be built occupying 400 square feet of concrete slab and a thatched roof, with its corresponding shelving.

4. Soils Laboratory

The only work to be done to this building will be to add a small extension to house equipment for chemical residue testing.

5. Central Veterinary Investigations Laboratory, Belize City

a. Secretary/Receptionist
b. Waiting area
c. Head of laboratory
d. Senior laboratory technician
e. Lab. technicians general office
f. Sample collector's office
g. Sample storage for daily use
h. Long term sample storage
i. Microbiology laboratory (clinical)
j. Microbiology laboratory (food)
k. Hematology/Parasitology
l. Hispatology
m. Biochemistry
n. Water quality
o. Residues analysis
p. Drugs store room
q. Conference room
r. Decontamination rooms
s. Janitor's room
t. Mechanical room
u. Computer room
v. Bathrooms (2)
w. Tea room
x. Rabies waste water storage treatment
y. Security station
z. Covered parking area

Offices to remain as are:

Room No. 104.	Rabies waste water storage
Room No. 106.	Residues analysis
Room No. 107.	Residues analysis
Room No. 108.	Sample storage
Room No. 109.	Tea room
Room No. 116.	Mechanical room
Room No. 119.	Microbiology (clinical)
Room No. 120.	Hematology

Room No. 121. Hispatology
Room No. 122. Biochemistry
Room No. 126. Drugs storeroom
Room No. 124. Janitors room
Room No. 125. Senior lab. technician

5. Quarantine Station and Apartment for Big Creek, Stann Creek District

Rooms:

a. Office
b. Work area
c. Storage room
d. Incinerator
e. Bath room
f. Living room
g. Dining room
h. Kitchen
i. Bedroom

This is the only quarantine station in the country that will house the living quarters of its officer. Negotiations will have to be made with the Banana Company to lease land for the construction of this facility.

6. Typical Quarantine Stations, Country Wide

Rooms:

a. Office
b. Work area
c. Storage room
d. Incinerator
e. Bath room

All proposed nine locations of quarantine stations will have basically the same layout with the exceptions of Big Creek and Western Border. Land lease negotiations will have to be made to house these facilities.

7. Refurbishing and Remodeling Requirements

The architect has done an overall appraisal of the existing facilities having noted that major repairs ought to be done on different rooms. This in order to convenient and comfortable

working conditions be given to the technicians and other staff. New furniture and equipment have been specified earlier in this proposal.

These repairs have been costed and their costs are shown on the Overall Cost Sheet in this proposal. The repairs that are to be done are mentioned below and these should comply with building procedures and materials for laboratories.

Some of these works are:

(a). Floors: cracks sealed and sheet vinyl replaced.

(b). Walls: cracks should be sealed, walls washed free of termites, walls should be steel floated on all laboratories and painted with epoxy paint.

(c). Doors: most doors need to be sanded and repainted, locks need to be changed and some doors need to be changed totally.

(d). 80% of fixed cabinets in rooms that are not presently being used need repairs with doors and hinges changed.

(e). Wall tiles need placed on bathrooms.

(f). Most sinks and lavatories need be changed or their faucet seals need replaced.

(g). All exterior walls need to be pressure washed, sealed and painted with adequate exterior paint.

(h). Most ceiling lighting fixtures need their ballasts and fluorescent tubes replaced and some need their diffusers.

(i). Electrical distribution panels needs to be reconditioned, circuits redefined and labeled and emergency generator put into working conditions.

(j). Fire detectors and extinguishers need to be installed in every room.

(k). Walls should be removed and relocated in head of laboratory office and secretary and waiting area.

In addition to the above repairs, there are areas which need to be built as new structures. These are:

(a). A six feet wide covered corridor within the inside perimeter of the building to provide covered access from one office to another.

(b). A security station to be built beside the stairs

(c). A decontamination area

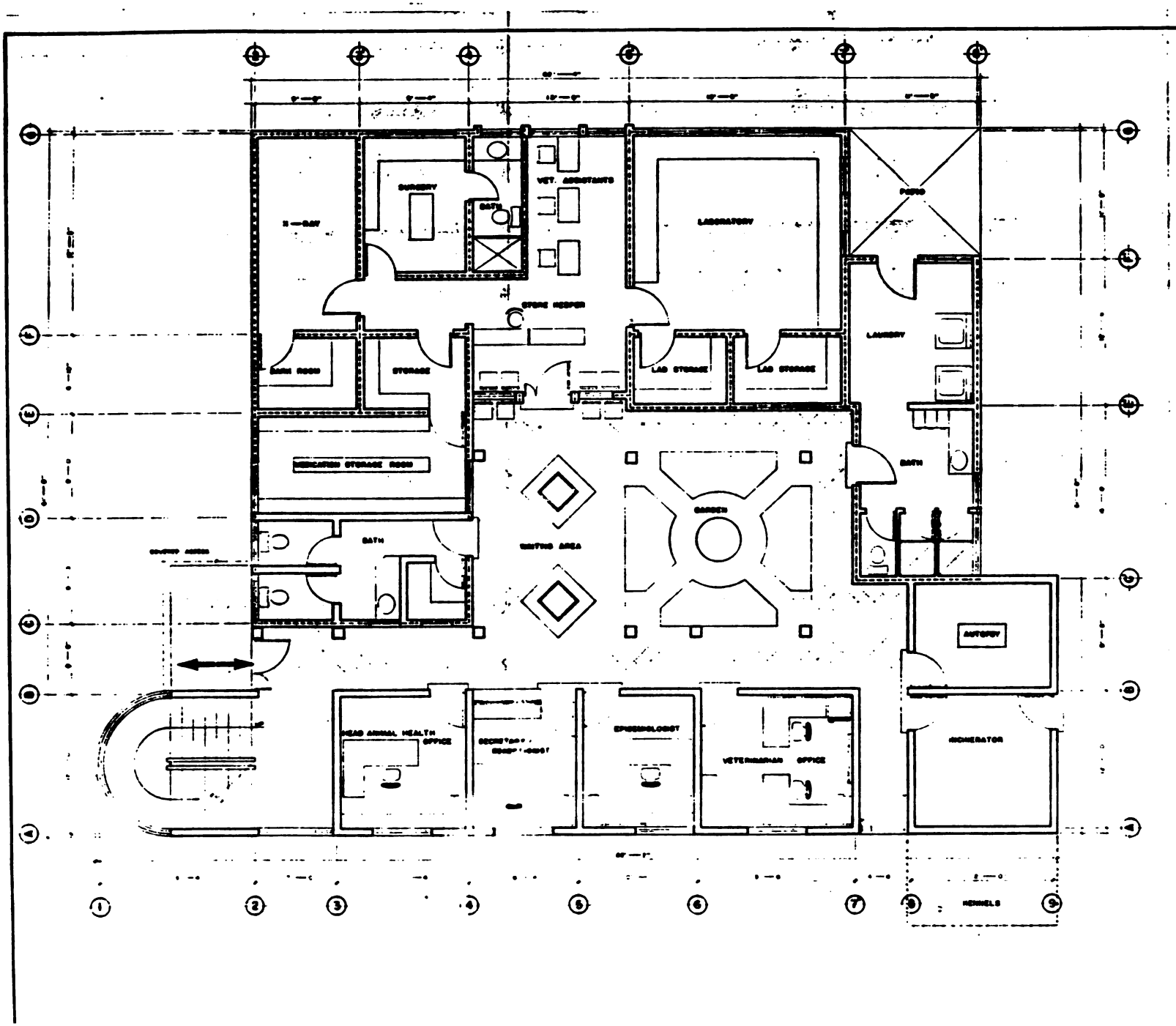
(d). A covered parking area for five vehicles

(e). A light roof structure over entrance

(f). A food microbiology laboratory on the first floor

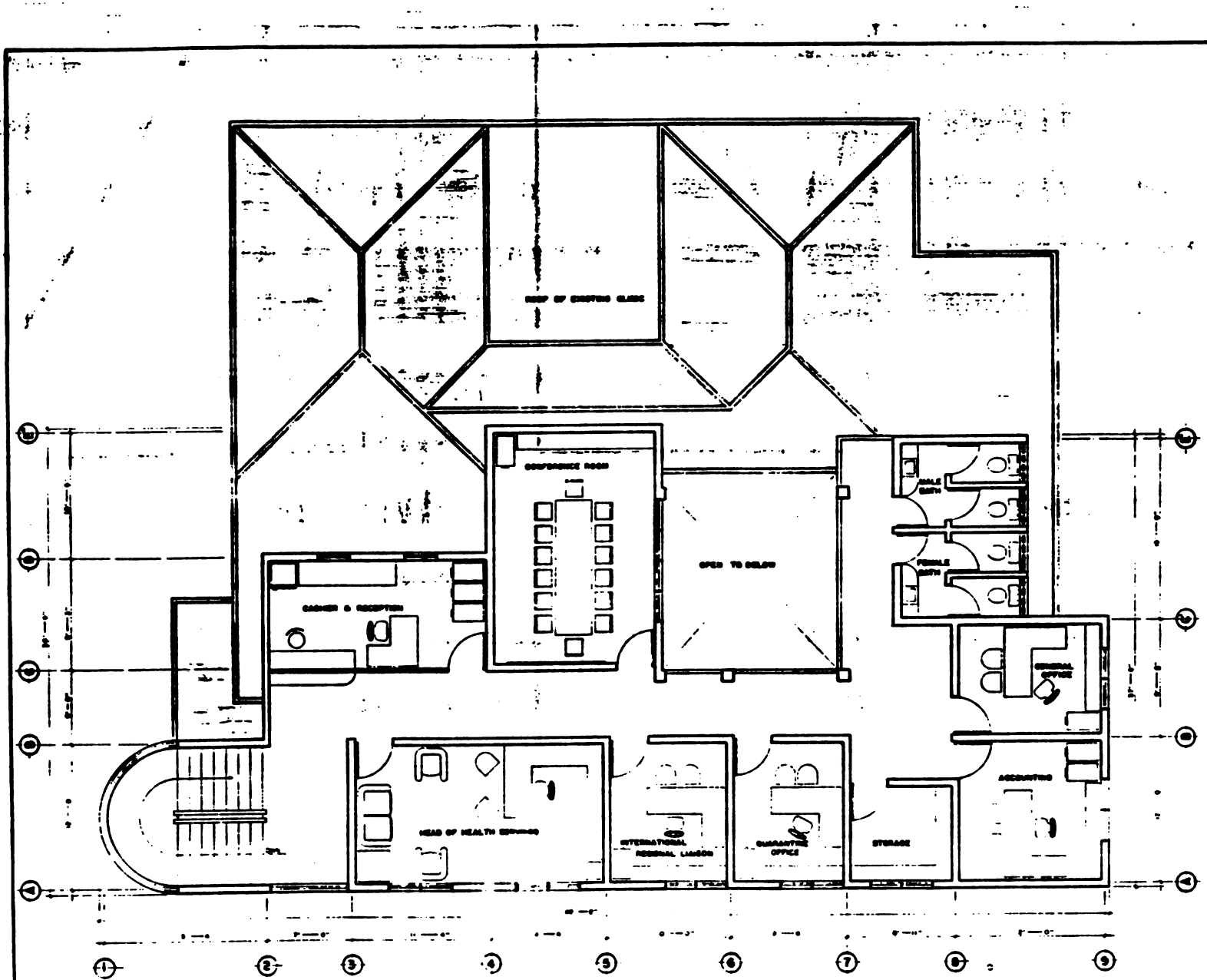
Appendix C.2
Architectural Designs of Infrastructural Facilities of the NAGHS

Annex C.3



VETERINARY CLINIC
Central Farm, Cayo

PROPOSED GROUND FLOOR

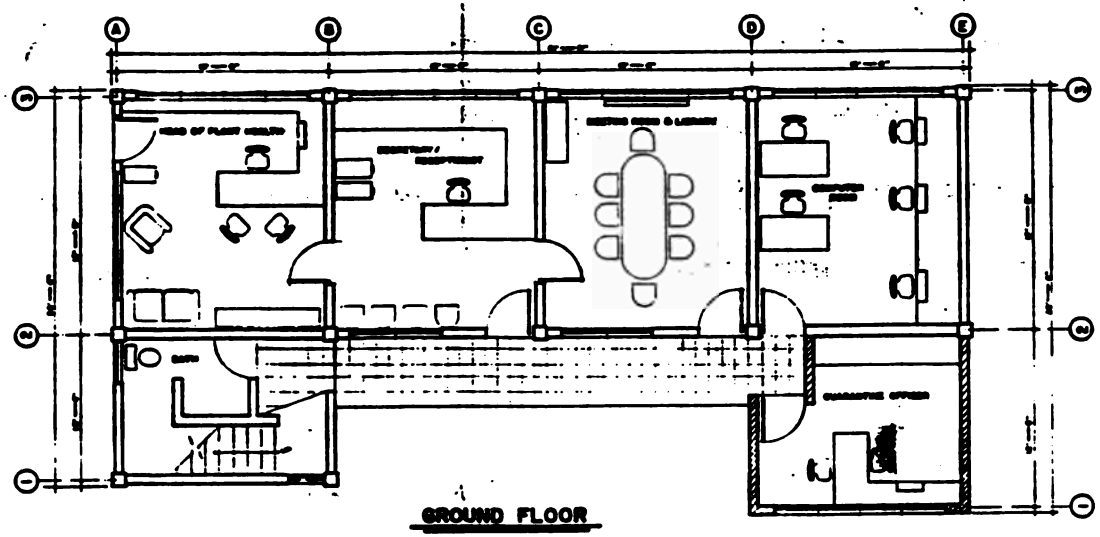


CENTRAL ADMINISTRATION OFFICES

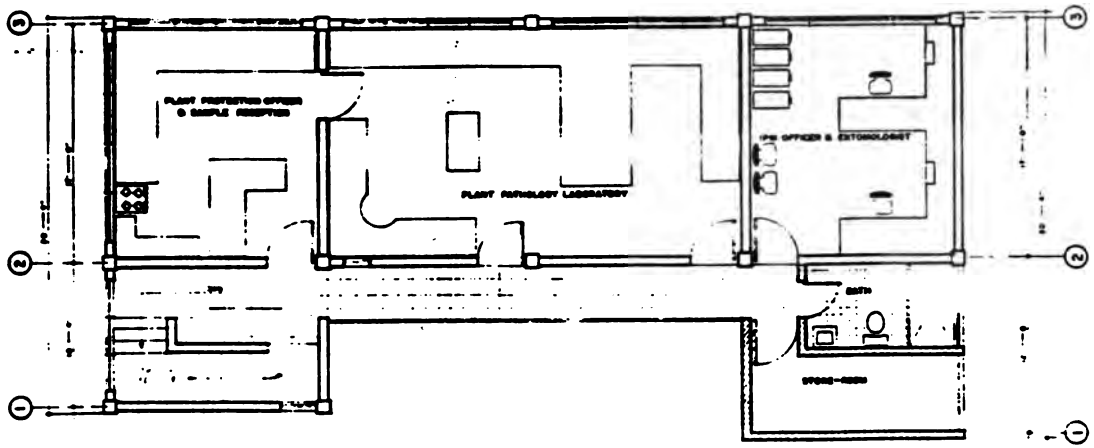
VETERINARY CLINIC
Central Farm, Cayo

PROPOSED FIRST FLOOR

JUNE 86



GROUND FLOOR

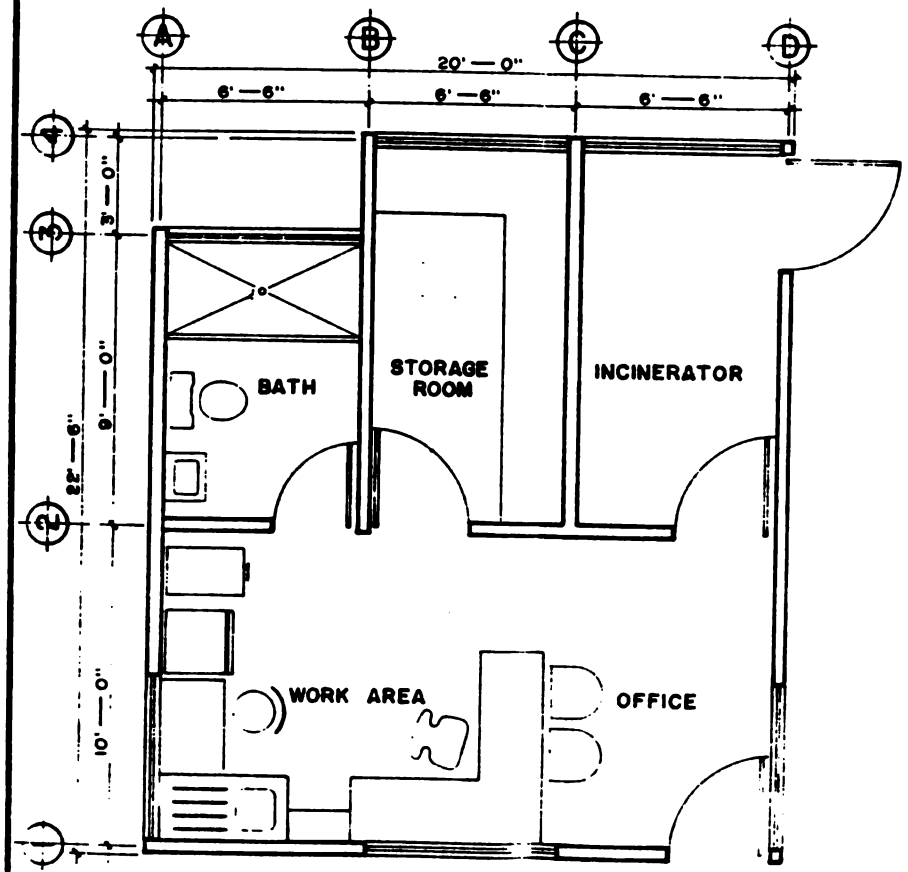


FIRST FLOOR

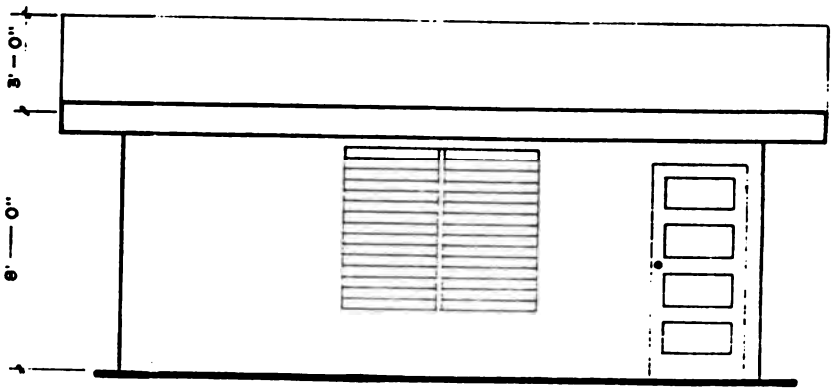
PLANT PROTECTION BLDG
Central Farm, Tokyo

PROPOSED LAYOUT

Annex C.5



ARCHITECTURAL PLAN



ELEVATION

NOTE: SEE TECHNICAL SPECIFICATION DOCUMENTS FOR CONSTRUCTION DETAILS AND BUILDING LOCATION

POLANCO & OLIVA ARCHITECTS

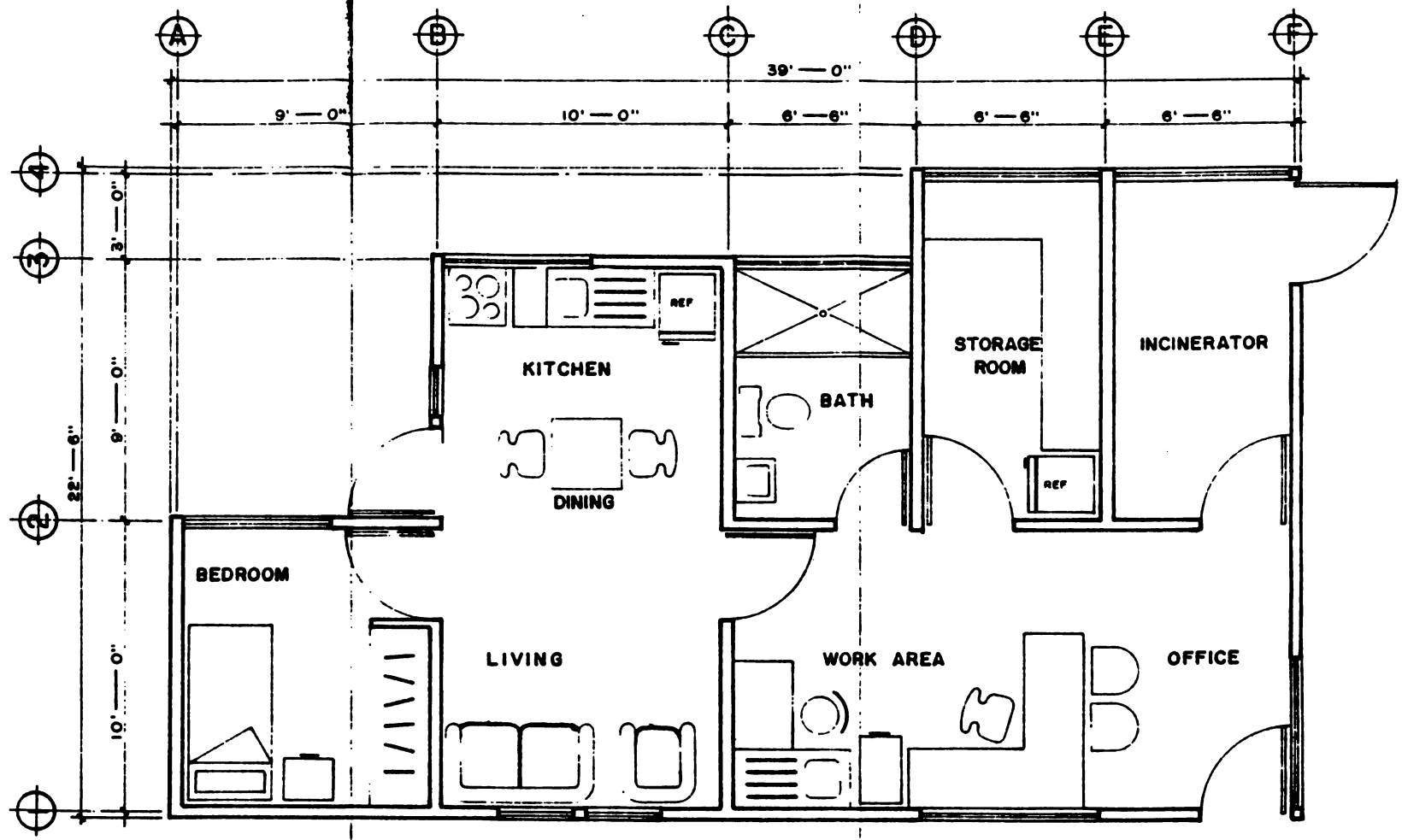
PROJECT

TYPICAL QUARANTINE STATION

CLIENT	DATE	SCALE	DESIGNED BY
M.A.F. G.O.B.	JULY 96	1/4" = 1' — 0"	A.O.

CONTENTS	DRAWN BY	CALCULATED BY
ARCHITECTURAL PLAN ELEVATION	M. R.	J.A.F.S.

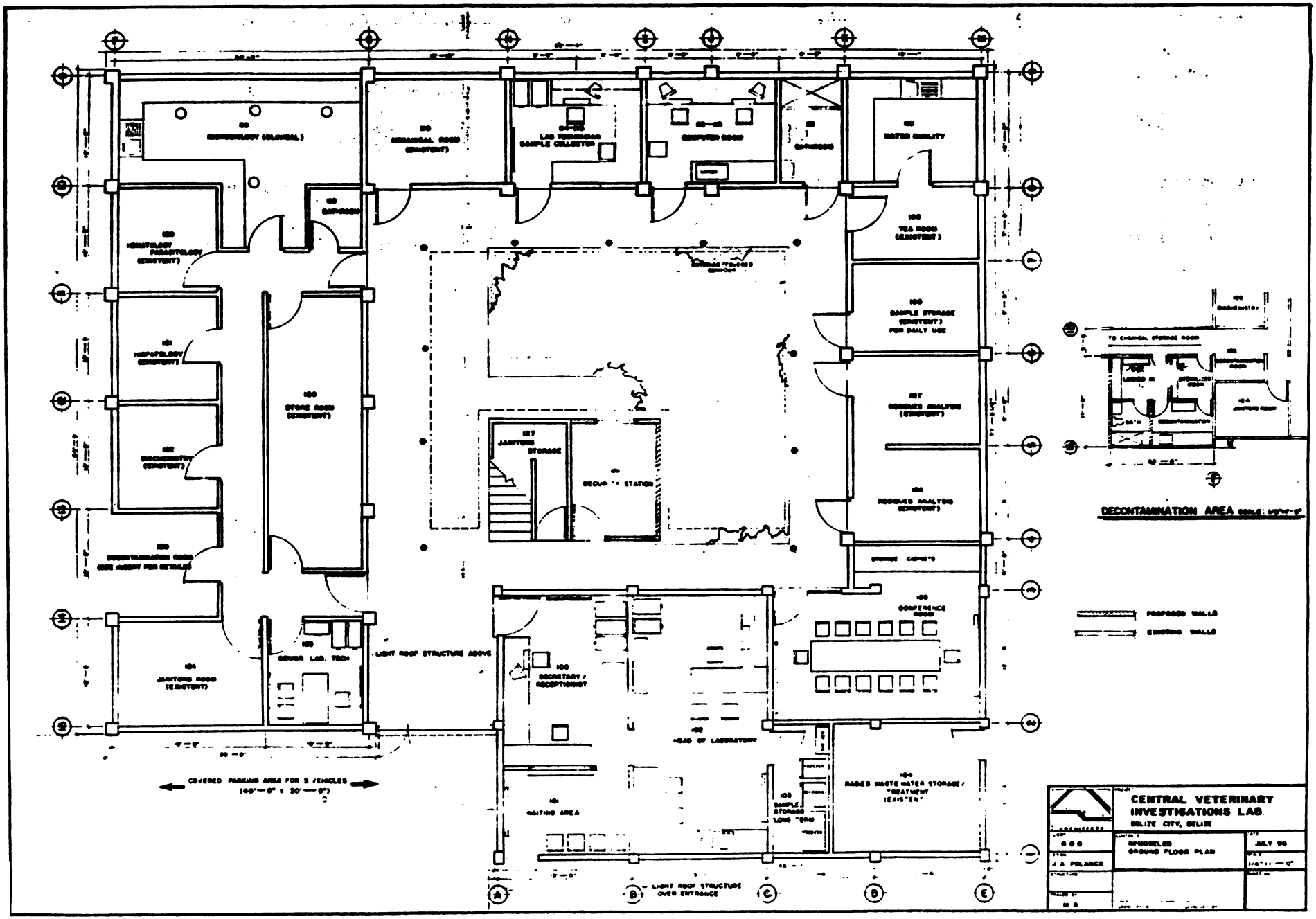
Annex C.4

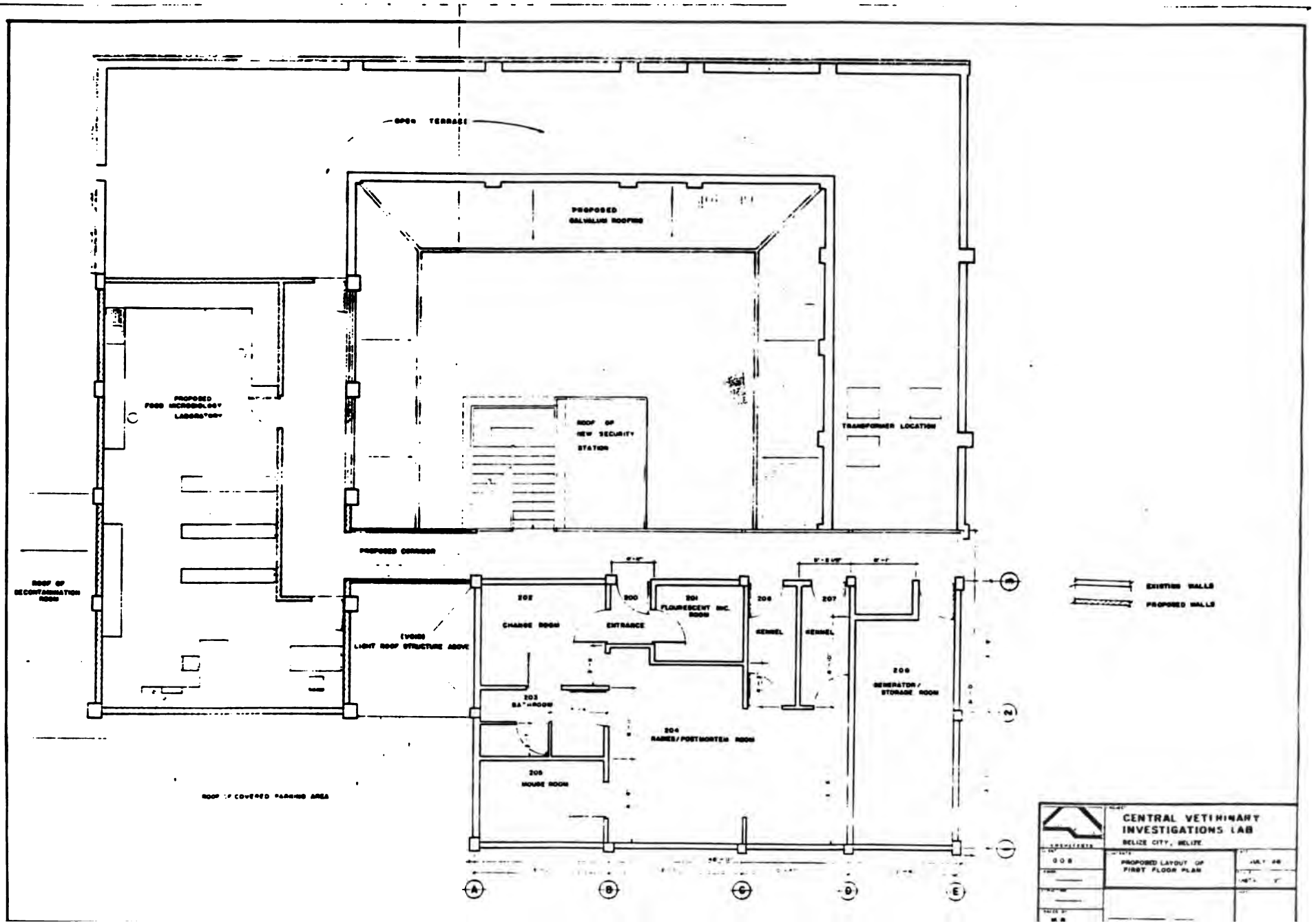


ARCHITECTURAL PLAN

NOTE : SEE SPECIFICATION DOCUMENTS FOR CONSTRUCTION DETAILS AND BUILDING LOCATION.

Annex C.8


DECONTAMINATION AREA
PROPOSED WALLS
EXISTING WALLS
CENTRAL VETERINARY INVESTIGATIONS LAB
BELIZE CITY, BELIZE
REMODELED GROUND FLOOR PLAN
JULY 96
COVERED PARKING AREA FOR 5 VEHICLES
LIGHT ROOF STRUCTURE ABOVE
LIGHT ROOF STRUCTURE OVER ENTRANCE


OPEN TERRACE
PROPOSED GALVALUME ROOFING
PROPOSED FOOD MICROBIOLOGY LABORATORY
ROOF OF NEW SECURITY STATION
TRANSFORMER LOCATION
PROPOSED CORRIDOR
ROOF OF DECONTAMINATION ROOM
(VOID) LIGHT ROOF STRUCTURE ABOVE
202 CHANGE ROOM
200 ENTRANCE
201 FLOURESCENT INC. ROOM
208 KENNEL
207 KENNEL
206 GENERATOR / STORAGE ROOM
203 BATHROOM
204 RABIES/POSTMORTEM ROOM
205 MOUSE ROOM
ROOF OF COVERED PARKING AREA
EXISTING WALLS
PROPOSED WALLS
A
B
C
D
E
1
2
CENTRAL VETERINARY INVESTIGATIONS LAB
BELIZE CITY, BELIZE
PROPOSED LAYOUT OF FIRST FLOOR PLAN

APPENDIX D
Diagnostic and Recommendations for Alternative Funding of Belize's Agricultural Health Service

Diagnosis and Recommendations for Alternative Funding of Belize's Agricultural Health Services

1. Current Status

The current delivery of services (who does it) and funding are compared with recommendations contained on these two topics in the "Guía para la Privatización de los Servicios Veterinarios en América Latina y El Caribe"[1], however, making allowances for the distinctive characteristics of Belize. This contrast leads then to specific recommendations on who should carry out the activities of the service and possible sources of funding for each of them.

1.1 Quarantine Inspection

Current management and sources of funding: At present all quarantine inspection services activities are undertaken and financed by the MAF. Risk analysis is generally financed by MAF, except when a trip to the country of origin is involved. In such case, MAF requests that the interested importer contributes with the expenses involved in travelling to the site in the foreign country. Re-exportation of rejected commodities or commodities in transit is financed by the importer. Small vehicles are charged BZ$2.50 and large vehicles BZ$5.00 for disinfestation at border crossings.

Recommended management and sources of funding: In the area of extension and education on quarantine the State is accountable for this activity, and defines the content of materials used in extension and education on quarantine. It can, however, be a mixed activity, undertaken by both the public and private sector, depending on the needs (**Table 1**). While this activity is normally financed by the State, the private sector can be asked to contribute to certain extension and education on quarantine when the beneficiaries are many and organized.

Risk analysis: This is a non-transferable State activity; normally financed by the State. However, importers should cover the costs of inspection visits (travel and per diem) to exporting countries, when such visits are required to assure that the origin of the commodity meets all animal health and plant protection requirements.

Sanitary inspection: This is a non-transferable State activity; normally financed by the State. However, if the inspection leads to the treatment of animals or plant material, a fee should be charged to the importer of the commodity.

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[1] Guía para la Privatización de los Servicios Veterinarios en América Latina y El Caribe, Oficina Regional de la FAO, Santiago, Chile, 1995.

Table
Current and Recommended Management and Funding of Quarantine Inspection Services

Activities	Current Management at Ports and Border Points		Recommended Management		Current Sources of Funds		Recommended Sources of Funds	
	Public	Private	Public	Private	Public	Private	Public	Private
Extension and education on quarantine	MAF		M_1	M_1	MAF		MAF	P_1
Risk analysis	MAF		E		MAF	X	MAF	P_1
Sanitary inspection	MAF		E		MAF		MAF	P_1
Issuing of official documentation	MAF		E		MAF		MAF	P_1
Inspection and management of official documentation	MAF		E		MAF		MAF	
Decommissions	MAF		E		MAF		MAF	
Retention	MAF		E		MAF		MAF	
Re-exportations	MAF		E			X		P_1
Treatment of feedstuff residues, and destruction of decommissions	MAF			P	MAF		MAF	P_1
Disinfestation and fumigation	MAF			P		X		P_1
Administration and servicing of quarantine stations	MAF			P	MAF		MAF	P_1
Preparation and approval of sites for quarantine purposes	MAF		E		MAF			P_1
Quarantine statistics	MAF		E		MAF		MAF	

Source: Adapted from Cuadro No.1, Guía para la Privatización de los Servicios Veterinarios en America Latina y El Caribe, Oficina Regional de la FAO para America Latina y El Caribe, Santiago, Chile, 1995.

Notes: E: Non-transferable State activity. M_1: Mixed activity.
P: Private activity, either completely or partial. P_1: Private funding, either completely or partial.

Issuing of official documentation: This is a non-transferable State activity; normally financed by the State. However, a fee should be assessed for the issuing of the official documentation needed to import or to export agricultural commodities. Depending on the number of documents issued per year, such fee could well cover most of the variable costs associated with this activity.

Inspection of imported goods and management of official documentation: This is a non-transferable State activity; normally financed by the State.

Decommissions: This is a non-transferable State activity; normally financed by the State.

Retention: This is a non-transferable State activity; normally financed by the State.

Re-exportations: This is a non-transferable State activity. While the State decides why a commodity is not allowed into the country and must be re-exported, or whether a commodity is allowed into the country for re-exportation, the importer is responsible for the cost of re-exporting the rejected goods, or the merchandise temporarily in-transit.

Treatment of feedstuff residues, and destruction of decommissions: This is an activity that can be carried out by the private sector, if enough volume and appropriate accreditation and supervision procedures are at hand. In Central America, OIRSA has been commissioned to undertake this activity and charge the importer for the service. Since OIRSA is not yet active in Belize, the State should continue with this activity. However, a fee should be charged on decommissions which are too big be destroyed at the entry point, and require transport to distant dumping sites.

Disinfestation and fumigation: These two activities can be carried out by the private sector, if an appropriate accreditation and supervision procedures exist. In Central America, OIRSA has been commissioned to undertake these activities and charge the importer for the service. Since OIRSA is not yet active in Belize, the State should continue with this activity.

The current fee being charged for disinfestation (fumigation is not carried out due to lack of equipment) is BZ$2.5 for small vehicles and BZ$5.0 for trucks and buses. This fee has been at this level for at least 8 years, and while such fee level apparently covers the variable costs involved, consideration should be given to doubling the current fees being charged. This would contribute to a partial covering of the fixed costs.

Administration and servicing of quarantine stations: It is common for producer organizations to manage quarantine stations under the supervision, specifications and norms set by the Service. Since the beneficiaries are importers or animal and plant producers, the management costs of permanent or temporary quarantine stations should be borne by the private sector.

Preparation and approval of sites for quarantine purposes: This is a non-transferable State activity. However, the variable costs involved in the preparation and approval of quarantine sites should be covered by the owners of the animals or products which must undergo quarantine.

Quarantine statistics: This is a non-transferable State activity, normally financed by the State.

1.2 Epidemiological Surveillance

The MAF carries out all epidemiological surveillance activities in animal health, and most in plant protection. A limited epidemiological survey and laboratory work is undertaken by CREI and BGA in the southern part of the country where most of the citrus and all the bananas are grown. All funding for this service comes from MAF, while in the plant protection

component, some funding has been provided by the private sector (CREI, BGA) in laboratory diagnostics, epidemiological surveys and studies.

Recommended management and sources of funding: For obligatory notification of diseases there is now an international obligation to report the incidence of pests and diseases to the World Trade Organization in Ginebra, Switzerland. Therefore, it is essential that private sector should report to the Service which in turns informs international authorities. This activity can to a degree be financed by the organized private sector (such as banana, citrus, sugar, livestock) to gather information at their level and pass it on to MAF for national monitoring and control as well as for official international reporting.

Laboratory diagnostics can be a private sector activity if social, cultural, political, market, infrastructure, skills, and financial conditions can be met. The State, however, must licensed the private laboratories according to acceptable norms. The State would also have to manage a reference laboratory to provide reference services and control the performance of the private laboratories. Since it is highly unlikely that these conditions can be met, it is recommended that MAF continues to undertake the laboratory diagnostics, but that the private sector be assessed a fee, sufficient to cover the variable costs associated with this activity.

Table 2
Current and Recommended Management and Funding of Epidemiology Surveillance

Activities	Current Management		Recommended Management		Current Sources of Funds		Recommended Sources of Funds	
	Public	Private	Public	Private	Public	Private	Public	Private
Obligatory notification of diseases	MAF		M_1	M_1	MAF		MAF	P_1
Laboratory diagnostics	MAF	X		P	MAF	X	MAF	P_1
Epidemiological surveys	MAF	X	E		MAF	X	MAF	
Epidemiological studies	MAF		M_1	M_1	MAF	X	MAF	P_1
Risk analysis	MAF		E		MAF		MAF	P_1
Compilation, processing, analysis and dissemination of epidemiological information	MAF		M_1	M_1	MAF		MAF	

Source: Adapted from Cuadro No.2, Guía para la Privatización de los Servicios Veterinarios en America Latina y El Caribe, Oficina Regional de la FAO para America Latina y El Caribe, Santiago, Chile, 1995.

Notes: E: Non-transferable State activity. M_1: Mixed activity.
P: Private activity, either completely or partial. P_1: Private funding, either completely or partial.

Epidemiological surveys: This is a non-transferable State activity, since it implies the presence of a disease that must be reported and sanitary measures need to be taken which should be undertaken by the State. Normally, the State covers the cost of this activity. In the past, the private sector (in the plant protection area) has contributed with some of the costs associated with this activity. It is recommended that such support be continued and formalized in the future.

Epidemiological studies: This is an indispensable activity for evaluating the zoosanitary situation in the country, and in which both sectors can participate. Normally it is financed by the State, however, in the case of important diseases, with great economic implication, and/or affecting organized private sector parties, such as producers of citrus, banana, sugar, livestock, papaya, habanero peppers, these should be approached for financial support. This is already taking place to some degree, and it should be continued in a formal manner in the future.

Risk analysis: This is a new epidemiological tool which allows to calculate and evaluate the risk that some disease may appear at a given site, as a result of an action that could introduce the etiological agent of a given disease. Due to the health risks involved, this is a non-transferable State activity, normally financed by the State. However, economically important commodities which are organized should be approached for some of the financial needs.

Compilation, processing, analysis and dissemination of epidemiological information: This is a non-profit mixed activity in which the private sector will have little interest; however, since it is an important activity affecting the efficiency and effectiveness of the epidemiological surveillance service, it must be carried out by the State, and it should be financed by the State.

1.3 Sanitary Campaigns

At the moment most sanitary campaign activities are carried out by MAF. A limited contribution is provided by the Livestock Association in information gathering, and in vaccination and/or application of drugs and disinfectants. Organized citrus, banana and sugar producers provide some limited assistance in vector control, epidemiological surveys, laboratory diagnostics and control of outbreaks. Again, most of the funding comes from the State, with private sector contribution limited to those organized groups such as citrus, banana, sugar and livestock producers which are the direct beneficiaries of this activity.

1.3.1 Recommended Management and Funding

Gathering of basic information: this can be a joint activity carried out under the responsibility of the State. Outside professional personnel, students, etc. can support this activity. Normally, this activity is financed by the State.

Extension, training, promotion, and sensitivity building: The content of material is defined by the services, while the production of material can be contracted out, under State financing. Dissemination can be undertaken through all media services, extension, private organizations,

churches, NGO's, etc. This activity is normally financed by the State. However, some of the cost could be shared with producer organizations, producers of pharmaceutical and biological products being used in the campaign.

Table 3
Current and Recommended Management and Funding of Sanitary Campaigns

Activities	Current Management		Recommended Management		Current Sources of Funds		Recommended Sources of Funds	
	Public	Private	Public	Private	Public	Private	Public	Private
GENERAL ACTIVITIES:								
Gathering of basic information	MAF	X	M_1	M_1	MAF	X	MAF	
Extension, training, dissemination of information	MAF		M_1	M_1	MAF		MAF	P_1
Strategic planning	MAF		E		MAF		MAF	
SANITARY CAMPAIGN ACTIVITIES:								
Control of animal movement	MAF		M_1	M_1	MAF		MAF	P_1
Vaccination and/or application of drugs and disinfectants	MAF	X		P	MAF	X	MAF	P_1
Vector control	MAF	X		P	MAF	X	MAF	P_1
Epidemiological surveys	MAF	X	M_1	M_1	MAF	X	MAF	P_1
Laboratory diagnostic	MAF	X		P	MAF	X	MAF	P_1
Control of outbreaks	MAF	X	E			X	MAF	P_1
Accreditation and supervision of private veterinarians and plant pathologists	MAF		E		MAF		MAF	
Eradication programs	MAF		E		MAF		MAF	P_1
Certification of free zones or sites	MAF		E		MAF		MAF	
DRUGS AND BIOLOGICAL INPUTS TO BE USED IN SANITARY CAMPAIGNS:								
Product bidding and purchase	MAF		E			X	MAF	
Production		X		p		X		P_1
Distribution and management		X		P		X		P_1

Source: Adapted from Cuadro No.3, Guía para la Privatización de los Servicios Veterinarios en America Latina y El Caribe, Oficina Regional de la FAO para America Latina y El Caribe, Santiago, Chile, 1995.

Notes: E: Non-transferable State activity. M_1: Mixed activity.
P: Private activity, either completely or partial. P_1: Private funding, either completely or partial.

Strategic planning: This is a non-transferable State activity, and is normally financed by the State. It is, however recommended that all social sectors affected by the campaign be given participation in the preparation of the strategy.

Control of animal movement: Since this activity is of public utility, the control of animal and plant movement should be undertaken by the professional staff of the services. However, administration and operation of the quarantine stations can be subcontracted to private sector, if possible. The variable costs of this activity (except the salary of the professional) should be charged to the owner of the animals or plants being quarantine.

Vaccination and/or application of drugs and disinfectants: If the case is considered of national emergency or of strategic importance, the State should carry out this activity; otherwise it can be carried out by accredited professionals, if an appropriate accreditation program is in place. In the first case the State can cover the costs, and/or solicit support by affected private parties; otherwise the variable costs of the activity should be paid by the client.

Vector control: Depending on the level of emergency, this activity can be carried out by the Service or accredited professionals. The cost is borne by the State in case of a national emergency; support can be sought form important affected private sector parties; if the case is local, private sector can cover variable costs.

Epidemiological surveys: These can be carried out by the Service, students and faculty of veterinary colleges. This activity is generally financed by the State. When the survey benefits a given area or group of farmers, these can be encouraged to contribute with the expenses.

Laboratory diagnostic: This can be a private sector activity if social, cultural, political, market, infrastructure, skills, and financial conditions can be met. However, the State must licensed private laboratories according to acceptable norms, and it must manage a reference laboratory to provide reference services and control the performance of the private laboratories. Since it is highly unlikely that these conditions can be met, it is recommended that MAF continues to undertake the laboratory diagnostics, but that the private sector be assessed a fee, sufficient to cover the variable costs associated with this activity. A cost recovery can be designed to recover variable costs, depending on the level of emergency.

Control of outbreaks: This is considered a strategic activity of a sanitary campaign; therefore, it is a non-transferable State activity, and is normally financed by the State. However, when the control activity benefits a given area or group of farmers, these can be encouraged to contribute with the expenses.

Accreditation and supervision of private professionals: This is a non-transferable State activity, financed by the State.

Eradication programs: This is a non-transferable State activity, generally financed by the State. However, when the control activity benefits a given area or group of farmers, these can be encouraged to contribute with the expenses.

Certification of free zones or sites: This is a non-transferable State activity. Properly accredited professionals in the private sector could be used. This activity is generally financed by the State.

Product bidding and purchase: This is a non-transferable State activity to assure quality of products and success of campaign. While bidding and purchasing of products is undertaken by the State, the cost of the inputs should be shared by the private sector, specially those which are organized and have a special interest in the outcome of the campaign.

Production: This is a private sector activity.

Distribution and management: This is a private sector activity.

1.4 Registry and Quality Control of Animal and Plant Products

Current management and funding: Due to the public utility nature of the registry and quality control of animal and plant products, the majority of the activities should come under public domain. At the moment only 3 out the 8 activities are being carried out by the Pesticides Control Board, including: (a) definition of norms; and (b) authorization and registry of use, 2) supervision and control. These activities are, however, limited to a limited number of some animal products and pesticides. Special trials for the importation of new products are undertaken in foreign countries due to the lack of equipment and personnel in Belize.

At the moment, PCB charges the private sector a fee for the authorization and registry of use of these products, as well as for supervision of production which is limited to the dilution of concentrated imported primary products.

Recommended management and funding: When, and if the other activities are implemented, they should be carried out by the PCB, with the possible exception of the quality control trials, and special trials for the importation of new products. If the annual volume is too low to justify maintaining a special laboratory and personnel, or a reference laboratory to monitor private laboratories, these two activities should be carried out in a foreign country under special arrangement with an accredited laboratory. Cost of service is paid by private sector according to a published tariff schedule.

At the moment, the private sector contributes some funding to the 1) authorization and registry of use and to 2) supervision of production. The current funding level should be analyzed to see whether the subsidies involved are at acceptable levels, or whether the private sector should be asked to contribute more to these two activities.

Table 4
Current and Recommended Management and Funding of Registry and Quality Control of Animal and Plant Products

Activities	Current Management		Recommended Management		Current Sources of Funds		RECOMMENDED SOURCES OF FUNDS	
	Public	Private	Public	Private	Public	Private	Public	Private
Definition of norms	PCB		E				MAF	
Registry and authorization of strains and seeds for production of biological materials	N.A.		E		N.A.	N.A.	MAF	P_1
Authorization and registry of use	PCB		E		PCB	X	MAF	P_1
Supervision of production	PCB		E		PCB	X	MAF	P_1
Quality control trials: For registry and quality control of biological, pharmaceutical materials, and veterinary materials being used.	N.A.			P	N.A.	N.A.		P_1
Supervision of quality control	N.A.		E		N.A.	N.A.	MAF	
Special trials for the importation of new products	F.C.			P	N.A.	N.A.		P_1
Accreditation and supervision of veterinarians as technical directors or responsible for the pharmaceutical industry	N.A.		E		N.A.	N.A.	MAF	

Source: Adapted from Cuadro No.5, Guía para la Privatización de los Servicios Veterinarios en America Latina y El Caribe, Oficina Regional de la FAO para America Latina y El Caribe, Santiago, Chile, 1995.

Notes: E: Non-transferable State activity.
P_1: Private funding, either completely or partial.
N.A. Not available.
M_1: Mixed activity.
P: Private activity, either completely or partial.
F.C. Foreign country.

1.5 National Emergency System

Presently, Belize does not have an official national emergency system for animal health and plant protection. This situation leaves the country highly vulnerable to the devastating consequences of the risk of introducing a disease or pest with the potential of affecting economically important crops and animals. The only program which comes close to being an emergency type system is the medfly control program which is fully funded, and subsidized by USDA. However, even this program uses regular budget funds when and outbreak occurs, which needs to be controlled in order to maintain the program's integrity and acceptance.

Table 5
Current and Recommended Management and Funding of National Emergency System for Animal Health and Plant Protection

Activities	Current Management		Recommended Management		Current Sources of Funds		Recommended Sources of Funds	
	Public	Private	Public	Private	Public	Private	Public	Private
Organization	N.A.		E		N.A.		MAF	
Training and updating of personnel	N.A.		E		N.A.		MAF	
Design and updating of emergency plans	N.A.		E		N.A.		MAF	
Funding and management of emergency funds	N.A.		E		N.A.		MAF	
Implementation of emergency program	N.A.		M_1	M_1	N.A.		MAF	

Source: Cuadro No.4, Guía para la Privatización de los Servicios Veterinarios en America Latina y El Caribe, Oficina Regional de la FAO para America Latina y El Caribe, Santiago, Chile, 1995.

Notes: E: Non-transferable State activity.
M_1: Mixed activity; normally financed by the public sector; however, affected parties can be approached for financial support
N.A. Not available.

Recommended management and funding: Due to the public utility nature of the national emergency system, the majority of the activities should come under public domain. When, and if implemented such system should be managed by the State. An emergency fund should be established, financed by the State and those sectors that can be affected directly by an emergency. The private sector contribution can be obtained from a small "cess" charge on the products which are the most likely stakeholders in such an emergency program. Private sector should be encouraged to participate in the training and updating of personnel, in the design and updating of the emergency plans, in the funding and management of the emergency funds, and in the implementation of any emergency program.

1.6 Inspection of Slaughter Houses, Processing and Packing Plants

At the moment the MAF approves slaughterhouses and processing plants for animal and plant products. The next 5 activities, however, are only undertaken for plant and plant products destined for the export markets, such as banana, papaya, and habanero peppers. Slaughter houses are inspected by officials of the Ministry of Health, and Belize does not export processed animal products needing USDA inspection. All activities are financed by MAF, except labor overtime for sanitary inspection at the processing and packing sheds used for such export products as papaya and habanero peppers, which is paid by the private sector.

Approval of slaughterhouses and processing plants: This is a nontransferable State activity, normally financed by the State.

Sanitary inspection: This can be a private sector activity if appropriate accreditation and supervision procedures are at hand, and a competitive market for such services can be established. Since these conditions cannot be met, it is recommended that this activity be continued to be carried out by MAF (the animal sanitary inspection needs to be reactivated in order to address important public animal health issues). The private sector should finance the positions through funds channeled to the State for this purposes.

Table 6
Current and Recommended Management and Funding of Sanitary Inspection of Slaughter Houses and Processing Plants for Animal and Plant Products

Activities	Current Management		Recommended Management		Current Sources of Funds		Recommended Sources of Funds	
	Public	Private	Public	Private	Public	Private	Public	Private
Approval of slaughterhouses and processing plants	MAF		E		MAF		MAF	
Sanitary inspection: Public health Animal and plant health	MAF		*	P	MAF		MAF	P_1
Laboratory analysis: Epidemiological control as a source of information Monitor progress of sanitary campaigns	MAF			P	MAF		MAF	P_1
Disposal of decommissions	MAF			P	MAF			
Evaluation and rating of slaughter houses and processing plants	MAF		E		MAF		MAF	
Sanitary certification	MAF		E		MAF	X	MAF	P_1
Accreditation and supervision of veterinarians and health inspectors within the private sector	MAF		E		MAF		MAF	

Source: Cuadro No.6, Guia para la Privatización de los Servicios Veterinarios en America Latina y El Caribe, Oficina Regional de la FAO para America Latina y El Caribe, Santiago, Chile, 1995.

Notes: E: Non-transferable State activity.
P: Private activity, either completely or partial.
P_1: Private funding, either completely or partial.
*: Not applicable when international norms require an official inspection.

Laboratory analysis: This can be a private sector activity if social, cultural, political, market, infrastructure, skills, and financial conditions can be met. However, the State must licensed

private laboratories according to acceptable norms. The State would also have to manage a reference laboratory to provide reference services and control the performance of the private laboratories. Again, since these conditions cannot be met, the State should continue to undertake the laboratory analysis and charge a fee, sufficient to cover variable costs of this activity.

Disposal of decommissions: This activity is feasible when economies of scale are present; but it must be done under the norms set by the State and under its supervision. Normally, a fee is charged to cover the cost of the disposal. Since the quantities involved are not large enough to justify private sector competition for this activity the State should continue to dispose any decommissions, and charge a fee to the producer/exporter. Otherwise, the producer/exporter should be made responsible for disposing decommissioned commodities according to State sanctioned procedures.

Evaluation and rating of slaughter houses and processing plants: This is a nontransferable State activity, normally financed by the State.

Sanitary certification: This is a nontransferable State activity, normally financed by the State.

Accreditation and supervision of veterinarians and health inspectors within the private sector: This is a nontransferable State activity, normally financed by the State.

1.7 Summary

With few exceptions, the current plant protection and animal health services are being managed, provided, and financed by the State. In other words, traditionally the system has been perceived by the State as providing a "public function", and has, therefore, as been treated as a "Cost Center" rather than a "Profit Center" facing different market segments and levels of demands for a number of differentiated services with revenue potential.

As a result of viewing and operating the services as a "Cost Center", whose costs "must be minimize", specially during lean budget times, budget allocations have been increasingly inadequate, reducing the system's effectiveness to the point where its real contribution to agricultural growth, diversification and competitiveness, as well as trade is highly questioned. The negative implications of this situation for Belize, whose foreign exchange earnings, employment and income generation come primarily from agricultural production and trade cannot be overstated, specially in view of the unprecedented changes being brought about by international trade agreements such as GATT/OMC, NAFTA and ALCA.

2. Alternative Institutional Funding Arrangements

The question of what alternative institutional arrangements should be considered in order to improve the efficiency and effectiveness of the agricultural health services is fundamental.

This report clearly demonstrated above the centralized institutional structure and public nature of the agricultural health service, and the institutional analysis brings to light the constraints of the current institutional arrangements and their negative impact on the effectiveness, the efficiency and the quality of the services.

The issue of institutional arrangements, and recommendations and strategies for improving the current conditions and, therefore, the effectiveness, the efficiency and the quality of the services are addressed in the Institutional Analysis component of this study. Therefore, the institutional changes addressed in this Section will be limited to alternative funding arrangements which will tend to distribute the costs of the service among providers, users and beneficiaries, and lead to a more "market oriented" management approach in the provision of the services.

2.1 Alternative Institutional Funding Arrangements

Depending on their nature, the products and services provided by the animal health and plant protection services can be divided into two groups, as follows:

- Products and services which always provide a direct benefit to a particular person or group, but which have a "public utility benefit"[1] as well. For example, a phytosanitary import permit will allow a private party to undertake a commercial transaction from which it will derive direct and private benefits. However, the whole country will also benefit, since it is protects from the introduction of a pest or disease, which can be harmful to the society. In this case, a charge can be assessed on the private entity for the service, since it can import a commodity without the risk of harm.

- Those products and services whose intent is to provide a "public utility benefit" first, but which can also lead to direct private benefit. These type of services are geared to benefit the whole society, say by controlling and/or eradicating a given pest, but certain groups are likely to benefit more from this service than others. For example, the medfly control and eradication program benefits all fruit growers whose products are host to the pest, as well as Belizean consumers who get higher quality fruits on their table. However, certain groups, such as papaya growers benefit additionally, in that they are allowed to export their products to countries which would, in the absence of the control and eradication program deny such imports.

Generally, the more the product or service provides a direct "private benefit" the easier it is to assess a fee for its provision, and visa versa, the more the product or service provides a "public benefit" the more difficult it becomes to charge for it.

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[1] A product or service with a "public utility nature" can be defined as the benefit or result of the provision of a good or service which benefits the whole society but whose costs cannot, or are difficult to charge directly to the beneficiaries of such good or service.

2.1.1 Services with a Direct Private Benefit

Examples of agricultural health services which always provide an immediate private benefit, but which can offer a public benefit as well, and with the potential of being provided at a "reasonable cost recovery level[4]", include those assigned a P_1 under recommended sources of funds in Tables 1 through 6. These activities, along with possible cost recovery mechanisms are summarized in Table 7.

With the exception of curative and preventive measures, all other activities should be considered "profit centers" with the potential of generating a variable stream of income, sufficient to cover the variable costs incurred in providing them. The reason for the first two to be different, is that a broad clientele which requires these services is in no position to pay the full cost or even a portion of it. This market segment includes the thousands of small farmers who own one or two farm animals, or produce a limited amount of cash food crops, and do not have the income level to pay the full cost or even a portion of the costs of these services. In these cases, a "subsidy" or transfer payment is required to cover the full cost of the service being provided, that is, these clients would receive the service for free or at most pay a nominal fee.

Essentially, a tariff structure can be established for these activities. This means that a certain fee (either fixed or variable, depending on volume or value) will be assessed for providing these services, and that such a fee schedule will be publicly announced. The level and variability of the fee must be related to the cost of providing them (variable cost in most cases), and be periodically reviewed and modified to fit new market developments. Therefore, in the absence of a competitive market for these services in Belize an understanding of the cost structure of each activity is essential to set the different fees at reasonable "market levels", seek further efficiencies in providing them, and obtain a reasonable balance between those which can absorb a higher fee level and those which cannot.

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[4] Reasonable cost recovery level does not imply full cost; this will depend on the ability and willingness of the beneficiaries to pay for it.

Table 7
Potential Cost Recovery Mechanisms for Health Service Activities which Provide Direct Private Sector Benefits

ACTIVITY	POTENTIAL COST RECOVERY MECHANISMS
• Laboratory diagnostics	• Minimum fee per test, covering tvariable costs of materials used in the test. • Variable fees depending on the quantity demanded by a client, and repeated use of materials required.
• Issuing phytosanitary import and export permits	• Simple minimum fee for all permits. • Variable fee structure depending on the commodity and its value.
• Quarantine inspection, and animal treatment at border points and ports	• Minimum fee per inspection. • Minimum fee per treatment of animals, plus cost of materials and current markup.
• Disinfestation of vehicles and fumigation at border points	• The current fee of BZ$2.5 and BZ$5.0 for small and large vehicles should be doubled.
• Treatment of food and feedstuff residues and destruction of decommissioned commodities	• If decommissions need to be transported beyond the premisses to an appropriate dumping site, the variable costs of such transport should be charged to the importer.
• Sanitary inspection and supervision of processing and packing facilities which process fresh commodities for export: o Processing and packaging sheds used for papaya, peppers and potentially other products authorized under the USDA/APHIS protocol. o Banana shipments	• Collection of a "cess" fee per unit to cover the salary of the plant protection inspector, including overtime. • Collection of a "cess" per box shipped to cover the portion of the salary related to inspecting banana shipments.
• Preparation and approval of sites for quarantine stations	• Charge for variable costs of undertaking preparation and approval; it can be a proportional daily fee that covers salary and per diem.
• Administration and servicing of quarantine stations	• If MAF will continue to manage and service quarantine stations, a fee structure should be elaborated to cover at least the variable costs.
• Trips to foreign countries to undertake risk analysis	• Travel and per diem should be provided by the party interested in importing the commodity which requires an inspection at the origin.
• Curative and preventive services (vaccination, application of drugs and disinfectants)	• Small and poor farmers should be charged the wholesale purchase cost of chemicals used. • Larger clients should pay variable costs plus the wholesale cost+margin on the drugs used; this revenue can be put into the revolving fund which can absorb the variable costs associated with servicing poor farmers.
• Control of animal and plant material movement	• In the case where the control is site specific, a daily rate can be charged to the farmer or group affected by the control.

• Epidemiological surveys	• Economically important private sector groups, such as banana, citrus and sugar should be approached to contribute part of the costs associated with such surveys which imply direct benefits for them.
• Registration and quality control trials of pharmaceutical, biological, and other products used in animal health and plant protection	• A fee should be charged for the initial registration, followed by periodic updating, say every 3 years of the original registration. • If quality control trials are undertaken, they should be charged the variable costs associated with the trials.

For example, charging the equivalent of shipping costs plus lab. fee for those samples being sent to Guatemala for soil analysis, will only discourage customers. Any fee below this cost will encourage the use of local laboratory diagnostics, assuming equivalent quality. The challenge is to find a fee level which will encourage the maximum demand for different laboratory diagnostics, but that will also cover most of the costs involved.

2.1.2 Services With a Public Utility First and a Private Sector Benefit Second

The second type of product and service includes those which have a public utility goal first, but can also lead, intentionally or not, to direct and indirect private sector benefit. Depending on how the benefits are shared, the costs can be partially recovered or not at all. Generally, the more the private sector shares in the "public" benefits generated by these programs, the more of the cost should be shifted to these beneficiaries, and visa versa. Examples of these kind of services being provided, and possible cost recovery mechanisms are contained in Table 8.

2.2 Management of Cost Recovery Mechanisms and Income Utilization

The cost recovery mechanisms described in Tables 7 and 8 have the potential of generating a steady cash flow for the agricultural health services, worth several hundred thousand BZ$ per year. However, the management of the cost recovery mechanism and the utilization of the income generated has to be carefully monitored, evaluated and adjusted as demand for specific activities and costs of providing them change over time.

Assuming an initial level of tariffs, cess fees, annual contributions from the private sector, and possible self-insurance schemes for the different activities and programs being carried out by the service, these should be reviewed at least annually to assess their impact on the demand for them. For example, an initial fee of BZ$10.0 for a given laboratory diagnosis may be too high for a large number of farmers, thus discouraging them from obtaining such test, affecting negatively their production, productivity, and income. If it is set too low demand will be greater but the fee charged at that level, may forgo capturing a portion of the costs associated with its provision, with the service forfeiting income and providing an explicit (but not necessary) subsidy to the client.

Therefore, annual reviews of the cost structure associated with providing the services, and comparisons with similar charges being levied in other countries in the region is necessary to adjust the fees in such a manner so that customers will be encouraged to access nationally provided services, and at the same time maximize the cost recovery process. Also, this review

and adjustment process should be done with the participation of the private sector which will be in a position to provide feedback in terms of value or quality perceived versus cost of the service.

Table 8
Potential Cost Recovery Mechanisms for Health Service Activities which Provide Public Sector Benefits

Activity	Potential Cost Recovery Mechanisms
• Control and eradication campaigns for specific pests:	
○ Medfly	• Direct beneficiaries such as papaya and habanero pepper growers should be approached to contribute an "annual maintenance fee" to the program. • Indirect beneficiaries, such as citrus growers should also be approached to contribute to the "annual maintenance fee" of the program, since the absence of the medfly translates in huge savings by not having to apply chemical controls, the drop rate of oranges is minimized, and the quality of oranges is not affected by this pest. • These beneficiaries should also be encouraged to contribute to an emergency fund, to be used when an outbreak occurs, and must be eradicated.
○ Screwworm	• The livestock grower association should be approached to contribute to the program, since they directly benefit from this program.
○ Vampire bat	• This program helps control the incidence of rabies, and due to its public utility nature, generally the State should pay for it; however, when an individual farmer or group of farmers request the service, a variable cost recovery fee should be assessed.
○ Africanized bee	• The public sector benefit of this program is questionable; it is recommended that the program be transferred to the Honey Producers Association, or that a handling fee be imposed to recover at least the variable costs associated with the provision of the service.
• Epidemiological studies	• While epidemiological studies are of public benefit, those studies with potential benefits to economically important crops (sugar, citrus, banana, papaya, etc.) should be supported by these organized producers.
• Sanitary inspection of slaughter houses, and laboratory analysis for animal and human health conditions.	• Collection of a "cess" fee per animal slaughtered to cover the salary of the animal health inspector should be implemented.
• Emergencies whose occurrence will vary within a given range of probability. In these cases the type of service required will depend on the nature of the emergency, and may vary from a focalized outbreak affecting a limited number of persons or area to a nationwide emergency, affecting the whole country. However, since the emergency can have wide economic and health implications, it needs to be treated in the interest of the whole society.	• Depending on the nature of the probable emergencies, the costs of addressing these can be covered from current national budget allocations, funding and management of emergency funds, and private sector co-financing.

The annual review of the performance of the cost recovery mechanism will require the implementation of a management information system (MIF) network to set up a data base to provide the quantitative information needed to review cost structures, income flows per activity, uses of funds, changes in demand and in the patterns for services, diseases and pests, changes in the charges, contributions, cess fees, etc.

The utilization of the funds should have one purpose, namely the maintenance and improvement of the agricultural health service. Therefore, its utilization should be oriented towards those activities which provide the greatest return to agricultural production and trade as well as to society at large. For this, the new service will have to establish proper accounts and financial controls to monitor sources and uses of funds, and be subject to external post-audits. This will imply a transfer of the current revolving fund being managed and controlled by the Ministry of Finance to the NPAHS.

3. Recommendations to Implement Alternative Funding Mechanisms

3.1 Strategic Objective

The fundamental strategic objective is to endow the agricultural health services of Belize with a market oriented institutional framework in order to create the incentives to increase demand for most health service activities being provided (specially those with a direct private benefit), improve its effectiveness and efficiency, meet GATT/OMC requirements, and make it as self-financing as possible.

3.2 Action Recommendations

In order to achieve the strategic objective[3], the following action recommendations are presented in the area of managing delivery of services, cost recovery, information, financial management, and promotion.

Agricultural health service activities with direct private benefit: For those agricultural health service activities which always provide a direct private benefit (Table 7), the following actions should be undertaken in order to set an initial tariff level for each:

- Determine potential demand for each activity and sub-activity, e.g., different laboratory diagnostics.

- Undertake analysis of cost structure by activity and sub-activity.

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[3]The achievement of such objective will also depend on fulfilling other conditions such as institutional changes, legal and regulatory adjustments, international information system, among others, and contained in the terms of reference for this study.

- Review tariff structures in neighboring countries, including Mexico and Panama where samples are being sent for analysis.

- Set initial tariff levels for each activity and sub-activity.

Agricultural health service activities with public utility: For those agricultural health service activities which provide a public utility, but can and do generate a private benefit as well (Table 8), the following actions should be undertaken:

- Negotiate with organized private sector annual contributions to existing control and eradication programs.

- Negotiate with animal producers on setting appropriate cess fees at slaughter houses to pay for the inspection and laboratory diagnostic service.

- Negotiate with organized private sector the structuring, financing and utilization of an emergency fund to cope with unforseen outbreaks of diseases or pests.

Management information system: The basic steps included in setting up a management information system to keep track of the all activities undertaken by the service, analyze costs, demand, patterns, etc., include the following:

- Determining the type of information needed to enable an annual evaluation of the efficiency and effectiveness of each activity provided by the system.

- Systematization of forms and flow of information.

- Organization of an electronic data base.

- Application of simple analytical tools to evaluate the effectiveness and efficiency of the system, including cost per activity, frequency of each, changes in demand and patterns, etc.

Financial management and control system: The design and implementation of an accounting and financial management system to monitor and control the sources and uses of funds of the agricultural health service would take the following steps:

- Negotiate oversight and external auditing with the Ministry of Finance and the MAF.

- Buy an off-the shelf accounting-financial management software .

- Install software in the Agricultural Health Services central office.

- Train personnel in its use.

- Link it to the management information system.

Promotion of the agricultural health services: The need for and the benefits of the agricultural health services should be promoted among users and beneficiaries in order to increase awareness, perception of benefit rather than "necessary evil", and demand for its various activities. This can be accomplished with the following actions:

- Development of promotional and educational materials.

- Provision of seminars and workshops on the need for (international agreements) and benefits gained (health, benefit/cost, etc.).

- Educational campaigns at different organizational levels such as organized producer groups, schools, communities, churches, NGO's, etc.

APPENDIX E
Summary of Costs of Investment, Personnel and Technical Assitance and Training

Summary of Costs for
Construction, Repairs and Rehabilitation of Infrastructure and Facilities. (BZ$) *

Infrastructure Facility	Location	Year 1	Year 2	Year 3	Year 4	Total
Central Administration Building	Central Farm	210.870				210.870
Veterinary Clinic	Central Farm	282.325				282.325
Central Investigatory Lab.	Belize City	344.251				344.251
District Veterinary clinic	Orange Walk		91.838			91.838
District Veterinary clinic	Toledo		30.850			30.850
Plant Health Laboratory	Central Farm		55.136			55.136
Soils Laboratory	Central Farm	26.625				26.625
Soils Laboratory Extension	Central Farm	60.000				60.000
Entomology Laboratory and Screenhouse	Central Farm	212.035				212.035
Quarantine Station **	Santa Elena Border	36.690				36.690
Quarantine Station **	La Union, Orange Walk		36.690			36.690
Quarantine Station §	International Airport, Ladyville		12.120			12.120
Quarantine Station **	Seaport, Belize City		8.760			8.760
Quarantine Station **	Dangriga			36.640		36.640
Quarantine Station	Big Creek, Stann Creek		63.130			63.130
Quarantine Station **	Punta Gorda			37.440		37.440
Quarantine Station **	Jalacte, Toledo			37.440		37.440
Quarantine Station §§	Western Border, Benque Viejo		32.900			32.900
TOTAL COST (BZ$)		1.172.796	331.424	111.520	-	1.615.739
TOTAL COST (US$)		$ 586.398	$ 165.712	$ 55.760	$ 0	$ 807.870

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* = Costs represent current rates (August 1996) for construction in Belize.

** = New facilities will be constructed.

§ = Only incinerator house is being built as a new structure. Required office space is to be rented from the Belize Airports Authority.

§§ = Consist of constructing a concrete walkway from the main building to the incinerator.

Summary of Cost of Laboratory Equipment and Supplies for NAPHS.

Item	Year 1	Year 2	Year 3	Year 4	Total
I. Plant Health Services					
- Requirements for Entomology Activities			75.371		75.371
- Requirements for Plant Pathology Lab.			26.201		26.201
Sub total		-	101.572	-	101.572
II. Soils Lab.					
- Requirement for the Soils Laboratory			39.829		39.829
Sub total	-	-	39.829	-	39.829
III. Internal Quarantine					
- Equipment Required			16.421		16.421
Sub total	-	-	16.421	-	16.421
IV. Animal Health Services					
- Veterinary ambulatory services			65.700		65.700
Sub total	-	-	65.700	-	65.700
V. Central Investigatory Laboratory					
- Hematology			18.856		18.856
- Histology			18.354		18.354
- Parasitology			366		366
- Serology			17.145		17.145
- Urinalysis			366		366
- Biochemistry			8.373		8.373
- Microbiology			23.265		23.265
- Residue Testing		30.418			30.418
- General Consumables		21.013			21.013
- Clinical Chemistry			16.372		16.372
- HACCP Analysis		10.229			10.229
- Building Equipment		57.875			57.875
- Repairs and Maintenance		25.575			25.575
Sub total (a)	-	145.110	103.096	-	248.206
<u>- Fish Testing</u>					
- Requirements for Fish Testing		72.928			72.928
- Requirem. of Equip.& Reagents for Wastewater Monitoring		11.730			11.730
- Cost of Food Testing for Fisheries Sector		55.363			55.363
Sub total (b)	-	140.021	-	-	140.021
Sub total	-	285.131	103.096	-	388.229
TOTAL (US$)	**-**	**285.131**	**326.629**	**-**	**611.761**
TOTAL (BZ$)	**-**	**570.262**	**653.240**	**-**	**1.223.502**

Summary of Costs for Equipment and Supplies. (US$)

	Year 1	Year 2	Year 3	Year 4	TOTAL
Computer Equipment and Supplies:					
- Administration and Management.		42.802			42.802
- Plant Health.		20.184			20.184
- Animal Health		17.759			17.759
- Central Investigatory Laboratory.		35.488			35.488
- Quarantine and Inspection.		10.799			10.799
Sub total	-	127.031	-	-	127.031
Office Equipment and Supplies:					-
- Administration and Management.		32.537			32.537
- Plant Health.		31.080			31.080
- Animal Health		60.439			60.439
- Central Investigatory Laboratory.		45.238			45.238
- Quarantine and Inspection.		9.081			9.081
Sub total	-	178.373	-	-	178.373
Other Equipment and Supplies:					
- Administration and Management.		1.853			1.853
- Animal Health		21.013			21.013
- Central Investigatory Laboratory.		20.515			20.515
- Quarantine and Inspection.		47.385			47.385
Sub total	-	90.765	-	-	90.765
Vehicles:					
- Administration and Management	29.000				29.000
- Animal Health Services		29.000			29.000
- Quarantine and Inspection		21.000			21.000
Sub total	29.000	50.000	-	-	79.000
Revolving Fund to purchase vehicles		250.000			
Sub total	-	250.000	-	-	250.000
TOTAL (US$)	**29.000**	**696.170**	-	-	**725.170**
TOTAL (BZ$)	**58.000**	**1.392.339**	-	-	**1.450.339**

Estimated cost for Technical Assistance and Training (US$).

Division	Specific Area	Technical Assistance	Training	Time Period * Local	Time Period * External	Year 1	Year 2	Year 3	Year 4	Total
I. Management and Administration of the NAGHS.										
	Organization and Management of the NAGHS.	X			6	30.000				30.000
	Development of Programming, Reporting, Monitoring and Evaluation System.	X		6		9.000				9.000
	Design of Financial and Accounting System.	X		6		9.000				9.000
	Design of operating manuals	X			1	5.000				5.000
	Information Systems:									
	- Design of Information Systems and Programs.	X		6		12.000				12.000
	- Upgrade Technical Capabilities on Information Systems Technology.		X	3		6.000				6.000
	Regulatory Framework:									
	- Review of Laws and Regulations of the AGHS.	X		12		30.000				30.000
	- Recommendations for improving laws and regulation and streghtenning regulatory framework.	X		12			30.000			30.000
	- Review Regional and International Legislation of Agricultural Health Services and harmonize Belize`s Laws.	X		12			60.000			60.000
	- Legal training of MAF Technicians		X	1			5.000			5.000
	- International Standards, Norms and Regulations of the Phytozoosanitary Measures.		X	2		10.000				10.000
	- PCB: Development of Reporting, Programming, Monitoring and Evaluation System.	X		3			4.500			4.500
Sub total						111.000	99.500	-	-	210.500

Estimated cost for Technical Assistance and Training (US$).

Division	Specific Area	Technical Assistance	Training	Time Period * Local	Time Period * External	Year 1	Year 2	Year 3	Year 4	Total
II. Plant Health Services										
	Management and Organization of the Plant Health Service.	X		6		30.000				30.000
	Administration in Laboratory Management.	X		2			10.000			10.000
	Design of Plant Health Programs and manuals.	X		2		10.000				10.000
	Development of Programming, Reporting, Monitoring and Evaluation System.	X		6		9.000				9.000
	Internal Quarantine.	X		1			5.000			5.000
	Plant and Disease Control Programs.	X		1			5.000			5.000
	Sampling Techniques.	X		1				5.000		5.000
	Administration and Management of Plant Health Service.		X		1		3.000			3.000
	Data Analysis.		X	1			1.000			1.000
	Data Base Management.		X	1			1.000			1.000
	IPM / Biological Control.		X		1		3.000			3.000
	Nematology.		X		1			3.000		3.000
	Plant Pathology.		X		3		6.000			6.000
	Plant Pathology: Identification of Fungal and Bacterial Diseases.		X		3		6.000			6.000
	Plant Physiology.		X		3			6.000		6.000
	Post Harvest Techniques.		X		1		3.000			3.000
	Quarantine.		X		1		3.000			3.000
	Risk Analysis.		X		1		3.000			3.000
	Taxonomy.		X		3			6.000		6.000
	Toxicology & Resistance Management.		X		1			3.000		3.000
	Use and Maintenance of Specific Equipment.		X	1			2.000			2.000
	Virology.		X		2			5.000		5.000
	Weed Control.		X		1		3.000			3.000
Sub total						49.000	54.000	28.000	-	131.000

Estimated cost for Technical Assistance and Training (US$).

Division	Specific Area	Technical Assistance	Training	Time Period * Local	Time Period * External	Year 1	Year 2	Year 3	Year 4	Total
III. Animal Health Services										
	Animal and Disease Control.	X		1		5.000				5.000
	Design of Animal Health Programs and manuals.	X		1		5.000				5.000
	Development of Programming, Reporting, Monitoring and Evaluations System.	X		3		15.000				15.000
	Internal Quarantine.	X		1			5.000			5.000
	Maintenance of Veterinary Equipment.	X		1			5.000			5.000
	Animal Health Information System.		X	3			6.000			6.000
	Internal Quarantine.		X	3			6.000			6.000
	International Regulations in Animal Health.		X		2	5.000				5.000
	Managerial training in Animal Health Programs.		X	2	1		10.000			10.000
	Meat Inspection.		X	2	1		10.000			10.000
	Prevention and control in exotic diseases.		X	2	1		10.000			10.000
	Risk Analysis.		X		1		3.000			3.000
	Surveillance and Epidemiology.		X		1		3.000			3.000
Sub total						30.000	58.000	-	-	88.000

Estimated cost for Technical Assistance and Training (US$).

Division	Specific Area	Technical Assistance	Training	Time Period * Local	Time Period * External	Year 1	Year 2	Year 3	Year 4	Total
IV. Central Investigatory Laboratory										
	Management and Organization of the Central Investigatory Laboratory.	X		6			30.000			30.000
	Development of Programming, Reporting, Monitoring and Evaluations System.	X		6			9.000			9.000
	Design of operating manuals	X			1		5.000			5.000
	Laboratory Management.		X		2		5.000			5.000
	Laboratory Equipment Maintenance.		X		2			5.000		5.000
	Sampling.		X		1			3.000		3.000
	Updating specific disciplines for C.I.L.. **		X		18			25.000	25.000	50.000
Sub total						-	49.000	33.000	25.000	107.000
V. Quarantine and Inspection Services.										
	Management and Organization of quarantine service.	X		3		6.000				6.000
	Design of operating manuals	X			1	5.000				5.000
	Development of Programming, Reporting, Monitoring and Evaluation System.	X		3		5.000				5.000
	Risk Analysis		X	1		2.000				2.000
	Quarantine System Analysis.		X	1			2.000			2.000
Sub total						18.000	2.000	-	-	20.000
TOTAL (US$)						**208.000**	**262.500**	**61.000**	**25.000**	**556.500**
TOTAL (BZ$)						**416.000**	**525.000**	**122.000**	**50.000**	**1.113.000**

* = Man-Months
** = Courses like Veterinary Pathology, Food Technology, Water Quality, Instrumentation.

Estimated Personnel Requirements of the NAGHS.

Units	Position	Currently recurrent Personnel (1)	Incremental Personnel
I- Management and Administration of NAGHS			
A. General:			
	Chief Agricultural Head Officer		1
	Computer and System Analist		1
	Secretary Receptionist		1
B- Finance and Accounting Unit:			
	Accounting Technician		1
	Cashier Clerk		1
Sub Total		**0**	**5**
II- Plant Health Service Division			
A. Plant Protection and Laboratory			
	Head of Plant Health Service	1	
	IMP Officer	1	
	Entomologist	1	
	Plant Pathologist	1	
	Plant Protection Officer	1	
	Agronomist	1	
	Quarantine Officer		3
	Secretary/Receptionist		1
	Data Entry Assistant		1
	Laboratory Assistant	1	1
B. Soils Laboratory			
	Soils Chemist	1	
	Assistant Technician	1	1
	General Assistant		1
C. Medfly Program			
	Medfly Inspector	7	0
Sub Total		**16**	**8**

Estimated Personnel Requirements of the NAGHS.

Units	Position	Currently recurrent Personnel (1)	Incremental Personnel
III- Animal Health Service Division			
A. Management and Administration			
	Head of Animal Health Service	1	
	Secretary		1
B. Veterinary Clinics (Central Farm, Orange Walk, Toledo)			
	Veterinary Officer	3	1
	Laboratory Technician	1	
	Epidemiology / Information Specialist	1	
	Animal Health Assistant	2	
	Officer assistant	1	
	Store Keeper	1	
	Receptionist	1	
	Driver	2	
	Watchman		1
C. Other Programs			
- Screw Worm			
	Screw Worm Techician	4	
	Clerk	1	
- Vampire Bat Control			
	Vampire Bat Technician	1	
- Beekeeping			
	Apiaries Inspector	2	
Sub Total		**21**	**3**

Estimated Personnel Requirements of the NAGHS.

Units	Position	Currently recurrent Personnel (1)	Incremental Personnel
IV- Central Investigatory Laboratory			
	Head of Laboratory: Veterinary Investigatory Offi	1	
	Fish Lab. Technician	1	
	Senior Laboratory Technician	1	
	Laboratory Technician	1	3
	Assistant Laboratory Technician		3
	Instrumentation Tecnician		1
	Microbiologist food technician	1	1
	Sample Collector		1
	Receptionist	1	
	Secretary		1
	Watchman	3	
	Janitress	2	
Sub Total		**11**	**10**
V- Quarantine and Inspection Services Division			
	Head of International Quarantine and Inspection	1	
	Quarantine Inspector Officer	11	4
Sub Total		**12**	**4**
VI- Registration and Control Unit			
	Head of Registration and Control Unit		1
	Consultant Technicians	3	
	Technical Assistants	2	
	Administrative Assitant	1	
	Clerk Typist	1	
Sub Total		**7**	**1**
TOTAL		**67**	**31**

(1)= These are personnel that are currently employed in the MAF's Agricuitural Health Service.

Distribution of the Estimated Cost of Personnel under Institutional Alternative One (BZ$)

Units	Current Recurrent Cost *	Incremental Personnel Cost **	Total Personnel Cost
I- Management and Administration of NAGHS			
A. General:		66.869	66.869
B- Finance and Accounting Unit:		23.395	23.395
Sub Total	-	**90.264**	**90.264**
II- Plant Health Service Division			
A. Plant Protection and Laboratory	169.315	69.070	238.385
B. Soils Laboratory	42.631	21.715	64.346
C. Medfly Program	89.011		89.011
Sub Total	**300.958**	**90.785**	**391.742**
III- Animal Health Service Division			
A. Management and Administration	32.458	8.906	41.363
B. Veterinary Clinics (Central Farm, Orange Walk, Toledo	275.554	35.379	310.934
C. Other Programs			
- Screw Worm	71.706		71.706
- Vampire Bat Control	15.130		15.130
- Beekeeping	31.027		31.027
Sub Total	**425.875**	**44.285**	**470.160**
IV- Central Investigatory Laboratory	139.467	122.716	262.183
Sub Total	**139.467**	**122.716**	**262.183**
V- Quarantine and Inspection Services Division	215.203	60.998	276.202
Sub Total	**215.203**	**60.998**	**276.202**
VI- Registration and Control Unit	124.126	26.406	150.532
Sub Total	**124.126**	**26.406**	**150.532**
TOTAL	**1.205.629**	**436.454**	**1.641.083**

* These cost are currently covered by the MAF and they include salaries, wages and social security.
** These include social security cost also.

Distribution of the Estimated Cost of Personnel under Institutional Alternative Two (BZ$)

Units	Current Recurrent Cost *	Incremental Personnel Cost **	Total Personnel Cost
I- Management and Administration of NAGHS			
A. General:		78.834	78.834
B- Finance and Accounting Unit:		25.654	25.654
Sub Total	-	104.488	104.488
II- Plant Health Service Division			
A. Plant Protection and Laboratory	201.157	75.733	276.890
B. Soils Laboratory	49.481	23.806	73.286
C. Medfly Program	97.628		97.628
Sub Total	348.266	99.539	447.805
III- Animal Health Service Division			
A. Management and Administration	38.868	9.758	48.624
B. Veterinary Clinics (Central Farm, Orange Walk, Toledo	320.179	41.663	361.842
C. Other Programs			
- Screw Worm	78.674		78.674
- Vampire Bat Control	16.602		16.602
- Beekeeping	34.049		34.049
Sub Total	468.371	51.419	539.790
IV- Central Investigatory Laboratory	160.081	136.431	296.511
Sub Total	160.081	136.431	296.511
V- Quarantine and Inspection Services Division	239.346	66.938	306.282
Sub Total	239.346	66.936	306.282
VI- Registration and Control Unit	136.255	31.606	167.860
Sub Total	136.255	31.606	167.860
TOTAL	1.372.319	490.418	1.862.736

* These cost are currently covered by the MAF and they include salaries, wages and social security.

** These include social security cost also.

APPENDIX F
Detail Costs of Construction and Repairs, Equipment, Supplies and Other Imports

Cost of Rehabilitation, Refurbishment and Construction of NAGHS Facilities.

Infrastructure Facility	Location	Area Square Feet		Costs *				TOTAL COST
		Refurbishment	Construction / Extension	Planning	Supervision of Construction	Refurbishment	Construction / Extension	
Central Administration Building	Central Farm		2.200	5.940	8.930		196.000	210.870
Veterinary Clinic	Central Farm	1.881	1.806	7.950	9.200	93.605	171.570	282.325
Central Veterinary Investigations Lab.	Belize City	5.446	3.702	9.700	11.300	130.211	193.040	344.251
District Veterinary Clinic	Orange Walk	832	446	2.500	3.100	43.868	42.370	91.838
District Veterinary Clinic	Toledo		353	850	1.800		26.200	30.850
Plant Health Laboratory	Central Farm	1.232	388	1.550	1.850	20.696	31.040	55.136
Soils Laboratory	Central Farm		580	750	875	4.000	21.000	26.625
Soils Laboratory Extension	Central Farm			1.500	2.500		56.000	60.000
Entomology Laboratory and Screenhouse.	Central Farm		3.607	8.000	7.000		199.035	212.035
Quarantine Station **	Santa Elena Border		431	1.000	1.250		34.440	36.690
Quarantine Station **	La Union, Orange Walk		431	1.000	1.250		34.440	36.690
Quarantine Station §	International Airport, Ladyville	294	82	350	800	4.410	6.560	12.120
Quarantine Station	Seaport, Belize City		82	1.000	1.200		6.560	8.760
Quarantine Station **	Dangriga		431	1.000	1.200		34.440	36.640
Quarantine Station	Big Creek, Stann Creek		720	1.750	3.000		58.380	63.130
Quarantine Station **	Punta Gorda		431	1.000	2.000		34.440	37.440
Quarantine Station **	Jalacte, Toledo		431	1.000	2.000		34.440	37.440
Quarantine Station §§	Western Border, Bengue Viejo	750	353	900	1.000	2.800	26.200	32.900
	TOTAL (BZ$)			49.749	68.255	299.590	1.212.155	1.615.739
	TOTAL (US$)			$ 22.879	$ 29.128	$ 149.795	$ 606.077	$ 807.879

* = Costs represent current rates (August 1996) for construction in Belize

** = New facilities will be constructed

§ = Only incinerator house is being built as a new structure. Required office space is to be rented from the Belize Airports Authority.

§§ = Consist of constructing a concrete walkway from the main building to the incinerator.

Plant Health Services: Requirements for Entomology Activities (US$)

Catalog Name	Reagent and Supplies	Catalog Number	Quantity	Unit Price	Total Cost
Bioquip	Steel Entomological Collection Cabinets	2512TAN	12	457.00	5,484.00
	Basswood Cornell University Drawers	1013AFP	144	48.50	6,984.00
	Macrolyte II high performance system	6423	1	2,739.00	2,739.00
	Mosquito Breeder	1425	2	10.50	21.00
	Spreading board	1023E	12	14.60	175.20
	Spreading board	1023F	12	16.95	203.40
	Mini tool set	4840	4	38.10	152.40
	Mini tools, handle	4800	2	16.25	32.50
	Mini tools, tip needle point	4801	2	24.50	49.00
	Mini tools tip, 160 hook	4807	2	33.45	66.90
	Mini tools tip 20 root knife	4808	2	30.85	61.70
	Mini tools tools tip, 45 probe	4812	2	31.30	62.60
	Mini tools tip, 90 hook	4818	2	33.45	66.90
	AC/DC collecting light	2804	4	73.00	292.00
	Replacement 15 watt BL tube	2607A	8	10.25	82.00
	DC battery pack	2861	4	135.00	540.00
	DC replacement battery	2861A	2	66.50	133.00
	Insect vac, DC	2820	4	87.50	350.00
	Outdoor cage (6x12x6ft) 32x32 mesh lumite	1412C	4	374.00	1,496.00
	Collapsible cage 8 x 8 x 8	1450A	12	58.50	702.00
	Collapsible cage 12 x 12 x 12	1450B	12	72.50	870.00
	Collapsible cage 18 x 18 x 18	1450C	12	125.00	1,500.00
	Collapsible cage 24 x 24 x 24	1450D	12	144.00	1,728.00
	Replacement stockinette sleeve	1450S	2	49.50	99.00
	Rearing cage 12 x 12 x 24	1450L	12	78.50	942.00
	Field cage 12 x 12 x 12	1451B	12	32.75	393.00
	Field cage 24 x 24 x 24	1451D	12	48.00	552.00
	Berlese Funnel	2831	6	56.00	336.00
	Gelatin Capsules	8100C	5	14.50	72.50
	Shell vials with corks	6610	10	60.20	802.00
	Plastic tubes 12 dram	8912	10	22.00	220.00
	Screw cap vials with caps (4 dram)	8804P	10	58.65	566.50
	Micro slides, single cavity	6330A	25	19.95	496.75
	Micro slides, double cavity	6330B	25	24.35	608.75
	Micro slides	6330B	25	20.25	506.25
	Round cover slips 15mm	6342AB	25	26.90	672.50
	Round cover slips 18mm	6342BB	25	22.35	558.75
	Cover glass 22mm sq. No.1	6341B	25	5.85	148.25
	Cover glass 22mm sq. No. 2	6341C	25	5.65	146.25
	Specimen clearing fluid	8373A	5	65.00	325.00
	Barber's Fluid	8374A	5	14.70	73.50
	Cellosolve	8378B	5	26.75	133.75
	Ligning Pink Stain	8377A	5	9.95	49.75
	Double stain	8379B	5	20.50	102.50
	Dropping pipette	4775	10	3.30	33.00
	PVA mounting medium	8371A	10	9.95	99.50
	Slide mounting medium	8370	10	9.20	92.00
	Carnoy-Lebrun Fixative	6376A	5	14.15	70.75
	Euparal mounting medium	6372B	5	46.00	230.00

Plant Health Services: Requirements for Entomology Activities (US$)

Catalog	Reagent	Catalog Number	Quantity	Unit Price	Total Cost
Bioquip	Euparal essence	6372D	5	8.40	42.00
	Microslide tool set	4831	5	22.50	112.50
	Pigma set of 6 pens black	1154J	10	12.50	125.00
	Pigma set of 6 pens colors	1154K	10	12.50	125.00
	Ethyl acetate	1185C	15	6.10	91.50
	Collecting Jar 9 oz.	1120A	15	2.25	33.75
	Collecting jar 16 oz.	1120B	15	2.65	39.75
	Collecting jar 32 oz.	1120C	15	2.90	43.50
	Ethyl alcohol	1163C	20	11.50	230.00
	KAAD larval fixative	1188C	15	13.00	195.00
	Pampel's solution	1184C	5	11.40	57.00
	Luminous paint in 4 oz. jar	1166B	10	14.50	145.00
	Luminous paint in 4 oz. jar	1166R	10	14.50	145.00
	Luminous paint in 4 oz. jar	1166W	10	14.50	145.00
	Luminous paint in 4 oz. jar	1166Y	10	14.50	145.00
	Plastic syringe	1162S	2	5.50	11.00
	Parasites and pathogens of insects vol. 1	3373	1	65.00	65.00
	Parasites and pathogens of insects vol. 2	3374	1	85.00	85.00
	Insect plant interactions vol. 1	9743	1	91.70	91.70
	Insect plant interactions vol.	9609	1	91.70	91.70
	Insect plant interactions vol. 3	9067	1	91.70	91.70
	Fundamentals of insect physilogy	9600	1	89.95	89.95
	The Insects	9022	1	49.95	49.95
	Forest entomology	9420	1	99.95	99.95
	Lab. manual for intro entomology	9066	1	25.00	25.00
	Insect defenses	9710B	1	29.95	29.95
	Ecological entomology	9358	1	145.00	145.00
	Artificial diets for insects, mites and spiders	9207	1	95.00	95.00
	Principles of Insect Morphology	3379B	1	27.95	27.95
	Immature Insects vol. 1	9667	1	96.91	96.91
	Immature Insects vol. 2	9668	1	229.95	229.95
	Insect pathology	3371	1	129.00	129.00
	Population biology of tropical insects	9419	1	110.00	110.00
	Physician's guide to arthropods of Medical Imp.	3327	1	119.00	119.00
	A manual of Foresic entomology	9671	1	45.00	45.00
	Biological control of vectors	9283	1	75.00	75.00
	The organic gardener's handbook of natural insect and disease control	3310	1	27.95	27.95
	Pets and diseases of tropical crops vol. 2	9951	1	48.95	48.95
	Integrated pest management for rice	9418	1	25.00	25.00
	Common insect pests of stored food products, a guide to their identification	9520	1	10.00	10.00
	Controlling turf grass pests	9578	1	61.00	61.00
	Insect pests of tropical food legumes	9480	1	158.95	158.95
	A worldwide guide to beneficial animals (insects/mites/nematodes) used for pest control	9657B	1	16.50	16.50
	Principles of acarology	8978	1	123.50	123.50
	How to know the spiders	9066	1	21.50	21.50
	Vol. 5 Dynastin	9560	1	191.00	191.00

Plant Health Services: Requirements for Entomology Activities (US$)

Catalog	Reagent	Catalog Number	Quantity	Unit Price	Total Cost
Bioquip	Vol. 10 Rutelini	9247	1	215.00	215.00
	Vol. 14 Dynastidae	9472	1	182.00	182.00
	Vol. 18 Cicindelidae	9667	1	217.00	217.00
	Escarabajos, 200 millones de años de evolución	9824	1	40.00	40.00
	An illustrated Catalog of the cryptorhynchinae of the new world	9449	1	15.00	15.00
	The bark and ambosia beetles of N. and CA	9074	1	74.50	74.50
	The gall midges of the neotropical region	3332	1	54.50	54.50
	Honey bee pathology	9212A	1	89.95	89.95
	Identification guide to the ant genera of the world	3323	1	65.00	65.00
	Hymenoptera of the world: An identification	8968	1	83.35	83.35
	The ants	9061	1	75.00	75.00
	The chrysidid wasps of the world		1	140.00	140.00
	The bee genera of north and Central America	3351	1	45.00	45.00
	Butterflies of the neotropical region vol. 3 part. 1	9758	1	243.00	243.00
	Butterflies of the neotropical region vol. 3 part 2	9436	1	235.00	235.00
	Butterflies of the neotropical region vol. 3 part 3	9591	1	235.00	235.00
	Butterflies of the neotropical region vol. 3 part 4	9696	1	235.00	235.00
	Butterflies of the neotropical region vol. 3 part 5	9978	1	220.00	220.00
	Butterflies of the neotropical region vol. 3 part 6	9549	1	235.00	235.00
	The moths of America north of Mexico	9651	1	65.00	65.00
	The moths of America north of Mexico	9601	1	46.00	46.00
	The moths of America north of Mexico	9602	1	59.00	59.00
	The moths of America north of Mexico	9604	1	70.00	70.00
	The moths of America north of Mexico	9610	1	66.00	66.00
	The moths of America north of Mexico	9613	1	36.00	36.00
	The moths of America north of Mexico	9614	1	36.00	36.00
	The moths of America north of Mexico	9618	1	45.00	45.00
	The moths of America north of Mexico	9617	1	55.00	55.00
	The moths of America north of Mexico	9618	1	55.00	55.00
	The moths of America north of Mexico	9620	1	33.00	33.00
	The moths of America north of Mexico	9621	1	36.00	36.00
	The moths of America north of Mexico	9622	1	36.00	36.00
	The moths of America north of Mexico	9630	1	50.00	50.00
	The moths of America north of Mexico	9640	1	46.00	46.00
	The moths of America north of Mexico	9607	1	70.00	70.00
	The moths of America north of Mexico	3418	1	70.00	70.00
	The moths of America north of Mexico	9660	1	75.00	75.00
	Handbook for scientific photography	3307	1	8.95	8.95
	Parasitoids	8960 B	1	29.95	29.95
	The care of fine books	9674	1	16.95	16.95
	Biology and management of rice insects	3444	1	89.95	89.95
	How to photograph insects and spiders	3442	1	16.95	16.95
	Sub total				40,109.96

Plant Health Services: Requirements for Entomology Activities (US$)

Catalog Name	Reagent and Supplies	Catalog Number	Quantity	Unit Price	Total Cost
Wards	Kodak Ektagraphic III Slide Projector	26W7816	2	956.00	1,912.00
	Replacement bulbs for above	26W7819	6	29.95	179.70
	Carousel slide tray	26W7814	8	16.95	135.60
	Illuminated 35 mm Slide sorter	30W5900	2	29.95	59.90
	27" Stereo Color Monitor/Receiver	25W0116	1	775.00	775.00
	4-head VHS Video cassette recorder	25W0203	2	349.00	698.00
	Thermolyne Oven/Incubator	15W7514	1	764.00	764.00
	Dazor series Desktop Magnifier lamp	15W5033	2	220.00	440.00
	Programmable Timer	15W1496	4	39.95	159.60
	Table Sterilizer/Autoclave	14W9009	1	5,430.00	5,430.00
	Biotronette Environmental Chamber	20W7630	1	2,275.00	2,275.00
	Standard grade Pyrex glass beakers 10 ml	17W4110	2	33.36	66.72
	Standard grade Pyrex glass beakers 20 ml	17W4111	2	28.68	57.36
	Standard grade Pyrex glass beakers 30 ml	17W4112	2	28.68	57.36
	Standard grade Pyrex glass beakers 50 ml	17W4113	2	28.68	57.36
	Standard grade Pyrex glass beakers 100 ml	17W4114	2	30.48	60.96
	Standard grade Pyrex glass beakers 150 ml	17W4115	2	28.66	57.38
	Standard grade Pyrex glass beakers 250 ml	17W4116	2	28.68	57.36
	Standard grade Pyrex glass beakers 400 ml	17W4117	2	34.08	66.16
	Standard grade Pyrex glass beakers 600 ml	17W4118	2	21.46	42.96
	Standard grade Pyrex glass beakers 600 ml	17W4119	2	29.78	59.52
	Standard grade Pyrex glass beakers 1000 ml	17W4120	2	40.96	81.96
	Standard grade Pyrex glass beakers 1500 ml	17W4121	2	33.04	66.08
	Standard grade Pyrex glass beakers 2000 ml	17W4122	2	54.12	108.24
	Petri dishes Disposable 60 x 15	16W7099	10	108.00	1,080.00
	Petri dishes Pyrex 60 x 15	17W0730	5	469.00	2,345.00
	Sub total				17,095.40
Phillip Harris	Basic Analytical Balance	B12018	1	1,495.00	1,495.00
	Thermometer, Digitemp	T44-800	2	30.20	60.40
	Microscope, Olympus Model CHS 213E	M42-540	1	1,670.66	1,670.66
	Stereoscopic microscope	M42-730	2	1,018.48	2,036.92
	Transilluminator base	M42-758	3	367.71	1,103.13
	LSGA-3 Incident illuminator	M42-754	3	252.35	757.05
	Centrifuge, Heraeus Labofuge 200	C33-010	1	611.00	611.00
	Dessicator/humidity cabinet	D34-260	1	871.58	871.58
	Neubauer heamacytometer	H12-134	2	56.18	112.36
	Humidity/temperature solid state meter	H82-331	1	199.00	199.00
	Heraeus Incubator	I52-326	1	895.00	895.00
	Stirrer, magnetic, Hotplate, Bibby	S72-674	1	400.00	400.00
	Twirl-lock bags (50 ml)	B10-387	10	41.50	415.00
	Twirl-lock bags (175 ml)	B10-388	10	43.75	437.50
	Twirl-lock bags (500 ml)	B10-388	10	66.75	667.50
	Twirl-lock bags (1200 ml)	B10-396	5	120.00	600.00
	Sub Total				12,352.10

Plant Health Services: Requirements for Entomology Activities (US$)

Catalog Name	Rapid Disease Detection Kits	Catalog Number	Quantity	Unit Price	Total Cost
	Phytopthtora	N1001	5	141.75	708.75
	Pythium	N1002	5	141.75	708.75
	Rhizoctonia	N1003	5	141.75	708.75
	Pseudomonas syringee pv. syringae	N1035	1	408.85	408.85
	Xanthomonas campestris pv. campestris	A1055	1	408.85	408.85
	Xanthomonas campestris pv. vesicotaria	A1095	1	408.85	408.85
	Sub-Total				3,352.80
Catalog Name	Books	Catalog Number	Quantity	Unit Price	Total Cost
ESA	Laboratory guide to insect pathogens and parasites	PPC9	1	89.50	89.50
	Spider mites-their biology, natural enemies and control. vol. 1	ESP6A	1	239.50	239.50
	Spider mites-their biology, natural enemies and control. vol. 2	ESP8B	1	250.75	250.75
	Fuirt flies: their biology, natural enemies, and control. vol. 1	ESP21A	1	250.75	250.75
	Fuirt flies: their biology, natural enemies, and control vol. 2	ESP21B	1	258.75	258.75
	Advances in Parasitic hymenoptera research	STL1	1	79.95	79.95
	Agricultural entomology	TIM1	1	89.95	89.95
	Catalog of the heteroptera: or true bugs, of Canada and the continental United States	STL3	1	69.95	89.95
	Insects of Australia (2 volume set) 2nd edition	CUP25	1	215.00	215.00
	Australian weevils vol 1-3	ESAWEEV	1	300.00	300.00
	Australian weevils vol 5-6	ESAWEEV	1	400.00	400.00
	Peterson field guide to the beetles of north america	HMC4	1	16.95	16.95
	IPM for citrus	ANR7	1	22.00	22.00
	IPM for cole crops and lettuce	ANR4	1	22.00	22.00
	IPM for tomatoes 3rd edition	ANR11	1	22.00	22.00
	Vegetable crop pests	CRC46	1	93.95	93.95
	Wood destroying insects	ADV2	1	39.95	39.95
	Sub-Total				2,480.95
	TOTAL				75,371.21

Plant Health Services: Requirements for Plant Pathology Laboratory (US$)

Application	Reagent	Catalog	Quantity	Total Cost US$
Virology	Carbonate Bicarbonate Buffer Capsules	Sigma C-3041	10 x 50 cgs	275.00
Bacteriology	Nutrient Agar	Sigma A.5308	5 x 1 kg	1,101.50
	Casamino Acids	Sigma C-9386	10 x 100 g.	87.50
	Yeast Extract	Sigma Y-0375	10 x 100 g.	153.50
	Peptone	Sigma P-8388	5 x 500 g.	128.00
	Malt Extract Tripheny Tetrazlium	Sigma M-0383	10 x 100 g.	65.00
	Chloride	Sigma T-8877	10 x 25 g.	421.00
	Polymyxim B-sulfate	Sigma P-1004	5 x 10 units	38.25
	Bacitracin		5 x 5 x 10 units	82.00
	Chloramphenicol	Sigma C-2900	5 x 500 units	150.50
	Cycloheximide	Sigma C-6255	5 x 5 g.	133.00
	Crystal Violet	Sigma C-3886	5 x 100 g.	60.00
	Nile Blue		5 x 5 g.	88.50
Mycology	Borax	Sigma B-9876	2 x 1 kg.	21.20
	Formaldehyde (37%)	Sigma F-1635	20 x 500 ml.	172.00
	Zinc Chloride	Sigma Z-3500	10 x 500 g.	359.00
	Clycerol	Sigma G-9012	10 x 1 L	423.00
	Mercuric Acetate	Sigma M-6279	10 x 500 g.	909.00
	Acetic Acid (Glacial)	Sigma A-6283	15 x 500 ml.	196.50
	Lead Acetate	Sigma L-3396	10 x 500 g.	155.00
	Zinc Sulfate	Sigma Z-0501	10 x 500 g.	188.00
	Potassium Hydroxide	Sigma 405-1	20 x 100 ml.	145.00
	Ammonium Sulfate	Sigma a-5132	5 x 1 kg.	78.00
	Magnesium Sulfate	Sigma M-7506	5 x 1 kg.	216.00
	Valcium Nitrate	Sigma C-1396	10 x 500 g.	59.50
	Potassium Iodide	Sigma P-8256	10 x 500 g.	551.00
	Potassium Phosphate	Sigma P-5379	10 x 500 g.	202.00
	Sodium Hydroxide	Sigma S-5881	10 x 500 g.	150.50
	Copper Sulfate	Aldrich 20,917-1	10 x 500 g.	378.00
	Sulfurous Acid	Aldrich 24,762-6	5 x 500 g.	118.00
	Formvar Chloroform (Deuterated Cmpd)	C8388	100 g.	22.95
	Pyronin B (Biol. Stain)	P6892	5 g.	25.35
	Bromophenol Blue	B8502	100 g.	16.70
	Phosphotungstic Acid (free Acid)	P4006	100 g.	41.00
	Sub-total			7,167.45

Plant Health Services: Requirements for Plant Pathology Laboratory (US$)

Application	Equipment	Catalog	Quantity	Total Cost US$
General	Curved forceps	Aldrich	Z16,869-6 2X	12.40
	Forceps	Aldrich	Z16,877-7 2X	19.60
	Forceps	Aldrich	Z18,878-5 2X	18.40
	Specimen forceps	Aldrich	Z16,872-6 2X	9.60
	Specimen forceps	Aldrich	Z16,873-4 2X	12.00
	Spoon Samplers	Aldrich	Z17,784-9 2X	21.60
	Spoon Samplers	Aldrich	Z17,785-7 2X	22.60
	Spoon Samplers		Z17,786-5 2X	25.00
	Autoclave	Phillip Harris	AAJO41 1X	7,367.50
	Temperature indicating Tape		A85-600 24X	162.36
	Disposal Bags		B10-401 5X	323.25
	Centrifuge		C34-200 1X	2,366.00
	Centrifuge Rotors		C34-215 1X	549.00
	Centrifuge Rotors		C34-218 1X	1,066.00
	Centrifuge Buckets/Carriers		C34-221 1X	560.50
	Centrifuge Buckets/Carriers		C34-224 1X	562.00
	Centrifuge Buckets/Carriers		C34-227 1X	355.50
	Centrifuge Tubes	Sigma	C8046 2X	268.70
	Centrifuge Tubes		C8296 2X	370.50
	Centrifuge Tubes Rack		R8630 5X	47.50
	Micro Tubes		T6524 2X	86.40
	Micro Tubes Rack		R2883 5X	56.50
	Multichannel Pipet		P3299 1X	529.00
	Reagent Reservoir		R9259 2X	102.00
	Pipet Tips		P2299 2X	70.00
	Pipet Tips		P2974 4X	76.00
	Filters		F1512 5X	318.50
	Filters		F1637 5X	393.20
	Corning pH Meter		15W2454 1X	559.00
	Microscope Slides		14W3500 10X	531.00
	Coverslips		14W3211 2 X 10 oz.	179.20
	Freezer/Refrigerator (16 w.ft.)		1	800.00
Virology	Microtitre Plates		M0153 20X	800.00
Bacteriology	Bactispreader	Ward	15W1993 2X	5.90
	Inoculating Needle		14W0956 10X	21.90
	Inoculating Loop		14W0957 10X	18.50
	Sub-total			18,827.31

Books and Periodicals	Catalog	Quantity	Total Cost US$
Virology-Practical Approach Methods for Plant Molecular	Sigma	V1630 1x	38.00
Biology		M2278 1x	49.95
PCR Technology: Principles / Applications		P3551 1x	19.95
Blancard D., Lecoq H., Pitrat M. 1994.			
A colour Atlas of Cucurbit Diseases; Observation,			
Identification and Control. Manson Publishing.			
John Wiley and Sons, 606 Third Avenue,			
New York N.Y. 10158-0012			100.00
Sub-total			206.90
TOTAL			26,200.66

Requirements for the Soils Laboratory
Central Farm

Item	Catalog Number	Quantity	Price per Unit (US$)	Total Cost (US$)
Electronic tp loading balance	263-018	1	3,695.00	4,249.25
Electronic top loading balance	237-958	1	470.00	540.50
Water distillator	250-585	1	1,375.00	1,581.25
Water replacement prefilter	D2729	2	11.00	25.30
Stirrer Commercial Blender	215-673	1	900.00	1,035.00
Flame photometer	345-371	1	4,180.00	4,807.00
Distillation apparatus	170-894	2	1,485.00	3,369.50
Bench top PH meter	238-428	1	1,570.00	1,805.50
Bench top electrode	085-928	2	73.00	167.90
Lab. carts 2-shel model	151-175	4	320.00	1,472.00
Soil grinder	08-415	1	1,480.00	1,702.00
Replacement fine gendryplates 08-425	08-425	2	38.00	87.40
Spectrophotometer model-690	258-680	1	1,950.00	2,242.50
UPS System		1	475.00	546.25
Washing sink (non-metal ceramic)		1	400.00	480.00
Atomic absorption (repairs)			2,000.00	2,000.00
Refrigerator				
Sub total				26,091.35
Chemical and Reagent				
Sulphuric Acid 98%		2 boxes (2.	158.70	365.01
Hidrochloric Acid		2 boxes (2.	132.01	303.62
Ortho-phosphoric Acid 85%		2 (2.5 L)	172.49	396.73
Sodium ACETATE (crystal 99.8%)		4 (5 kg)	118.20	543.72
Sodium Hydroxide 98%		4 (2.5 kg)	92.40	425.04
Ammonium Acetate		4 (2.5 kg)	276.04	1,272.54
PH Buffer 7 & 9		1 (500 ml)	14.80	17.02
PH Buffer 4		1 (500 ml)	14.50	16.68
Whatman filter paper (#1 - 11 dem. Qualitativ		12 (100 pk)	3.75	51.75
Cupric Sulfate		4 (500 g)	57.10	262.66
Selenium Powder		2 (500 g)		
Perchloric Acid (60-72%)		1 box (2.52	453.63	521.67
Lantharum cloride		2 (1 kg)	269.10	618.93
Hydrogen Peroxide (50% and 30%)		1 (500 mls)		
Reference Sal. -500 mls (1-500 mls of each)				
Calcium	SC 191-100 (500 ml)	1	13.80	15.87
Copper	SC 194-500 "	1	39.30	45.20
Co	SC 193-500 "	1	39.30	45.20
Fe	SI 124-500 "	1	36.20	41.63
Na	SS 139-500 "	1	39.30	45.20
Mg	SM 51-500 "	1	39.30	45.20
Mn	SM 81-500 "	1	39.30	45.20
Zn	SZ 13-500 "	1	39.30	45.20
Pb	SL 21-500 "	1	39.30	45.20
Se	SS 464-500 "	1	39.30	45.20
Cd	SC 118-500 "	1	35.10	40.37
Al	SA 442-500 "	1	36.20	41.63
As	SA 449-500 "	1	39.30	45.20
K	SP 351-500 "	1	39.30	45.20
Sub total				5,396.82

Requirements for the Soils Laboratory
Glassware

Item	Catalog	Quantity	US$ Price	Total Cost (US$)
Volumetric flasks				
500 mls vol.	104-356	2 cs	250.16	500.32
100 mls vol.	104-323	2 cs	160.20	320.40
50 mls vol.	104-315	2 cs	150.36	300.72
25 mls vol.	104-307	2 cs	141.00	282.00
250 mls vol.	104-349	2 cs	201.96	403.92
1000 mls vol.	104-364	2 cs	151.80	303.80
(Erlenmeyer) Conical Flasks				
cs 6 500 mls vol.	096-236	2 cs	99.00	198.00
12 250 mls vol.	096-228	2 cs	104.16	208.32
12 125 mls vol.	096-210	2 cs	98.88	197.76
cs1 Burretts - 50 mls	041-236	4 cs	50.74	202.96
Beakers				
100 mls	029-538	2 cs	75.84	151.68
250 mls	029-553	2 cs	71.52	143.04
400 mls	029-561	2 cs	84.96	169.92
50 mls	029-520	2 cs	71.52	143.04
Measuring cylinders				
6 25 mls	074-179	2 cs	267.78	535.56
24 10 mls	074-336	1 cs	186.24	186.24
12 5 mls	371-757	2 cs	95.28	190.56
12 100 mls	074-344	2 cs	159.24	318.48
4 250 mls	074-203	3 cs	178.44	535.32
8 500 mls	074-369	2 cs	194.64	389.28
4 1000 mls	074-377	3 cs	136.40	409.20
Pippets				
12 0.5	265-869	2 cs	42.72	85.44
1.0	265-890	2 cs	42.72	85.44
2.0	265-891	2 cs	42.72	85.44
5.0	265-894	2 cs	45.96	91.92
10.0	265-895	2 cs	51.12	102.24
Micro - Kjeldahl Flasks				
Quant. case/pk. 3 30 mls	10-11B	3 cs	154.80	464.40
2 300 mls	10-11D	4 cs	338.50	1,346.00
Sub total				8,351.20
TOTAL				39,826.37

Supply Requirements for the Quarantine Service. (BZ$)

Item	Quantity	Unit/Price	Total Cost
Education			
-Bristol Board and markers	1	250.00	250.00
-Masking tape, thumb tacks, paint, celotex, brushes			
-T.V. and radio announcements	1	2,000.00	2,000.00
-T.V. and radio programmes	1	2,000.00	2,000.00
Drugs: Diphenodine Paste			
-cases (for year)	5	160.00	800.00
-Diphenodione Suspension	10	300.00	3,000.00
Suplementary Equipment			
-5-man tent	3	700.00	2,100.00
-Sleeping bags	3	250.00	750.00
-Portable stove and tank	1	300.00	300.00
-First aid kits	2	125.00	250.00
-Insect repellant	2	50.00	100.00
Automatic Syringes	4	150.00	600.00
Mist Nets	20	80.00	1,600.00
Foreseps	28	24.15	676.20
Knifes	9	20.00	180.00
Microscope	9	1,840.00	16,560.00
Aluminum Poles	10	120.00	1,200.00
Headlights	2	75.00	150.00
Gloves	2	15.00	30.00
Batteries (6 volts)	6	15.00	90.00
Bulbs (6 volts)	12	3.00	36.00
Rubber Boots	2	45.00	90.00
Raincoats	2	30.00	60.00
Strings	2	10.00	20.00
TOTAL			32,842.20

Animal Health Services: Equipment and Supplies for Veterinary Ambulatory Services (US$)

Item	Quantity	Unit Price	Total Cost
Autoclaves to sterilize equipment	3	4,600.00	13,800.00
Cold sterilizing trays to sterilize equipment in field	4	46.00	184.00
Pandora Veterinary bags to carry supplies in field	9	230.00	2,070.00
Mohr medical cases to carry drugs in field	9	264.50	2,380.50
Tru-cut biopsy needle-diagnostic work	10	23.00	230.00
Instrument cleaning bristle brushes	10	4.60	46.00
D3 Anchor nylon scrub brushes-super brush-for surgery prep.	24	3.45	82.80
Professional halogen penlight-clinical work	18	46.00	828.00
Halogen penlight bulbs-replacement	18	11.50	207.00
Pocket woods light and replacement bulbs-diagnostic	8	69.00	552.00
Replacement bulbs for light	16	10.35	165.60
Welch Allyn indirect viewing lens-clinical	8	63.25	506.00
Optivisors (2 x power) 10" focal-diagnostic	5	34.50	172.50
Optiloupes-diagnostic	5	23.00	115.00
Veterinary electro surgical units-field surgery	2	1,725.00	3,450.00
Disposable pocket cauteries-high temperature: field surgery	12	34.50	414.00
Disposable pocket cauteries-low temperature: field surgery	12	34.50	414.00
Sets stainless steel feeding pans, heavy gauge (3/8 qt, 1 7/8 qt)	4	57.50	230.00
Reimer's stainless steel modified emasculators-surgery	6	276.00	1,656.00
Urinary catheters for stallions-clinical	24	17.25	414.00
Heavy duty dehorners-self-explanotory	8	28.75	230.00
Tube dehorners-for calves and goats	8	11.50	92.00
Universal dental floabs-clinical	6	57.50	345.00
Wolftooth elevator-clinical	6	28.75	172.50
Meier's Equine dental wedge-clinical	8	63.25	506.00
Wolftooth extractor forceps-clinical	4	57.50	230.00
Sutter style O.B. handles-reproductive work	10	17.25	172.50
O.B. wire guides-reproduction	10	11.50	115.00
Obstetrical saw wire-reproducton	24	17.25	414.00
Obstetrical chains, 30" long, stainless steel-reproducton	12	34.50	414.00
Moore's O.B. handle, stainless steel-reproduction	12	13.80	165.60
Hercules fetal extractors-reproduction	4	258.75	1,035.00
Hoof knives right, 3/8" clinical	8	28.75	230.00
Hoof testers, heavy duty-clinical	3	46.00	138.00
Hoof picks-clinical	12	2.30	27.60
Wrecht fetotomes-reproducton	4	230.00	920.00
Calf snares, cable type-reproduction	8	28.75	230.00
Perivaginal sutures tapes and needles-reproduction	12	40.25	483.00
Frick's oral speculum-clinical	6	23.00	138.00
Stomach pumps-clinical	4	115.00	460.00
Sets horse stomach tubes (foal, small, medium, large)-clinical	8	103.50	828.00
Set teat surgical kit tubes + knife + cuvette+ human extractor -surgery	6	120.75	724.50
Sub-Total			35,968.1

Item	Quantity	Unit Price	Total Cost
Equine cassette holder (x-rays - diagnostic	2	115.00	230.00
Equiparax Radiograph Positioner	2	217.35	434.70
Sets quick release nylon dog muzzles-restraint	8	28.75	230.00
Sets quick release cat muzzles -restraint	8	17.25	138.00
Kelch-all poles - 5' - restraint	12	161.00	1,932.00
Pr. buckskin animal handling gloves-restraint	8	46.00	368.00
Role syringes - restraint (rasier)	8	138.00	1,104.00
Instrument Trays 9" x 5" x 2" with Flatcover	3	40.25	120.75
Cordless 2 speed clipper	3	443.90	1,331.70
A5 Clipper Blade:			
15 x #40 Blade	15	24.15	362.25
15 x #15 Blade	15	24.15	362.25
15 x #5 Blade	15	28.75	431.25
Cans Blade wash	8	4.60	27.60
Clipper Sharpening Kits	3	69.00	207.00
Clipper Sharpening Compound	3	8.90	20.70
Hoof rot shears	3	29.90	89.70
Allis Tissue Forceps 6" s/s	8	38.60	220.80
Litman Master Classic Stethoscope	6	92.00	552.00
Stainless steel Hospital Bucket 12" top, 7 7/8" Base, 10" Deep	3	55.20	165.60
s/s Heavy jars with fitted covers 4 7/8" x 6 7/8" high	12	47.15	565.60
Holders for bleeding needles	38	0.35	12.00
Box of 100 Blood Collection Tubes 7 ml. - SERUM	30	17.25	517.50
Box of 100 Blood Collection Tubes 7 ml. - EDTA	30	16.40	552.00
Blood Collecting Needles (box of 100 - 20 6x1 1/2)	30	21.85	655.50
Rectal Thermometers	38	5.75	207.00
Surgical Instrument Kits Miltex German s/steel	3	906.20	2,718.60
Surgical Instrument cleaner 8 oz bottle	6	8.05	48.30
Necropsy Knives 7", wide blade	3	24.15	72.45
Necropsy knives - boning knife curved	3	23.00	69.00
Hack Saws	3	13.80	41.40
Hack Saw Blades	100	0.58	57.50
Medium Sized Axes	3	28.75	86.25
Packs of 100 Sterilene Sample Containers	10	57.50	575.00
Benz-All Germicidal Concentrate 40 ml bot.	20	23.00	460.00
Packs of 100 Poly Sleeve OB	12	19.55	234.60
Funnel Type Gravity Flow 1/v seb.	38	12.65	455.40
Packs assorted sovereign Polypropylene urethral catheters	12	14.95	179.40
Pen Rose Drains			
1/4" x 12" long	38	1.27	40.00
1/2" x 12" long	38	1.27	40.00
Small Stomach Tubes			
3/8" x 3 1/2' (small)	6	9.20	55.20
1/2" x 4 1/2 (large)	6	11.50	69.00
Sureflo teflon 1/2 catheter			
16 Gauze x 2"	30	5.75	172.50
18 G. x 2"	30	2.875	86.25
22 G. x 1 1/4"	30	2.875	86.25
Sub-Total			16,155.20

Item	Quantity	Unit Price	Total Cost
Optivisor #4 Power = 2x Focal = 10"	3	31.05	93.15
Optiloupe for Optivisor Magnifier - a 2.5x power to one eye	3	17.25	51.75
Welch Allyn 3.5 volt Trans illuminator	3	54.05	140.00
Replacement bulbs	9	17.25	155.25
Sterile Biopsy Punches 6mm (box of 50)	3	86.25	258.75
Only J-111JW Dose Syringe 460 ml	3	23.00	69.00
Only J-200 Uterine Prolasse Tray	3	11.50	34.50
Packs Sureflow Pack with 10 tubes for injured teats 1-J-132	12	5.75	69.00
J-35R Hoof trimmer - Horse and Cattle	2	172.50	345.00
J545 Swan Morton Scalpel Blade:			700.00
#15 Small normal 100/pk	2		
#10 Small 100/pk	10		
#12 Curved-abcess 100/pk	2		
J64B 5 litre Collapsable bag.	30	11.50	345.00
J64S Complete Infusion Set for LA	30	5.75	172.50
J64T Administration set	30	5.75	172.50
J65 Sterile Disposable Blood Transfusion Set with filter, drip chamber,	20	11.50	230.00
J27D Double Valved Pump for use with catheters, uterine infusion, etc.	6	23.00	138.00
J902S Stone Knife Sharpener	6	11.50	69.00
J902 ds Medium Sized Diamond sharpener	3	23.00	69.00
J61 LA Technovit Liquid 250 cc	12	34.50	414.00
J61PA Technovit Powder 500g	12	11.50	138.00
J61-t12 Package with 12-14 Treatment Accessories and 12 wooden blo	3	115.00	345.00
J29A Rubberized OB Apron	6	17.25	103.50
J22F Rettinger Farrowing Snare	6	11.50	69.00
J22 Piq Obstetrical Forceps	3	23.00	69.00
Spray Lube for instruments	12	8.05	96.60
Tuff box - for PM instruments	4	57.50	230.00
Braun Surgical Suture 50 m. long			
Casette #3 Chromic	12	108.10	1,297.20
Casette 2-0 Chronic	12	63.25	759.00
Casette Braunamid non-absorbable 50 m long			
Casette #3	12	34.50	414.00
Casette 2-0	6	34.50	207.00
Magnetic Needle Holder	6	6.90	41.40
Dexon Synthetic Absorbable Suture			
Box of 36-27" x 3-0 Dexon Suture with swegged Tapered 1/2 circle ne	3	105.80	317.40
Suture Needles			
3/8 Circle cutting edge Regular eye #10 (packs of 12)	12	9.20	110.40
3/8 Circle Cutting Edge Regular eye #16 (packs of 12)	12	9.20	110.40
3/8 Circle Taper Point Regular Eye #18 (packs of 12)	12	9.20	110.40
Keith Straight Abdominal-Triangular Point 2" long (pack of 12)	12	13.80	165.60
TB Syringe with needle (Box of 100)	10	14.95	149.50
Hypodermic Needles			
Hypodermic needle (box of 100) 18G x 1 1/2"	10	9.20	92.00
Sub-Total			8,351.80

Item	Quantity	Unit Price	Total Cost
Hypodermic needle (box of 100) 206 x 1 1/2"	10	9.20	92.00
Hipodermic needle (box of 100) 206 x 1"	10	9.20	92.00
Hipodermic needle (box of 100) 236 x 1"	3	32.20	96.60
Hipodermic needle (box of 100) 226 x 1"	3	9.20	27.60
Hipodermic needle (box of 100) 166 x 1 1/2"	6	20.70	124.20
Hipodermic Syringes:			
Eccentrue Tip 20cc (box of 20)	100	17.25	1,725.00
Syringe 3cc with 206 x 1" needle (box of 100)	20	20.70	414.00
Syringe 6cc/without needle (box of 50)	20	11.50	230.00
Bandages and Surgical Gauze:			
Vet Wrap 8 rolls of 2" x 5 yard x 24 rolls (box)	10	35.65	356.50
Elastic Adhesive Tape 5 yds.:			
1"	30	13.80	414.00
2"	30	13.80	414.00
Gauze Sponge Pack of 200 3x3	100	6.90	690.00
Cotton Roll (1lb)	50	4.60	230.00
Gloves			
Disposable Latex Gloves (box of 100 7 1/2 - 9)	20	6.90	138.00
Surgeon Latex Gloves Sterile (box of 50 size 8)	5	32.20	161.00
Sub-Total			5,204.90
TOTAL			65,700.00

Central Investigatory Laboratory

Requirements for Hematology Testing (US$)

Item	Number of Tests	Quantity	Unit Price	Total Cost	Cost Per Test
Leukostat stain	1,000	2	63.00	126.00	0.06
Cyanmethhemoglobin standard	6 vial	1	28.00	28.00	4.67
Cyanmethhemoglobin powder	6 vial	2	30.00	60.00	5.00
Vacutainer Multisample needles	1,000	2	150.00	300.00	0.15
Vacutainer Single-sample needl	1,000	2	160.00	320.00	0.16
Blood tubes	1,000	2	255.00	510.00	0.26
Microscope slides	1,440	2	256.00	512.00	0.18
Microhematocrit Centrifuge		4	500.00	2,000.00	
Coulter Counter (JT3)		1	15,000.00	15,000.00	
TOTAL				18,856.00	

Requirements for Histology (US$)

Item	Number of Test	Quantity	Unit Price	Total Cost	Cost Per Test
Microtome blades	500 cs	1	520.00	520.00	0.10
Buffered 10% Formalin	20 L	2	56.00	112.00	0.06
Ethanol	4 gal	2	183.00	366.00	0.92
Paraplast	8 kg	2	50.00	100.00	0.13
Hemo-de	4 gal	1	106.00	106.00	0.54
Miscellaneous				1,500.00	
Equipment					
Microtone		1	8,950.00	8,950.00	
Microtone Blade holder		1	698.00	698.00	
Paraffin Imbedding Machine		1	6,000.00	6,000.00	
TOTAL				18,354.00	

Requirements for Urinalysis Testing. (US$)

Item	Number of Test	Quantity	Unit Price	Total Cost	Cost Per Test
Multistix 10SG	100	2	56.00	112.00	0.56
Microscope slides	1440	1	256.00	256.00	0.18
TOTAL				368.00	

Central Investigatory Laboratory

Requirements for Parasitology Testing. (US$)

Item	Number of Test	Quantity	Unit Price	Total Cost	Cost Per Test
Zinc Sulphate	500 g	2	20.00	40.00	0.04
Ether	500 mls	2	20.80	41.60	0.04
Sodium Chloride	2.5 kg	2	14.00	28.00	5.60
Microscope slides	1,440	1	256.00	256.00	0.16
TOTAL				365.60	

Requirements for Serology Testing. (US$)

Item	Number of Test	Quantity	Unit Price	Total Cost
New Castle Disease antibody test	480	2	395.00	790.00
Avian influenza type A	50	2	45.00	90.00
Infectious bursal disease (ELISA)	480	2	495.00	990.00
Infectious bursal disease (AGID)	33	3	8.00	24.00
Fowl Cholerae (Pasteurella)	480	2	825.00	1,650.00
Marek's Disease	50	2	120.00	240.00
Psittacosis		2	11.50	23.00
Equine Infectious Anaemia				
Bovine Leucosis				
M. Gallisepticum Elisa	480	2	395.00	790.00
PA	200	2	120.00	240.00
M. Synoviae Elisa	480	2	395.00	790.00
PA	200	2	120.00	240.00
Brucella abortus antigen (for SAT)	825	1	15.00	15.00
Brucella abortus antigen (for RBT)	1,660 ml	1	27.00	27.00
Brucella ovis antigen for plate test	5ml	5	12.00	60.00
Brucella suis antigen for plate test				
Brucella melitensis antigen for pla	5 ml	5	31.50	157.50
Brucella abortus positive antisera	1 ml	2	88.00	176.00
Brucella ovis positive anticera	5 ml	2	58.00	112.00
Brucella melitensis positive antise	5 ml	2		
Negative bovine serum				
Blood tubes	1,000	2	225.00	450.00
SST tubes	1,000	1	405.00	405.00
Pipette tips	1,000	2	40.00	80.00
Glass tubes	1,000	1	50.00	50.00
Equipment				
Microplate reader		1	6,500.00	6,500.00
Repeating Dispenser (1 ml)		2	155.00	310.00
Diluter (with accessories)		1	2,935.00	2,935.00
TOTAL				17,144.60

Central Investigatory Laboratory: Requirements for Biochemistry Testin (US$)

Item	Number of Test	Quantity	Unit Price	Total Cost	Cost Per Test
Albumin (BCG)	80	2	17.50	35.00	0.22
Alkaline Phosphatase	100	2	30.00	60.00	0.30
ALT (SGPT)	150	2	32.50	65.00	0.22
Amylase	100	2	32.00	64.00	0.32
AST (SGOT)	150	2	32.50	65.00	0.22
Bilirubin combo	160	2	35.00	70.00	0.22
Calcium	125	2	27.50	55.00	0.22
Cholesterol	125	2	50.00	100.00	0.40
Creatinine	165	2	229.00	458.00	1.39
Creatinine Kinase	125	2	20.00	40.00	0.16
Glucose	160	2	27.50	55.00	0.17
Total Protein	80	2	16.50	33.00	0.21
Urea Nitrogen	100	2	29.00	58.00	0.29
Uric Acid	50	2	25.00	50.00	0.50
Pipette tips	1000	3	40.00	120.00	0.04
Glass tubes	1500	1	60.00	60.00	0.04
Miscellaneous				1,500.00	
Spectrophotometer, Genesys 5		1	5,485.00	5,485.00	
TOTAL				8,373.00	

Central Investigatory Laboratory: Requirements for Equipment & Regents for Food Microbiology Laboratory (US$)

Item	Catalog Number	Quantity	Unit Price	Total Cost
Revco ultra-low freezer	291-778	1	4,300.00	4,300.00
FY balance (2100 g)	287-754	1	1,000.00	1,000.00
IEC centrifuge	048-603	1	825.00	825.00
Nalgene centrifuge tubes	053-306	3	28.00	84.00
Imperial incubator	251-383	2	1,620.00	3,240.00
Gas Pak 150 system	L4360628	2	540.00	1,080.00
Gas Pak Plus	L4371040	10	25.00	250.00
Campy Pak Plus	L431045	10	35.00	350.00
Labcraft knife set	234-625	3 pk	42.00	126.00
Specimen forceps	124-784	10	11.00	110.00
Coverglass forceps	107-144	10	8.00	80.00
Labcraft spatula	254-318	24	5.00	120.00
Nalgene jars (500)	044-255	2 pk	28.00	56.00
Nalgene jars (1000)	044-537	2 pk	34.00	68.00
Volumetric pipet	312-554	2 case	98.00	196.00
Volumetric pipet	312-556	2 case	145.00	290.00
Pipet pumps	265-807	5	13.00	65.00
Pipet pumps	265-808	5	15.00	75.00
NIST thermometer	248-419	2	500.00	1,000.00
Lab bottles	263-016	1	150.00	150.00
Petri dishes	079-582	4	85.00	340.00
Campylobacter test kit	L40850	4	115.00	460.00
E.Coli 0157:H7 test kit	286-139	4	80.00	240.00
Gram stain set	D3328-321	5	30.00	150.00
Catalase test reagent	D3564-262	4	53.00	212.00
Kovacs reagent	D3551-267	4	50.00	200.00
Oxidase reagent	D3550-268	4	50.00	200.00
Sodium desoxycholate	D3572-262	4	50.00	200.00
Voges-Proskauer A	D3558-260	4	50.00	200.00
Voges-Proskauer B	D3559-269	4	50.00	200.00
KOH solution (40%)	12262	2	18.00	36.00
KOH solution (10%)	D3565-261	2	50.00	100.00
Nitrate A	D3554-264	4	48.00	192.00
Nitrate B	D3555-263	4	48.00	192.00
Pyrex flasks	97-212	2 pk	28.00	56.00
Pyrex flasks	97-253	2 case	98.00	196.00
Kimax flasks	97-576	4	48.00	192.00
Bismuth sulphite agar	11031	2	85.00	170.00
TCBS agar	11686	4	75.00	300.00
Tryticase soy agar	11043	4	40.00	160.00
TSI agar	11749	4	45.00	180.00
Brilliant green bile broth (2%)	11080	3	80.00	160.00
Brain heart infusión agar	12425	4	28.00	112.00
Brilliant green agar	11073	3	63.00	189.00
Levin eosin methilene blue agar	12439	3	25.00	75.00
EC broth	12432	3	20.00	60.00
M-Endo broth	11120	2	62.00	124.00
Kliger iron agar	11317	4	69.00	276.00
MacConkey agar	11387	4	50.00	200.00
MacConkey sorbital agar	0079-17-7	2	63.00	126.00
Sub total				14,683.00

Central Investigatory Laboratory: Requirements for Equipment & Regents for Food Microbiology Laboratory

Item	Catalog Number	Quantity	Unit Price	Total Cost
Selenite cystine broth	11606	3	55.25	165.75
KLD agar	11638	3	82.00	246.00
Lauryl sulphate broth	11336	3	45.00	135.00
Listeria enrichment broth	12333	4	40.00	160.00
Motility test medium	12444	4	35.00	140.00
Tetrathionate broth base	11706	3	36.00	108.00
Hektoen enteric agar	12210	2	48.00	96.00
Lysine iron agar	11362	3	47.00	141.00
Urea agar base	0283-01-7	3	45.00	135.00
Baird-Parker agar	11023	2	180.00	360.00
Mannitol salt agar	11407	2	34.00	68.00
Blood agar base	12423	3	20.00	60.00
Oxford medium	0225-17-0	2	88.00	176.00
SIM medium	11578	3	58.00	188.00
LPM agar	12336	2	107.00	214.00
Methylene blue	12043	2	66.00	132.00
Grade A agar	99394	3	49.00	147.00
Yeast extract	11926	2	29.00	58.00
Plate count agar	0479-17-3	2	55.00	110.00
Oxford antimicriobic supplement	0214-60-9	2	88.00	138.00
EY Tellurite	0779-73-1	3	103.00	309.00
Egg Yolk Enrichment	3347-61-2	4	81.00	244.00
Yersinia selective agar	1817-17-2	2	75.00	150.00
MR-VP medium	0016-01-1	4	43.00	172.00
EMB agar	0076-01-6	2	48.00	96.00
Simmons citrate agar	0091-01-9	3	57.00	171.00
Esculin	0158-12-6	2	102.00	204.00
Rhamnose	0175-13-4	4	68.00	272.00
Mannitol	0170-17-5	4	32.00	128.00
Xylose	0181-13-6	4	30.00	120.00
Bacto-peptone	0118-01-6	4	44.00	176.00
Urea broth	0272-01-0	3	32.00	96.00
E.Coli H antiserum	2159-47-0	3 bottles	52.00	156.00
Kimax test-tubes (13 x 100)	225-769	2 case	230.00	460.00
Kimax test-tube (16 x 100)	225-805	2 pk	110.00	220.00
Kimax test-tube (16 x 125)	225-813	2 pk	110.00	220.00
Kimax test-tube (16 x 150)	225-821	2 pk	110.00	220.00
Kimax test-tube (20 x 150)	225-847	2 pk	96.00	192.00
Kimax test-tube (10 x 75)	224-253	3 pk	26.00	78.00
Micropipette	228-028	2 pk	75.00	150.00
Micropipette	228-034	2 pk	75.00	150.00
Micropipette tips	228-074	2 pk	140.00	280.00
Micropipette tips	228-080	2 pk	140.00	280.00
E. Coli 0157 antiserum	2970-47-7	3 bottles	52.00	156.00
Buffered peptone water	1810-17-9	2 bottles	50.00	100.00
Vibrio cholerae antisera (poly)	2432-47-9	4 bottles	78.00	312.00
Vibrio cholerae antisera (inaba)	2430-47-1	3 bottles	65.00	195.00
Vibrio cholerae antisera (ogawa)	2431-47-0	3 bottles	65.00	195.00
UVM Enrichment broth	12348	2 bottles	62.00	124.00
Sub total				8,581.75
TOTAL				23,264.75

Central Investigatory Laboratory: Equipment and Supplies for Residue Testing

Item	Qty.	Description	Unit Price US$	Total Cost US$
7600SYS	1	Charm II 7600 System	21,275.00	21,275.00
		Components:		
EQ-A12-PA	1	6600 Analyzer		
EQ-E36-SEL	1	Power Regulator - 110 Volt		
PRN-SER-32	1	Printer, SER/32 Column		
EQ-P15-CS	1	Inctronic Dbl Heat Block 110V		
EQ-E26-LA	1	Dispenser, 3 ml for Optifluor		
EQ-P07-SP	1	Centrifuge, Clinical 428, 110V		
EQ-P13-RM	1	Heating Block, Large Well, 110V		
EQ-A23-TH	1	Meat Grinder/Extractor, 110V		
EQ-P09	1	Prep Module #6600, Includes:		
EQ-P13-TH	1	Maxi Mix II - 120 Volt		
PEQ-006-WB	1	Timer Digital - West Bend		
EQ-A02	1	Kit Accessory for 7600, Includes:		
EQ-A11-VW	1	Graduated Cylinder 100 ml		
EQ-A02-VW	1	Pipet 10ml (pkg/25)		
THERM.5	1	Thermometer, 12", 0.5 Increment		
EQ-A07-SS	1	Pens, Marking		
EQ-A09-VW	1	Test Tube Rack		
EQ-A20-VW	1	Centrifuge Tube Rack		
EQ-A05-VW	1	Pipet 0.3 ml		
EQA01-VW	1	Pi-Pump Green Plastic		
EQ-A21-TH	1	Scissors 5 1/2"		
EQ-A29-EL	1	Pipet, Finn Digital to 5 ml		
T-CATM-100	2	Aflatoxin Test Kit (100 tests)	454.25	908.50
PST-OC-120-M	2	Pesticide for milk (120 tests)	1,207.50	2,415.00
TBL8-100	2	Beta Lactam Test Kit (100 tests)	304.75	609.50
SULFA-100	2	Sulfa Test Kit (100 tests)	316.25	632.50
TET2-100	2	Tetracycline Test Kit (100 tests)	316.25	632.50
GTBL-100	2	Aminoglycoside Test Kit (100 tests)	316.25	632.50
GABM-T-100	2	Gentamycin Antibody Test Kit (100 tests)	373.75	747.50
CAP-100	2	Chloramphenicol Antibody Test Kit (100 tests)	632.50	1,265.00
ETBL-100	2	Macrolide Test Kit (100 tests)	316.25	632.50
CLTBL-40	2	Cloxacillin Antibody Test Kit (40 tests)	166.75	333.50
ALK-100	2	Alkaline Phosphatase Test Kit (100 tests)	166.75	333.50
TOTAL				30,417.50

Central Investigatory Laboratory: Reagents and Supplies Requirements.
General Consumables. (US$)

Item	Number of Test	Quantity	Unit Price	Total Cost
Biohazard Bags 19 x 23	200	2	100.00	200.00
Biohazard Bags 37 x 48	100	2	145.00	290.00
pH buffer ph 10	500 ml/X6	1	44.00	44.00
pH buffer pH 4	500 ml/X6	1	44.60	44.60
pH buffer pH 7	500 ml/X6	1	40.00	40.00
Phosphate buffered saline	100	2	20.25	40.50
Ringers Solution	100	2	13.90	27.60
Saline Tablets	100	2	13.25	26.50
Antibacterial Soap	1 gal	1	37.00	37.00
Isopropyl Alcohol	16 L	2	110.00	220.00
Pipets 1 ml	1000	1	136.00	136.00
Pipets 2 ml	500	1	87.00	87.00
Pipets 5 ml	200	1	49.00	49.00
Pipets 10 ml	200	1	50.00	50.00
Pipets 25 ml	200	1	114.00	114.00
Dacron Swabs	1000	1	60.00	60.00
Microscope		2	1,089.00	2,178.00
Microhematocrit Centrifuge		1	500.00	500.00
Sub Total				4,144.40

Central Investigatory Laboratory: Reagents and Supplies Requirements.
General Consumables. (US$)

Item	Catalog Number	Quantity	Unit Price	Total Cost
Polyethylene sample bags	01-816A2"	500	0.31	156.00
Polyethylene sterile bags	01-815-23"	2500	0.12	293.00
500 ml labeled washing bottles	01-409-23A"	72	3.08	222.00
Centrifuge IEC clinical model	05-101-5"	2	781.00	1,562.00
Microhaematocrit rotor	05-110-15"	2	305.00	610.00
Microhaematocrit reader	05-040-25"	2	209.00	418.00
Centrifuge tubes 15 ml	05-538-32B"	24	11.21	269.00
Cell counter manual	02-670-14	3	379.00	1,137.00
Haemacytometer set	02-671-5	4	118.00	472.00
Platelet/leucocyte count	13-680-1	4	252.25	1,009.00
Leucocyte count	13-680-20	4	222.75	691.00
Reticulocyte stain set	13-680-16	1	83.45	83.45
Microscope slides	12-544-14	4	256.00	1,024.00
Gram stain set	SG-100-G	12	25.00	300.00
Capillary tube sealant	02-678	1	174.00	174.00
Haematocrit tubes	21-176-6	10	9.00	90.00
Culture swab transport system	DF9340-26-0	500	0.41	205.00
Anaerobic culturette system	14-910-3	3	101.28	303.85
Refractometer	13-962	3	402.67	1,208.00
Multistix 10 SG	AM-2310A	3	36.25	108.75
Polytoam mailers	03-528-10	5	46.00	230.00
Azostix	AM2850	3	22.50	67.50
Glucofilm	AM2585	3	19.15	57.45
Microscope	12-578-2S	3	1,395.00	4,185.00
Objective lens 40x	12-572-40A	3	93.69	281.07
Objective lens 10x	12-572-100A	3	178.80	536.40
Immersion oil	12-367	12	8.70	104.40
Cover glass	12-544-10	10	25.90	259.00
Test tube rack	14-802-8	12	23.50	282.00
Biomedical waste container	286-196	90	2.00	180.00
Staining jar set		3	50.00	150.00
Sub Total				16,868.87
TOTAL				21,013.27

Central Investigatory Laboratory: Equipment and Supplies for Clinical Chemistry

Catalog Number	Description	US$ Price
1077841	Ektachem DT60 analyzer	5,980.00
1224120	Ektachem DTE module	3,536.25
1336114	DTSC Module - V 9.0 Update	4,594.25
Sub-Total		14,110.50
	Supplies	
8475550	Kodak Ektachem DT Pipette	224.25
1235357	Kodak Ektachem DTE Pipette	212.75
8004772	Charger Assembly	23.00
1266600	Pipette Holder	6.90
1849342	Accessory Kit	207.00
1213115	Kodak Ektachem micro sam. Cups	92.00
1474030	Kodak Ektachem DT sample tips	11.50
1235456	Kodak Ektachem DTE dual sample cups	11.50
8187155	Kodak Ektachen D60 thermal printer paper, 3 rolls/Pkg.	9.20
Sub-Total		796.10
	Kodak Ektachem DT slides (25 slides/Pkg)	
1251453	Hemoglobin	38.81
1532316	Glucose	40.25
1532332	Urea Nitrogen (BUN)	40.25
1425800	Total Protein	41.69
1532175	Cholesterol	46.58
1559632	Total Bilirubin	46.87
1532134	Uric Acid	53.19
1532589	Ammonia	53.19
1560945	Amylase	61.61
8001331	Phosphorus	84.69
8035305	Magensium	66.13
1480664	HDL Cholesterol	69.00
1335504	Micro HDL Cholesterol	69.00
1532290	Sodium	46.00
1532258	Potassium	46.00
1269208	Kodak Ektachem electrolyte reference fluid	16.10
8327462	Creatinine (single slide)	53.19
1825579	AST (SGOT)	60.37
1859685	ALT (SGPT)	60.37
1888395	LDH	60.37
1979426	Alkaline Phosphatase	60.37
1710540	Calcium	84.69
1975560	CK/CPK	67.56
Sub-Total		1,228.49
	Controls and Calibrators	
1957927	Kodak Ektachem calibrator and diluent set (for all chems except Hb and CKMB), 3 sets/Pkg.	69.70
8042889	Kodatrol control 1 (for all chems except Hb, CKMB, 12 sets/Pkg.	49.45
8341018	Kodatrol control 2 (for all chems except Hb and CKMB), 12 Sets/Pkg.	49.45
8433062	Kodak Ektachem Hb calibrator, 1 Set/Pkg.	10.35
6269896	Kodak Ektachem Hb control, 6 Btls/Pkg.	35.85
Sub-Total		234.60
TOTAL		16,371.69

Central Investigatory Laboratory: Equipment for HACCP Analysis

Catalog Number	Description	US$ Price
	Equipment	
BP-LUM-K	Luminator System Keypad Model-Includes: battery & universal charger	4,019.25
	Luminator Options	
PRN-LUM	32 column serial printer with AC adapter	373.75
B-PACK	Battery pack, 10AA quick charge Ni - Cad batteries	51.75
EQ-P18-CS	Inctronic I electronic incubator	546.25
	Pipetter & Dispenser Options for use With Luminator 6600 Analyzers	
AK-4000	Alkaline Phosphatase Test Accessory Kit - Includes: 100 ul Pipetter, 1 ml Dispenser and ALK. Phos. Module	225.40
PAS-4000	ABC Shelf Life Test Accessory Kit - Includes: 1 ml Dispenser, 300 ul Dispenser (2), 300 ul Pipetter and Shelf Life Module	343.85
FIL-4000	ABC Water Quality Accesory Kit - Includes: 300 ul Dispenser, 1.0 ml Dispenser, 300 ul Pipetter and Water Quality Module	281.75
PST-4000	Pesticide Test Accessory Kit - Includes: Includes: 50 ul Pipetter, 100 ul Pipetter, 1 ml Pipetter and Pesticide Module	439.30
SOM-4000	Charm Somatic Cell Test Accessory Kit - Includes: 300 ul Dispenser, 1.0 ml Dispenser (2) 1.0 ml Pipetter and Somatic Cell Module	343.85
	Work Stations	
ABC-6600-WS	Charm 6600 Analyzer Work Station - for use with alkaline phosphatase, shelf life or swab tests. Includes: prep board, timer, test tube rack, tablet holder, pipetter stand, swab bin and module track. Buffer modules are sold separately.	143.75
FIL-SOM-WS	Charm Luminator/6600 Work Station-for use with somatic cell or water quality/clear juices tests. Includes: prep board, timer, test tube/microtube rack, tablet holder, pipetter stand, filter-syringe support stand, waste container & lid and module track. Buffer modules sold separately	172.50
PST-6600-WS	Charm 6600 Workstation for use with the pesticide test. Includes: 15 ml conical tube storage, pipetter, stand, test tube/microtube rack and prep board	143.75
	Charm PocketSwab Test (Monitoring Hygienic Surfaces)	
POCKSWB-100	Single Service ATP Hygiene Monitoring Test	276.00
	Charm ABC Shelf Life Prediction (Keeping Quality of Pasteurized Milk)	
SHELF-500	Includes reagents & buffers	1,144.25
	Charm II Somatic Cell Quality	
SOMMILK-100	Somatic cell measurements in raw milk- Includes reagents, buffers, filters, syringes & bivalves	316.25
FIL-100	Microbial quality of water - Includes reagents, buffers, filters, syringes & bivalves	287.50
	Charm Alkaline Phosphatase Test	
DIL-AP-10	Diluent AP	51.75
	Charm Acid Phosphatase Test	
CHEF-100	Single Service Heat Efficiency Test for Tissue	287.50
	Charm Water Quality-ColiGel and E*Colite	
CGEL-100	Coliforms/E.coli water quality - enumeration	454.25
	Disposable Supplies for the Luminator /6600 Systems	
100-ULT-BG	Pipet tips, 100 microliter - 1000/bag (1 bag)	18.04
1-MLT-X4	Pipet Tips, 200-1000 ul-250/box (4 boxes)	31.05
2-MTC-X1*	Microtubes with caps - 500/bag (1 bag)	63.25
TST**	Test Tubes, 13x100 mm - 250/box (4 boxes)	43.70
	Optional Equipment for the 6600 System	
VHLDR	Vial holder for 6600 analyzer (holds microtube vials)	172.50
TOTAL		10,229.19

* Microtubes can

** For use with th

NOTE: All kits include positive control tablets.

Central Investigatory Laboratory: Repair and Maintenance. (US$)

Item	Quantity	Unit Price US$	Total Cost
Building Equipment			
Air Condition Units	26	650.00	16,900.00
Pest Removal	1	400.00	400.00
Office equipment (including Lab. Cha	1	5,000.00	5,000.00
Painting Outside	1	4,000.00	4,000.00
Laboratory Rooms	1	11,000.00	11,000.00
Laboratory vehicle	1	20,000.00	20,000.00
Door Locks	25	15.00	375.00
Butane Gas	4	50.00	200.00
Sub total			**57,875.00**
Repairs			
Laminar Flow Cabinets	2	1,500.00	3,000.00
Volvo diesel engine	1	15,000.00	15,000.00
Water baths	4	25.00	100.00
Installation of AC units	1	1,900.00	1,900.00
Central Air Conditioning	1	1,750.00	1,750.00
Autoclave	1	1,200.00	1,200.00
Incinerator	1	2,500.00	2,500.00
Single job Door Lock install	25		
Shelf removal to Pm room	10		
Lab room cabinet repairs	2	62.50	125.00
Sub total			**25,575.00**
TOTAL			**83,450.00**

Central Investigatory Laboratory: Requirements for Fish Testing (US$)

Equipment	Catalog #	Unit Price	Quantity	Total Cost
Kimax Brand Heavy Duty Beakers	02-55-20C	48.15	1 pk	48.15
Kimax Brand Heavy Duty Beakers	02-55-20E	91.55	1 pk	91.55
Wide Mouthed Ultra-Clean Bottles	03-321-3E	147.00	2 cases	294.00
Nalgene Unitary LDPE Drop-dispensing Bottles	03-409-13A	138.40	1 case	138.40
Nalgene Polyallomer Dispensing Bottles	03-007-1C	29.10	2 pks	58.20
Wheaton Media/Lab Bottles Graduated	06-404D	138.69	1 case	138.69
Nalgene Color Coded LDPE Wash Bottles	03-409-17E	70.20	1 case	70.20
Shurlite Safety Gas Lighter	12-007	3.30	5	16.50
Flints for 12 - 007	12-007-5	2.20	3 pk	8.60
Nalgene Round Carboys Polyethylene w/Spigots	02-963C	129.35	2	258.70
Carl Zeiss Microtome/model HM 325 (Rotary)	12-600-38	8,752.00	1	8,752.00
Reichert-Jung Histoembedder Paraffin Embedding System	12-653-68	5,857.00	1	5,857.00
Sharp High Profile Carbon Steel Blade	12-634-4	79.00	1 pk	79.00
TBS Flotation Bath	15-183-19	995.00	1	995.00
Fisher Tissue Prep Embedding Media	T565	84.40	1 case	84.40
Simport Biopsy Cassettes	15-182-700A	80.00	1 pk	60.00
Color Frost Disposable Microscope Slides	12-550-40	23.10	2 pks	48.20
Staining Dishe for 20 Slides w/Removable Rack	08-802	43.00	3 pks	129.00
Dish and Cover	08-812-1A	75.79	7 pks	530.53
Fisher Gram Stain Kit	SG100D	25.00	4 pks	100.00
Bouffant Cap	17-969-30	28.00	3 pks	84.00
Fisherbrand Wast Hamper	14-827-40	126.50	2	253.00
Fisherbrand Waste Bag	14-827-43A	53.50	2 case	107.00
Fisherbrand Latex Lab Gloves	11-394-101D	124.00	2 case	246.00
Fisherbrand Latex Lab Gloves	11-394-101D	124.00	2 case	246.00
Sciencle Wara Autoclave Glove	11-394-299	15.75	3 pks	47.25
Hycheck Contact Slides for Disinfection Control	DF9039-36-4	45.10	10 pks	451.00
Hycheck Contact Slides for Enterobacteriacease	DF9039-36-4	45.10	10 pks	451.00
Hycheck Contact Slides for Pseudomonas	DF9040-36-1	45.10	10 pks	451.00
Hycheck Contact Slides for Total Plate Count	DF9053-36-5	45.10	10 pks	451.00
Hycheck Contact Slides for Yeast & Moulds	DF9038-36-5	45.10	10 pks	451.00
Fisher finest Premium Slides - Superfrost Slaide	14-905-30	28.30	2 pk	56.60
Securline Marker II	14-905-30	23.00	1 pk	23.00
	14-905-35	23.00	1 pk	23.00
Fisherbrand Unbreakable Cover Slips	12-547	43.75	1 pk	43.75
Fisher brand Microslide Containers	03-447	15.00	3	45.00
Fisherbrand Nonpyrogenic Disposable pippetts	13-675-3A	213.00	1 case	213.00
	13-676-10H	60.00	5 case	300.00
	13-676-10J	83.00	5 case	315.00
Brickman Pipet Helper Filler/Dispenser	21-381-237	42.00	5	210.00
Precision Dynamics Culture (CATS)	14-905-10	100.50	2 pks	201.00
Kimble Cylinders - Kimax Brand Serialized Class A	08-548B	283.35	1 case	283.35
	08-548D	306.55	1 case	306.55
	08-548E	231.00	1 case	231.00
Kimax Brand w/Reinforced Beaded Top Erlenmyer Flask	10-039C	41.65	2 pks	83.30
	10-039D	39.85	2 pks	79.70
	10-039F	41.35	2 pks	82.70
	10-039H	26.00	4 pks	104.00
	10-039K	42.95	4 pks	171.60
Sub Total				**23,000.12**

Central Investigatory Laboratory: Requirements for Fish Testing (US$)

Equipment	Catalog #	Unit Price	Quantity	Total Cost
Fisher Brand Dissecting Forceps	08-890	65.00	1 case	65.00
Fisher Brand Dissecting Forceps	08-887	69.00	1 case	69.00
Fisher Infrared stirring Hot Plate	11-493-615	875.00	2	1,750.00
Labline Imperial III Standard Incubator	11-702-16	3,050.00	2	6,100.00
Micromaster Phase Contrast Microscope	12-572-2FAZ	2,450.00	2	4,900.00
Fisher Steromaster II Series Microscope	12-591-2	695.00	2	1,390.00
Mens Cover up Barrier	17-987-190C	40.00	2	80.00
Fisher Brand Hexagonal Polystyrene Weighing Dishes	02-202C	335.00	1 pk	335.00
Difco Disposable Loops	DF 1906-95-9	71.30	2 pks	142.60
Difco Disposable Needles	DF 1907-95-8	71.30	2 pks	142.60
Surgins Face Mask	17-989-39	100.00	2 case	200.00
Bactigen Salmonella, Shigella Slide Test	WA-14E1	337.15	2 pks	674.30
Streptococcal Disease Test	WA-135007	66.25	10 pks	680.25
Enterotube II	RD-43128	138.45	8 pks	1,107.60
Bactrol Disca Set A	DF 1628-32-2	213.75	6 pks	1,710.00
Falcon Integrid Phage Typing Grid Dishes	08-757-145	108.50	20 cases	2,170.00
Baten Model 900A Automatic Colony Counter	07-911-7	995.00	1	995.00
	13-300-86	79.00	3	237.00
Mens Cover-up Barrier Jacket	17987-190D	40.00	2	60.00
Scienceware Ode - Clave Deodorant Pads	14-488-31	78.50	2 pk	157.00
Analytical Balance	01-913-44	1,695.00	2	3,790.00
Electronic Top Loading Balance	01-913-427	1,025.00	2	2,050.00
Budget-Saving Toploaders	01-913-255	845.00	3	2,535.00
Precision Analytical & Reference Weights	02-225-15A	690.00	1	690.00
Hexagonal Polystyrene Weighung Dishes	02-202D	406.00	1 cases	406.00
Body Cushion Vibration Damping & Insulation Pads	01-917-1	84.00	1 pk	84.00
Precision Digital Circulating Water Bath	15-474-101	1,695.00	2	3,390.00
Bath Clear Algecide	13-641-336	335.00	1 case	335.00
Kimax Brand Heavy Duty Beakers	02-55-20A	62.55	1 pk	62.55
Replacement Filters	21-381-237	47.25	2	94.50
Brichman Dispensette II Bottle Top Dispensors	13-688-84	385.00	2	770.00
Fisher Isotemp General Purpose Lab. Refridgerators	13-988-376G	5,695.00	2	11,390.00
Fisherbrand Dissecting Scissors	08-951-20	20.35	6	122.10
	08-951-25	27.50	6	165.00
Fisher Brand Non mercury Thermometer	15-041-5C	15.75	10	157.50
Max/Min. Thermometer	15-091	44.00	3	132.00
Sub Total				**49,159.00**
TOTAL				**72,928.00**

Central Investigatory Laboratory: Requirements for Equipment and Reagents for Wastewater Monitoring (US$)

Item	Catalog Number	Quantity	Unit Price	Total Cost
B.O.D. Trak apparatus	26197-00	1	1,500.00	1,500.00
B.O.D. Incubator model #205	26162-00	1	1,790.00	1,790.00
B.O.D. nutrient pillows	14160-66	5	7.00	35.00
B.O.D. nutrient pillows	14861-98	5	10.00	50.00
B.O.D. standard solution	14866-10	4	21.00	84.00
C.O.D. reagent vials	21259-15	3	170.00	510.00
C.O.D. standard solution	12186-49	3	23.00	69.00
D.O. 175 Dissolved Oxigen meter	50175-00	1	800.00	800.00
Dissolved Oxygen probe kit	50161-00	2	45.00	90.00
EC 20 Portable pH/ISE meter	50075-00	1	800.00	800.00
pH electrode solution	50301-49	3	20.00	60.00
Refractometer, for salinity	25982-00	1	360.00	360.00
Portable turbidimeter, model 2100 P.	46500-00	1	900.00	900.00
Polyseed inoculum	24712-00	3	98.00	294.00
Nitrification inhibitor	2533-34	3	84.00	252.00
Lithium hidroxide pillows	14163-69	4	17.00	66.00
Glass fiber filter paper	25461-00	3	92.00	276.00
Drierite indicating dessicant	20887-01	4	9.00	36.00
Stopcock grease	562-75	3	22.00	66.00
Sulphuric acid, 1N	1270-53	2	7.00	14.00
Sulphuric acid, 0.02N	203-53	3	9.00	27.00
Sodium thiosulphate standard solution	352-53	3	12.00	36.00
Sodium hidroxide standard solution	1045-53	2	12.00	24.00
Starch indicator solution	349-53	4	6.00	24.00
Potassium iodide	12289-49	2	14.00	28.00
Pour thru cell	45215-00	2	240.00	480.00
Lead trak kit	41100-48	1	400.00	400.00
Nitrate analyzis package	23488-00	1	350.00	350.00
Nitrate electrode membrane module	46133-00	3	35.00	105.00
Nitrate standard	307-49	2	11.00	22.00
Nitrate standard	1947-49	2	13.00	26.00
Ammonium sulphate cartridge	25971-02	4	9.00	36.00
PhosVer 3 reagent	2125-99	4	18.00	72.00
Phosphate pretreatment reagent	14501-66	2	18.00	36.00
Phosphate standard solution	171-10	3	22.00	66.00
Alkalinity standard solution	14278-20	3	20.00	60.00
Bromoresol methyl red solution	23292-49	4	12.00	48.00
Chloride analysis package	23484-00	1	370.00	370.00
Chloride standard solution	23708-53	3	16.00	48.00
Chloride standard solution	183-49	3	17.00	51.00
Fluoride analysis package	50269-00	1	340.00	340.00
Fluoride standard solution	294-49	3	10.00	30.00
Fluoride standard solution	359-49	3	14.00	42.00
SulfaVer 4 reagent	12065-99	4	19.00	76.00
Sulphate standard solution	14252-10	3	22.00	66.00
Iron standard solution	14254-10	3	22.00	66.00
RoVer rust remover	300-01	3	7.00	21.00
Hardness standard solution	2187-10	3	22.00	66.00
Sample cell for spectrophotometer	20950-00	5 pairs	60.00	300.00
Mixing cylinder	20886-40	10 cylinder	16.00	160.00
Electromagnetic stirrer	45300-01	2	190.00	380.00
TOTAL				11,730.00

Central Investigatory Laboratory: Cost of Food Testing for Fisheries Sector, (US$ per Test/Year)

1. Aerobic Plate Count		Cost
2 Cooperatives:		
	Northern	480.00
	National	320.00
Sub total		800.00
6 Shrimp Farms:		
	Nova	241.00
	Laguna Madre	160.00
	Cherax	200.00
	Paradise	100.00
	Caribbean	100.00
	Aqua-Mar	125.00
Sub total		926.00
TOTAL		1,726.00

2. Most Probable Number of Fecal Coliforms		Cost
2 Cooperatives:		
	Northern	495.00
	National	330.00
Sub total		825.00
6 Shrimp Farms:		
	Nova	248.00
	Laguna Madre	165.00
	Cherax	200.00
	Paradise	125.00
	Caribbean	125.00
	Aqua-Mar	135.00
Sub total		998.00
TOTAL		1,823.00

3. Yeast & Moulds		Cost
2 Cooperatives:		
	Northern	100.00
	National	100.00
Sub total		200.00
6 Shrimp Farms:		
	Nova	100.00
	Laguna Madre	100.00
	Cherax	100.00
	Paradise	100.00
	Caribbean	100.00
	Aqua-Mar	100.00
Sub total		800.00
TOTAL		800.00

Central Investigatory Laboratory: Cost of Food Testing for Fisheries Sector, (US$ per Test/Year)

4. BIOCHEMICAL DEFRENTIATION		Cost
2 Cooperatives:		
	Northern	300.00
	National	200.00
Sub total		500.00
6 Shrimp Farms:		
	Nova	300.00
	Laguna Madre	200.00
	Cherax	150.00
	Paradise	100.00
	Caribbean	100.00
	Aqua-Mar	150.00
Sub total		1,000.00
TOTAL		1,500.00

4. Biochemical Defrentiation * Escherichia Coli		Cost
2 Cooperatives:		
	Northern	398.00
	National	265.00
Sub total		663.00
6 Shrimp Farms:		
	Nova	200.00
	Laguna Madre	133.00
	Cherax	150.00
	Paradise	100.00
	Caribbean	100.00
	Aqua-Mar	125.00
Sub total		808.00
TOTAL		1,471.00

4. Biochemical Defrentiation * Salmonella		Cost
2 Cooperatives:		
	Northern	1,832.00
	National	1,220.00
Sub total		3,052.00
6 Shrimp Farms:		
	Nova	918.00
	Laguna Madre	615.00
	Cherax	700.00
	Paradise	500.00
	Caribbean	500.00
	Aqua-Mar	550.00
Sub total		3,783.00
TOTAL		6,835.00

Central Investigatory Laboratory: Cost of Food Testing for Fisheries Sector, (US$ per Test/Year)

4. Biochemical Defrentiation * Vibrio Cholerae		Cost
2 Cooperatives:		
	Northern	880.00
	National	590.00
Sub total		1,470.00
6 Shrimp Farms:		
	Nova	420.00
	Laguna Madre	300.00
	Cherax	350.00
	Paradise	275.00
	Caribbean	275.00
	Aqua-Mar	265.00
Sub total		1,905.00
TOTAL		3,375.00

4. Biochemical Defrentiation * Vibrio parahaemolyticus		Cost
2 Cooperatives:		
	Northern	880.00
	National	590.00
Sub total		1,470.00
6 Shrimp Farms:		
	Nova	420.00
	Laguna Madre	300.00
	Cherax	350.00
	Paradise	275.00
	Caribbean	275.00
	Aqua-Mar	265.00
Sub total		1,905.00
TOTAL		3,375.00

4. Biochemical Defrentiation * Aeromonas hydrophila		Cost
2 Cooperatives:		
	Northern	1,100.00
	National	750.00
Sub total		1,850.00
6 Shrimp Farms:		
	Nova	550.00
	Laguna Madre	375.00
	Cherax	400.00
	Paradise	350.00
	Caribbean	350.00
	Aqua-Mar	415.00
Sub total		2,440.00
TOTAL		4,290.00

Central Investigatory Laboratory: Cost of Food Testing for Fisheries Sector, (US$ per Test/Year)

4. Biochemical Defrentiation * Campylobacter		Cost
2 Cooperatives:		
	Northern	1,000.00
	National	700.00
Sub total		1,700.00
6 Shrimp Farms:		
	Nova	500.00
	Laguna Madre	300.00
	Cherax	400.00
	Paradise	350.00
	Caribbean	350.00
	Aqua-Mar	400.00
Sub total		2,300.00
TOTAL		4,000.00

4. Biochemical Defrentiation * Vibrio vulnificus		Cost
2 Cooperatives:		
	Northern	880.00
	National	590.00
Sub total		1,470.00
6 Shrimp Farms:		
	Nova	420.00
	Laguna Madre	300.00
	Cherax	350.00
	Paradise	275.00
	Caribbean	275.00
	Aqua-Mar	265.00
Sub total		1,905.00
TOTAL		3,375.00

4. Biochemical Defrentiation * Shigella		Cost
2 Cooperatives:		
	Northern	1,168.00
	National	800.00
Sub total		1,968.00
6 Shrimp Farms:		
	Nova	600.00
	Laguna Madre	400.00
	Cherax	500.00
	Paradise	350.00
	Caribbean	350.00
	Aqua-Mar	375.00
Sub total		2,575.00
TOTAL		4,543.00

Central investigatory Laboratory: Cost of Food Testing for Fisheries Sector, (US$ per Test/Year)

4. Biochemical Defrentiation * Yersina enterocolitica		Cost
2 Cooperatives:		
	Northern	1,200.00
	National	900.00
Sub total		2,100.00
6 Shrimp Farms:		
	Nova	650.00
	Laguna Madre	425.00
	Cherax	500.00
	Paradise	400.00
	Caribbean	400.00
	Aqua-Mar	415.00
Sub total		2,790.00
TOTAL		4,890.00

4. Biochemical Defrentiation * Listeria monocytogenes		Cost
2 Cooperatives:		
	Northern	1,250.00
	National	925.00
Sub total		2,175.00
6 Shrimp Farms:		
	Nova	700.00
	Laguna Madre	475.00
	Cherax	550.00
	Paradise	450.00
	Caribbean	450.00
	Aqua-Mar	500.00
Sub total		3,125.00
TOTAL		5,300.00

4. Biochemical Defrentiation * Staphylococcus aureus		Cost
2 Cooperatives:		
	Northern	900.00
	National	725.00
Sub total		1,825.00
6 Shrimp Farms:		
	Nova	600.00
	Laguna Madre	425.00
	Cherax	500.00
	Paradise	380.00
	Caribbean	380.00
	Aqua-Mar	400.00
Sub total		2,685.00
TOTAL		4,310.00

Central Investigatory Laboratory: Cost of Food Testing for Fisheries Sector, (US$ per Test/Year)

4. Biochemical Defrentiation * Bacillus cerus	Cost
2 Cooperatives:	
Northern	800.00
National	625.00
Sub total	1,425.00
6 Shrimp Farms:	
Nova	500.00
Laguna Madre	325.00
Cherax	400.00
Paradise	350.00
Caribbean	350.00
Aqua-Mar	400.00
Sub total	2,325.00
TOTAL	3,750.00

Administration and Management - Equipment and Supplies Requirements.

PAHO Equipment & Supplies	Quantity	Supply Sources Local	 Imported	Cost/Unit ($US)	CIF Cost ($US)	Total Cost (US$)
Computer Equipment and Supplies:						
Computer P5-120 Gateway2000	4		X	$ 1,700	$ 1,955	$ 7,820
Laser Jet Printer 5 Si Hewlet Packard	1		X	$ 3,225	$ 3,709	$ 3,709
Network accessories	4		X	$ 164	$ 188	$ 752
NW -Hub 8 ports	5		X	$ 1,000	$ 1,150	$ 2,352
NW -Microsoft Windows NT software	1		x	$ 840	$ 966	$ 966
NW -Microsoft Windows NT cards	2		x	$ 110	$ 127	$ 253
NW -Server Computer (w/3 modems)	1		X	$ 9,000	$ 10,350	$ 12,075
Scanner HP Scanjet 4C	1		X	$ 935	$ 1,075	$ 1,075
Electrical instalation, materials and polarizatio	1		X	$ 6,000	$ 6,900	$ 6,900
UPS VA	1		x	$ 6,000	$ 6,900	$ 6,900
Sub total						$ 42,802
Office Equipment and Supplies:						
AC Unit	6	X		$ 1,750	$ -	$ 10,500
Bookshelf	6	X		$ 175	$ -	$ 1,050
Bulletin Board	6		X	$ 109	$ 126	$ 656
Computer & printer desk	1	X		$ 250	$ -	$ 250
Computer desk	4	X		$ 250	$ -	$ 1,000
Chair	14	X		$ 70	$ -	$ 980
Desk-top Calculator	2		X	$ 75	$ 86	$ 173
Fan	6		X	$ 90	$ 104	$ 621
Fax machine	1		X	$ 250	$ 288	$ 288
Filing cabinet	9		X	$ 350	$ 403	$ 3,623
Large table with 15 chairs	1	X		$ 1,250	$ -	$ 1,250
Office chair	4	X		$ 70	$ -	$ 280
Office chair (Executive)	1	X		$ 450	$ -	$ 450
Office desk	5	X		$ 250	$ -	$ 1,250
Office desk (Executive)	1	X		$ 450	$ -	$ 450
Photocopy machine Xerox	1		X	$ 7,500	$ 8,625	$ 8,625
Typewriter	1		X	$ 300	$ 345	$ 345
Whiteboard	2		X	$ 200	$ 230	$ 460
Whiteboard (big)	1		X	$ 250	$ 288	$ 288
Sub total Total						$ 32,537
Other Equipment and Supplies:						
Accounting computer program	1	X		$ 500	$ -	$ 500
Refrigerator	1	X		$ 950	$ -	$ 950
Security Iron safe	1		X	$ 350	$ 403	$ 403
Sub total						$ 1,853
Vehicles:						
Toyota FourRunner	1	X		$ 29,000	$ -	$ 29,000
Sub total						$ 29,000
TOTAL						$138,440

Animal Health Services - Equipment and Supplies Requirements.

AHS Equipment & Supplies	Quantity	Supply Sources		Cost/Unit ($US)	CIF Cost ($US)	Total Cost (US$)
		Local	Imported			
Computer Equipment and Supplies						
Computer P5-120 Gateway2000	6		X	$ 1,700	$ 1,955	$ 11,730
Laser Jet Printer 5 Hewlet Packard	1		X	$ 3,225	$ 3,709	$ 3,709
Network accessories	4		X	$ 164	$ 188	$ 752
Personal SurgeArrest Strip 6' 7-Outlets	6		x	$ 19	$ 22	$ 131
Printer Epson Stylus 1000	2		x	$ 475	$ 546	$ 1,093
UPS 350 VA	2		x	$ 150	$ 173	$ 345
Sub total						$ 17,759
Office Equipment and Supplies:						
AC Unit	11	X		$ 1,750	$ -	$ 19,250
Aereal Equipment cabinet	1	X		$ 800	$ -	$ 800
Bookshelf	16	X		$ 175	$ -	$ 2,800
Bulletin board	5		X	$ 90	$ 104	$ 518
Computer desk	4	X		$ 250	$ -	$ 1,000
Counter	1	X		$ 400	$ -	$ 400
Chair	8	X		$ 70	$ -	$ 560
Fan	12		X	$ 90	$ 104	$ 1,242
Fax machine	1		X	$ 250	$ 288	$ 288
Filing cabinet	14		X	$ 350	$ 403	$ 5,635
Lockers	5	X		$ 150	$ -	$ 750
Office chair	3	X		$ 70	$ -	$ 210
Office desk	9	X		$ 250	$ -	$ 2,250
Photocopy machine Xerox 5322	1		X	$ 7,500	$ 8,625	$ 8,625
Sink & counter (complete)	6	X		$ 1,535	$ -	$ 9,212
Switchboard	1	X		$ 1,000	$ -	$ 1,000
Typewriter	1		X	$ 300	$ 345	$ 345
Wallshelf	7	X		$ 150	$ -	$ 1,050
Wash & sink	1	X		$ 60	$ -	$ 60
Wash basin (complete)	2	X		$ 88	$ -	$ 175
Washer	1	X		$ 1,795	$ -	$ 1,795
Whiteboard	2		X	$ 200	$ 230	$ 460
Wood storage cabinet	1	X		$ 800	$ -	$ 800
Wooden Shelf	8	X		$ 55	$ -	$ 440
Work bench	1	X		$ 400	$ -	$ 400
Workbench (6' x 3')	1	X		$ 375	$ -	$ 375
Sub total						$ 60,439

Animal Health Services - Equipment and Supplies Requirements.

AHS Equipment & Supplies	Quantity	Supply Sources		Cost/Unit ($US)	CIF Cost ($US)	Total Cost (US$)
		Local	Imported			
Other Equipment and Supplies:						
Clothing dryer	1	X		$ 1,495	$ -	$ 1,495
Dryer	1	X		$ 1,495	$ -	$ 1,495
Large Incinerator	1	X		$ 7,500	$ -	$ 7,500
Incinerator	1	X		$ 3,000	$ -	$ 3,000
Kennels	3	X		$ 75	$ -	$ 225
Refrigerator	6	X		$ 950	$ -	$ 5,700
Refrigerator (storage)	1	X		$ 1,000	$ -	$ 1,000
Small freezer	1	X		$ 598	$ -	$ 598
Sub total						$ 21,013
Vehicles:						
Toyota FourRunner	1	X		$ 29,000	$ -	$ 29,000
Sub total						$ 29,000
TOTAL						$ 128,211

Plant Health Services - Equipment and Supplies Requirements.

PHS Equipment, Supplies, etc.	Quantity	Supply Sources		Cost/Unit (US$)	CIF Cost ($US)	Total Cost (US$)
		Local	Imported			
Computer Equipment and Supplies:						
Computer P5-120 Gateway2000	6		X	$ 1,700	$ 1,955	$ 11,730
Network accessories	6		X	$ 164	$ 188	$ 1,128
Laser Jet Printer 5 M Hewlet Packard	2		X	$ 1,751	$ 2,014	$ 4,027
Laser Jet Printer 5 Si M+ Hewlet Packard	1		X	$ 3,849	$ 4,426	$ 4,426
Sub total						$ 20,184
Office Equipment and Supplies:						
AC Unit	4	X		$ 1,750	$ -	$ 7,000
Bookshelf	9	X		$ 175	$ -	$ 1,575
Bulletin Board	2		X	$ 90	$ 104	$ 207
Computer desk	3	X		$ 250	$ -	$ 750
conference table & 8 chairs	1	X		$ 700	$ -	$ 700
Fax machine	1		X	$ 250	$ 288	$ 288
Filing cabinet	12		X	$ 350	$ 403	$ 4,830
Office cabinet	2	X		$ 800	$ -	$ 1,600
Office chair	10	X		$ 70	$ -	$ 700
Office desk	5	X		$ 250	$ -	$ 1,250
Photocopy machine Xerox 5322	1		X	$ 7,500	$ 8,625	$ 8,625
Storage cabinet	2	X		$ 800	$ -	$ 1,600
Switchboard	1		X	$ 1,000	$ 1,150	$ 1,150
Typewriter	1		X	$ 300	$ 345	$ 345
Whiteboard	2		X	$ 200	$ 230	$ 460
Sub total						$ 31,080
TOTAL						$ 51,263

Quarantine Services - Equipment and Supplies Requirements.

QS Equipment & Supplies	Quantity	Supply Sources Local	 Imported	Cost/Unit (US$)	CIF Cost ($US)	Total Cost (US$)
Computer Equipment and Supplies:						
Computer P5-120 Gateway2000	4		X	$ 1,700.00	$1,955.00	$ 7,820.00
Personal SurgeArrest Strip 6´ 7-Outlets	4		X	$ 22.50	$ 25.88	$ 103.50
Printer Epson Stylus 1000	4		x	$ 475.00	$ 546.25	$ 2,185.00
UPS 350 VA	4		X	$ 150.00	$ 172.50	$ 690.00
Sub total						$ 10,798.50
Office Equipment and Supplies:						
AC Unit Total	1	X		$ 1,750.00	$ -	$ 1,750.00
Bookshelf Total	2	X		$ 175.00	$ -	$ 350.00
Bulletin board Total	1		X	$ 90.00	$ 103.50	$ 103.50
Computer desk Total	5	X		$ 250.00	$ -	$ 1,250.00
Fax machine Total	4		X	$ 250.00	$ 287.50	$ 1,150.00
Filing Cabinet Total	7		X	$ 350.00	$ 402.50	$ 2,817.50
Office chair Total	13	X		$ 70.00	$ -	$ 910.00
Office desk Total	3	X		$ 250.00	$ -	$ 750.00
Sub total						$ 9,081.00
Other Equipment and Supplies:						
Bathroom & washbasin	9	X		$ 865.00	$ -	$ 7,785.00
Incinerator (to be installed)	9	X		$ 3,000.00	$ -	$ 27,000.00
Refrigerator	9	X		$ 950.00	$ -	$ 8,550.00
Uniform (allowance of $75)	9	X		$ 75.00	$ -	$ 675.00
Working table (special table)	9	X		$ 375.00	$ -	$ 3,375.00
Sub total						$ 47,385.00
Vehicles:						
Hi-Lux Toyota Double Cab	1	X		$21,000.00	$ -	$ 21,000.00
Sub total						$ 21,000.00
Total						**$ 88,264.50**

Central Investigatory Laboratory - Equipment and Supplies Requirements.

CIL Equipment & Supplies	Quantity	Supply Sources Local	 Imported	Cost/Unit ($US)	CIF Cost ($US)	Total Cost (US$)
Computsr Equipment and Supplies:						
Computer P5-120 Gateway2000	6		X	$ 1.700	$ 1.955	$ 11.730
Laser Jet Printer 5 M Hewlet Packard	1		X	$ 1.751	$ 2.014	$ 2.014
Network accessories	6		X	$ 164	$ 188	$ 1.128
NW -Hub 8 ports	2		X	$ 409	$ 470	$ 941
NW -Microsoft Windows NT software	1		x	$ 840	$ 966	$ 966
NW -Microsoft Windows NT cards	2		x	$ 110	$ 127	$ 253
NW -Server Computer (w/2 modems)	1		X	$ 10.000	$11.500	$ 11.500
Personal SurgeArrest Strip 6´ 7-Outlets	6		x	$ 19	$ 22	$ 131
Scanner HP Scanjet 4C	1		X	$ 935	$ 1.075	$ 1.075
Electrical instalation, materials and polarization	1		X	$ 2.000	$ 2.300	$ 2.300
UPS VA	1		x	$ 3.000	$ 3.450	$ 3.450
Sub total						$ 35.488
Office Equipment and Supplies:						
AC Unit	13	X		$ 1.750	$ -	$ 22.750
Bookshelf	10	X		$ 175	$ -	$ 1.750
Bulletin board	4		X	$ 90	$ 104	$ 414
Computer desk	3	X		$ 250	$ -	$ 750
Chair	15	X		$ 70	$ -	$ 1.050
Fan	1		X	$ 90	$ 104	$ 104
Fax machine	1		X	$ 250	$ 288	$ 288
Filing cabinet	9		X	$ 350	$ 403	$ 3.623
Large table with 10 chairs	1	X		$ 1.000	$ -	$ 1.000
Office chair	4	X		$ 70	$ -	$ 280
Office desk	5	X		$ 250	$ -	$ 1.250
Photocopy machine Xerox 5322	1		X	$ 7.500	$ 8.625	$ 8.625
Storage cabinets	2	X		$ 800	$ -	$ 1.600
Typewriter	1		X	$ 300	$ 345	$ 345
'Wallshelf	4	X		$ 150	$ -	$ 600
Wash sink	2	X		$ 60	$ -	$ 120
Whiteboard	3		X	$ 200	$ 230	$ 690
Sub total						$ 45.238
Other Equipment and Supplies:						
Camera	1		X	$ 350	$ 403	$ 403
Deep freezers	2	X		$ 1.265	$ -	$ 2.530
Freezers (Large)	3	X		$ 2.444	$ -	$ 7.331
Laboratory benches	8	X		$ 125	$ -	$ 1.000
Overhead projector	1		X	$ 550	$ 633	$ 633
Projector Screen	1		X	$ 250	$ 288	$ 288
Refrigerator	4	X		$ 950	$ -	$ 3.800
Slide projector	1		X	$ 800	$ 920	$ 920
Slide Trays	2		X	$ 20	$ 23	$ 46
Television Monitor 27" Color	1		X	$ 600	$ 690	$ 690
VHS	1		X	$ 500	$ 575	$ 575
Videocamera/recorder	1		X	$ 2.000	$ 2.300	$ 2.300
Sub total						$ 20.515
TOTAL						$ 101.240

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