RESERVE MANAGEMENT CONSULTANT'S REPORT No.2

THE ESTABLISHMENT, DEVELOPMENT AND PROPOSED USES OF A MANAGEMENT INFORMATION SYSTEM AS AN AID TO MANAGEMENT OF THE NATURE RESERVES OF WESTERN AUSTRALIA

by

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NOTE

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PART ONE

MANAGEMENT INFORMATION SYSTEM COMPONENTS

1. INTRODUCTION

The aims of this paper are twofold. First, to briefly describe the principles upon which the design and establishment of an information system are based. The establishment of the Western Australian Nature Reserve Management Information System (MIS) and the resultant increased efficiency in nature reserve management are a complementary part of this aim. The second aim is to provide an instructional paper to guide the use and development of the MIS.

As with all MISs, changes will occur over time. This paper may help those responsible for the maintenance and operation of the MIS to cope with these changes.

Definitions:

Fundamental to a basic understanding of this document is the defining of several key terms.

i) Management: The process whereby a multiplicity of tasks such as "planning, scheduling, commanding, organising, hiring, training, controlling, by one or more people with the aim of achieving specific goals." (BURCH & STRATER; 1974; p.50)

"The function of organising and administering a business or a group of administrators." (ROBIN; no date given; p.68)

ii) Systems: "A system can be defined as any integrated assemblage of components or subsystems designed to achieve an objective." (BURCH & STRATER; 1974; p.9)

"... an organised or complex whole; an assemblage or combination of things or parts forming a complex or unitary whole." (JOHNSON, et. al. in SCHODERBEK; 1971; p.361)

"... an organised collection of interrelated elements characterised by a boundary and functional unity..." (DECHERT IN SCHODERBEK; 1971; p.76)

iii) Data: "... raw facts in isolation which, when placed in a meaningful context, ... allows inferences to be drawn (relating to) the measurement and identification of people, events and objects." (BURCH & STRATER; 1974; p.260)

iv) Information: "... the aggregation or processing of data to provide knowledge or intelligence..." (BURCH & STRATER; 1974; p.23)

"... purpose orientated organised data..." (FIRMIN et. al.; in SCHODERBEK; 1971; p.313)

v) Management Information System:
- also referred to as an Information System

"... systematic, formal assemblage of components that performs data processing operations to;

a) meet legal and transactional data processing requirements,
b) provide information to management for support of planning, controlling and decision-making activities, and
c) provide a variety of reports, as required, to external constituents." (BURCH & STRATER; 1974; p.313)

"... a system for collecting, storing, retrieving and processing information that is used, or desired, by one or more managers in the performance of their duties." (EIN-DOR & ELI SEGEV; 1978; p.16)

When considering these definitions, one can see that there is no definitive statement. They all differ, albeit in varying degrees, to allow for the differing contexts and situations in which they have been used. However, once the specific differences have been laid aside, the general concepts are found to be very similar.

2. INFORMATION

Function of Information:

The primary function of information, and hence of an information system, is to increase the knowledge or reduce the uncertainty of the user. Uncertainty is the "nemesis to decision-making (and since) information decreases uncertainty, it follows that information is a key aid to knowledgeable decision-making." (BURCH & STRATER; 1974; p.36)

Information is also used for other purposes. It is fundamental to the production of documents based on an accumulation of information drawn from different areas and compiled in a form that has continuity, reasoning and proposes a series of management guidelines. eg. Management plans.

Classification of Information:

As there is no universally accepted MIS classification scheme, each user provides a classification which is appropriate to the subject matter and objectives of the system.

The task of classification requires clear communication, allowing users to become fully aware of the location of all information, lessening the risk of information loss and confusion.

Producing Information from Raw Data:

Before information can be used, the raw data needs to be changed into a usable form. There are ten basic operations used to produce meaningful output from raw data. These are:

1) capturing
2) verifying
3) classifying
4) arranging
5) summarising
6) calculating
7) storing
8) retrieving
9) reproducing
10) disseminating/communicating

(BURCH & STRATER; 1974; p.26)

These operations are essential to the task of ordering the data. If they are not carried out, the information system becomes inefficient and consequently, of less value to the user.

Cost of Information:

The cost of information is arrived at by totalling expenditure incurred in:

i) acquiring hardware;
ii) employing personnel to carry out systems analysis, design and implementation;
iii) accruing office space, - with computers, environmental control is also important;
iv) converting from the old to the new system;
v) operating the new system.

While some costs are variable eg. system operation, and others are non-variable eg. conversion cost, one must appreciate that all costs are dynamic.

Value of Information:

Once the desired information has been converted/obtained from the raw data, its value needs to be ascertained. The value of information is based on the ten attributes listed below:

1) accessibility
2) comprehensiveness
3) accuracy
4) appropriateness
5) timeliness
6) clarity
7) flexibility
8) verifiability
9) freedom from bias
10) quantifiable

(BURCH & STRATER; 1974; p.34)

The value of these attributes is difficult to measure, nevertheless they are important in ascertaining whether the cost of obtaining information exceeds the value of that information.

Cost Vs, Value:

One of the objectives of an information system is "to reach an optimum point where the marginal value of information equals marginal cost of providing that information." (BURCH & STRATER; 1974; p.35.)

This point is relevant when dealing with information that can be given a monetary value. However, when dealing with information and commodities that have no easily measured monetary value, as is the case with nature reserves, then cost/benefit analysis is inappropriate. Nature conservation values are highly subjective and, although based on all available information, they do not possess monetary value in real terms. Their values can be attributed to the needs and desires of those wishing to use the land, eg. farmer vs. conservation oriented organisation.

When comparing the cost of acquiring information with the value of the information, one will find that the optimum point will change in relation to increases/decreases in the cost/value of the information.

Figure 1.

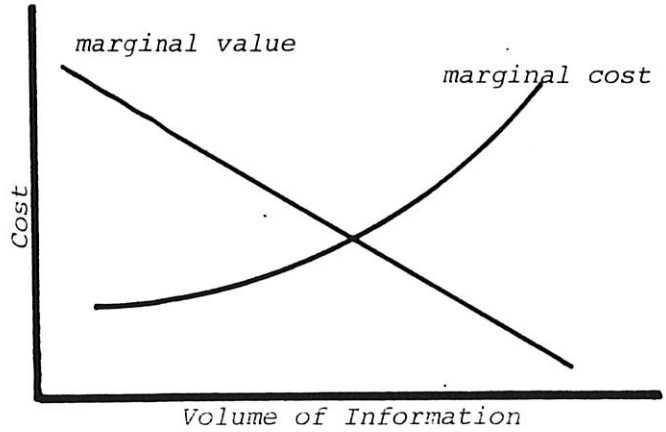

Figure 1: Relationship of marginal value and marginal cost of information. (BURCH & STRATER; 1974; p.35)

Effectiveness of Information:

Information will be most effective if it includes data that reflects/ represents past and existing conditions while able, to a certain extent, to predict future events. If it does this, the job of decision-makers becomes easier, as it lessens the level of uncertainty involved in decision-making.

3. THE MANAGEMENT FUNCTION:

The primary responsibility of management is the effective management of systems, whether they be business or otherwise, towards the attainment of certain goal-related objectives. The activities undertaken by management to carry out this task can be divided into three areas of responsibility:

Planning

Planning is the foundation of management. It includes the setting of objectives, the description of activities and methods and establishment of criteria that will allow those objectives to be achieved. Information is required by management to set the planning and hence management, process in action, for without it there is little on which to base judgements. Planning is also basic to controlling and decision-making. This places even greater importance on information.

Controlling

Controlling is the task carried out when plans deviate from their given direction. The factors associated with deviations from plans are usually outside the control of management and it is therefore the job of the manager to realign the plans to achieve the desired objectives, having taken into account the new influencing factors.

As mentioned earlier, the planning function establishes goals while the controlling task ensures that these goals are attained. However, the task of controlling is totally ineffective without information. For management to control effectively "a subsystem which measures the outputs of the system and compares this measurement with the planned objective" (BURCH & STRATER; 1974; p.63) needs to be in operation to provide this information. It is only then that management can take

the appropriate action to correct departures from the original plan. This process is referred to as a "closed-loop system" of feedback and is very important in the management function.

Decision-making

This is primarily concerned with problem-solving and involves selecting the best alternative so that management performance can be improved, a problem solved, or conflict within an organisation resolved.

There are two types of decision-making:

i) Programmed - involves an automatic response to previously established policies eg. deciding whether an apiary site permit should be allocated on a particular nature reserve;

ii) Non-programmed - involves dealing with those problems that are not clear-cut. "They are normally complex, wherein only a portion of the parameters are known, and many of the known parameters possess a great deal of probabilism." (BURCH & STRATER; 1974; p.53), eg. attempting to decide whether a nature reserve should be declared a "prohibited access area" before the complete range of nature conservation values has been determined.

With regard to Reserve Management decision-making, the process is initially non-programmed. As more information is gained, in the form of Reserve Officer and Wildlife Officer reports, management plans and research documents, the more programmed the decision-making process becomes. Therefore non-programmed decision-making is based on a lower level of information than programmed decision-making and as such, produces a less educated decision. As the level of knowledge (i.e. information) increases, so too does the degree of 'education' until finally a point is reached where it is deemed that a programmed (educated) decision can be be made.

As well as being divided into two types, decision-making also occurs at three levels.

They are:

i) Strategic - The majority of these problems are "of a nonrecurring nature, of great importance, and must be handled by management under conditions of almost total uncertainty." (BURCH & STRATER; 1974; p.67 - 57). A great deal of experience, knowledge and the ability to apply them is required at this level of decision-making. However, a well designed and effective information system will make the job easier, eg. deciding whether to allow test-drilling for oil/gas on a nature reserve (as with the Adele Island).

ii) Tactical - involves making decisions pertinent to short-term activities and the allocation and efficient utilisation of resources for the attainment of objectives. eg. determination of location and degree of maintenance of firebreaks on nature reserves. The effective information system aids this process by "implementation of modelling techniques which help to select, simplify, diagnose and optimise information". (BURCH & STRATER; 1974; p.57)

iii) Technical - involves solving well-defined, routine problems where standards are fixed and decisions are known. eg. the construction/ maintenance of firebreaks. Due to the nature of the problems, information used at this level rarely needs to be supplemented.

When reviewing the abovementioned decision-making levels, one can see that each level has different informational requirements. This is shown in Figure 2.

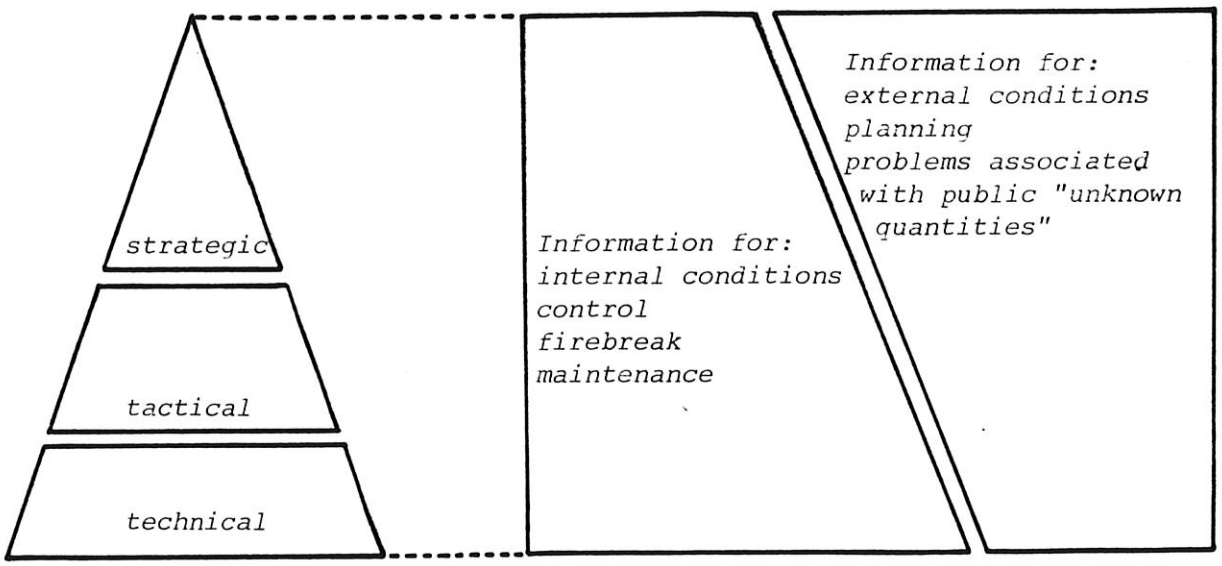

Figure 2:

Kinds of information required for various classifications of decision-making. (adapted from BURCH & STRATER; 1974; p.55)

N.B.

The lines shown in Figure 1 cannot be precisely delineated, as they are usually blurred and tend to overlap.

In the context of reserve management, the lines change as the level of management changes. Management of nature reserves incorporates all three levels of decision-making, with varying degrees of intensity. The variation is dependent on the amount of information available and the level to which it has been processed, i.e. whether data obtained for a nature reserve has been collected and is still in its raw form, or whether it has been processed to its most usable form.

4. MANAGEMENT INFORMATION SYSTEMS:

Effectiveness of the MIS:

All organisations have an information system of one kind or another which aids the management process. They all have different purposes, with varying degrees of success in fulfilling their task. However, the information system with the highest degree of success (ie. effectiveness) is usually the system that can best satisfy all three levels of decision-making (ie. strategic; tactical; and technical).

Communication:

Communication is one of the most important elements in contributing towards effective management.

"Communication takes place when information is transmitted from a source to a receiver through a defined channel linking them" (BURCH & STRATER; 1974; p.59) Within the management context, it is the basic process dealing with the flow of information and its dissemination to management. An effective information system will ensure that information is conveyed in a manner that will lead to proper (ie. the intended) perception by the user.

However, in aiming for this goal, communicators need to be aware of the noise factor (ie. unwanted information). Noise interferes with the information between the source and receiver at various levels and "is sometimes manifested in inaccurate or biased reports" (BURCH & STRATER; 1974; p.59) When many communication channels lead to one area or cross-over, cumulative noise results, creating a higher level of distortion. It is important that communication networks are well defined so any noise that is transmitted is minimised.

Further to this, is the importance of communication interfaces. An interface is "any person or device that acts as a translator from one mode of communication to another." (BURCH & STRATER; 1974; p.487). The people involved in a communication network, whether representing a source, receiver or interface, require the ability to pass on

information that is accurate, relevant, punctual and timely, as well as receive it, and use it, in the manner for which it was intended. If they are unable to do this, the systems effectiveness will be reduced.

5. SYSTEMS APPROACH TO MIS

"The basic objective of the systems approach to information systems is to make available a broad base of comprehensive information, flowing on a timely basis, to those managers and others throughout the organisation who, by receiving such information, can make effective decisions." (BURCH & STRATER; 1974; p.79)

This basic objective is achieved by separating the management functions of planning, controlling and decision-making from the information systems function of providing information of sufficient quality and quantity for the management process to be effective, while at the same time functioning as "an interlocking, co-ordinated assemblage of subsystems" that constitute a network of connections. (BURCH & STRATER; 1974; p.79)

The systems approach is concerned more with the individual component and its role within the system, than with its role as an individual unit per se. In other words, the effectiveness of the components considered together as a system is greater than the sum of the effectiveness of each component when considered separately. (ie. the whole is greater than the sum of its parts).

Three steps are involved in establishing an information system via the systems approach. They are: systems analysis; systems design; and systems implementation. Each is discussed below.

Systems Analysis

Systems analysis involves both qualitative and quantitative methods in determining the type of system which will best fit the requirements of an organisation. This determination requires extensive discussions between the systems analyst and organisation representatives, allowing the analyst to develop a full understanding of: the organisation's expectations; the resources they are prepared to make available to the analyst; any restrictions that need to be applied; any priorities.

Systems Design

In order to have a viable information system responsive to a variety of informational requirements, all the measureable data pertaining to the organisation must be organised in a manner which enables it to be readily recorded, stored, processed, retrieved and communicated as required by a variety of users.

To achieve the criteria set above, a number of steps need to be followed. They are:

i) defining the systems goals;
ii) developing a conceptual model;
iii) applying organisational restraints;
iv) defining data processing activities; and
v) preparing the systems design proposal.

Once completed, and the design proposal accepted, the task of establishing the information system can begin.

The design and development of an information system also requires inputs from all the functional areas which will provide and use the information. The task of co-ordinating these inputs is important, for without co-ordination it is very probable that the system will be carrying information that is irrelevant or which is already recorded in other information storage systems (ie. Head Office files in the case of the Department of Fisheries and Wildlife).

An information system also needs to be designed to allow users to understand how the system operates and what type of information it contains. If these factors are not fully understood, the effectiveness of the system will be reduced.

One further point is that staff using the system will all have different levels of knowledge, as well as different requirements from the system. For an information system to be effective, it needs to cater for those different requirements, as well as supply information where jobs may overlap or where job-substitution is involved.

The Reserve Management section is involved in direct management, planning, administration and co-ordination. In this situation an information system would be put to varying degrees of use and the system needs to provide for this range of uses. At the same time, users need to be aware of, and make sure that the primary reason for establishment of the system (in this case, more effective nature reserve management) does not take second place to an inherent desire to accumulate irrelevant information.

Other criteria that need to be adhered to when designing an information system are:

i) a need to be unrestricted in terms of the infra-structure in, and from, which the information will be stored and retrieved. (eg. computer vs. filing cabinet; paper vs. magnetic disc);

ii) the ability for infrastructure type to be changed according to the needs and/or desires of management and/or the system.

iii) the ability to meet low maintenance requirements;

iv) the ability to gather and process raw data in such a way as to produce the information required for all levels of decision-making within and around the effected organisation.
(taken from general review of literature)

If one or more of the abovementioned criteria are not met when designing a MIS, the chances of the system performing at optimum efficiency are reduced.

Systems Implementation

Systems implementation is the final stage in establishing a MIS. It involves implementing the previously mentioned and discussed procedures and infrastructure. However, one must always be aware of the need for constant communication between the analyst and those personnel who requested the system, the users of the system, management and others involved with it. If communication is not maintained, there may be calls for new system functions to be performed, new types of information to be processed and stored, and priority changes that will go unheeded

until the system is fully established. The analyst then has to completely revise the structure to accommodate the new requirements.

The three phases of systems development are shown in Figure 3.

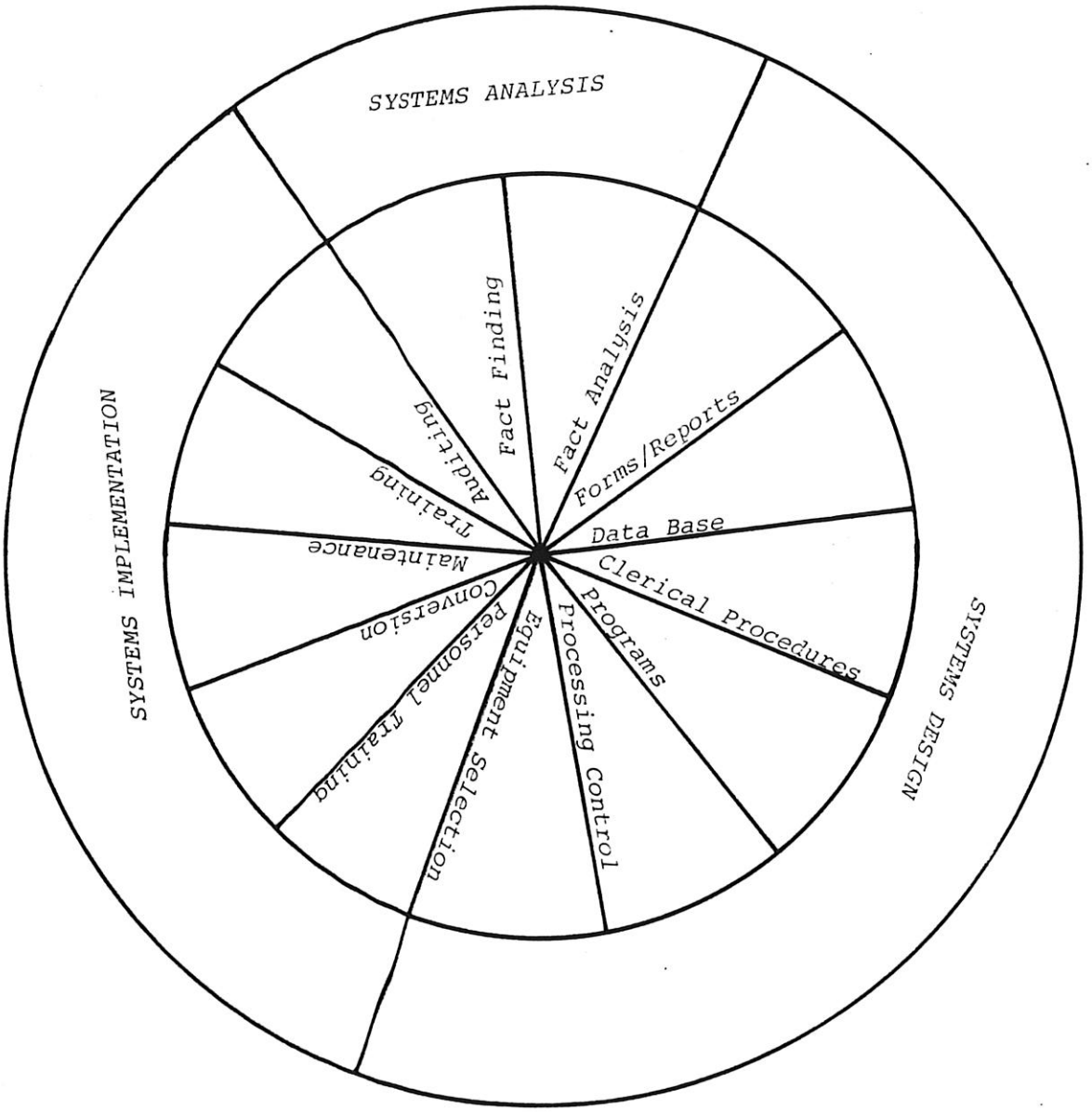

Figure 3: An illustration of the life cycle of an information system and the major activities associated with each life cycle phase.
(BURCH & STRATER; 1974; p.12)

The life cycle concept is a concise way of illustrating the viable and dynamic nature of the information system, as well as providing an overview of the systems development methodology.

However, there is one factor that must not be neglected. "The usefulness of the information systems output, the efficiency of its operations, and the reliability of the overall system's performance can vary considerably over time. Consequently, the information system is subject to deterioration, obsolescence, and eventually to replacement." (BURCH & STRATER; 1974; p.12). Fortunately, it is unlikely that this would occur to the whole system at any one time. On the contrary, it is more likely to occur to the subsystems within the total system. Even then it would be a gradual process, either spreading as changes in one subsystem affect another, or being confined to one or two subsystems. The nature and rate of spreading is dependent on the degree of interrelatedness between the subsystems.

6. PEOPLE INVOLVED WITH THE MIS:

The key ingredient in every system is people. "People design, develop, operate and maintain the system, and they utilise the output generated by the system." (BURCH & STRATER; 1974; p.345). For a new information system to be most effective, those involved must be aware of both their individual responsibilities to the system and the system's responsibilities to them.

The abovementioned information indicates that there are two broad categories of personnel involved with the system - users of information and operating personnel. Information users include general management staff and staff specialists, while operating personnel includes those involved in preparing input, processing data, and operating and maintaining the system. In the Reserve Management section's case, these two categories tend to overlap, as those using the system will also be operating it, albeit to varying degrees.

For staff to use and operate the system efficiently, training in the development and operation of it is necessary. Part Two of this document contributes to this function.

PART TWO

THE NATURE RESERVE MIS OF THE WESTERN AUSTRALIAN DEPARTMENT OF FISHERIES AND WILDLIFE

1. ESTABLISHMENT OF THE TOTAL MIS

System Analysis

After initial discussions with the Chief Reserve Management Officer and Reserve Management Officer - Planning of the Western Australian Department of Fisheries and Wildlife, the following points were raised and guidelines laid down to aid the establishment of the new MIS.

It was necessary to establish a new MIS because the existing system was ineffective. This was due to:

- its establishment with little thought as to how its goal(s) would be achieved;
- its design as an interim measure;
- its lack of information subsystems present at the time;
- its inability to cater for possible future management strategies;
- the absence of a standardised format for recording data.

The new system was to "incorporate a standardised, systematic approach to the storage and utilisation of data relevant to Nature Reserve management. This data will be administrative, technical and biological, and will involve incorporating existing, and establishing new areas, of data storage. The system will integrate not only existing Departmental files, and existing management information, it will also provide access to information on rare and endangered flora present on Reserves, current waterbird research and fire ecology data. In addition, it is envisaged that the system will allow easy access to the relevant topographic and/or cadastral maps, and aerial photography of the Reserve under consideration.

An important part of this systemised approach is the development of a standardised method for recording data, whether it be administrative, technical or biological. In a standardised form Reserve information for any Nature Reserve within Western Australia can be easily compared with information for any other Nature Reserve within the State." (excerpt from 'letter of contract offer').

Further consultation was carried out with the Chief Reserve Management Officer, Reserve Management Officer - Planning, and the Reserve Officer to ascertain their individual information requirements. Close liaison was maintained with these three officers throughout the period of establishment, as they were to be the prime users of the system.

After discussions, an 'inventory' of the information stored in the map room, administrative office, and management files, as well as on the aerial photographs and computer, was completed. (Appendix I)

The results of this exercise indicated that little interaction existed between the information subsystems. It also revealed a dearth of information relevant to the future management of nature reserves, with most of the existing information being used for day-to-day management only. (Reserves for which a Management Plan has been prepared are an exception).

It was obvious that the function of the Reserve Management Section was roughly divided into two areas - operations and planning. Although functionally divided, there was a need for the section to be working towards a common goal, and the introduction of a new MIS is a major factor in helping to achieve that goal. However, it is important for the system to cater for both planning and operations, hence the introduction of a Management Data Storage (MDS) file and an Operations (Op.) file.

The function of the MDS, as the title suggests, is one of data storage. The rationale behind selection of a MDS is to provide an information system which will cater for the informational requirements of the planning section, and at the same time provide background information for the operations section.

The Op. file is an operational subsystem of the MDS, and as such is designed to complement the MDS. It is streamlined to facilitate a high degree of accessibility, primarily to allow rapid access to fire suppression information. It is a storage/retrieval subsystem for information that is required for everyday management procedures and is

therefore concerned with information that is up-to-date and required quickly.

System Design

In order to cater for operations and planning, a flow diagram was devised indicating how the newly established subsystems would interact with the old subsystems.

The interrelationships and expected interactions between existing and new systems and subsystems are indicated in figure 4.

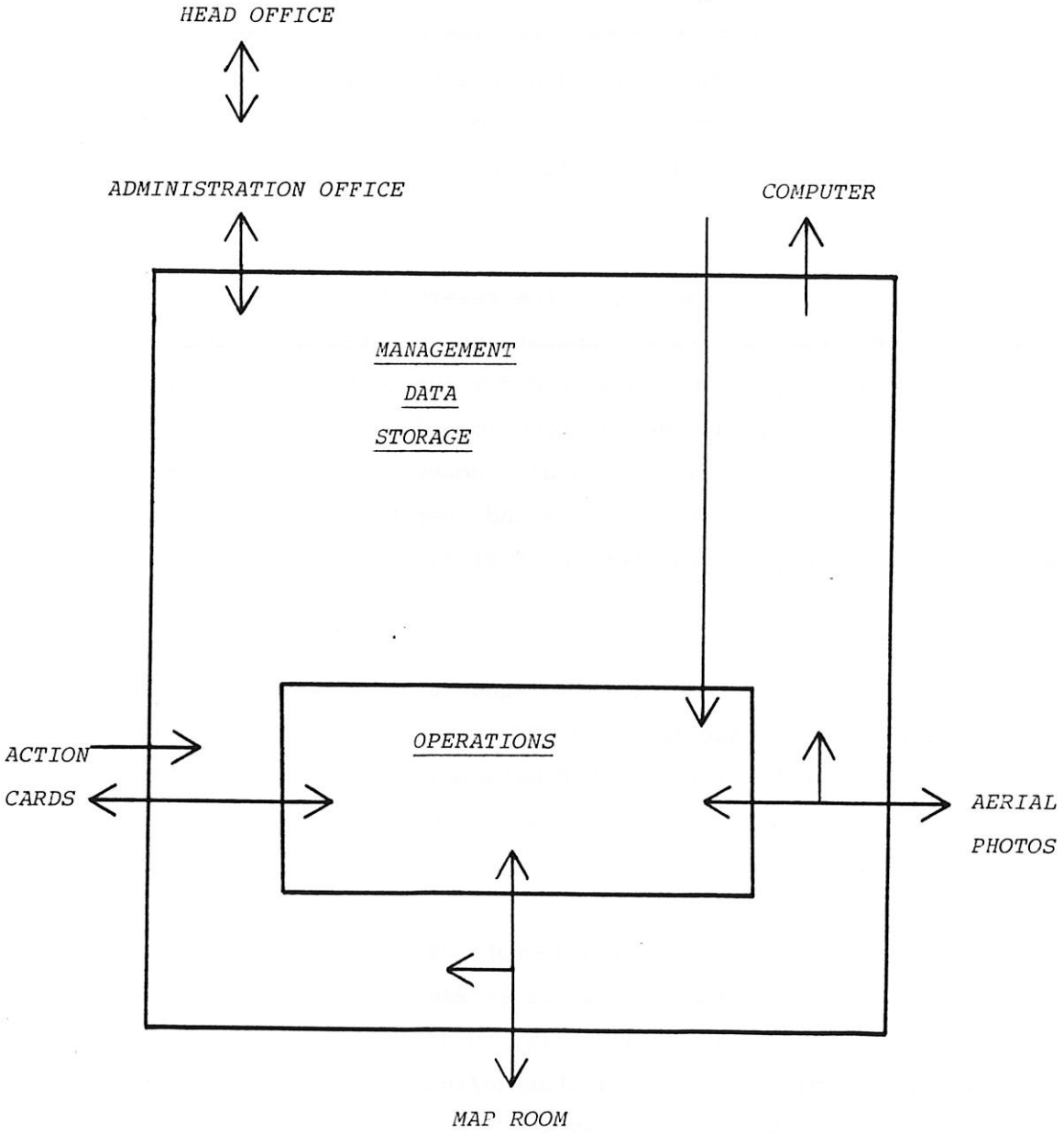

Figure 4: Flow diagram showing how the subsystems making up the new MIS are interrelated.

Based on the aforementioned guidelines, concepts and interactions, a MIS composed of the following subsystems was devised. The sub-systems are outlined and discussed in the following section (A to J), each being divided into two sub-sections, "Design" and "Implementation".

(A) Management Data Storage file:

Design:

MDS files will be stored in a 4-drawer filing cabinet, with Unifile "whisper glide" suspension files constituting the actual file. Each file will represent a reserve and will be labelled with the relevant reserve number on either a Blue tag or a Yellow tag. Blue tags indicate that an Op. file exists for that reserve, while Yellow tags indicate lack of an Op. file. Yellow tags should only be in use in the short term, as eventually all reserves will have both MDS and Op. files. (It is necessary to use Yellow tags for the present as it is essential to ascertain whether a reserve has an Op. file in the case of fire. This situation will change once the MIS is completed).

Each MDS file will be divided into discrete sections under the following headings:

i) Technical data - past maintenance data eg. quotes/costs; sign, gate and fence specifications; master copies of diagrams eg. maps;

ii) Biophysical data - from present records and field data;

iii) Research/Publications - from Research officers, technical staff and others;

iv) Fire History - data on fires up until 10 - 15 years before the present. This will allow the more recent fire history to be included in the Fire Supppression Kit (contained in Op. file);

v) Action Cards - storage of completed Action Cards.

Information for each component is stored in appropriately labelled manila folders; and recording of this information will be standardised.

MDS files will also be cross-referenced to all other subsystems via information attached to the front of the file.

If part or all of a reserve is being used for research, a coloured sticker will be placed on the front of the relevant file. (See Cross-referencing section - Part 2, Section I).

Implementation:

Once design of the MDS was complete, a 'mock-up' was used to test whether it could effectively perform the tasks set. The 'mock-up' involved five reserves of differing size, classification and purpose. All other subsystems were involved in the 'mock-up' to determine if they could function individually and as part of a system.

The 'mock-up' proved to be successful, and after a few small changes, conversion from the old to the new system took place. At the stage of writing, the full conversion had not been completed, due to a shortage of manila folders, a 4-drawer filing cabinet and aerial photo wallets.

Once the conversion has been completed, personnel training will take place. Fortunately, the staff involved in operating the system have been on hand throughout its establishment, and are already aware of most maintenance and operating requirements.

The most important maintenance requirement is the updating of information and the input and processing of raw data as it comes to hand. This last point is particularly important as much of the data to be used by management has yet to be gathered.

(B) Operations File:

Design:

The Op. file will also incorporate the use of 4-drawer filing cabinets, Unifile "whisper glide" suspension files and manila folders for storage and retrieval purposes. They too will be labelled by reserve number, with

tags being coloured Red or White. Red tags indicate that the reserve does not have firebreaks. Each file will be divided into discrete sections, the number of sections depending on the range of management activities being undertaken on the reserve. The number of subfiles and information they contain can be increased or decreased, whenever it is deamed suitable, or beneficial to the efficiency of this subsystem.

There are some operational management activities which will apply to most reserves eg. firebreak maintenance and construction, and other activities which will only apply to select reserves, eg. signs, walking trails, apiary sites etc.

Fire Suppression Kits will be stored at the rear of the Op. file at all times. This allows for rapid access to these kits in the case of fire on a reserve. (Part 2, Section Ci).

All files will incorporate a standardised method of recording data and, where necessary, will be cross-referenced to all other subsystems.

Implementation:

The process of implementation is the same as with the MDS files. (See Part 2, Section Aii).

(C) Fire Suppression Kit (FSK):

This kit is a subfile of the Op. file.

Design:

The FSK was designed to allow for easy access to information vital for successful fire suppression on a particular reserve. Relevant information has been centralised in the FSK so that it can be rapidly accessed by personnel involved in the Fire-fighting operations.

The kit will have two forms - Master Kit and Basic Kit. The Master Kit is designed for use as the primary source of information for the Basic Kit, and for 'prescribed burning' operations. It will contain more comprehensive information than the Basic Kit and is not to be removed from the

Op. file. It is the only sub-file containing all information pertinent to fire suppression. If lost, information must be collected and collated again.

The Basic Kit is designed for use in the field in all fire management situations. It is dispensable and, as such, is the only kit to be taken into the field. Its uses/functions include getting the fire-crew from the Wildlife Research Centre to a particular reserve, and the provision of information needed for fire-suppression, eg. location of watering point and type, location and orientation of firebreaks, etc. Three identical Basic Kits will be stored in the Op. file to cater for the possibility that all 3 fire units may be in the field at one time.

All fire suppression information will be stored in transparent plastic brief wallets and will be individually marked in relation to their status. Data will be recorded in a standardised format. (See Appendix II for contents of Fire Suppression Kits).

Implementation:

In addition to the steps outlined in Part 2, Section A., implementation of Fire Suppression Kit requires: the completion of maps for all reserves; a list of local authorities connected with fire suppression; ordering of aerial photos; collation of other related data. (See Appendix II). As there are many reserves, this task will take time to complete, but it is important that most of it is completed before the beginning of the 1983-84 fire season.

Appendix III shows the various situation dependent methods of using the MIS to gain access to fire supppression information.

(D) Action Cards:

Design:

Action Cards will be the responsibility of the Reserve Officer. They are designed to enable him/her to keep up-to-date records of firebreak and general maintenance, and also to facilitate rapid access in the

event of telephone queries, etc. They are the personal record of the Reserve Officers as to what he/she has done in relation to maintenance administration. When completed, they will be stored in the MDS files. (See Appendix IV for card specification and content).

Implementation: (see steps in Part 2, Section A)

This system has been designed and implemented by the present Reserve Officer.

(E) Administrative Details:

Design:

Administrative information concerning reserves will also be recorded in a standardised format. (See Appendix IV vii). It will be stored in lever-arch files in reserve number sequence. The files will be located in the clerk's office and are designed for use by both Reserve Management and Research Staff.

Implementation:

As the sheets containing the administrative information have been revised, there is a need for them to be retyped. This job has already commenced, but much remains to be done to complete the task.

(F) Map Room

Design:

The map room remains unaltered from its previous state, and is under the control of the Reserve Management Technical Officer. All maps are stored in map cabinets and are numbered according to index sheets. The index sheets are located on a pinboard above the map cabinets.

The choice of maps depends on the user's information needs, with four types available: topographic; cadastral; lithos; and topo./cadastral. The scales available are indicated in Appendix I.

Implementation:

As the map room was previously established, no implementation procedures were required.

(G) Aerial Photographs:

Design:

Aerial photographs will be labelled according to reserve number. They will be stored in photo wallets, (available from Government Stores). They are to be used in the office and for data collection in the field. Another set of aerial photos will be included in the Master Fire Suppression Kit, and will be used in the interpretation of fire behaviours and in the implementation of fire supppression programs. Both sets of photos will be black and white and show full stereo coverage.

All photos will have reserve boundaries, firebreaks and, where necessary, areas of special importance eg. rare and endangered flora, marked on them. As well, all aerial photos should be individually marked with reserve number in case separation from their parent set occurs.

Full stereo coverage of some of the Shires in the South West is held by the Reserve Management Section. Stereo coverage of any reserves situated within a Shire will be stored in individual reserve wallets. To facilitate ease of access when complete Shire sets are required, a wallet bearing the Shire's name, names of reserves in the Shire, and the relevant photos will be available. Wallets bearing those reserve names and numbers will also be installed in the system. When the aerial photos from one of these reserves are required, the "reserve wallet" will refer the user to the relevant "Shire wallet". eg. for photos in reserve wallet No. ABC, see Shire wallet No. XYZ.

Implementation:

Although 50% of the wallets have been labelled, the completion of this task is dependent on the arrival of the next batch of wallets. As well, aerial photos need to be ordered for many reserves before this subsystem is complete.

NB. Aerial photographs not held in, or belonging to, the Reserve Management Section should not be integrated into this subsystem. This will guard against the possibility of the photos either being withdrawn from the system by their "owner", or being used for long-term field work, by somebody else in the Centre.

(H) Computer:

Design:

Not applicable.

Implementation:

Information stored on computer will be integrated into the MDS and Op. files as it becomes available.

(I) Cross-referencing Method:

Design:

Cross-referencing is used when information in a certain "unit of storage" eg. MDS, Op. file, etc., provides information that can be applied in more than one area at any given time.

Cross-referencing in this MIS involves the use of an information sheet that will be attached to the front of the MDS files by means of a sheet of clear contact, (it will not weaken with age as do adhesive tapes and glue). This data immediately refers the user to another subsystem so they can access the information required.

A system of colour coding will also be used to refer file users to the varying areas of research and the respective Research officers. (See Appendix IV v for design format).

Implementation: (see Part 2, Section A).

Cross-referencing information has not been attached to all files, as the data has yet to be collected.

(J) Standardising of Data Records:

Design:

Standardising the format for recording data facilitates ease of comparison between data from two or more reserves. For example, if data is standardised, attributes of reserves in a particular area can be compared to ascertain if subtle differences in soil type, flora and fauna etc. exist.

Implementation: (see Part 2, Section A).

Standardisation has been carried out in the following areas:

- Biophysical data (see Appendix IV i);
- Firebreak construction/maintenance (See Appendix IV ii);
- Fire Suppression Kits
  : access maps (regional, local and reserve based)
  : listing of local contacts (see Appendix IV iii);
- Cross-referencing (See Appendix IV iv);
- Action Cards (See Appendix IV v);
- Administrative information (see Appendix IV vi).

PART THREE

CONCLUSIONS AND RECOMMENDATIONS

1. CONCLUSION:

This document has attempted to outline the most salient functions involved in establishing a MIS and, in doing so, relate them to the establishment of a MIS for the Reserve Management Section of the Western Australian Department of Fisheries and Wildlife.

Part 1 of the document dealt with the processes which contribute to successful and effective management. Throughout, it emphasises the importance of information in aiding the processes of planning, controlling and decision-making, which are integral parts of the management function.

The varying levels of devision-making require different types of managerial skills. These skills need to be complemented by information, thus allowing for more effective management. Lack of appropriate information in certain situations will result in ill-informed decisions being made, often leading to misuse of resources.

Before the new MIS was designed, the existing information was divided into interrelated subsystems. This formed the basis for the design and establishment of the new MIS.

Part 2 provides a description of the design and implementation of the various subsystems. It has been structured so it can be used as an instructional aid describing how the MIS was established, and as a detailed explanation of how the established system should be used.

Throughout, mention is made of a standardised format for recording data. This will allow comparison between all nature reserves in Western Australia.

The new subsystems (MDS and Op. files) have been integrated into the old system. As well, cross-referencing of all subsystems has been carried out to allow for a higher level of efficiency in

assessing and retrieving and information.

Overall, there is a basic need for data to be proceessed, stored and retrieved in a manner that allows for effective management. Regular up-dating of the MIS with accurate information will ensure this; thus providing an invaluable aid to both day-to-day operations and the long-term planning goals of the Department of Fisheries and Wildlife's Reserve Management Section.

2. RECOMMENDATIONS:

The following list of recommendations is aimed at increasing the efficiency of the new MIS and hence reserve management.

Over time, situations may change and some of these recommendations may not be relevant, however, at present they all contribute to the efficient operation of the new MIS.

It is recommended that:

a) a priority list of reserves be established in relation to collection of data;

b) further standardisation of data recording be carried out;

c) the system be kept up-to-date at all times
- the Graduate Assistant to be assigned this task;

d) the collection of data from local authorities, if possible, be performed by a centralised authority eg. Department of Local Government. This information could also be used by other Departments with similar needs eg. Forests Department, Public Works Department;

e) sources of information be recorded when collecting data;

f) letters of request to local authorities, landholders etc. be standardised where possible;

g) the Op. file be kept as "streamlined" as possible to alleviate cluttering;

h) all Reserve Management Officers, as much as possible, collect required data on field trips;

i) a closer working relationship between the Reserve Management Section and Wildlife Officers be cultivated;

j) a "borrowing sheet" be introduced to enable files to be traced should they be required in an emergency situation eg. fire;

k) Fire Suppression Kits for those reserves deemed as highly susceptible to fire be completed as soon as possible - use of a priority list;

l) Run Sheets (ie. a list of distances and landmarks en route to reserves) be prepared for each reserve;

m) Map Holders be fitted to all fire fighting vehicles to aid

in interpretation of Fire Suppression Kits;

n) Line thicknesses used when drawing reserve maps be standardised to prevent misinterpretation of information;

o) symbols used when drawing reserve maps be standardised to prevent misinterpretation of information;

p) fire-fighting vehicles have access to a "Traveller's Atlas of Western Australia" at all times.
- the Atlas should have reserves marked on it;

q) all aerial photographs be individually labelled with their reserve number to avoid loss from original set;

r) all aerial photographs have reserve boundaries, firebreaks and, where necessary, areas of special importance, apiary sites and land units marked on them;

s) completion of the transfer of Administrative information into the new format be achieved as soon as possible;

t) liaison with the Administrative Clerk re changes in the status of reserves be an ongoing process;

u) casual staff employed by the Reserve Management Section be trained in the use of the system;

v) any new information subsystem be cross-referenced to the existing subsystems;

w) when the Katanning and Wongan Hills offices are established, they be encouraged to use an idential MIS. - to facilitate comparison;

x) Reserve Management staff introduce changes into the system if the need arises for another information subsystem, or if it will increase the efficiency of the MIS for the reserve management purposes. - this should only be done after consultation between staff;

y) all recorded data pertaining to vegetation, soils and fauna follow a recognised, standardised format.

APPENDICES

APPENDIX I:

Inventory of Information Stored in Subsystems of the Old Management Information System

Reserve Management Files

- firebreak construction/maintenance

: included costs
distances
contractor responsible for maintenance
fire contact
fire history (in some cases)
fire access maps (in some cases)

Head Office Files

- Wildlife Officer Reports
- Administrative details
- History of reserve.

Map Room

- topographic maps
  : 1:25,000
  : 1:100,000
  : 1:500,000
- cadastral maps
  : 1:50,000
- lithographic maps
  : 80 chain
  : 40 chain
- topo./cadastral maps
  : 1:50,000
- miscellaneous maps
- management reports
  : results of reserve surveys indicating biophysical data, carried out by the present Reserve Management Technical Officer.

N.B.: all reserves are marked on the 80 chain lithos, and most on the cadastral and topographic maps.

Aerial Photographs

- not available for all reserves; of those available, most show
  : reserve boundaries
  : firebreaks

Computer

- presently used for storage of data pertaining to rare and endangered flora (for the Flora Atlas)

Administrative Information

- access to Head Office files
- shires list
- reserves list, showing
  : vested or unvested
  : area
  : file No.
  : local authority
  : classification
  : purpose
  : name
  : reserve No.
  : gazettal dates

Action Cards

- cards showing administrative information on firebreak and general maintenance.

Further information on research topics is available from Research Officers at the Wildlife Research Centre.

APPENDIX II:

CONTENTS OF FIRE SUPPRESSION KITS

1. General access map showing:
   - nearest towns
   - most direct access
   - standpipe locations

2. Nature Reserve Map showing:
   - reserve boundary
   - roads
     : type of surface
   - firebreaks and tracks
     : conditions; surface; improvements made; whether accessible year round
   - adjoining fencelines
   - gates on private land
   - gates giving access to reserve
   - dams
   - water tanks
   - bores/wells
   - creeks
     : intermittent or perennial
   - lakes
     : intermittent or perennial
   - standpipes
   - bush adjoining reserve
   - rock outcrops
   - location of signs
   - areas of special value
     : buildings; rare/endangered flora

3. A Second Nature Reserve Map Showing:
   - vegetation
     : including rare and endangered species
   - low/high fuel areas
   - fire history
     : accompanied by written report
   - topography

: can be limited to features likely to effect fire behaviour or vehicle access

- boundaries of adjoining property holders
  : indicating type of farming undertaken eg. wheat/beef, etc.
- whether rare fauna present
  : if so, where 'home sites' are located.

4. Listing of Local contacts, both public and government authorities, giving name, address and telephone number.
   - Shire office
   - Shire clerk
   - Shire ranger
     : if present
   - Chief Fire Control Officer
   - Local Fire Control Officer
   - Fire Brigade Captain
   - Police
   - Ambulance
   - Hospital
   - Adjoining landholders
   - nearest bulldozing contractor
   - other Government bodies eg. Forestry; National Parks; S.E.C.; Public Works; etc.
   - interested bodies eg. Town/city counciles.

5. A list of radio call signs of the relevant abovementioned bodies/ positions
   A list of equipment held by Shire that may be useful for fire-fighting.

6. Aerial photographs in full stereo
   - black and white

All of the abovementioned information will be available in the Master Fire Suppression Kit.

Those items mentioned in points 1, 2 and 5 will be available in the Basic Fire Suppression Kit.

STEPS TO BE FOLLOWED WHEN FIRE SUPPRESSION INFORMATION IS REQUIRED

SITUATION 1

Step 1 — Given Res. No.

Step 2 — Go Straight to Op. file

Step 3 — File exists / File not there

Step 4 — F/breaked / Not F/breaked - most likely not have Fire Supp. Kit available in short term. / Admin. info. for res. No. found in clerks office / Check MDS

Check MDS → Yellow tag (no file) / Blue tag (file)

Step 5 — Fire Supp. Info.

Basic Kit available for use by fire crew in field.

Master Kit for use in office and field by permanent Dept'l officers only.

- ie. Res. Officer
  Res. Man. Off. - planning
  Chief Res. Man. Officer

Various maps available to ascertain where res. is situated.
- use in conjunction with Traveller's Atlas of W.A.

Check with R.O.
- hopefully move to left-hand side of flow-chart

Step 6 — Use whatever info. is available for res. on the Op. and MDS files. → PROCEED TO FIRE!

SITUATION II

Step 1 — Given Location No. only-staff should try to gain as much information as possible from the source. ie. area of fire, wind direction, local fire officer etc. This will enable them to ascertain which area to look for on the 80 chn lithos.

↓

Step 2 — Go to 80 chain lithos and find out where fire has been reported ie. closest reserve number.

↓

Step 3 — If fire IS threatening → ↓ → Step 4: Follow steps suggested in Situation 1. - from the beginning.

Step 3 — If fire IS NOT threatening → ↓ → Step 4: ABORT MISSION!

SITUATION III

Step 1 — Given General Area only - see explanation under Step 1 in Situation 2.

↓

Step 2 — Go to map room to ascertain whether fire is close to or liable to threaten a res.

↓ ↓

Step 3 — If fire IS threatening → Follow steps suggested in situation 1.

If fire IS NOT threatening → ABORT MISSION!

APPENDIX IV i

BIOPHYSICAL DATA SHEET

RESERVE NO.: RESERVE NAME:

SHIRE: AREA:

INFORMATION SOURCE: DATE INFORMATION RECORDED:

DISTANCE/DIRECTION FROM-PERTH: - NEAREST TOWN:

CLIMATE:
including A.A.R.

TOPOGRAPHY:

GEOLOGY AND GEOMORPHOLOGY:

SOILS:

VEGETATION:

FAUNA:

BIRDS:

MAMMALS:

REPTILES:

AMPHIBIA:

PESTS:

Animal:

Plant:

WATER BODIES ON THE RESERVE:

SURROUNDING LAND-USES:

MISCELLANEOUS INFORMATION:

APPENDIX IV ii

Reserve

Reserve No. Name File No.

Shire Litho.

Length of Firebreaks (km) Frequency of maintenance.

Time of year of maintenance

How Maintained. Cost:

Contractor for Maintenance:

Name:

Address:

Phone: Location No.

Fire Contact:

Name:

Address:

Phone: Location No.

APPENDIX IV iii

'NAME OF SHIRE'

SHIRE OFFICE: Address Phone No.

SHIRE CLERK:

A/SHIRE CLERK:

SHIRE RANGER:

CHIEF F.C.O.:

LOCAL F.C.O.:

BRIGADE CAPTAINS:

POLICE:

AMBULANCE:

ADJOINING LANDHOLDERS:

LOCAL BULLDOZING CONTRACTOR:

OTHER GOVT. BODIES:

OTHER LOCAL AUTHORITIES:

APPENDIX IV iv

INFORMATION FOR CROSS-REFERENCING WITH: Aerial Photographs
Maps
Administrative Information
Information on Computer
Research Officers

AERIAL PHOTOGRAPHS
Wallet No.:

Maps:

LITHO No.:

TOPO/CADASTRAL No.:

TOPO No.:

CADASTRAL No.:

LATITUDE:

LONGITUDE:

AUST. GRID REFERENCE:

TRAVELLER'S ATLAS OF W.A.: Map No.: Ref. No.:

INFO. on COMPUTER:

ADMINISTRATIVE OFFICER:

RESEARCH OFFICERS/AREA OF RESEARCH:

Flora Research	Waterbird Research	Flora Atlas
Mammal Research	Fire Ecology	

APPENDIX IV v

FIREBREAK MAINTENANCE

Reserve No.: Name:

Shire:

Contractor:

FRONT OF CARD

- card size 203 mm x 152 mm

Action Month: Area

Frequency: Length of Breaks:

File No.: Litho No.:

Date	Letter to Contractor	Account Rendered	Cost	Length	W/O Advised	H.O. File

BACK OF CARD

GENERAL MAINTENANCE

Reserve No.: Name:

Local Authority:

Area: File No.: Litho No.:

ACTION REQUIRED	COMPLETED DETAILS

FRONT OF CARD

- card size 203 mm x 152 mm

ACTION REQUIRED	COMPLETED DETAILS

BACK OF CARD

APPENDIX IV vi

ADMINISTRATIVE INFORMATION

W.A. NATURE RESERVE NO.:

GOVERNMENT GAZETTE
Date Page No.

FILE NUMBER:

PURPOSE:

NAME:

CLASS (Land Act):

AREA:

VESTING:

LOCATION NO (S):

CLASSIFICATION:
(Wildlife Act
Section 12A)

LOCAL AUTHORITY:

LITHO NO (S):

CADASTRAL MAP NO (S):

TOPO. MAP NO (S):

LATITUDE:

LONGITUDE:

AUST. GRID REFERENCE:

TRAVELLER'S ATLAS OF W.A.: Map No.: Ref. No.:

AERIAL PHOTOGRAPHS
Wallet No.:

INFO. ON COMPUTER:

WILDLIFE DISTRICT RESPONSIBLE:

RESEARCH OFFICERS/AREA OF RESEARCH:

NOTES:

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FIREBREAK MAINTENANCE

Reserve No:

Name:

Shire:

Contractor:

Action Month:

Area:

Frequency:

Length of Breaks:

File No.:

Litho No.:

DATE	letter to contractor	account received	cost	length	W/O advised	H.O. file

FIREBREAK MAINTENANCE

Reserve No:

Name:

Shire:

Contractor:

Action Month:

Area:

Frequency:

Length of Breaks:

File No.:

Litho No.:

DATE	letter to contractor	account received	cost	length	W/O advised	H.O. fil

APPENDIX IV iv

INFORMATION FOR CROSS-REFERENCING WITH: Aerial Photographs
Maps
Administrative Information
Information on Computer
Research Officers

AERIAL PHOTOGRAPHS
Wallet No.:

Maps:

LITHO No.:

TOPO/CADASTRAL No.:

TOPO No.:

CADASTRAL No.:

LATITUDE:

LONGITUDE:

AUST. GRID REFERENCE:

TRAVELLER'S ATLAS OF W.A.: Map No.: Ref. No.:

INFO. on COMPUTER:

ADMINISTRATIVE OFFICER:

RESEARCH OFFICERS/AREA OF RESEARCH:

Flora Research

Waterbird Research

Flora Atlas

Mammal Research

Fire Ecology