Information Science Section
Western Australian Department of
Conservation and Land Management

Critical Assessment of the Plant Biodiversity Information System

Consultancy Report

prepared for the Botanic Gardens
of Adelaide and State Herbarium
by

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1. EXECUTIVE SUMMARY

The purpose of the consultancy was to:

- Develop a strategy for consolidation and further development of the South Australian Plant Biodiversity Information System (PBIS) through integration of knowledge outputs from the State Herbarium (see Appendix 1) and
- Provide recommended modifications to the DENR Implementation Strategy (Appendix 4)

Of the nine areas in the Project Brief where specific advice had been sought (pages 2-4, Appendix 1), the three highest priority areas were considered to be:

1. How best to centralise and develop the State's Census of Plants.

   Our recommendations here focussed on custodianship issues, how to populate the CENSAP database, the future availability of DHUD resources, how to ensure data provision and quality, and capture taxonomic changes, access to CENSAP, simplification of CENSAP form, and future publication.

2. How to refine and extend the State Herbarium's specimen database.

   We investigated and made recommendations on the ADHERB database platform, the importance of streamlining specimen data entry and the utility of barcoding, the production of specimen labels, and methods for more fully integrating specimen exchange, loans management and identification with the specimen database.

3. Provide advice on an integrated Plant Biodiversity Information System.

   Our recommendations here focussed on the development of a user-friendly PBIS user interface, built around the framework of a proposed Botanic Gardens and State Herbarium Intranet site and incorporating not only access to the component databases but also descriptive information and spatial display and analysis tools.

We also considered it important to discuss management strategies for implementing IT across an institution, covering areas such as formal structures for corporate communication and decision-making, Information Technology support and training and the need for an IT professional on staff.

A complete listing of the recommendations and associated specific activities made in this report can be found on page 33.

2. INTRODUCTION

The consultants, Alex R. Chapman[1] and Paul Gioia[2], prepared this report at the request of the Manager, Plant Biodiversity Research of the State Herbarium and Botanic Gardens Group of the South Australian Department of Environment and Natural Resources (DENR).

The consultants are Research Scientists from the Information Science Section of the Western Australian Department of Conservation and Land Management. Much of their work has focussed on Information Technology applications within the WA Herbarium.

The purpose of the consultancy was to:

- Develop a strategy for consolidation and further development of the South Australian Plant Biodiversity Information System (PBIS) through integration of knowledge outputs from the State Herbarium (see Appendix 1) and
- Provide recommended modifications to the DENR Implementation Strategy (Appendix 4)

This report is based on and assumes familiarity with the Botanic Gardens and State Herbarium Strategic Plan within the DENR Corporate Strategic Plan (Appendix 2), the Strategic Information Technology Plan (Appendix 3) and the associated Implementation Strategy (Appendix 4).

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3. METHODS

After exchange of strategic documents, we met at the commencement of the consultancy with the Coordinating Committee to discuss the agenda and prioritise areas for advice and review.

3.1 Prioritisation of tasks

Of the nine areas in the Project Brief where specific advice had been sought (pages 2-4, Appendix 1), the three highest priorities were considered to be:

1. How best to centralise and develop the State's Census of Plants, especially the needs of the state herbarium and its current computing platform, data entry and maintenance by herbarium staff, as well as examining the relationship between the Herbarium and Biological Survey project.

2. How to refine and extend the State Herbarium's specimen record database ADHERB.

3. Provide advice on an integrated Plant Biodiversity Information System with a user-friendly front end, especially with regard to enabling widespread dissemination of herbarium information to staff and customers, with emphasis on the utility of a WWW interface and mapping functionality.

It was agreed that primary reference be made in our report to the Strategic Plan 1996/97 - 1998/99 (April 1996) (Appendix 2) and then to the Corporate IT Strategic Plan, Attachment 5 (Appendix 4).

3.2 Interviews

As outlined in the proposed agenda (pages 5-6, Appendix 1), interviews with relevant DENR, DHUD and Herbarium staff were conducted in order to understand in some detail existing IT structures, protocols and resources pertinent to PBIS datasets.

Additional interviews were scheduled with Dr. J. Jessop, Dr. L. Haegi, Dr. W. Barker from the Botanic Gardens and State Herbarium and Mr. T. Mittiga from the Resource Information Group. Followup discussions were also held with many individual staff members.

It should be noted at this point that at all times we found interviewees open and willing to share information and ideas about IT issues in their area of expertise, and were generally very positive and supportive of the State Herbarium's endeavours to move forward in its strategies for IT development and integration.

4. PRIORITISED AREAS FOR ASSESSMENT

We present here a discussion of the three prioritised areas of the project brief. At the beginning of each section we highlight the corresponding Core Business Objective and Programme as outlined in the Strategic Plan 1996/97 - 1998/99 (April 1996).

4.1 CENSUS OF SOUTH AUSTRALIAN PLANTS

(Core Business 2 - Objective 2.1 - Programme 1 - Dissemination of plant biodiversity information)

4.1.1 Custodianship

Maintenance and custodianship of taxonomic data have been areas of concern for some time within the Herbarium and Botanic Gardens and the Natural Resources Group (NRG) within DENR. There is a strong view from Herbarium management (and some branches of NRG) that the Herbarium is the *primary institution within the state having sufficient expertise* to be the custodian of taxonomic information for South Australia.

Unfortunately, custodianship of taxonomic data has become, at best, ambiguous due to the historical role of the Biological Survey Project which is part of the Resource Management Branch of NRG in DENR.

It is important to note here the distinction between *data* and *information*. Data refers to the actual records contained within the Flora Database whereas information refers to the *interpretation* of those data. The Herbarium's role extends to the correct *interpretation* of data contained within the Flora Database and is the authoritative arbiter in the case of dispute or where taxonomic clarification is required.

There is a clear need for the Herbarium, as the authoritative institution for taxonomic data, to assert its custodial responsibilities with regard to any database purporting to be an authoritative Census of South Australian Plants.

R1: *It is recommended that Herbarium management should communicate with senior management within DENR (and possibly DHUD) to affirm the role of the Herbarium as custodian of taxonomic information in South Australia.*

Specific Activities

1. The Herbarium must articulate and document clearly its custodial responsibilities
2. Investigate the appropriate forum to effect recognition of Herbarium custodianship. (There may be particular committees of relevance.)
3. Obtain written confirmation to that effect

4. Determine the Herbarium's functional requirements of the Flora Database (eg policies on inclusion, exclusion of particular names, interface requirements for CENSAP and SEDIT).

Another way of asserting custodianship of taxonomic *information* is to act as the primary point of contact for taxonomic queries or clarification. This will help reduce any ambiguity for customers, particularly other government agencies, as to the State Herbarium's custodial role.

R2: *It is recommended that a Herbarium staff member with relevant expertise be nominated as the first point of contact for enquires regarding taxonomic information.*

4.1.2 Populating the CENSAP database

The Biological Survey Database is comprised of two main sections: the Survey Database and the Flora Database. The Survey Database consists of species records acquired from field survey, some of which have vouchered material. The Flora Database is a list (or census) of plant names (mostly vascular) of South Australia and is used as a lookup table for the Survey Database when validating names and checking currency.

Because of historical changes in departmental structure, the computing infrastructure used to store and maintain the Flora Database is located in the Department of Housing and Urban Development (DHUD). Additionally, there has been a service level agreement (since expired) between DENR and DHUD for the provision of system development support. The actual data entry and maintenance for the Biological Survey and Flora Database are provided from within the Resource Management Branch and DHUD.

The Flora Database is freely available to the Herbarium, a reflection of the large degree of cooperation and goodwill that have been extended from DHUD and NRG toward the Herbarium. As it currently stands, the Flora Database fulfils most, if not all, of the current requirements of the State Herbarium for supporting ADHERB and producing a printed census.

Data from the Flora Database has been incorporated into the TITAN environment as CENSAP, the Census of South Australian Plants, by Dr. W. Barker This, in conjunction with the Census of Australian Vascular Plants (CAVP) and the Australian Plant Name Index (APNI), serves as a lookup table to provide validation for species names within the Herbarium Specimen Database (ADHERB). No value adding occurs with CENSAP; it remains a direct copy of the Flora Database.

As the recognised custodian, the Herbarium should ideally maintain a census using its own staff and computing resource, with arrangements for the disbursal of that database to users. However, given the current limitation in available staff and budget, and given the fact that DHUD and NRG are effectively maintaining a de facto census at no charge to the Herbarium, it makes sense to explore ways in which the Herbarium can continue to assert

its custodianship of taxonomic data while, at the same time, taking advantage of the current provision of resources, with a view to ultimately assuming complete responsibility for the maintenance and provision of taxonomic data.

While it is technically possible to access the Flora Database directly from the State Herbarium there are a number of advantages to copying the database locally, on a regular basis, to within the TITAN environment:

- The Flora Database is currently housed in an Oracle environment which precludes direct integration into the TITAN environment. Copying the data across to the TITAN environment will enable the full integration of the census data with ADHERB (eg using census data as a lookup table for validating species names).
- Giving Herbarium staff access to the Flora Database as well as CENSAP would require training in two different database and user interface environments for access to the same information.
- Having a local copy of the census in the TITAN environment will simplify the development of a single, integrated front end for PBIS.
- In the event that arrangements with NRG or DHUD should change, the CENSAP application will be available to readily become the primary source of census information for the State.

There are a number of methods by which data can be automatically exported on a regular basis from one hardware/software platform to another. These can include complete table copies or a drip feed system where only changed information is transferred.

R3: *It is recommended that the Herbarium continue to use and support the Flora Database as it currently stands, and that data be provided to the Herbarium in an appropriate format and with appropriate filtering for entry into the CENSAP database.*

Specific Activities

1. Herbarium to employ TITAN contractor to investigate and implement most efficient way to transfer data from the Flora Database to CENSAP and to develop specifications for data transfer. Transfer should be fully automatic, requiring no user interaction and provide for minimum lag time as per Herbarium specifications
2. DHUD staff to write scripts for downloading data into transfer format as per specifications from contractor
3. Specify to TITAN contractor that existing links between ADHERB and CENSAP, CAVP and APNI are fully operational.

4.1.3 Future availability of DHUD resources

Resources for maintaining the Flora Database are directed to DHUD and NRG rather than the State Herbarium. In particular, DHUD provide both computing and system development resources to maintain the Flora Database. While there has been a service level agreement between the two departments, it is a political reality that, from time to time, departmental priorities are reviewed. It is inevitable that, at some stage in the future, this relationship might be altered or even downgraded.

The Account Manager for the Botanic Gardens has indicated the willingness of the Resource Information Group to oversee any migration of both the Survey and Flora databases to DENR, should this be required. Whilst there is no need for action at this stage, the Herbarium and NRG need to keep a watching brief on the situation.

4.1.4 Ensuring data provision and quality

The Flora Database is currently compiled by a taxonomist from within Resource Management Branch (Dr. P.J. Lang) in consultation with the a representative from the Herbarium. However, the Flora Database has essentially been driven by the needs of the Biological Survey Group rather than as a project owned and maintained by the Herbarium. As a consequence, there is a potential for Biological Survey priorities to be implemented without sufficient regard for Herbarium priorities.

While we are not aware of instances where this has happened, it is important that the custodians be involved in any decisions affecting taxonomic information and the functioning of the Herbarium's information systems.

> ***R4:*** *It is recommended that a standing committee, composed of representatives from the State Herbarium, NRG and DHUD, meet as required to oversee any changes to the Flora Database that may impact on Herbarium or NRG operations.*

Obviously, the requirements of key users of taxonomic information must be taken into account in how the Herbarium manages these data. Any modifications to the existing database, as a result of custodial requirements, must not preclude existing functionality provided to the Biological Survey Project, given this project provides most of the resources required to maintain the census.

4.1.5 Capturing taxonomic changes

It is an important function of the State Herbarium to capture, maintain and disseminate authoritative taxonomic information. Tools are available to assist in the dissemination and utilisation of that information to help maintain the value and integrity of corporate and project-based databases containing species names. Therefore, it is important the taxonomic information held within the Flora Database be compatible with such tools.

Additionally, if the Herbarium chose to use species editing tools such as SEDIT in the future, some enhancements to the Flora Database might be required to facilitate its use. Tools such as SEDIT can be not only used within the Herbarium, but offered for distribution to external agencies or private collectors. In so doing, reliance on the provision of authoritative data from the Herbarium is increased along with the Herbarium profile.

For example, SEDIT can take advantage of historical taxonomic information including currency, misapplications, exclusions, and taxonomic and nomenclatural synonymy, where captured in the census database. It can display this information in a hierarchical manner allowing the user an insight into the taxonomic history of the names. Currently, the data model underlying the Flora Database can supply only a limited amount of this historical information.

In this context, we examined the underlying data model of the Flora Database for its potential use with SEDIT. In our opinion the current model could be used with SEDIT. However, there are some limitations preventing the full exploitation of SEDIT's capability in displaying taxonomic history. To supply such information would require a change in the data model.

R5: *It is recommended that the Herbarium evaluate the use of tools such as SEDIT, and* if *extra information is needed to be captured, then requests for change to the Flora Database can be made via the Standing Committee (see previous recommendation)*

Specific Activities

1. Herbarium to evaluate the use of tools such as SEDIT.
2. Negotiate for acquisition and/or customisation of tool to suit Herbarium requirements.
3. Obtain data model specifications for the species editing tool chosen and determine any additional information to be captured.
4. Request, via the Standing Committee, for modifications to the Flora Database to cater for additional information requirements.
5. DHUD programmers to modify the Flora Database appropriately.

4.1.6 Access to CENSAP

Herbarium staff indicated it would be of great benefit to have online access to CENSAP. By making CENSAP more generally available within the Herbarium, staff could more easily keep themselves informed of the latest changes to taxonomic information from a central, up to date source, with a consequent increase in productivity.

R6: *It is recommended that Herbarium staff should be given online query (i.e. read only) access to CENSAP, along with appropriate training.*

Specific Activities

1. Ensure PC resource available
2. Ensure PC has TELNET capability and access to CENSAP
3. Provide user with training

4.1.7 Simplification of CENSAP form

Herbarium staff have been encouraged to use a draft form for the capture of taxonomic changes for ultimate inclusion into CENSAP. There is a perception that the current form is too complex and time-consuming to use. As a result, few forms have been filled in to date.

It was expressed that the complexity of the form was necessary to fully capture associated taxonomic information. By way of comparison, a single page form has been used at the WA Herbarium for a number of years, which has operated successfully to capture essential information.

It may be the case that information currently required by the Biological Survey, such as conservation status, is not needed by CENSAP. While it is an appropriate role for scientists to assess and recommend conservation status, this function does not have to be associated directly with the CENSAP form itself.

If the form were simplified, by prioritising the essential information to be conveyed, this would encourage more staff to use it.

R7: *It is recommended that a new, simpler form be designed which reflects Herbarium priorities and has the approval of a majority of staff.*

Specific Activities

1. Form a working group comprised of botanists and technical staff to develop and consensually agree on a simplified form
2. Assign a group member with word-processing experience the task of entering proforma
3. Distribute to staff for comment and modify accordingly.
4. Submit to management for approval
5. Implement procedures for the timely delivery of forms to the Flora Database operator. (This could be in either paper format or via email.)

4.1.8 Producing a printed Census

A number of staff identified the desirability of producing another edition of the census. To date, this has been prevented solely through lack of financial resources.

Currently, there is still the existing capability for generating the Census from the Flora Database, both as a hardcopy and as the primary input into a published document so long as all relevant taxonomic history has been captured.

By maintaining the Census locally in CENSAP, as has been recommended, a printed census or other species lists, can be more easily produced, subject to available funding. By taking full control of the process, without need for the involvement of other agencies, the State Herbarium can further affirm its custodianship of the census.

R8: *It is recommended that the State Herbarium evaluate the feasibility of producing the printed census directly from CENSAP as per Herbarium specifications.*

Specific Activities

1. Determine requirements for printed census
2. Seek advice from Knowledge Engineering as to the capability of TEXPRESS to create the census as required.

4.2 ADHERB SPECIMEN DATABASE

(Core Business 2 - Objective 2.1 - Programme 2 - Development of the Specimen-vouchered Database of South Australian Plant Biodiversity)

The ADHERB Specimen Database has been developed over the last seven years predominantly through the efforts of Dr W. Barker, Senior Botanist at the State Herbarium. Under his custodianship and administration the database has developed into a sophisticated tool for the capture and validation of specimen label data, and some 95,000 records have been entered to date.

It is clear that this database is of prime importance to the state's plant biodiversity research programmes as the authoritative source of vouchered species distribution and ecological information.

It can not be stated too strongly that the only truly reliable source of biological information concerning the distribution, habitat or ecological occurrence of a species is one based on consistent and rigorous vouchering of well-collected plant material in a state herbarium with high quality identification and curation, and access to taxonomic specialists.

Conversely, non-vouchered site or opportunistic records, while of use as an ancillary dataset, are prone to degradation in accuracy of identification with time, as there is no reliable method to maintain currency with advances in taxonomic knowledge. See Appendix 5 (Marchant 1996), for a recent discussion on the value of specimen vouchering.

4.2.1 Specimen Data Entry

In order to raise the profile and perceived utility of ADHERB to staff in the Herbarium and the rest of DENR, as well as other potential customers, it is essential that the database grows to include a greater percentage of the specimen collection.

> ***R9:*** *It is recommended that the highest priority be given to herbarium specimen data capture.*

There are a number of strategies for increasing the data entry rate, even apart from the obvious employment of additional database operators. The following strategies, which individually may have modest impact, when implemented as a whole, should significantly improve the data capture rate. These are most readily categorised by whether the material to be databased is drawn from the existing collection backlog or from new material entering the herbarium for the first time.

4.2.1.1 Herbarium specimen database backlog

Firstly, to aid in increasing the data capture rate, it may be useful for the Herbarium to consider prioritising label information for entry into the database.

It is our experience in PERTH that the fields most often queried are: Sheet No., Genus, Species, Collector, Collectors No., Locality. While we are not inferring that this is the only information people require, it should be noted that in AD, as is the case for most herbaria, there is little extra label information on many of the older specimens to that specified in the above fields.

Therefore, it may be an acceptable strategy to define a set of core fields for databasing a specimen. To this set we would include latitude and longitude and fields necessary to encode and calculate geocode (eg. Nearest named place), as well as the NSXCode in the Flora Database. A flag indicating that more label data exists on a specimen would also be essential.

While this strategy implies that many of the more recent records will be incomplete in the database, at least the core information is available for use and the specimen can be a part of other curation strategies involving the database. As funds become available at a later date, or when the core data capture policy is reviewed, the incompletely databased material can be identified and updated.

Secondly, while observing use of the existing form it became apparent that general navigation through the form comprised a significant component of the data entry process for each record. Dr Barker subsequently confirmed that up to 40 key strokes could be eliminated by a rationalisation of the form.

Additionally is may also be helpful to group the identified minimum core fields together on a single screen of the form.

R10: *It is recommended that a working group be established to consider the selection of an appropriate set of core fields to enter for each specimen and enter* only *those fields for existing collections.*

Specific Activities

1. Establish the 'Core Fields' working group
2. Discuss and agree on core fields
3. Submit to management for approval
4. Redesign insertion form to minimise keystrokes and group core data fields together as appropriate
5. Instruct staff accordingly.

Another area for improvement is in taking advantage of existing curatorial procedures where material is already being removed from the shelves. If the work flow were modified to incorporate the databasing of core fields from each specimen label, this would represent only a modest increase in overall processing time.

In particular, outgoing loans and specimen re-determinations could be targeted with this strategy.

progress could be displayed as a graph in the databasing area, providing a focus for recognition of the project and its progress.

If a number of people are involved in the exercise, target setting, together with the above visual indicators of progress, provides a positive environment for working as a team, which adds its own momentum for progress. This can also provide feedback to people not directly involved, thus giving further recognition to the efforts of team members.

It is also possible to encourage staff by the provision of incentives. A simple example of this from PERTH: a senior manager in the Division promised to take the database staff to lunch when a major databasing target was reached.

4.2.2 Specimen Labels

It is important to acknowledge the need for quality control in databasing processes. Quality and accuracy of data entered, rather than speed of entry, should be emphasised. This said, we feel that trivial typographical errors in a database record, while unfortunate, do not generally reduce the information content therein, and should not be seen as a reason to retard label production and subsequent specimen incorporation.

R16: *It is recommended that printed specimen labels should be produced at the time of databasing the specimen and without a secondary editing phase.*

Furthermore, we understand that there is already a large backlog of records in ADHERB requiring labels. It has been estimated that some 50% of these records could move to the label production stage if the above recommendation is adopted. The remainder of these records appear to require some further work before labels can be produced and the specimens incorporated.

R17: *It is recommended that the label backlog be prioritised for label production and a strategy for handling the more problematic records developed.*

Simple tools exist within the Unix operating system underlying ADHERB, which could be co-opted to aid data entry accuracy.

R18: *It is recommended that the use of a spell-checking facility for ADHERB text fields to investigated.*

Specific Activities

1. Evaluate functionality of Unix 'spell' command
2. If acceptable, incorporate into ADHERB and train database staff accordingly.

TEXPRESS has enhanced functionality to utilise the Postscript language to format pages of label reports for printing. By utilising this new functionality together with a Laser printer, the quality of the resulting specimen label will be

enhanced to include more sophisticated character formatting, (bold and italics) and a greater degree of control over paragraph placement.

R19: *It is recommended that functionality within ADHERB be developed to enable Postscript printing of labels.*

4.2.3 Database Platform

The TITAN database system is the corporate database environment and it is important that currency of the system is maintained. Upgrading existing TITAN databases to TEXPRESS will ensure stable ongoing support by Knowledge Engineering, as they are phasing out support for all versions of TITAN by the end of 1996.

While there are no obvious differences between the TITAN and TEXPRESS interface, the underlying structure of the database engine has been significantly upgraded to work more efficiently. Also, TEXPRESS databases can take advantage of new interface modules such as TEXHTML, TEXODBC, TEXQL and TEXAPI. The modules provide significant additional functionality to TEXPRESS databases by allowing alternative GUI interfaces to be programmed, or enabling connectivity with other relational databases.

Version upgrades are included in AD's existing maintenance contract with Knowledge Engineering and so are cost-neutral. The TEXQL and TEXAPI modules can be included at no initial cost in the new TEXPRESS licence once the upgrade is effected, however, licensing these new modules will increase the quarterly maintenance fee.

R20: *It is recommended that an immediate upgrade to the latest version of TEXPRESS be effected.*

4.2.4 Barcoding of specimen sheets

While we recognise the benefits of bar-coding at our own institution, implementing such a system on top of a pre-existing sheet numbering system is not a trivial exercise.

Barcoding presents significant advantages to both the daily handling of material and the long-term maintenance of the collection. Some advantages of adopting a barcode system for handling herbarium specimens are:

- a single machine-readable number which takes the role of sheet identifier and database record key value,
- simplified error-free query of the database by sheet number, while still maintaining the ability to key the sheet number when a barcode reader is not available,
- presence of a barcode provides simple identification of sheets already databased,

- streamlined and error-resistant specimen recognition for entry and editing,
- extremely useful in work scenarios such as return of loans, where large numbers of records can be quickly accumulated without keying error and flagged as returned, thereby allowing missing loan material to be quickly discerned.

Difficulties with adopting a barcoding system once a sheet numbering system and specimen databasing are in place include:

- associating the barcode with existing databased and incorporated specimen sheets can be difficult and time-consuming,
- deciding on appropriate methods for barcoding new as opposed to existing specimen sheets; ie. pre-printed barcodes *vs* barcodes generated at time of databasing; generation and mounting of barcode strips *vs* the barcode printed on new specimen labels.

We recommend a working group to oversee the evaluation and implementation of such a major task. We envisage that this working group would contain members from both Database and Curation Committees.

R21: *It is recommended that the State Herbarium evaluate the adoption of specimen barcoding as a core strategy for maintaining the Herbarium collection efficiently.*

Specific Activities

1. Form a 'Bar Code Conversion' working group
2. Agree on required functionality of the bar coding system
3. Investigate the functionality within TEXPRESS to allow the printing of barcodes within a specimen label for new collections or as a separate barcode label for existing herbarium collections
4. Submit to management for approval
5. Modify database system to be able to generate bar codes. (This may require additional hardware depending on the solution adopted.)
6. Train database operators and curation staff on new procedures.

4.2.5 Exchange specimens

The State Herbarium participates in a specimen exchange program with a number of other national and international herbaria. For outgoing exchange material, this process provides an opportunity to capture the specimen data from the replicate remaining in AD, in line with a previous recommendation. It also serves as an integrated method of preparing the documentation accompanying the exchange material, as well as the ongoing compilation of statistics on the exchange program for use in yearly reports and reviews.

Incoming exchange material should also be databased as recommended, but at least for material emanating from other Australian herbaria, some opportunities exist for automating the data entry process.

HISPID (Herbarium Information Standards and Protocols for the Interchange of Data), exists as a working standard facilitating the interchange of specimen data between Australian herbaria. Now that actual data exchange has begun between some herbaria (HISCOM, 1996), and the latest HISPID standards document is to be published shortly, it is possible for AD to take advantage of this as a way of automating data entry for incoming exchange material.

Once methods for importing HISPID exchange data into ADHERB are established, it is possible to envisage their use in other ways. For example, all Australian herbaria have established a specimen database and most contain a considerable number of records, some of which are of duplicate AD material previously distributed. Data repatriation for subsets of the State Herbarium collection not yet databased could be negotiated with other Australian herbaria, perhaps under the auspices of CHAH.

R22: *It is recommended that the State Herbarium participate in the digital exchange of specimen data utilising the HISPID standard format.*

Specific Activities

1. Develop data import grammars to ADHERB, and HISPID-style reports from ADHERB
2. Develop and document new procedures
3. Train database operators and curation staff on new procedures.

4.2.6 Loans Management

Outgoing loans is another area where advantage can be taken of material, being gathered from the herbarium collection, can be databased prior to packing and dispatch.

Apart from aiding the long-term goal of completing the databasing of the collection backlog, time previously spent compiling packing documentation in other ways can be put towards databasing each sheet, from which the packing information can be subsequently generated as a database report.

When databased loans are returned, further time can be saved by utilising the database as a tool for managing loans, so that querying and reporting on loan status for individual records, or partial returns is at least semi-automated. Combined with the implementation of specimen barcodes, this approach can have a major impact on loans management procedures.

Finally, if such an approach were adopted, advantage can then be taken of the National Herbarium of NSW's *Loans Management System*, a TEXPRESS-based application for automating the management of outgoing

and incoming loans, which is being freely distributed to compatible Australian herbaria.

R23: *It is recommended that the State Herbarium enter specimen data for outgoing loans into the ADHERB database, and investigate the use of the Loans Management System to further aid in automating loans management.*

Specific Activities

1. Evaluate the integration of NSW's Loans Management System
2. Modify existing outgoing loans protocols to include databasing
3. Develop appropriate loan reports
4. Train database operators and curation staff on new procedures.

4.2.7 Specimen Identification Service

The State Herbarium performs a significant number of specimen identifications 'over the counter' each year. This involves identification by specialists and small enquiries can often be handled on the spot. Larger enquiries which can't be serviced immediately, require a method for tracking progress and outcome. Therefore a simple management system enabling the enquiries to be logged and the recording of contact details, tracking its progress, simple reporting, printing correspondence and audit reporting would be desirable.

There a number of alternative solutions, but two have precedence because they integrate with other recommended strategies and could be delivered at the ID service counter. Firstly it would be possible for a tool such as SEDIT to be used for logging over the counter queries. SEDIT would allow easy, error-free access to plant names and data entry into user-defined fields appropriate to the ID service.

Alternatively, a small TEXPRESS application could be written which had similar functionality to the SEDIT option, but would perhaps integrate more closely to ADHERB if identified material was subsequently kept for incorporation to the main collection.

R24: *It is recommended that the State Herbarium evaluate the use of software to help manage the front desk identification service.*

4.3 PLANT BIODIVERSITY INFORMATION SYSTEM

(Core Business 2 - Objective 2.1 - Consolidate and further develop the South Australian Plant Biodiversity Information System through integration of knowledge outputs from the State Herbarium)

The *Plant Biodiversity Information System* (PBIS) aims to be an integrated and easily accessible source of authoritative information on the indigenous and naturalised flora of South Australia with particular reference to taxonomy, nomenclature and distribution. In time it is intended that descriptive information be introduced.

While the CENSAP and ADHERB databases are the primary components, it should also include links to the living collections and library services information systems. As all the Botanic Gardens Group's major corporate data bases exist in a TITAN environment, then our discussion below on implementation of TEXHTML is relevant across the board.

4.3.1 Development of a PBIS Database Interface

Currently, PBIS consists of two major corporate databases on a single computing platform, however, it requires further development in order to be perceived as an entity in its own right. Some obvious drawbacks are that:

- it does not provide a single readily-recognisable front end,
- the interfaces are text-based and not attractive, easily used or learnt,
- it requires specific access protocols (login and password),
- it cannot be accessed widely throughout the Department or by its target audience (who are not clearly defined).

An integrated user-friendly front end is required to clearly embody PBIS as an identifiable entity with a defined purpose and client focus. It is our conviction that the most appropriate direction in which to develop this interface is using the tools commonplace now throughout the world for accessing the Internet, specifically the World Wide Web.

There are many advantages to providing a uniform interface via a scalable and extensible paradigm such as the Internet's World Wide Web. The same interface, once developed, can be viewed on any connected graphical computing platform and within or beyond the departmental network.

The State Herbarium is well-placed to implement such an interface because the main PBIS components, ADHERB and CENSAP are implemented in a database environment (TITAN/TEXPRESS) where methods for developing a Web forms query and retrieval interface (via TEXHTML) have been available for some time and are actively being developed.

R25: *It is recommended that the State Herbarium develop an HTML interface to the PBIS.*

Specific Activities

1. Obtain a 6 (or preferably 12) month evaluation license for Knowledge Engineering's TEXHTML module. (Note that final purchase price of the TEXHTML module is $10,000.)
2. Negotiate for a 2 or 3 day visit from a KE staff member to enable the TEXHTML module
3. Set up an HTTP daemon to enable the database computer to serve HTML document requests
4. Set up some query interfaces into all the TEXPRESS databases comprising the PBIS, but at least ADHERB and CENSAP
5. Provide training in the modification of integral files during this period as well. (Cost of on-site support from KE is $1000 per day, plus travel and accommodation.)

Note that this recommendation can only be implemented after effecting the upgrade from TITAN to TEXPRESS (ideally timed with another Adelaide KE customer site visit to share transport costs).

4.3.2 Botanic Gardens and State Herbarium Intranet Site

Concurrent with implementation of the PBIS interface, however, planning of the PBIS delivery mechanism must take place. In order for the proposed PBIS Web interface to be more widely available, a site for the Botanic Gardens and State Herbarium Group would need to be developed.

It is common in early stages of web site development to make the content visible to a closed audience, rather than the whole Internet. This is most commonly achieved by setting the site up as an 'Intranet' site, whereby only users on the corporate local or wide area network can see it.

A prototype Intranet site would not be difficult to set up and need only consist of a few pages initially in order to provide a framework for presentation of the PBIS TEXHTML database interface.

Once the prototype is up and working it can be used to provide 'proof of concept' presentations to managers within DENR. Other groups in the Department (such as RIG) have considerable experience at setting up their own Intranet and Internet sites, and so a departmental framework already exists for providing the context for a Group Intranet site.

R26: *It is recommended that a prototype Botanic Gardens and State Herbarium Intranet site be developed, in line with DENR's current Application Development Framework (Draft 0.5, August 1996) and following DENR's general Internet Policy and Standards (April, 1996).*

Note that the provision of copyrighted information may be subject of concern for the provider. This aspect is covered within the DENR Internet Policy and Standards document.

4.3.3 Descriptive Information

While specimen label and plant names information will provide the initial content for PBIS, it is important to look further ahead and plan to integrate other types of information into the system. The creation of authoritative plant descriptions for the State's flora is a clearly identifiable area of expertise in the State Herbarium. An interactive system such as the Web presents great opportunities for delivering authoritative and maintained flora descriptions as part of the Plant Biodiversity Information System.

Plant descriptions may be sourced from existing or new DELTA datasets or existing electronic documents such as the Flora of South Australia archive files, and current descriptions from the State Herbarium's taxonomic journal. While the translation of word-processed or typeset descriptions to HTML is not difficult it will be time-consuming and does require some detailed training. On the other hand DELTA, an international coding standard, can be employed to provide this functionality. The DELTA translation software now enables the automated production of HTML pages with index page and so, for existing datasets, will only require an investment in learning the methodology for implementing automated translation.

It is our opinion that while packages (such as *Viridans*) are an attractive method of packaging basic flora information it is still a fundamentally static method of publishing species data and its species mapping is flawed.

Unless close links are made with custodial institutions such as the State Herbarium to source current distribution and taxonomic data, its species distribution maps will remain vulnerable to error for the reasons presented above (page 13) on the accuracy of non-vouchered identifications.

We believe that at this time it is more productive to concentrate on fundamental data capture and interactive delivery of information over the Web. Packaging of information into static products can still be achieved where appropriate in this model, but primary effort must be focussed on the accumulation of authoritative expert knowledge in a maintainable on-line environment.

4.3.4 Spatial Display and Analysis

Specimen data almost always have associated geocode data and therefore lend themselves to graphical display and, potentially, spatial analysis.

The display of specimen distribution was identified by a number of staff as highly desirable, both to disseminate specimen information in an attractive format and also as a tool to validate locality information.

Because most mapping packages rely on proprietary data storage formats, it is necessary for data to be exported from TITAN and converted into the appropriate format. Though it is possible to exploit technologies such as the World Wide Web to display spatial information, the techniques are not yet mature enough to be easily implemented. At this stage a mapping package such as MapInfo or ArcView is the preferred way of viewing spatial information.

Also required are base map layers as per Herbarium specifications (eg coastline, roads, protected areas, Herbarium regions).

R27: *It is recommended that the entire ADHERB database be exported, on a regular basis, to an external format for visualisation.*

Specific Activities

1. Select which mapping package to utilise (preferably one compatible with Arc/Info coverages)
2. Employ consultant skilled in specified mapping package
3. Export the data to an external file and convert to appropriate format
4. Obtain required topocadastral base map data for whole of South Australia (and wider areas where required) and gazetteer from Resource Information Group in required format and with arrangements for periodic updating
5. Consultant to customise mapping package to facilitate easy display of points over base map, particularly optimisation to select points of particular species or collector.

This scenario could be best achieved by taking advantage of Arc/Info software and expertise held at RIG. Arc/Info processes could be implemented to provide automatic conversion of data from TEXPRESS to ArcView shape files. (This access need not impact on RIG by utilising their software and hardware through automated processes outside normal business hours.) These files could be then made available locally at the Herbarium.

Note that once these basic coverages are available, other spatial analyses may then be possible.

4.3.4.1 Mapping Software Standards

A range of mapping softwares are available from off-the-shelf and in-house sources. DENR has flexible standards environment which encourages the use of most commercially available packages (though with a leaning to those packages directly accessing or supporting Arc/Info coverages).

It is our opinion that commercially available packages should be used, where possible, in preference to in-house packages. There is a huge demand for commercial desktop mapping packages, ensuring continual improvement and support for the software.

Software developed in-house should only be considered if it provides certain functionality not currently or likely to be provided by commercial software.

4.3.4.2 Training

Though most commercially available mapping packages have become relatively easy to use, there is still a reasonable learning curve involved. Users ought to be familiar with basic geographic and mapping concepts to make best use of the software.

R28: *It is recommended that the State Herbarium negotiate with Resource Information Group for the availability of in-house or external training courses for specified mapping software.*

5. DISCUSSION OF MANAGEMENT ISSUES

Many of the issues raised during the consultancy period, while having direct relevance to one or more of the three priority areas discussed above, also have broader management implications. In order to effect real change in response to a reworking and improvement of the IT environment we would make these observations and recommendations regarding staff management in the State Herbarium.

5.1 Communication

In times of change and with implementation of new IT strategies it is crucial that all staff have one or more focussed forums for communication, allowing contribution to the development of new procedures and protocols, and the sharing of information and skills in a non-threatening environment.

While we recommend regular general staff meetings should be put in place, we particularly see the need for the formation of a small number of groups or committees to deal cooperatively with finding solutions to implementing change in the following areas.

We envisage that the Committees would be standing committees providing a regular and ongoing forum for the discussion and resolution of major institutional issues as they arise. Although the core members of these committees may need to be explicitly identified it is expected that the meetings will be open to all staff to participate as needed.

In contrast, committees will spawn Working Groups with a defined membership and lifespan, in order to resolve specific issues and report back to the main committee on its findings.

Committees and Working Groups recommended in this document are the:

1. Database Committee

    - CENSAP Form Working Group - to discuss and finalise the simplification and amalgamation of the existing CENSAP forms.

    - ADHERB Core Fields Working Group - to identify and agree on a minimum set of specimen label fields to be databased in order to facilitate data entry into ADHERB.

2. Curation Committee

    - Barcode Conversion Working Group - to evaluate the options for implementing a barcode system for the State Herbarium and recommend a workable solution.

5.2 Information Technology Support and Training

The ability of the Herbarium to retain its profile as an institution of excellence in research and as a provider of timely and expert information has become increasingly dependent on its efficient and effective use of Information Technology (IT). This has been reflected in the increasing use of and dependence on database and analysis software within the Herbarium.

As a consequence, many curatorial procedures and protocols have been, and are being, modified to accommodate the use of IT with the Herbarium's work flow. This has place a greater demand on staff to increase computer literacy so that best use can be made of the IT resource.

As these demands have increased, IT support and training have become major issues of concern for staff. Some staff have taken up IT skills with a greater enthusiasm and ease than others, leading to an uneven distribution of skills. Because of this, and because of limited resources, this has led to the unfortunate situation of some staff being treated as de facto IT support for the rest of the Herbarium.

Furthermore, for historical reasons and because of limitations in resource, one staff member has effectively been operating as database administrator for the last five years, even though his official position is Senior Botanist. Dr. W. Barker, without any formal training, has learnt TITAN and Unix functions sufficiently to have designed and created TITAN databases, designed forms and reports as well as performed database and Unix system maintenance functions.

As a result, the Herbarium now has indispensable systems such as ADHERB, CENSAP and a range of other supporting databases, each of which placing greater demands on Dr. Barker for system support.

At a time when there is little enough resource available for taxonomic research within the Herbarium, it is unsatisfactory for this situation to continue.

In addition to the requirements of system development and maintenance, is the increasing requirement for business systems analysis. The number of Herbarium Information systems is growing along with the requirement for effective system integration. The requirements of staff for greater access to those systems is also increasing, along with the need to provide information in a variety of ways. As system complexity increases, so does the need for the Herbarium to plan effectively, to assess its IT requirements and to regularly review and update its information systems.

In our opinion it is unreasonable to expect these demands on Dr. Barker. We believe there is a strong business case to support the provision of IT support at the business analyst and system design and development level. (Though these are essentially two different types of expertise, it should not be difficult to find personnel with both types of skills.)

The justification and requirement for a business analyst position in each major section within DENR has already been identified by RIG.

In the first instance there is a demonstrated case for a full-time position to assist in the development of an IT plan and consequent system development. Once the initial planning stages are complete, and once major system development has been completed, the full-time nature of this position could be reviewed.

From our experience, however, systems always increase in complexity. As user demands are satisfied, new ones are created. Hardware and software technology is continuously changing. It is much more likely, that, at the end of planning and development stages, the need for a continuing full-time position will be self-evident.

Because there is little likelihood of finding personnel skilled in TITAN database management within Adelaide, TITAN system administration training will be required.

R29: *It is recommended that the State Herbarium appoint, on a contract basis, a suitably skilled business analyst and systems administrator*

Specific Activities

1. Define job description (skills will be required in Unix, Oracle, client-server methodology)
2. Advertise for and appoint position on initial six-month or one-year contract
3. Send for TITAN training
4. Develop and refine IT plan based on Herbarium requirements
5. Implement system redevelopment
6. Review position and apply business case for a permanent position if required.

5.2.1 Desktop access, support and training

As staff are granted greater access to IT systems, the need for access to PCs and desktop PC support and training will increase.

The level of availability for current-model PCs is limited within the Herbarium. It has already been stated within the draft IT plan for the need for PC access for all staff. We reaffirm this need as crucial to the effective and efficient operation of Herbarium business.

R30: *It is recommended that the State Herbarium should plan and budget for the acquisition of a PC for every staff member requiring access to IT systems or desktop functions (eg word-processing).*

We believe there is a justifiable case for providing a desktop support position on a part-time basis. This could be filled externally. Alternatively, a position could be shared between other groups within DENR.

One other option is to investigate the willingness of existing technical staff to take on a part-time desktop support role. At least one staff member has already demonstrated an aptitude for PC technology. With extra training, this may obviate the need to find extra resource to appoint someone externally.

R31: *We recommend the appointment of a part-time desktop support position.*

Specific Activities

1. Investigate possible sources for a desktop support position
2. Appoint position and provide extra training as required.

6. COMMENTS ON IMPLEMENTATION STRATEGY

This section makes comment on components of the DENR Implementation Strategy relevant to the Botanic Gardens of South Australia and State Herbarium (Appendix 4).

We make reference to the components of the Implementation Strategy using the Activity name and Reference No. indicated at the top of each page of the Strategy. We have ordered each Activity and our comments on it in sequence, according to our perceptions of the ideal order of implementation. Of course, as indicated by the existing Implementation Strategy, timing of certain Activities will necessarily overlap.

6.1 Upgrade Hardware and install Local Area & Wide Area Network (7.2)

All components of the PBIS require robust digital communications within the Botanic Gardens and State Herbarium and between it and DENR and other agencies. Hence implementation of this Activity has prime importance in the short term and must be completed in order for other activities to become functional. While it appears that LAN implementation and connection to the DENR WAN is well underway, staff must have ready access to these networks in order to utilise PBIS and therefore distribution of client hardware and software must also be prioritised.

Relevant recommendations in this document: R6, R30

6.2 Engage IT Systems Officer (7.3)

It has been clearly identified that a full-time IT Systems Officer is needed to directly manage and implement the upgrading and extension of the PBIS in its most general sense. This position will by its nature have broad scope and will include database management, systems analysis, technical liaison within and beyond the Department, interface design and PC and network support. This position will needed to be supplemented at times with specific support for the TITAN databases, and general PC support.

In particular, the IT Systems Officer would be immediately and directly involved with the TITAN database upgrades as part of their initial information transfer and skills development.

Relevant recommendations in this document: R29, R31

6.3 Update and Integrate Information Systems (7.1.2)

This is the Activity containing the bulk of the PBIS work. Ideally the Project Steering Committee would include the newly appointed IT Systems Officer so as to familiarise them fully with the nature of existing systems and the plans for their updating and integration into the fully-fledged PBIS. However, much of the urgent work has already been well-identified and can be performed by a TEXPRESS consultant. If the IT Systems Officer has been appointed then working closely with the consultant would be an important part of their on the job training, but this aspect should not delay the urgent upgrade components.

Relevant recommendations in this document: R3, R8, R14-15, R20, R22-28

6.4 Implement DENR Corporate Systems (7.1.5)

While not the focus of our review, this is Activity is clearly dependent on the establishment of robust LAN and WAN connections with the rest of DENR. Therefore, while initial applications requiring this connectivity may be administrative in nature, good use of the bandwidth can be subsequently made with the development of the PBIS interface on the DENR intranet and the access to GIS data and applications in areas such as RIG.

Relevant recommendations in this document: R26-28

6.5 Introduce Bar Code Facilities (7.1.3)

This Activity will require careful analysis of workflow effects, and planning for its implementation, which can be done in parallel with other Activities listed here. However, its success will be contingent, in part, on ready access to the enabling technology, ie. scanners, database connectivity and training, and as such is dependent on the outcome of previous activities.

Relevant recommendations in this document: R21, R6, R12

6.6 Implement New Systems (7.1.4)

There is a large amount of work involved in upgrading and integrating existing systems at the Botanic Gardens and State Herbarium, which involves, in part, a rethinking of the way clients will access the core information held by the agency. It is important to capture the motivation behind ideas for new systems, and have a forum for their consideration, evaluation and planned integration into the PBIS. However, implementation of new systems which would clearly be part of the PBIS, would be premature until the PBIS strategy is clearly developed.

7. RECOMMENDATIONS AND SPECIFIC ACTIVITIES

R1: *It is recommended that Herbarium management should communicate with senior management within DENR (and possibly DHUD) to affirm the role of the Herbarium as custodian of taxonomic information in South Australia.*

Specific Activities

1. The Herbarium must articulate and document clearly its custodial responsibilities
2. Investigate the appropriate forum to effect recognition of Herbarium custodianship. (There may be particular committees of relevance.)
3. Obtain written confirmation to that effect
4. Determine the Herbarium's functional requirements of the Flora Database (eg policies on inclusion, exclusion of particular names, interface requirements for CENSAP and SEDIT)

R2: *It is recommended that a Herbarium staff member with relevant expertise be nominated as the first point of contact for enquires regarding taxonomic information.*

R3: *It is recommended that the Herbarium continue to use and support the Flora Database as it currently stands, and that data be provided to the Herbarium in an appropriate format and with appropriate filtering for entry into the CENSAP database.*

Specific Activities

1. Herbarium to employ TITAN contractor to investigate and implement most efficient way to transfer data from the Flora Database to CENSAP and to develop specifications for data transfer. Transfer should be fully automatic, requiring no user interaction and provide for minimum lag time as per Herbarium specifications
2. DHUD staff to write scripts for downloading data into transfer format as per specifications from contractor
3. Specify to TITAN contractor that existing links between ADHERB and CENSAP, CAVP and APNI are fully operational.

R4: *It is recommended that a standing committee, composed of representatives from the State Herbarium, NRG and DHUD, meet as required to oversee any changes to the Flora Database that may impact on Herbarium or NRG operations.*

R5: *It is recommended that the Herbarium evaluate the use of tools such as SEDIT, and* if *extra information is needed to be captured, then requests for change to the Flora Database can be made via the Standing Committee (see previous recommendation)*

Specific Activities

1. Herbarium to evaluate the use of tools such as SEDIT
2. Negotiate for acquisition and/or customisation of tool to suit Herbarium requirements
3. Obtain data model specifications for the species editing tool chosen and determine any additional information to be captured
4. Request, via the Standing Committee, for modifications to the Flora Database to cater for additional information requirements
5. DHUD programmers to modify the Flora Database appropriately.

R6: *It is recommended that Herbarium staff should be given online query (i.e. read only) access to CENSAP, along with appropriate training.*

Specific Activities

1. Ensure PC resource available
2. Ensure PC has TELNET capability and access to CENSAP
3. Provide user with training.

R7: *It is recommended that a new, simpler form be designed which reflects Herbarium priorities and has the approval of a majority of staff.*

Specific Activities

1. Form a working group comprised of botanists and technical staff to develop and consensually agree on a simplified form
2. Assign a group member with word-processing experience the task of entering proforma
3. Distribute to staff for comment and modify accordingly
4. Submit to management for approval
5. Implement procedures for the timely delivery of forms to the Flora Database operator. (This could be in either paper format or via email.)

R8: *It is recommended that the State Herbarium evaluate the feasibility of producing the printed census directly from CENSAP as per Herbarium specifications.*

Specific Activities

1. Determine requirements for printed census
2. Seek advice from Knowledge Engineering as to the capability of TEXPRESS to create the census as required.

R9: *It is recommended that the highest priority be given to herbarium specimen data capture.*

R10: *It is recommended that a working group be established to consider the selection of an appropriate set of core fields to enter for each specimen and enter* only *those fields for existing collections.*

Specific Activities

1. Establish the 'Core Fields' working group
2. Discuss and agree on core fields
3. Submit to management for approval
4. Redesign insertion form to minimise keystrokes and group core data fields together as appropriate
5. Instruct staff accordingly.

R11: *It is recommended that a protocol be established prioritising the databasing of any specimen moving out of or into the collection.*

R12: *It is recommended that appropriate training be provided to technical officers and botanists so that simple database edits can be made by them without forwarding to the database operators.*

R13: *It is recommended that for new collections entering the Herbarium, the current practise of entering all label data into the ADHERB database be continued.*

R14: *It is recommended that the transfer of Biological Survey specimen data into ADHERB be automated.*

Specific Activities

1. Develop a data conversion scheme in conjunction with NRG and DHUD staff
2. Develop a holding database (equivalent in structure to ADHERB) for the Biological Survey data
3. Develop a simple automated methodology for importing data from the holding database into ADHERB as specimens are processed.

R15: *It is recommended that a PC package such as HERBIE be adopted for use by both internal staff and external clients .*

Specific Activities

1. Develop a strategy to implement the use of such a package
2. Develop appropriate TEXPRESS grammars and databasing protocols for entering ADHERB sheet numbers on receipt of the data files along with incoming specimens, to allow automated upload of the specimen data
3. Provide support and training to collectors using the package.

R16: *It is recommended that printed specimen labels should be produced at the time of databasing the specimen and without a secondary editing phase.*

R17: *It is recommended that the label backlog be prioritised for label production and a strategy for handling the more problematic records developed.*

R18: *It is recommended that the use of a spell-checking facility for ADHERB text fields to investigated.*

Specific Activities

1. Evaluate functionality of Unix 'spell' command
2. If acceptable, incorporate into ADHERB and train database staff accordingly.

R19: *It is recommended that functionality within ADHERB be developed to enable Postscript printing of labels.*

R20: *It is recommended that an immediate upgrade to the latest version of TEXPRESS be effected.*

R21: *It is recommended that the State Herbarium evaluate the adoption of specimen barcoding as a core strategy for maintaining the Herbarium collection efficiently.*

Specific Activities

1. Form a 'Bar Code Conversion' working group.
2. Agree on required functionality of the bar coding system
3. Investigate the functionality within TEXPRESS to allow the printing of barcodes within a specimen label for new collections or as a separate barcode label for existing herbarium collections
4. Submit to management for approval
5. Modify database system to be able to generate bar codes. (This may require additional hardware depending on the solution adopted.)
6. Train database operators and curation staff on new procedures.

R22: *It is recommended that the State Herbarium participate in the digital exchange of specimen data utilising the HISPID standard format.*

Specific Activities

1. Develop data import grammars to ADHERB, and HISPID-style reports from ADHERB
2. Develop and document new procedures
3. Train database operators and curation staff on new procedures.

R23: *It is recommended that the State Herbarium enter specimen data for outgoing loans into the ADHERB database, and investigate the use of the Loans Management System to further aid in automating loans management.*

Specific Activities

1. Evaluate the integration of NSW's Loans Management System
2. Modify existing outgoing loans protocols to include databasing
3. Develop appropriate loan reports
4. Train database operators and curation staff on new procedures.

R24: *It is recommended that the State Herbarium evaluate the use of software to help manage the front desk identification service.*

R25: *It is recommended that the State Herbarium develop an HTML interface to the PBIS.*

Specific Activities

1. Obtain a 6 (or preferably 12) month evaluation license for Knowledge Engineering's TEXHTML module. (Note that final purchase price of the TEXHTML module is $10,000.)
2. Negotiate for a 2 or 3 day visit from a KE staff member to enable the TEXHTML module
3. Set up an HTTP daemon to enable the database computer to serve HTML document requests
4. Set up some query interfaces into all the TEXPRESS databases comprising the PBIS, but at least ADHERB and CENSAP
5. Provide training in the modification of integral files during this period as well. (Cost of on-site support from KE is $1000 per day, plus travel and accommodation.)

R26: *It is recommended that a prototype Botanic Gardens and State Herbarium Intranet site be developed, in line with DENR's current Application Development Framework (Draft 0.5, August 1996) and following DENR's general Internet Policy and Standards (April, 1996).*

R27: *It is recommended that the entire ADHERB database be exported, on a regular basis, to an external format for visualisation.*

Specific Activities

1. Select which mapping package to utilise (preferably one compatible with Arc/Info coverages)
2. Employ consultant skilled in specified mapping package
3. Export the data to an external file and convert to appropriate format
4. Obtain required topocadastral base map data for whole of South Australia (and wider areas where required) and gazetteer from Resource Information Group in required format and with arrangements for periodic updating
5. Consultant to customise mapping package to facilitate easy display of points over base map, particularly optimisation to select points of particular species or collector.

R28: *It is recommended that the State Herbarium negotiate with Resource Information Group for the availability of in-house or external training courses for specified mapping software.*

R29: *It is recommended that the State Herbarium appoint, on a contract basis, a suitably skilled business analyst and systems administrator*

Specific Activities

1. Define job description (skills will be required in Unix, Oracle, client-server methodology)
2. Advertise for and appoint position on initial six-month or one-year contract
3. Send for TITAN training
4. Develop and refine IT plan based on Herbarium requirements
5. Implement system redevelopment
6. Review position and apply business case for a permanent position if required.

R30: *It is recommended that the State Herbarium should plan and budget for the acquisition of a PC for every staff member requiring access to IT systems or desktop functions (eg word-processing).*

R31: *We recommend the appointment of a part-time desktop support position.*

Specific Activities

1. Investigate possible sources for a desktop support position
2. Appoint position and provide extra training as required.

8. REFERENCES

Department of Environment and Natural Resources (April, 1996). Internet Policy and Standards.

Hendrick, Geoff (August, 1996). Application Development Framework (DRAFT 0.5). Department of Environment and Natural Resources.

Herbarium Information Systems Committee (1996). HISCOM96 Report and Recommendations to the Council of Heads of Australian Herbaria (CHAH).

9. GLOSSARY OF TERMS

AD	Index Herbariorum code for South Australian State Herbarium
ADHERB	Adelaide Herbarium Specimen Database
APNI	Australian Plant Names Index
CALM	WA Department of Conservation and Land Management
CAVP	Census of Australian Vascular Plants
CENSAP	Census of South Australian Vascular Plants
CHAH	Council of the Heads of Australian Herbaria
DELTA	Descriptive Language for Taxonomy
DHUD	Department of Housing and Urban Development
DENR	Department of Environment and Natural Resources
GUI	Graphical User Interface
HTML	Hyper Text Markup Language
KE	Knowledge Engineering, TITAN/TEXPRESS database developers
NRG	DENR's Natural Resources Group
PBIS	Plant Biodiversity Information System
PERTH	Index Herbariorum code for Western Australian Herbarium
RIG	DENR's Resource Information Group
SEDIT	Species Editing Software application developed by CALM
WAHERB	Western Australian Herbarium Specimen Database

10. INDEX

11. APPENDICES

1. Botanic Gardens of Adelaide & State Herbarium (23 August 1996). Background document for consultancy to assess Plant Biodiversity Information System, (includes Project Brief).

2. Botanic Gardens of Adelaide & State Herbarium (April 1996). Strategic Plan 1996/97 - 1998/99. Department of Environment and Natural Resources.

3. Botanic Gardens and State Herbarium (October 1995). Strategic Information Technology Plan, 1995/96 - 1997/98. Department of Environment and Natural Resources.

4. Department of Environment and Natural Resources (1996). Corporate IT Strategic Plan, Attachment 5 - Botanic Gardens and State Herbarium.

5. Marchant, N.G. (1996). Vouchering Science, Science and Information Division Newsletter 2/2. Dept Conservation and Land Management.

APP. 1

Botanic Gardens of Adelaide & State Herbarium
Department of Environment and Natural Resources

Background document for consultancy to assess Plant Biodiversity Information System

23 August, 1996

Consultants

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Paul Gioia, Information Science Section, Department of Conservation and Land Management, Perth

Coordinating team

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John Jessop, Chief Botanist, State Herbarium of South Australia (8228 2308)

Bill Barker, Senior Botanist, State Herbarium of South Australia (Consultancy Facilitator) (8228 2303; home 8271 3601)

Tom Mittiga, Manager, IT Planning and Development, Resource Information Group, DENR (Botanic Gardens & State Herbarium IT Accounts Manager) (8204 9010)

Housekeeping

Contact: Ms Tina Eadsforth, Secretary, State Herbarium (8228 2303)

Accommodation: Yarrabee

Project Brief

General outcomes

- A strategy for consolidation and further development of the South Australian Plant Biodiversity Information System through integration of knowledge outputs from the State Herbarium
- Recommended modifications to the DENR Implementation Strategy *(see DENR Corporate Strategic IT Plan 1996/97–98/99 of April 1996, Attachment 5)*

Specific advice to be provided on:

- Platforms for development of the various databases and communication of data
- How best to centralise and develop the State's Census of Plants CENSAP (State Herbarium the custodian) taking into account
    - ◊ that it is central to plant data sets in both the State Herbarium and the Biological Survey (the DHUD/NRG Flora database)
    - ◊ that the existing plant census database of the Biological Survey is based on the State Herbarium's census data. It has been recently shifted to an Oracle platform with a PowerHouse front end, also to be moved to Oracle. (Consult with P. Lang NRG taxonomist and S. Wheldrake DHUD programmer).
    - ◊ the needs of the State Herbarium and its existing specimen database ADHERB, currently a Titan 3.4 DBMS on a Unix platform
    - ◊ the need for data entry and editing by the State Herbarium staff as authorities on the State's flora
    - ◊ potential advances in putting the National Census in electronic form, compiled by specialists from around Australia
    - ◊ the desirability of automatic reporting to appropriate authorities through State Herbarium specialists of new records of rare taxa or of noxious weeds (by adding rare and weediness statuses to taxa to flag important records being entered into specimen database ADHERB)
    - ◊ the desirability of the introduction of a customer oriented package (such as SEDIT developed by the WA Herbarium) to indicate the areas of existing plant species lists that need upgrading through changing taxonomic knowledge as expressed in CENSAP (e.g. new or synonymised species, changing circumscriptions of species)
- How to refine and extend the State Herbarium's specimen record database ADHERB with particular attention to:-

- ◊ adequacy of the current version 3.4 of Titan DBMS given current and prospective resourcing and the advantages of upgrading to KE TExpress
- ◊ benefits from improved linking with CENSAP (some obvious changes needed)
- ◊ use of a PC based package (such as Herbie developed by the WA Herbarium) to encourage field workers to database their own data in a form that can be readily uploaded into ADHERB
- ◊ improvements to data entry form
- ◊ benefits and drawbacks of development of a specimen management system associated with ADHERB, including the introduction of barcoding, to deal with
  - * labelling (hardware and paper)
  - * exchange
  - * loans
  - * identification lists
- ◊ development of data interchange procedures conforming with HISPID data standards for handling exchange (past and future) and loans
- ◊ error checking, if possible at data entry stage
  - * spell checks
  - * geocoordinate checks (by comparing calculated with given, by use of mapping packages, use of BIOCLIM)
- ◊ research databases for specialists on staff (combine with ADHERB vs. keep separate and simple)

- Other taxon (species) based needs (linked to CENSAP and ADHERB), including:-
  - ◊ type register
  - ◊ images (photographic, line drawings, other artwork)
  - ◊ reference herbarium
  - ◊ other special purpose collections (pollen, seed, carpological, wet, etc.)
- Development of descriptive data sets and outputs (such as descriptions, interactive keys) on an individual (researcher orientated) or institutional (integratable) basis

- Developing a user friendly front end to the Plant Biodiversity Information System (via e.g. HTML, Access, TExpress) for:

    ◊ staff (data entry, editing, manipulation)

    ◊ customers

  This would include menu or button driven options to provide as seamless as possible production of :

    ◊ specimen or taxon-based reports (data dumps or specially formated outputs)

    ◊ distribution maps (printed or on-line, on LAN or WAN; GIS integration)

    ◊ other value added outputs such as cluster analyses (e.g. producing regions high in Plant Isolates indicating conservation priorities)

- Security, passwords, permissions on the various platforms, registration and user pay capabilities

- Interaction with other data sets (specimen based, taxon based), including:-

    ◊ Biological Survey data (Flora, Survey)

    ◊ National Census of Plants (see under CENSAP)

    ◊ databases in other herbaria

- Adequacy and integration of mapping packages: future needs and strategy (in-house, value adding for customers), taking into account capabilities elsewhere in DENR and DHUD (e.g. ArcInfo, MapInfo, Viridans) and resourcing required.

Form of Report

The report is required in a completed state at the end of the consultancy period, subject to agreed minor modifications.

It should take reference to the Project Brief and include the following information:

- Recommendations for a strategically directed plan for developing and expanding the Plant Biodiversity Information System to enhance data acquisition, maintenance and dissemination, taking into account existing and likely future resources
- The actions required to achieve these strategies, presented in a chronology reflecting dependencies and the Botanic Gardens & State Herbarium priorities
- Each actions to be provided with:
    - ◊ its dependence on other actions being achieved
    - ◊ the nature of the work required
    - ◊ an estimate of the time-frame and resources required
- Where there are alternative approaches to components of the plan an evaluation of the relative costs and benefits

In view of the short timespan of the consultancy, the various components of the project brief are to be dealt with according to the priorities set by the coordinating team in conjunction with the consultants.

Proposed Agenda (subject to change)

Sunday 25th August

6:45 pm. Bill Barker to meet Alex and Paul at Adelaide Airport (QF568 from Perth departing 2:35 pm)

Monday26th August

9:00 am. Meet Coordinating Commitee:

- Set priorities in Consultancy, with reference to Project Brief.
- Modifications to Agenda
- Other issues arising

12:00 noon: Tom Mittiga, RIG,
over lunch at Caffe San Marco, East Terrace/Rundle St

- DENR IT infrastructure: present and future (network diagrams)
- Other issues

2:00 pm: Ashleigh Coombs, Pastoral Management, Natural Resources Group, DENR (NRG's Departmental IT Advisory Committee representative) (8204 8854)
at NRG, Kensington

- Working in the DENR and DHUD IT environment providing user applications

Tuesday 27 August

9:00 am: Sally Wheldrake, Manager, Data Support Unit, Information Data Analysis Branch, Dept of Housing & Urban Development (8303 0618)
Peter Lang, Biological Survey & Research, Natural Resources Group, DENR (8204 8780)
Lee Heard, Geographical Analysis & Research Unit, Information Data Analysis Branch, Dept of Housing & Urban Development (8303 0697)
at Department Housing & Urban Development, 4th Floor136 North Terrace

- The Biological Survey's Flora (census), Survey (site record) and other data sets, their nature and potential for interfacing with the Plant Biodiversity Information System; concerns and ideas; other issues

1:30 pm: State Herbarium staff

- Presentation by consultants on specimen, census, descriptive and spatial data input, maintenance and dissemination (examples from WA Herbarium)
- Discussion

3:00 pm: Eva Kuzmanov
Helen Skuse

- Data entry: towards solving problems, concerns; ideas; other issues

4:45 pm: Graham Bell

- Data handling and curation issues; other issues

Wednesday 28 August

9:00 am: Dean Cunningham
Martin O'Leary
Helen Smyth
Helen Vonow

- Curation issues; other issues

10:45 am: Munir Abid
Graham Bell
Bob Chinnock
Hellmut Toelken
Tina Eadsforth
Gilbert Dashorst

- Research, documentation, identification, and general herbarium issues

5:30 pm: Australian Systematic Botany Society (SA Chapter) presentation (Visitors welcome)

Thursday 29 August

9:00 am: Coordinating Committee

- Progress and review of priorities

Friday 30 August

3:30 pm: Coordinating Committee

- Presentation of draft Report

Saturday 31 August

- To be used if needed

Sunday 1st September:

7:30 am. Bill Barker to deliver Alex and Paul to Adelaide Airport (QF561: departs 8:35 am Adelaide, arrives 10:20 am Perth)

Sites to be considered in assessment

Within the Adelaide Metropolitan area

State Herbarium of South Australia

This is the core site of the Plant Biodiversity Information System.

Botanic Gardens of Adelaide and State Herbarium, DENR

Two information systems impinge on the PBIS as well as other branches of the group.

- Library Services Information System
    - ◊ Bibliographic data sets being compiled (Titan, ? Access) or are shared (*Index Kewensis*)
- Living Collections Information System
    - ◊ Need for links to data (Census, Bibliographic) and applications (mapping) in the PBIS
    - ◊ Automatic link of data relating to wild-collected and cultivated vouchers for accessions and seed exchange programme.
- Conservation and Horticultural Research
    - ◊ Need for links to data (Census, Bibliographic) and applications (mapping, identification packages) in the PBIS
    - ◊ Use of the State Herbarium for housing vouchers
- Community and Education Services
    - ◊ Need for links to data (Census, Bibliographic) and applications (mapping, identification packages) in the PBIS
- Education Officer, Department of Education

A position in the Adelaide site of the Botanic Gardens for organising student tours and education material.

- ◊ Need for links to data (Census, Bibliographic) and applications (mapping, identification packages) in the PBIS

Biological Survey of South Australia

A joint operation of the **Natural Resources Group of DENR** and the **Information Data Analysis Branch of the Department of Housing and Urban Development (DHUD)**

A number of important data sets relate to or complement those of the Plant Biodiversity Information System. These are mainly held on Oracle platform. They include:

- Site record database (Survey). The survey is grid-based and therefore the taxa listed for each grid site are therefore pinpointed by geocoordinates. About 20% of taxon records are vouchered.

  Identifications for this survey provided by the State Herbarium number about 20 000 and are stored in a holding database ADID pending the development of an automated massaging of data from the Survey database for (semi-)automatic loading into ADHERB.

- Plant census database (Flora). This is the Oracle database from which the State Herbarium's CENSAP, currently on a Titan platform, has been derived.

- A database of vouchered off-site (opportunistic) records. These vouchers are (presumably) stored in the State Herbarium and would be treated in the same way as the Survey vouchers.

- A rare plant database containing population data. Are these vouchered?

Information Data Analysis Branch, Department of Housing and Urban Development

As well as providing the platforms for the Biological Survey databases, this group has a very strong ArcInfo capability. It has had a long commitment to quality mapping of physical and environmental data. This computing section is largely derived from the former Department of Environment & Planning.

Environmental Database Coordinating Committee

Chair is Dr David Goodwins with representation from the Botanic Gardens & State Herbarium. It's function is the documentation of data sets on the environment in broad terms and the facilitation of their coordination.

Natural Resources Group, DENR

- Resource Management
  - ◊ Biological Survey and Research
  - ◊ Coastal Management

- ◊ Pastoral Management
- ◊ Vegetation Conservation
- ◊ Wetlands Management
- ◊ Wildlife Management

- Land and Business Services
  - ◊ Reserve Planning
- Regional Offices (Parks, Reserves, etc.)
- State Heritage
  - ◊ Natural Resources Council
- Natural Resources Policy

Resource Information Group, DENR

Data Management Branch, Data Acquisition Branch

Strong ArcInfo and GIS capabilities; producer of aerial photographs, topographic and cadastral maps; aerial, cadastral and geodetic surveys.

Geographical Names Board, Data Management Branch

Produces the South Australian Gazetteer of Place Names, which is now integrated into the Australian equivalent (AUSLIG).

Utilises standard topographic maps for producing the grid references as the standard method of providing localities with geocoordinates.

The State Herbarium is accumulating a file from ADHERB of place names on specimen labels that are not in the South Australian Gazetteer. This has been forwarded once to the GNB.

AUSLIG Gazetteer has still to be acquired and linked to ADHERB.

Environmental Protection Authority, DENR

Water Resources Group, DENR

Animal and Plant Control Commission, Department of Primary Industries

Weed research, identification and control: information dissemination. Small herbarium, (?fully) duplicated in the State Herbarium.

Spatial Information projects, Office of Information Technology, Department of the Premier

A South Australian Government initiative

South Australian Museum

Department of Mines and Energy

Fossil data

Geological information

Universities

Botany Department, University of Adelaide

School of Biological Sciences, Flinders University of South Australia

Roseworthy Campus, University of Adelaide

etc.

Elsewhere in South Australia

Western Mining Corporation, Roxby Downs

Over the last decade a strong link has developed between the botanist involved in monitoring the vegetation of an extensive area of the arid regions between Roxby Downs and the Lake Eyre region. Duplicates of specimens in the company's herbarium are deposited in the State Herbarium.

Projected Arid Lands Botanic Garden, Port Augusta herbarium

A herbarium has been proposed for this establishment.

Interstate and overseas sites

Australian herbaria

Overseas herbaria

23 August, 1996

APP. 2

DEPARTMENT OF ENVIRONMENT
AND NATURAL RESOURCES

Strategic Plan

1996/97 - 1998/99

The Botanic Gardens of Adelaide and State Herbarium

TABLE OF CONTENTS

Marketing Strategies

Marketing Plan

The current marketing plan is focussed on specific segments of the operations including the Bicentennial Conservatory and Yarrabee. The outcome of the marketing effort has produced significant public relations and financial benefits to the organisation. On review of the Corporate Policy on Marketing it will be desirable to extend the role of the marketing function over the total operations to raise public awareness about the scientific, educational and recreational value of the Botanic Gardens to the community. The marketing plan will also address the nature of extent of community education programmes conducted as well as revenue raising opportunities.

The Marketing Plan will be completed by December 1997 and updated on an annual basis.

Market Research Study

An immediate marketing strategy will be to conduct extensive market research to enable greater effectiveness in the promotion of community understanding in the plant world and promotion of opportunities for recreation and tourism.

It is planned to complete this market research study by December 1998.

6.2. Specific Objectives

Core Business 1.
Promotion of community understanding of the plant world through presentation of living plant displays in a landscaped garden setting, interpretive programmes, and information services

Objective 1.1. Promote active management, planning and development of the living collections.

Objective 1.2. Implement new living plant collection initiatives.

Objective 1.3. Develop and implement interpretive programmes identifying new strategies and initiatives to promote community understanding of the plant world.

Objective 1.4. Develop and manage a pro-active information service.

Core Business 2
Plant biodiversity research, documentation and conservation.

Objective 2.1. Consolidate and further develop the South Australian Plant Biodiversity Information System through integration of knowledge outputs from State Herbarium programmes.

Objective 2.2. Determine curatorial and data capture priorities to enhance the role of the State Herbarium collections as a research and knowledge resource.

Objective 2.3. Develop and enrich the plant biodiversity research programme by reviewing priorities and exploring new opportunities including strategic partnerships.

Objective 2.4. Expand threatened species programme to enhance capability in conservation of endangered species and initiate germ plasm storage and biology project.

Core Business 3
Development and promotion of opportunities for recreation and ecotourism in a garden setting.

Objective 3.1. Maintain and improve infrastructure assets at Mount Lofty Botanic Garden and Wittunga Botanic Garden.

Objective 3.2. Maintain and improve infrastructure assets at Adelaide Botanic Garden and Black Hill Flora Centre.

Objective 3.3. Expand collection of visitor information to add qualitative to quantitative data.

Objective 3.4. Identify and implement new customer driven initiatives and events.

Programme Management and Administration

Objective 4.1. Establish and maintain best practice procedures and systems in corporate management, administration and financial management.

Objective 4.2. Provide proactive human resources support in management, training, development and counselling.

Objective 4.3. Establish and maintain programmes to document management, maintain and maximise the return on assets.

Objective 4.4. Provide information, expert advice and marketing services for the development and pursuit of business plans.

Objective 4.5. Identify a strategy for the sustainable development and funding of an information technology capability consistent with the programmes of the Botanic Gardens.

7. FINANCIAL AND WORFORCE PLAN

Support Services represent those services which support and facilitate the core business of the Botanic Gardens and State Herbarium. Specifically, Support Services are provided by the Corporate Services Branch of DENR and include:

- Financial Management
- Human Resource Management
- Information Technology
- Business Services and Marketing
- Asset Management

The Support Service Strategies necessary to address the identified Support Service strategic objectives are as follows:

Workforce Skills

Additional skills which need to be included in the workforce are those involving business management and engineering, provided they cannot be readily provided from within DENR or other Government agencies. These skills would complement the strong scientific and horticultural skills now available to management.

It is planned to request the assistance of the Human Resources Branch, DENR to investigate and recommend initiatives to address this issue and it is anticipated that this strategy be implemented progressively.

Staff Development

A comprehensive staff development plan for all employees will be developed and implemented. The plan should be consistent with the overall staff development requirements of DENR and accordingly, considerable assistance of the Human Resources Branch of DENR will be required. It is envisaged that the staff development plan will be completed by June 1997.

Finance

Finance for capital development and operating costs comes from several sources:

- SA Government - recurrent budget
  capital works budget
- Federal Government - capital grants
- Botanic Gardens Board - marketing and fund raising activities
- General public - bequests, legacies, and donations.

ACTION PLAN

CORE BUSINESS 2

Plant biodiversity research, documentation and conservation.

Objective: 2.1. Consolidate and further develop the South Australian Plant Biodiversity Information System through integration of knowledge outputs from State Herbarium

Programme: 1	Dissemination of plant biodiversity information	
Programme Manager:	Manager, Plant Biodiversity Research	
Action	Due Date	Responsibility
1. Review needs, systems and procedures to ensure regular updating and availability in electronic form of the Census of South Australian Plants (CENSAP) database.	December 1996	Manager, PBR Chief Botanist
2. Review publication need and frequency of CENSAP in hard copy.	March 1997	Chief Botanist
3. Review method of dissemination of information presented in Flora of South Australia, explore potential links with CENSAP and assess combination of updatable electronic and hard copy publication.	June 1997	Manager, PBR Chief Botanist
4. Review method of publishing Journal of the Adelaide Botanic Garden.	December 1997	Task Group
5. Review information dissemination needs generally with a view to identifying relevant categories of publication.	June 1998	Task Group

PBR - Plant Biodiversity Research

ACTION PLAN

CORE BUSINESS 2

Plant biodiversity research, documentation and conservation.

Objective: 2.1. Consolidate and further develop the South Australian Plant Biodiversity Information System through integration of knowledge outputs from State Herbarium

Programme: 2	Development of the Specimen-vouchered Database of South Australian Plant Biodiversity
Programme Manager:	Manager, Plant Biodiversity Research

Action	Due Date	Responsibility
1. Identify and promote development of the Database as a high priority.	September 1996	Manager, PBR
2. Protect data capture to date, maintain currency and control access to promote demand for further development of the database.	December 1996	Chief Botanist
3. Assess impact and demand of Biological Survey on State Herbarium resources and ability to proceed with database development.	December 1996	Manager, PBR/ Chief Botanist
4. Negotiate more appropriate level of funding for utilisation of State Herbarium resources by Biological Survey.	December 1996	Manager. PBR/ Director
5. Continue to purse all possible avenues of funding to enable data capture to proceed at a realistic rate.	June 1997	Manager, PBR

PBR - Plant Biodiversity Research
L. Haegi, April 1996

ACTION PLAN

CORE BUSINESS 2

Plant biodiversity research, documentation and conservation.

Objective: 2.1. Consolidate and further develop the South Australian Plant Biodiversity Information System through integration of knowledge outputs from State Herbarium.

Programme: 3	Develop a marketing plan for Plant Biodiversity Research
Programme Manager:	Manager, Plant Biodiversity Research

Action	Due Date	Responsibility
1. Identify and refine the products, involving staff (ie SA Plant Biodiversity Database; expert knowledge on South Australian plant biodiversity; expert plant identification service; centre of excellence in conservation biology and relevant techniques).	January 1997	Manager, PBR
2. Identify key customers and market segments (Minister, Chief Executive, Natural Resources? Landcare, ANCA, DHUD,.....).	January 1997	Manager, PBR
3. Identify target for marketing plan (initially:?improving funding base).	March 1997	Manager, PBR
4. Identify possible alternative funding resources including sponsorship.	May 1997	Manager in consultation with Marketing Officer

PBR - Plant Biodiversity Research

L. Haegi, April 1996

ACTION PLAN

CORE BUSINESS 2

Plant biodiversity research, documentation and conservation.

Objective: 2.2. **Determine curatorial and data capture priorities to enhance the role of the State Herbarium collections as a research and knowledge resource.**

Programme: 1	Develop and begin to implement plan for incorporation of backlog of specimens into main collection.
Programme Manager:	Chief Botanist

Action	Due Date	Responsibility
1. Obtain accurate description of extent and nature of backlog.	June 1996	Curatorial Team
2. Identify phases of curatorial process required for each element in backlog.	August 1996	Curatorial Team
3. Prioritise elements in backlog for data capture and incorporation.	September 1996	Manager, PBR/ Chief Botanist
4. Allocate curatorial team time to backlog project and set targets.	October 1996	Chief Botanist
5. Implement plan for project.	October 1996	Curatorial Team

PBR - Plant Biodiversity Research
L Haegi, April 1996

ACTION PLAN

CORE BUSINESS 2

Plant biodiversity research, documentation and conservation.

Objective: 2.2. Determine curatorial and data capture priorities to enhance the role of the State Herbarium collections as a research and knowledge resource.

Programme: 2	Set priorities for data capture and incorporation of incoming material.
Programme Manager:	Chief Botanist

Action	Due Date	Responsibility
1. Set priorities for data capture and incorporation with particular reference to research work, updating of information and specimen quality.	December 1996	Chief Botanist/ Manager, PBR
2. Determine protocols including time limits.	March 1997	Chief Botanist/ Manager, PBR
3. Allocate resources.	March 1997	Chief Botanist/ Manager, PBR
4. Establish programme for monitoring adherence to time limits and other criteria.	June 1997	Chief Botanist/ Manager, PBR

ACTION PLAN

CORE BUSINESS 2

Plant biodiversity research, documentation and conservation.

Objective: 2.2. Determine curatorial and data capture priorities to enhance the role of the State Herbarium collections as a research and knowledge resource.

Programme: 3	Complete incorporation of Herbarium of Cultivated Plants specimens into State Herbarium.
Programme Manager:	Manager, Plant Biodiversity Research

Action	Due Date	Responsibility
1. Continue incorporation of specimens into State Herbarium.	Ongoing	Hort. Botanist
2. Identify site for temporary storage of backlog specimens.	September 1996	Hort. Botanist
3. Establish plan for incorporating backlog.	September 1996	Hort. Botanist
4. Activate plan.	October 1996	Hort. Botanist
5. Identify site for Reference Collection of Cultivated plants in consultation with CEIS	December 1996	Hort. Botanist
6. Move reference Collection.	February 1997	Hort. Botanist
7. Continue development of Reference Collection.	Ongoing	Hort. Botanist

ACTION PLAN

CORE BUSINESS 2

Plant biodiversity research, documentation and conservation.

Objective: 2.3 **Develop and enrich the plant biodiversity research programme by reviewing priorities and exploring new opportunities including strategic partnerships.**

Programme: 1	Establish a strategic plant biodiversity research programme.
Programme Manager:	Manager, Plant Biodiversity Research

Action	Due Date	Responsibility
1. Establish/update register of existing projects.	December 1996	Manager/ Research Scientists
2. Identify goals for completion.	February 1997	Manager/ Research Scientists
3. Establish plan for writing up and publication.	March 1997	Manager/ Research Scientists
4. Establish program of regular reviews of progress.	March 1997	Manager/ Research Scientists
5. Consider strategic directions and plan future program.	May 1997	Manager/ Research Scientists
6. Explore possibilities for strategic partnerships and funding for visiting researchers to participate in collaborative work.	June 1997	Manager/ Research Scientists

ACTION PLAN

CORE BUSINESS 2

Plant biodiversity research, documentation and conservation.

Objective: 2.4. Expand threatened species programme to enhance capability in conservation of endangered species and initiate germ plasm storage and biology project.

Programme: 1	Reinforce the development of the Botanic Gardens as a centre of excellence for plant conservation biology by redirecting resources to relevant plant biodiversity conservation projects.
Programme Manager:	Manager, Plant Biodiversity Research

Action	Due Date	Responsibility
1. Transfer Plant Pathologist position to Conservation Biology and Horticultural Research Team.	July 1996	Manager, PBR
2. Review core business of team and redirect most resources to conservation biology.	September 1996	Manager, PBR/ Team
3. Broaden research programme over range of conservation biology themes; set priorities; determine programme use with aims and targets.	December 1996	Senior Scientist
4. Prepare draft proposal for germ plasm storage programme with identified aims, priorities and resources implications.	December 1996	Senior Scientist
5. Explore opportunities for revenue raising by selling skills and expertise derived on a consulting basis.	April 1997	Senior Scientist

PBR - Plant Biodiversity Research

L Haegi, April 1996

ACTION PLAN

BUSINESS AND SUPPORT SERVICES

Objective: 4.5. Identify a strategy for the sustainable development and funding of an information technology capability consistent with the programmes of the Botanic Gardens of Adelaide and State Herbarium.

Programme	Ensure provision of adequate resources to enable continued development and management of information technology.
Programme Manager:	Manager, Plant Biodiversity Research

Action	Due Date	Responsibility
1. Continue to co-ordinate a programme of IT development.	Ongoing	Manager, PBR
2. Identify and seek funding for recurrent cost of IT.	July 1996	Manager, PBR
3. Identify resources for and establish PC support and IT co-ordination.	July 1996	Implementation Team
4. Assess and establish proposal to meet IT training needs.	September 1996	Manager, BSS
5. Review the IT Strategic Plan.	November 1996	Manager, PBR

PBR - Plant Biodiversity Research
BSS - Business and Support Services
IT - Information Technology

L Haegi. April 1996

DRAFT

STRATEGIC INFORMATION TECHNOLOGY PLAN

FOR THE

BOTANIC GARDENS

and

STATE HERBARIUM

1995/96 - 1997/98

DEPARTMENT OF ENVIRONMENT AND PLANNING

October 1995

As sent to Alex & Paul 8/7/96

Table of Contents

1. EXECUTIVE SUMMARY

1.1 Introduction

The Department of Environment and Natural Resources (DENR) consists of six operational Groups supported by a Corporate Services Group. Each Group of DENR is required to prepare a three year Strategic IT Plan (SITP), covering the IT requirements needed to support their Strategic Business Plan.

In August 1995 the Director Botanic Gardens and State Herbarium approved a project to prepare a Strategic IT Plan. A project team was formed with support from the Corporate IT Branch to prepare the SITP, see Appendix 1.1.

1.2 Scope

The scope of the Strategic IT Plan is:

- Internal Botanic Gardens and State Herbarium IT requirements,
- Information requirements of other DENR Groups and customers of the Botanic Gardens and State Herbarium,
- Whole of Government system implementations that are sponsored by DENR

1.3 Objectives

The objectives of the SITP are to:

1. provide a plan to develop and implement IT systems which satisfy the Business Objectives of the Botanic Gardens and State Herbarium,
2. identify information requirements of customers of the Botanic Gardens and State Herbarium,
3. provide an Annual Operational IT Plan,
4. identify project benefits and costs,
5. comply with government and DENR IT policies.

This SITP focuses on the business/administrative systems, architecture and communications to support the business objectives and critical success factors of the Botanic Gardens and State Herbarium.

This SITP does not address IT systems specific to the other Groups of DENR.

1.4 Method

To evaluate the adequacy of current IT systems interviews were held with staff of the Botanic Gardens and State Herbarium,
Follow up interviews were conducted to clarify the information received.

Interviews were also held with the Project Managers of the whole of government projects to determine the availability of future IT systems and products for potential use by the Botanic Gardens and State Herbarium.

1.5 Summary of Findings

IT Systems

The development of effective systems over the last few years has been hampered to some extent by the lack of network facilities to the wide area network of government. This is preventing access to the evolving whole of government systems. TITAN DBMS software used to manage the databases has fallen behind current releases and needs to be upgraded. Several new systems need to be developed to improve the productivity of Botanic Gardens and State Herbarium staff.

Project/Change Management

The strategic projects planned need to be put on a formal project and change management footing to reduce the possibility of failure.

Standard Desktop Environment (SDE)

There is an unsatisfactory situation with regard to PC's to support the Microsoft Standard Desktop Environment. There are 25 PC's in the Botanic Gardens and State Herbarium of which only 14 are really capable of utilising the Microsoft standard desktop environment software. There are plans in the PC replacement program to acquire a further 30 PC's over the next 3 years. Appropriate training needs to also be scheduled and funded.

IT Infrastructure

The current infrastructure is totally inadequate to provide effective IT services both within the Botanic Gardens and State Herbarium and to customers and resources on the wide area network. Effective electronic data communication with other herbaria and Botanic Gardens has not been possible.

Plans and proposals to establish a LAN within the Botanic Gardens and State Herbarium and provide a 10 Mbs link to the WAN should enable a more effective service to be developed and provided.

IT Resources

The resourcing of IT hardware, software, network and support has been inadequate and several important programmes have suffered as a consequence. The proposal to engage an IT Systems Officer should improve the focus for IT initiatives.

Current IT Technology

There was concern that there was a lack of knowledge of current developments in Information Technology and whole of government systems. Several of the newer technologies (Internet, CD-ROM, Multimedia, Electronic Mail, Electronic Forms) could potentially be used effectively by the Botanic Gardens and State Herbarium and have been discussed in this SITP.

1.6 Conclusions

Although strategic plans have been established and indicative dates identified, future implementation of the plans is critically dependent upon available funding for the. Botanic Gardens and State Herbarium. Where there is a funding shortfall the Management of the Botanic Gardens and State Herbarium will make decisions based upon the identified priorities and benefits to the Botanic Gardens and State Herbarium and customers. Some strategic projects may therefore be deferred.

To address objective 1 the business objectives of the Botanic Gardens and State Herbarium were examined and IT strategies and specific IT activities and projects over the next three years identified. The key initiative is to establish a LAN within the Botanic Gardens and State Herbarium and access to the State WAN. Two strategic whole of government IT systems (Masterpiece 2000 and Concept HRMS) are currently being implemented within DENR and the Botanic Gardens and State Herbarium needs to negotiate their usage of these systems

The needs and information requirements of the customer groups from objective 2 have been identified and documented. These will need to be discussed, identified and actioned through the project Steering Committees whose establishment for each Strategic Project is recommended in this SITP.

Objective 3 is satisfied by the Implementation Strategy defined within the SITP. This provides an annual operational plan (Gantt Chart) for the Botanic Gardens and State Herbarium Management to monitor progress of the Strategic IT projects.

The project benefits and costs for the projects have been included in the benefits and costs section of the SITP to satisfy objective 4. The benefits associated with the whole of government systems Masterpiece 2000, Concept HRMS, and RECFIND Records Management systems will not be restated in this IT Plan as approval occurred some time ago.

The strategies proposed within this SITP conform to government and DENR policies as required in objective 5.

1.7 Implementation Strategy

The proposed IT strategy identifies short term initiatives which will give immediate benefits to the Botanic Gardens and State Herbarium and DENR, together with longer term strategic activities.

The proposed strategies in this Section cover:

- IT Applications Systems strategy
- IT hardware, software and network infrastructure strategy
- IT Management strategy

Section 7 contains the details of the all the strategies developed

Applications Strategy

All strategic projects must be controlled utilising formal Project, Quality and Change Management procedures involving a Project Steering Committee comprising a representation of staff an user personnel. Project Managers will be appointed to manage the projects.

Four main projects have been identified within the application systems strategy to satisfy the objectives of the strategic business plan of the Botanic Gardens and State Herbarium

Update and Integrate Databases

Establish a Steering Committee of users and internal staff to guide the project and identify a Project Manager to develop a total project schedule. Upgrade the TITAN DBMS to the latest level and introduce a Graphical User Interface. Integrate a number of databases and acquire staff for data entry and checking.

Introduce Barcode Facilities

Develop a business case and strategy to acquire and utilise Barcode facilities.

Implement New Systems

Establish a Steering Committee of users and internal staff to guide the projects and identify a Project Manager to develop project schedules. Develop a business case for each system and develop and implement according to priority established.

- database and scan the collections of Botanic Gardens and State Herbarium for use in information packages
- database and print the stamp collection
- develop a nursery catalogue index system
- extend the use of sign engraving in the Botanic Gardens

Implement DENR Corporate Systems

Establish a schedule to introduce DENR Corporate Administration systems Concept HRMS, the Masterpiece Financial software, Report Writer, Online Policies and Procedures, the RECFIND Records Management system and Electronic Mail.

Identify a Project Manager to develop a schedule for implementation of these systems.

Hardware Software and Network Strategy

The hardware strategy identifies the need to upgrade the HP server disk to 5 Gb in 1995/96. There will be a need to upgrade the processor capacity depending on the activity associated with the new systems proposed.
The existing supplier of the application server is HP and to support future Disaster Backup recommendations any future application server should also be HP computer.

The software strategy supports DENR and government standards. ORACLE has been identified as the strategic relational database management system for DENR corporate data management applications.
The TITAN DBMS is in use in the Botanic Gardens and State Herbarium to manage the data in the databases. This is a defacto standard throughout Australian Botanic institutions.

Where possible, application packages will be acquired in preference to customised development and where appropriate the whole of government systems will be adopted if they clearly satisfy DENR requirements. Where it is decided to use customised development, rigorous Project Management and QM principles will be applied to the conduct of IT development projects.

The Botanic Gardens and State Herbarium will adopt the Standard Desktop Environment (SDE) of the Microsoft products:

- Word
- Excel
- Project
- MS-Mail
- Scheduler+
- Access

The network strategy includes the installation the 10 Mb connection to the government WAN and the implementation of a Local Area Network in the BOTANIC GARDENS AND STATE HERBARIUM.

IT Management Strategy

The IT Management strategy proposes that all Strategic IT Projects should have a business case prepared. All Strategic IT Projects should be monitored on a monthly basis against the project plan from the Strategic IT Plan.
Strategic IT projects should be an agenda item on the monthly Management meetings.
It is proposed to engage a IT Systems Officer as the focus and coordinator of all IT activities for the Botanic Gardens and State Herbarium initially on a 2 year basis.

1.8 Benefits and Costs

The benefits associated with the implementation of Masterpiece 2000, Concept HRMS and RECFIND Records Management projects will not be restated as the business cases were accepted early 1995. This cost benefit analysis will only be conducted on new initiatives.

Following are estimated productivity benefits of introducing the IT new systems and activities proposed within this SITP.

	COST/BENEFIT ANALYSIS NEW PROJECTS					
		Present	1995/96	1996/97	1997/98	Total
$000's		Value				
Benefits						
Human Resources		0				0
Corp Finance		0				0
Corp Infrastructure		15	2	7	7	16
Public Comms		430	50	210	210	470
Administration Applic		1325	428	464	530	1422
	Totals	1769	480	681	747	1908
Costs						
Human Resources		0				0
Corp Finance		0				0
Corp Infrastructure		10	10			10
Public Communications		10	10			10
Administration Applic		28	28			28
	Totals	48	48	0	0	48
Net		1721	432	681	747	1860
Cost/Benefit to CSG						
Net Benefit to DENR		3404				

The following spreadsheet reflects the ongoing IT costs associated with each component of expenditure. Details are given in Appendix 9.2.

		IT COSTS				
		Present	1995/96	1996/97	1997/98	Total
$000's		Value				
Costs						
Human Resources		258	115	72	87	274
Corp Finance		496	249	156	116	521
Corp Infrastructure		170	113	39	24	176
Public Communications		21	10	11	1	22
Administration Applic		188	48	70	85	203
PC Replacement		367	64	172	163	399
	Totals	1501	599	520	476	1595
DISCOUNT RATE	7.00%					
DISCOUNT FACTOR	1.07					

2. INTRODUCTION

Over the last 10 years Information Technology (IT) has become increasingly significant in the day to day functioning of the Botanic Gardens & State Herbarium.

The Botanic Gardens & State Herbarium has recognised the importance of IT in introducing it to a number of its programmes, but this has not been developed to full capability for reasons largely relating to lack of an adequate resource base.

Current IT is significantly deficient in both hardware and software and in extent of availability to staff.

This first Strategic IT Plan for the Botanic Gardens & State Herbarium plots a path for development of a sustainable and acceptable IT capability to support identified programmes over the next three financial years.

It is planned that revision of the Strategic IT Plan take place annually in consultation with programme managers, staff and users of the services provided, to ensure the effectiveness of IT in achieving the aims of the Corporate Business Plan of the Botanic Gardens and State Herbarium.

3. GROUP STRUCTURE AND OBJECTIVES

3.1 GROUP STRUCTURE

The structure of the organisation is currently under review. It is proposed in the Glenn Management Review that activities be allocated to five main areas, namely Science Programmes, Community Education and Information, Living Collections (Adelaide), Living Collections (Mt Lofty) and Business Support Services. IT is highly relevant, though in varying ways, to all these branches.

3.2 GROUP OBJECTIVES

The Board of the Botanic Gardens and State Herbarium have identified four core businesses. They are:

1. Curation and presentation of the collections of the Botanic Gardens & State Herbarium
2. Promotion of community understanding of the plant world and gardens
3. Systematic study and research into the biodiversity of plants
4. Development and promotion of opportunities for recreation and tourism

3.3 OBSTACLES TO ACHIEVING GROUP OBJECTIVES

The range and efficiency of activities of the Botanic Gardens are constrained by deficiencies in IT in many areas, which include:

- The lack of an effective network, both internal between users, and external, linking to the rest of DENR and beyond.
- The varying capabilities of existing desktop hardware and software.
- Insufficient hardware (PCs, terminals and associated equipment), and network access to corporate facilities of DENR.
- The lack of on site professional expertise with sole responsibility for IT matters (IT Systems Officer).
- Knowledge of field (IT potential).
- Practical capabilities.
- The inadequate resourcing of important current or potential programmes to convert Botanic Gardens and State Herbarium information to IT accessible data.
- The lack of training of staff in IT.

4. EXISTING SYSTEMS AND INFRASTRUCTURE

4.1 CURRENT INFRASTRUCTURE

A summary of the numbers and distribution of PC equipment is contained in Appendix 2.

Currently the Botanic Gardens & State Herbarium has the following IT capability:

- A Hewlett-Packard Unix workstation with 2 Gb of hard disk space capacity.
- Internal users on PCs or monochrome terminals are linked to the HP by 19K baud serial cable.
- There is one modem providing up to 28K baud access by the satellite gardens and Black Hill Flora Centre.
- A direct line link via 2 terminals to Southern Systems for Library and (who have 2400 baud modems and 1 14.4K).
- A range of stand-alone desktop and notebook PCs (see Appendix 2) with individual facilities used by professional, curatorial and clerical staff.
  Much of it is outmoded or rapidly becoming so, and in need of replacement.

4.2 CURRENT SOFTWARE

- Microsoft Office where the PCs are capable of running it.
- The TITAN database management system, a textual system developed by Knowledge Engineering and geared for large datasets (millions of records) as can be anticipated in museums and herbaria, and used by the some of Australian botanic gardens.
- Hennig86 and other scientific software tools.
- DELTA/INTKEY software for storing descriptive and illustrative information and presenting them in the form of plant descriptions and interactive keys to identification.

4.3 CURRENT IT SYSTEMS

4.3.1 Plant Biodiversity Information

This services the Plant Diversity, Flora Information and Herbarium Services programmes of the State Herbarium of South Australia
It comprises a series of essential databases of information pertaining to the flora of the planet, particularly of South Australia and the Australian region and of the collections housed in the State Herbarium of South Australia.

Databases are:

- ADHERB (collections of the State Herbarium: 87 000 of 800 000 have been to date)
- ADID (database of identifications data relating to collectors and organisations which have associated data held externally in electronic form).
- CENSAP (census of South Australian [vascular] plants)

- CAVP (Census of Australian Vascular Plants)
- APNI (Australian Plant Name Index)
- SAGAZ (South Australian Gazetteer of Geographical Place Names) and a series of databases of research groups of botanists.

4.3.2 Living Collections Information System

This services the Living Collection Programmes.
It comprises a series of databases documenting the living displays in all Gardens, nursery holdings, including the conservation collections and conservation research collections.

Databases are:
- DAISY (data on the plantings in all Gardens of the Botanic Gardens of Adelaide)
- REF (taxonomic literature),

4.3.3 Library Information System

The Library is the State's principal repository for literature on the Australian and world flora and on horticulture. Currently principal IT component is a link to the Australian Bibliographical Network (ABN). Accessions and loans etc., are currently dealt with by card indices and conventional filing systems.

4.3.4 General Ledger (CAGL) and Treasury Accounting System (TAS)

Access to these systems as part of the Departmental system for managing conventional financial resources.

4.4 OPERATIONAL PROBLEMS

Operational efficiency is compromised by the lack of an adequate network link to the rest of DENR and the world beyond, particularly in the absence of

- electronic mail
- participation in whole of Department or Government initiatives in the areas of human resources, finances and other information interchange
- exchange of data between other herbaria and botanic gardens
- access to the Internet (AARNet, World Wide Web) with its growing and already substantial use by the wider world scientific and botanical community

the lack of links and interfaces for a potentially significant body of users of the unique environmental data held in the institution, in particular Resource Management Branch, and other branches of Natural Resources Group, DENR, SA Museum, DHUD, Australian Nature Conservation Agency, Universities.

4.5 INFORMATION FLOWS

CUSTOMERS/SUPPLIERS	INFORMATION EXCHANGED
Botanic Gardens and State Herbarium Board)	Policy/Planning
DENR Executive)	Policy/Planning Management
DENR CSG)	Financial Data
DENR NRG)	Plant Biodiversity
State Herbaria)	Plant Biodiversity
World Herbaria)	Conservation
Researchers)	Plant identification/mapping
Horticulturists)	Index ?
Botanists)	Plantings of the Botanic Gardens
Public)	Loan and exchange information

5. IDENTIFIED USER REQUIREMENTS

5.1. INFORMATION SYSTEM REQUIREMENTS

5.1.1 Upgrade and Integrate Databases

The achievement of on-line compatible links to other analogous and complementary data sets in DENR, elsewhere in Government and interstate is of great importance to plant biodiversity and conservation research and planning in this state and Australia in general. To accomplish this the following things need to be done.

- The Plant Biodiversity Information System needs to be upgraded. (Details are contained in Appendix 2).
- The collections of the State Herbarium of South Australia need to be databased.
- A method of integrating the associated databases developed.
- A user-friendly method of accessing the data in the databases needs to be developed.
- Need to provide efficient data interchange between the State Herbarium's database of specimen-based data (ADHERB) and its Census of South Australian Plants (CENSAP) with the respectively complementary and partially duplicating data in the Natural Resources Group (Survey and Flora databases).
- Provide access to DENR-owned botanical and GIS information and externally held botanical data, and to LOTS and DCDB systems.

5.1.2 Information Dissemination

There is a need to facilitate the dissemination of information on plant biodiversity, conservation, and horticulture not only by the traditional means of books, scientific papers, articles and brochures, but also by way of electronic media, recognising that this latter avenue will rapidly take on great importance in both the scientific and public arenas.

This may be achieved by

- A desktop publishing design capability for production of brochures, leaflets, display text, for effective communication of information in the scientific, horticultural, education, environmental and promotional arenas.

- Introducing and developing links to the Internet for imparting information from various areas of the Botanic Gardens & State Herbarium to the public and in the scientific, horticultural, educational and environmental arenas.

5.1.3 Introduction Of Barcoding

The introduction of barcoding capabilities would

- Remove substantial replication in the search and documentation of record-based information in both the State Herbarium and the Living Collections,

leading to significant re-allocation of staff time to much-needed support in other areas of core business.

- Ensure rapid recording of data relating to loan and exchange of herbarium specimens, for use in the State Herbarium of South Australia and the recipient institution, and enable reading of bar-coding on incoming material from other institutions. Linked to the Plant Biodiversity Information System.

- Facilitate record handling in the Living Collection Information System and library systems.

5.1.4 Develop the Library Information System

Develop the Library Information System to:

- Record accessions and local and external circulation of holdings, probably using the TITAN DBMS
- Enhance accessibility of information in the library and external bibliographic databases
- Present bibliographic and catalogues of scientific information (e.g. Index Kewensis, a compilation of the places of original publication of all the world's plant species) in a more accessible, computerised form.

5.1.5 Update the Living Collections Information System

Improve accessibility and data capture in the Living Collections Information System (80 000 records) to staff and the public by

- upgrading its user interface
- developing a GIS capability for utilisation in gardens planning, monitoring and information sharing, including mapping of individuals within collections as a component for field updating of data.
- providing capability for field updating of data
- develop data interchange with Australian and overseas Botanic Gardens and conservation based monitoring organisations eg., (ANPC, BGCI).

5.1.6 New Systems

- Database and scan the slide and other illustrative material collections of the Botanic Gardens & State Herbarium (over 40 000 slides) for use in information packages
- Produce a data register of museum artefacts (approx. 6 000).
- Database the print and stamp collection (approx. 2 000)
- Develop a nursery catalogue index system

5.2 IT ARCHITECTURE REQUIREMENTS

5.2.1 Networking

- The provision of a 10 Mb link to the existing DENR network.

- The provision of a Local Area Network (LAN) and file server to provide document sharing, E-mail services, and PC and workstation connectivity.

These links are essential to enable participation in Department-wide routines currently being developed in the clerical, financial and human resources areas. This will also provide access to AARNet (Internet). Provide future redundancy in case of failure of the single microwave link.

5.2.2 Hardware upgrade

- Upgrade the HP Server disk capacity from 2 Gb to 5 Gb to cater for expansion of databases.
- Provide a backup server in case of failure of the HP server.
- Provide networked printers on each floor of the Administration/Plant Records and State Herbarium buildings, to replace existing printers connected to PCs.
- Introduce a high resolution colour scanning or digitising capability for paintings, illustrations, prints, colour photographic slides, etc. for the production of material useful for educational and information packages and for archival purposes.
- All appropriate staff should have access to a personal computer on their desk to access relevant core and support applications, in conformity with DENR and Government requirements.
- Provide facsimile functionality direct from PC.
- Introduce developments in multimedia technology to ensure that users have appropriate and high quality means of accessing information provided by the Botanic Gardens & State Herbarium.

5.2.3 Upgrade TITAN Database

Upgrade to the newest versions of TITAN DBMS and develop the application (through use of Standard Query Language (SQL) and ODCB drivers) to ensure efficient interchange of data with other Departmental databases (e.g. the Flora and Survey databases of the Natural Resources Group) and those in other Australian herbaria and botanic gardens.

5.2.4 Sign Engraving

Upgrade sign engraving software to enable extension of its use in the Botanic Gardens and to enable direct input of data from the living collections database to the engraving system.

5.2.5 Scientific and GIS Applications

Provide training of staff in scientific and GIS applications assist them in:

- developing classifications of plant groups
- generating consistent plant descriptions, from which IT based description and identification packages can be developed
- investigation of environmental factors influencing distribution (through mapping and GIS)
- developing bibliographic databases
- developing GIS plots of plant location in the various Gardens and coordinate surveying.

5.3 PERSONNEL REQUIREMENTS

5.3.1 IT Systems Officer

An IT Systems Officer should be appointed as a matter of urgency to service the IT needs of the Botanic Gardens & State Herbarium. It is anticipated this person would be required for initially for two years, and then subject to review. This officer would:

- provide specialist technical and applications support
- provide requirements analysis of the Botanic Gardens & State Herbarium in consultation with administrators of its various programmes
- perform programming services for identified requirements
- be a focal point for all Botanic Gardens & State Herbarium IT requirements
- ensure that formal development methodologies are followed
- ensure that technical documentation for applications is developed
- ensure quality assurance testing of systems is applied
- provide IT advice to the Group.

The IT Systems Officer would be operationally responsible to a line manager in the Botanic Gardens & State Herbarium, but professionally responsible to the Manager, Business Applications Systems in Corporate IT, DENR.

On the basis of the requirements above, it is envisaged that this position would be classified at level 5 of the Administrative Services Stream.

This resource would cost the Botanic Gardens and State Herbarium approximately $52,000 per annum (salary plus 23% on costs).

5.3.2 Staff Training

Staff training in scientific, curatorial, business and administration, and clerical areas should be introduced as a necessity to increase work efficiency and capability. If resources dictate and it is practical, this may be done by training particular staff who could in turn act as trainers of the rest of the staff.

5.3.3 Support Staff for Plant Biodiversity Information System

Data entry operators are required to recommence development action on the incorporated holdings and routine re-identifications of the Plant Biodiversity

Information System. (Some 87 000 of 800 000 South Australian, Australian and overseas collections have been databased, largely on Commonwealth funds).

Only incoming collections are being databased at present.

Technical staff are required to development efficient methods to check data integrity of the Plant Biodiversity Information System.

Investigations need to be undertaken to examine what current technology can assist in the databasing of the collection (scanners, voice recognition etc.)

6. FUTURE IT FRAMEWORK

This section describes the future IT framework within which the Strategic IT Plan (SITP) and recommended strategies must operate. There are two main influences which impact the SITP:

- DENR Corporate IT Policies.
- Whole of Government initiatives in IT.

The Australia New Zealand Land Information Council (ANZLIC) on which DENR has representation also promulgates policies, standards and guidelines for data with which DENR, as participant, is required to conform.

In general, DENR will seek to adopt policies and directions which conform to Government initiatives and selections for IT, even when not mandated.

6.1 DENR Corporate IT Policies

As part of the application of Quality Management (QM) principles to its operations, DENR has committed itself to the creation of formal definitions of IT policies.

The policy areas are:

- General
- Applications
- Data
- Database
- IT Infrastructure

6.1.1 General IT Policy

In accordance with the Government requirements, DENR (as with all agencies) must undertake the following IT activities in addition to their operational system development and implementation:

- IT Planning to support the Business Planning activities,
  Corporate Strategic IT Plan (3 year),
  Group Strategic IT Plan (3 year),
- Security Management and annual review of selected operational systems,
- Capacity Planning and Review for new or operational IT systems,
- Service Level Agreement management for outsourced IT services,
- Quality Management system development for IT activities.

6.1.2 Application Systems Policy

In the mainframe environment, the 'S.A. Department of Lands Standards and Procedures' are being revised to incorporate the latest approaches to development.

Where appropriate, application packages will be acquired in preference to customised development. Where it is decided to use customised development, rigorous QM principles will be applied to the conduct of IT development projects, standards for which are under active consideration.

Application development in the Desktop environment will seek to use Microsoft application development tools.

6.1.3 IT Data Policy

DENR complies with data policies, standards and guidelines which have been formulated or promulgated by various bodies including the S.A. Government, the Australia New Zealand Land Information Council, the Australian Standards body, and DENR itself. These are summarised in Appendix 6.1.

6.1.4 Database Policy

ORACLE has been identified as the de facto strategic relational database management system for DENR corporate data management.

The government is considering the adoption of ACCESS and FOXPRO as strategic database products for the desktop environment, but has not yet made an announcement.

6.1.5 IT Infrastructure

In future undertakings, DENR will adopt open systems standards defined in Government document "IT Architecture and Standards for the SA Public Sector". In connecting its existing wide area network to the Statenet, DENR has used and will use prescribed Government network standards appropriate to such connection, as defined in the Government document "Whole of Government Datacommunications Network Implementation Strategy".

The network transport protocol TCP/IP will be used for achieving wide area network connectivity.

6.2 Whole Of Government Initiatives In IT

In addition to the Government standards referenced in 6.1.6 above, the South Australian Government has initiated a number of projects which will lead to some IT functions and application systems being mandated for government agencies, and so have some bearing on IT strategies for the Botanic Gardens and State Herbarium.

6.2.1 Open Systems

The Government's standards for open systems are defined in its document "IT Architecture and Standards for the SA Public Sector", and in new emerging government and industry standards (approved and de facto).

6.2.2 Integrated Office Systems (IOS), and Standard Desktop Environment (SDE)

A contract for the supply and maintenance of desktop computers is due to be signed in late 1995. The Microsoft Office suite of programs mandated by the Government for the IOS/SDE has already been taken up by most of the Botanic Gardens and State Herbarium wherever possible.

6.2.3 Records Management

Recfind Corporate from GMB (Sydney) has been chosen as the records management software. It is to be implemented by all agencies by mid 1998.

6.2.4 Electronic Services Business

The Government's vision is to become a world leading centre of commercially driven developers and exporters of tailored solutions for the electronic delivery of services and conduct of business. The EDI standard for document interchange is likely to be a cornerstone of this thrust, and should be anticipated as a requirement for transfer of business information.

6.2.5 Spatial Industry Development

Contract negotiation with a suitable company for a joint development of a Whole-of-State Spatial Information (WOS SI) Infrastructure is expected to begin in November 1995. DENR as a whole will be deeply involved in this project as the lead agency.

6.2.6 Video Conferencing

The Government's initiative in this area may or may not affect or be of interest to the Botanic Gardens and State Herbarium. To date, a government feasibility study has been completed and next steps are being considered.

6.2.7 Imaging/Workflow Management

A Government feasibility study will commence in the next 3-4 months. It is possible that agencies will be required to use any system recommended. Many DENR business processes, including some of Botanical Gardens and State Herbarium, are natural workflow processes.

6.3 IT Technology Analysis

This section briefly alludes to the available or emerging technologies that will be available for future systems to use.

6.3.1 INTERNET

Internet is the world's largest computer information network. There are over 30 million users on this global network, availing themselves of the essentially free information offered by the many thousands of computing nodes which comprise the network. The number of users is estimated to double each year. Organisations

recently included on the network with information to share include government and private organisations.

The SA Government has identified the State Library of SA as the site to manage the SA Government's Internet Web File Server.

An internal-to-SA-government Internet access server facility the SA Government Internal Web Site - has been established which will be restricted to SA government agencies only and be managed by Southern Systems. A project to coordinate DENR usage of both types of Internet access has been established within the Corporate IT Branch of the Resource Information Group.

6.3.2 NEXUS - Schools Network, and Education Network Australia (EdNA)

NEXUS is an electronic information service designed and developed by the Education Department of South Australia which provides schools with relevant educational materials and curriculum projects. Some 600 South Australian schools, over 2100 other Australia wide schools and some 200 private users all over Australia have simple access to a multitude of databases on any number of topics covering most areas of the school curriculum.

Charges are levied for usage by schools based on connection time. There are normally no charges for suppliers of information on Nexus, which means DENR could load information on NEXUS for access by schools at no cost. However, surcharges in addition to Nexus charges can be levied and the revenue returned to the information supplier.

An Australia wide education network is currently being established called EdNA, the Educational Network of Australia. This may complement or supersede the Nexus Schools Network and will need to be monitored.

6.3.3 Electronic Mail

The whole of government standard product mandated is Microsoft Mail.

Currently products are being evaluated by the Integrated Office Systems Project in OIT to select a common 'electronic mailbox' which will enable all government utilities and departments to send and receive messages from within their own department to and from all other government departments.

6.3.4 Electronic Forms

This facility is used with Electronic Mail to create standard electronic forms such as a leave request forms. Facilities provided by forms include mandatory fields, some validation functions, and electronic signatures.

6.3.5 Workflow

This is a facility that provides the ability to set a predetermined, or a logically determined, path for a given electronic form. Standard or specific processes can be

defined for different forms that require actions by different people as the forms 'circulate' to the people whose input is required.

6.3.6 CD ROM's (Compact Disk Read Only Memory)

These are physically identical to the audio CD's but are formatted to hold digital data. Capacity is approximately 600Mb, compared to a floppy disk of 1.44Mb. CD ROM's may be used to store text and colour graphics and can be distributed as a complete product.
Production and packaging costs are variable. Quotations are required and will depend on volumes.

6.3.7 Image Scanners

Colour or mono scanners can be obtained which scan images and digitise them for capture on any suitable mass storage medium. The image can then be displayed by electronic means, and used in documents.

7. PROPOSED IT STRATEGY

It is recognised that the introduction of IT to a planned agenda will increase productivity of operations and that increasingly over time the Botanic Gardens and State Herbarium and its staff will become increasingly dependent on IT.

It is recognised that the means of providing information in the scientific or public arena will become increasingly more efficient and economical using IT.

The proposed strategies in this Section cover:

- IT Applications Systems strategy
- IT Hardware, Software and Network infrastructure strategy
- IT Management strategy

As a general IT strategy it will benefit DENR and the Botanic Gardens and State Herbarium if whole of government standards are adopted wherever possible.

7.1 IT Applications Systems Strategy

Objective
Applications will be developed in a coordinated and consistent manner using defined project and quality control processes. Access to information applications will be provided to users by on-line multi user access, and information reports obtained by them through a common easy to use graphical interface.

7.1.1. General

Project Management and Quality Control

All development projects must be managed utilising a Project Board (Steering Committee) and formal Project Management Methodology as defined by the IT Quality Management procedures. Only by this method can information of project issues be clearly and directly communicated to users of the applications, project schedule and costs be monitored and controlled, and a quality management process be exercised.

Change Management

Where an application system is in a production status, in order to maintain a reliable quality service to users of these systems, a strict Change Control System must be implemented. This will ensure all aspects of the changes to the production system have been documented and signed off, a backout plan defined and users of the production application prewarned of the event before the changes are made.

7.1.2 Update and Integrate Databases

Corporate Plan Objective
This project addresses Group objectives 1 ,2 and 3.

Strategy

Establish a Steering Committee of Users and internal staff to guide the project and identify a Project Manager to develop a total project schedule. Upgrade the TITAN DBMS to the latest level and introduce a Graphical User Interface. Integrate a number of systems and acquire staff for data entry and checking.

Specific Activities

1. Establish a project Steering Committee to oversee the project and appoint a Project Manager to develop a project business case and schedule.
2. Upgrade the TITAN DBMS.
3. Upgrade the systems according to the schedule
   - Plant Biodiversity Information System
   - Living Collections
   - Develop a Library Information System
   - Provide access to DENR systems LOTS, GIS, DCDB
   - Develop data interchange with ADHERB/CENSAP/NRG Survey and Flora
4. Obtain relevant training.
5. Examine ways of disseminating the information by using Internet, CD-ROM's, Nexus schools network, Educational Network of Australia (EdNA) and other technology.

7.1.3 Introduce Barcode Facilities

Corporate Plan Objective

This project addresses Group objective 1.

Strategy

Develop a business case and strategy to acquire and utilise Barcode facilities.

Specific Activities

1. Develop a business case including costs, resources and strategy to utilise Barcode facilities to improve efficiency within the Botanic Gardens and State Herbarium.
2. Acquire hardware and software
3. Obtain relevant training.
4. Introduce Barcoding to loan/exchange procedures and the nursery.

7.1.4 Implement New Systems

Corporate Plan Objective

This project addresses Group objectives 1, 2 and 4.

Strategy

Establish a Steering Committee of Users and internal staff to guide the projects and identify a Project Manager to develop a total project schedule. Develop a business case for each system and develop and implement according to priority established.

Specific Activities

1. Establish a project Steering Committee to oversee the project and appoint a Project Manager to develop a project business case including costs, development resources and strategy, ongoing support activities and schedule for each project.
2. Implement the systems according to the schedules established:

- database and scan the collections of the Botanic Gardens and State Herbarium for use in information packages
- database and print the stamp collection
- develop a nursery catalogue index system
- extend the use of sign engraving in the Botanic Gardens

3. Obtain relevant training.
4. Examine ways of disseminating the information by using Internet, CD-ROM's, Nexus schools network, Educational Network of Australia (EdNA) and other technology.

7.1.5 Implement DENR Corporate Systems

Corporate Plan Objective

This project addresses Group objectives 1 and 2.

Strategy

Establish a schedule to introduce DENR Corporate Administration systems Concept HRMS, the Masterpiece Financial software, Report Writer, Online Policies and Procedures and the RECFIND Records Management system. Identify a Project Manager to develop a schedule for implementation of these systems.

Specific Activities

1. Establish a Steering Committee of Users and internal staff to guide the project and identify a Project Manager to develop a total project schedule.
2. Implement systems according to the schedule
   - Concept HRMS
   - Masterpiece Accounts Payable, General Ledger
   - Online Policies and Procedures
   - RECFIND Records Management
   - End User Report Writer
   - Electronic Mail
3. Obtain relevant training.

7.2 IT Hardware, Software and Network Infrastructure strategy

General Strategy

In adopting and aggressively supporting DENR Corporate IT standards and the whole of government standards where appropriate, the Botanic Gardens and State Herbarium would have available the necessary hardware, software and network infrastructure to provide seamless access by all groups and regional offices of DENR to Botanic Gardens and State Herbarium Information Systems and similarly access by Botanic Gardens and State Herbarium to other DENR systems.

7.2.1 Hardware Strategy

Botanic Gardens and State Herbarium and DENR will adopt open systems standards defined in the Government document "IT Architecture and Standards for the SA Public Sector".

Servers

Upgrade the HP server disk to 5 Gb as soon as possible in 1995/96. Plan to upgrade the processor in 1996/97, the timing will depend on the development activity associated with the proposed new systems in Section 7.1.

The existing supplier of the application server is HP and to support future Disaster Backup recommendations any future application server should also be HP.
The Botanic Gardens and State Herbarium will utilise the standard file/print server recommended by the Corporate IT branch of DENR.

Desktop
The Botanic Gardens and State Herbarium and DENR will adopt the whole of government standard Intel based Personal Computer specifications recently established.

PC Replacement Strategy
A total of 30 PC's and 3 printers within the Botanic Gardens and State Herbarium are planned to be replaced over the next three years. Appendix 2 defines the schedule and costs and when these replacements will occur.

A current project within the Standard Office Environment Group of the Office of Information Technology is to evaluate the potential usage and cost impact of Windows 95. This may have further cost implications to the PC replacement program.

7.2.2 Software Strategy

Application Server Operating System
Botanic Gardens and State Herbarium and DENR will adopt open systems standards defined in Government document "IT Architecture and Standards for the SA Public Sector". This requires POSIX standards P1003.1,2. which the UNIX operating systems HP-UX, SUN-Solaris and Digital-Unix products comply.

File and Print Servers Operating System
Current file and print servers throughout DENR will be standardised on the Microsoft 'NT' server software. This will provide a common platform for file and print services, file transfer, and Electronic Mail throughout all locations of DENR. Country region capability will be dependent on funding and requirement.

Relational Data Base Architecture
ORACLE has been identified as the strategic relational database management system for DENR corporate data management applications.
The TITAN DBMS is in use in the Botanic Gardens and State Herbarium to manage the data in the databases. This is a defacto standard throughout Australian Botanic institutions.

Applications Software
Where possible, application packages will be acquired in preference to customised development and where appropriate the whole of government systems will be adopted if they clearly satisfy DENR requirements. Where it is decided to use customised development, rigorous Project Management and QM principles will be applied to the conduct of IT development projects.

End User Reporting Tool

OIT have initiated an investigation into two products for end user reporting. A common product is desired for both the Concept system and the Masterpiece system. The products under investigation are Computer Associates Workbench and Computer Associates Visual Express. The Botanic Gardens and State Herbarium will adopt the product selected for end user reporting.

Standard Desktop Software
The Botanic Gardens and State Herbarium will adopt the Standard Desktop Environment (SDE) of the Microsoft products:

- Word
- Excel
- Project
- MS-Mail
- Scheduler+
- Access

All other desktop software must be referred to the Botanic Gardens and State Herbarium IT Support person prior to any acquisition activity.

The Office of Information Technology have advised Agencies not to acquire the new Windows 95 until a whole of government strategy has been developed.

7.2.3 Network Strategy

Install the 10 Mb connection to the government WAN and implement a Local Area Network in the BOTANIC GARDENS AND STATE HERBARIUM
In connecting its existing wide area network to the Statenet, DENR will use prescribed Government network standards appropriate to such connection, as defined in the Government document "Whole of Government Datacommunications Network Implementation Strategy".

The network transport protocol TCP/IP will be used for achieving wide area network connectivity.

7.3 IT Management Strategy

7.3.1 IT Projects and Funding

All IT projects must have a business case prepared discussing the project, options considered, benefits and costs. This must be presented to the Management Group for approval of resourcing and funding.

7.3.2 IT Project Monitoring

All Strategic IT Projects must be monitored on a monthly basis against the project plan from the Strategic IT Plan or project plan. Any significant variation requires explanation and a discussion of the impact on the project budget, potential delay in services to customers of the Botanic Gardens and State Herbarium and a revised schedule prepared.

IT should be an agenda item on the monthly Management meetings.

7.3.3 IT Systems Officer

An IT Systems Officer is required to service the Botanic Gardens and State Herbarium, and play a key role in the implementation of the projects outlined in this section. The proposed duties of the IT Systems Officer are outlined in Section 5.3.1 of this document.

Development of a job specification, position call and appointment procedures should commence immediately.

8. IMPLEMENTATION STRATEGY

This section describes the various projects to be undertaken to implement the Proposed IT Strategy.

DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES

IT PROJECTS - **SUMMARY:**

IT PLANNING 1995/96

GROUP: **BOTANIC**

REF NO.	PRIORITY	PROJECT DESCRIPTION	SPONSOR	CAPITAL	DATE REQ'D
		STRATEGIC PROJECTS			
7.2	A	Upgrade hardware and install LAN, WAN			
7.3.3	A	Engage IT Systems Officer			
7.1.2	B	Update and integrate ~~databases~~ information systems			
7.1.5	B	Implement DENR Corporate Systems			
7.1.3	C	Introduce barcode facilities			
7.1.4	C	Implement sundry new systems			

Priority A - critical to achieve business objectives
Priority B - high importance
Priority C - non strategic projects

DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES

IT PLANNING 1995/96

ACTIVITY Objective/Description		
Update and integrate databases and ~~make more user friendly~~ information systems The tasks in this project are described in 5.2.3, 5.1.1, 5.1.4, 5.1.5, 5.3.3, 5.3.4	**Group**	Botanic Gardens
	Ref No	7.1.2
	Benefit to	
	Cap. Cost	
	Rec. Cost	
STRATEGY Business Plan Ref. Addresses points 1,2,3 of the Group objectives	**Cost Ratio**	

KEY ACTIVITIES

Action No.	Branch	Responsi-bility	Task Description	Jul 95	Aug	Sep	Oct	Nov	Dec	Jan 96	Feb	Mar	Apr	May	Jun	96/ 97	97/ 98
1			Establish a Project Steering Committee, appoint Project Manager, develop a business case.														
2			Upgrade TITAN DBMS														
3			Upgrade Plant Biodiversity Information System														
4			Update Living Collections														
5			Develop Library Information System														
6			Access to DENR systems (GIS, LOTS, DCDB)														
7			Data interchange ADHERB/CENSAP/NRG Survey & Flora														
8			Examine ways of disseminating information using current technology														

Indicate Due Date: 

DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES

IT PLANNING 1995/96

ACTIVITY Objective/Description		
Introduce barcode facilities Supports Group Objective 1.	**Group**	Botanic Gardens
	Ref No	7.1.3
	Cap. Cost	
	Rec. Cost	
STRATEGY Business Plan Ref. Introduce efficiencies into current operations		
	Benefit to Cost Ratio	

KEY ACTIVITIES

Action No.	Branch	Responsi-bility	Task Description	Jul 95	Aug	Sep	Oct	Nov	Dec	Jan 96	Feb	Mar	Apr	May	Jun	96/ 97	97/ 98
1			Develop a business case														
2			Acquire and install hardware and software														
3			Obtain relevant training														
4			Introduce to loan/exchange procedures														
5			Introduce to labelling in the nursery														

Indicate Due Date:

DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES

IT PLANNING 1995/96

ACTIVITY Objective/Description		
Implement new systems As described in Sections 5.1.6 and 5.1.2 of the SITP	**Group**	Botanic Gardens
	Ref No	7.1.4
	Cap. Cost	
	Rec. Cost	
STRATEGY Business Plan Ref. Addresses points 1,2,4 of the Group objectives		
	Benefit to Cost Ratio	

KEY ACTIVITIES

Action No.	Branch	Responsi-bility	Task Description	Jul 95	Aug	Sep	Oct	Nov	Dec	Jan 96	Feb	Mar	Apr	May	Jun	96/ 97	97/ 98
1			Establish a Project Steering Committee, appoint a Project Manager, Develop a Business case for each project.														
2			Database and scan the collections of Botanic Gardens and State Herbarium for use in information packages														
3			Produce a data register of museum artefacts														
4			Database the print and stamp collection														
5			Develop a nursery catalogue index system														
6			Extend use of sign engraving in the Botanic Gardens														
7			Information dissemination by way of electronic media														

Indicate Due Date:

DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES

IT PLANNING 1995/96

ACTIVITY Objective/Description		
Implement DENR Corporate Systems Concept, Masterpiece, Online Procedures, Recfind.	**Group**	Botanic Gardens
	Ref No	7.1.5
	Cap. Cost	
	Rec. Cost	
STRATEGY Business Plan Ref.		
Supports objectives 1,2, and 4 of the Group objectives		
	Benefit to Cost Ratio	

KEY ACTIVITIES

Action No.	Branch	Responsi-bility	Task Description	Jul 95	Aug	Sep	Oct	Nov	Dec	Jan 96	Feb	Mar	Apr	May	Jun	96/ 97	97/ 98
1			Establish a Steering Committee and identify a Project Manager to coordinate IT activities														
2			Implement Concept														
3			Implement Masterpiece														
4			Implement Online Policies and Procedures														
5			Implement RECFIND														
6			Implement end user reporting tool														
			Obtain relevant training														

Indicate Due Date: 

DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES

IT PLANNING 1995/96

ACTIVITY Objective/Description		
Upgrade hardware at Botanic Gardens and State Herbarium and **install Local Area and Wide Area Networks** PC replacement program	**Group**	Botanic Gardens
	Ref No	7.2
	Cap. Cost	
	Rec. Cost	
STRATEGY Business Plan Ref. Addresses points 2,3,4 of the Group objectives		
	Benefit to Cost Ratio	

KEY ACTIVITIES

Action No.	Branch	Responsi-bility	Task Description	Jul 95	Aug	Sep	Oct	Nov	Dec	Jan 96	Feb	Mar	Apr	May	Jun	96/ 97	97/ 98
1			Install LAN/WAN link to Southern Systems														
2			Upgrade HP Server, printer, scanner														
3			PC Upgrades program and additions including Microsoft Office software														
4																	
5																	

Indicate Due Date:

DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES

IT PLANNING 1995/96

ACTIVITY Objective/Description		
Engage IT Systems Officer	**Group**	Botanic Gardens
	Ref No	7.3
	Cap. Cost	
	Rec. Cost	
STRATEGY Business Plan Ref.		
Facilitate IT planned Projects and activities		
	Benefit to Cost Ratio	

KEY ACTIVITIES

Action No.	Branch	Responsi-bility	Task Description	Jul 95	Aug	Sep	Oct	Nov	Dec	Jan 96	Feb	Mar	Apr	May	Jun	96/ 97	97/ 98
1			Develop Job Specification and obtain approval for ASO5 level														
2			Call position on temporary 2 year basis														
3			Appoint IT Systems Officer														
4																	
5																	

Indicate Due Date: 

9. BENEFITS AND COSTS

10. RECOMMENDATIONS

APPENDICES

APPENDIX 1

ACKNOWLEDGMENTS

The contributions of the following are gratefully acknowledged

Botanic Gardens and State Herbarium

Dr Brian Morley	Director, Botanic Gardens
Dr Laurie Haegi	Assistant Director
Dr Bill Barker	Senior Botanist

Corporate IT Branch RIG

David Griffiths	IT Account Manager
Tom Mittiga	Manager IT Planning

Sponsor for this Plan

Dr Brian Morley
Director, Botanic Gardens
Botanic Gardens and State Herbarium
Telephone (08) 228 2320

Project Manager for this Plan

Dr Bill Barker
Senior Botanist
Botanic Gardens and State Herbarium
Telephone (08) 228 2303

APPENDIX 2

PCs in the Botanic Gardens and State Herbarium

Processor	Current Number	Replace/New		
		96	97	98
286	5	1	2	2
386	6	3	1	2
486 (Planned Acquire)	14	5	13	12
Value		$30,000	$67,000	$59,000

Value at $4100 per desktop unit, $5600 per Notebook unit

APPENDIX 3

Upgrade the Plant Biodiversity Information System

Upgrade the Plant Biodiversity Information System by providing

- a friendly "front end" to facilitate access to data by DENR and other users (e.g. the public)
- a link to GIS and plant identification applications to provide up-to-date details on the geographical occurrence of plant taxa
- urgently required is a means of exchange of data of thousands of records currently databased by the Natural Resources Group (Survey databases to be transported to Oracle DBMS) using identifications made by the State Herbarium, but also required for the specimen database of the Plant Biodiversity Information System, particularly where it is the repository for the Survey's voucher specimens.
  Currently 12 500 specimens from the Biological Survey of the Natural Resources Group, for which the State Herbarium has provided determinations, await development of this interchange procedure. Until data are imported into the specimen database ADHERB, the specimens cannot be labelled and incorporated into the collections of the State Herbarium.
- a means of efficiently upgrading the Flora database of the Natural Resources Group, which is dependent on the basic taxonomic data on the South Australian flora databased in the Census of South Australian Plants (CENSAP) database of the State Herbarium.
  A process of exchanging forms compiled by hand in the State Herbarium is being developed as an interim measure.
- a PC based application by which field collectors may choose to database their own collection data which can then be automatically imported into the specimen database (ADHERB) of the State Herbarium.
- the most efficient and precise methods of determining latitudes and longitudes and precision ratings from locality statements on herbarium collections using the state gazetteer, DCDB and topographic data
- the upgrading of GPS equipment to that which stores information on geocoordinates and to provide automatic capture of this information for use in the ADHERB database.
- development of a GIS program utilising cluster analysis of locations of plant collections, for determining isolated clusters of location records, assembling these for an assemblage of species (e.g. the flora as a whole), and so providing a tool for prioritising regions in conservation policy and programmes.

Marchant, N.G. (1996). Vouchering Science, in *SIDNEWS, Science and Information Division Newsletter* 2(2). Dept WA Department of Conservation and Land Management

VOUCHERING OUR SCIENCE

Dr Neville Marchant
Head, WA Herbarium

A voucher can be defined as something "serving to confirm or prove something" (OED). In biology it usually refers to a preserved specimen lodged in a museum or herbarium collection which represents a sample of an organism or taxon which has been studied.

A prime role for SID's herbarium is to "voucher" our scientific observations and results. In effect, each of the 375,000 herbarium specimens is a voucher; each one represents a particular taxon at a specific locality and a particular habitat. This broad-scale vouchering role is why the herbarium actively seeks to increase its holdings of well annotated material which provides the basic data for SID's electronic information systems.

Any research which gathers field data on plants and habitats can be vouchered efficiently in the SID herbarium through its databasing system. It is, of course, essential to have a voucher herbarium specimen which needs to be a well chosen sample of a single taxon with adequate labelling and an indication of what research project is being vouchered.

The herbarium can curate collections related to a particular SPP, geographic area or particular project. Specimens may voucher photographs, bioprospecting samples, the key plants of a particular animal habitat or a detailed botanical survey of a defined geographic area. In these cases plant specimens can be collected and processed for incorporation in the herbarium as vouchers for the particular research effort. Incidentally, it is imperative to build specimen processing costs into any grant application as detailed in the Staff Guidelines.

Vouchers add particular value to scientific publications where plant names are cited in relation to particular biological research. For example, vouchering of disease impacts on a species, fire responses, chromosome number determinations, conservation status or functional characters such as mode of perennation, age to first seed set, etc. It is usually mandatory for scientific reports and publications to include a note on which institution holds the vouchers. In any plant research in WA, vouchers should be lodged in the WA Herbarium which has the internationally recognised acronym PERTH. It is remarkable that many biological scientist/authors haven't vouchered their observations; there are some classic local examples where we do not know what species has been referred to in papers and books. Any publication referring to *Eucalyptus redunca* var. *elata* or *E. wandoo*, for example, could now refer to any of six taxa (see *Nuytsia* 8:1). The point is that our names are continually being revised and we have a management system to continually update these changes on voucher material.

If you are compiling a list of species for a particular purpose and each taxon name has a voucher in the herbarium where the special field " voucher for....." has been completed, then it is possible to obtain an updated list at the time of preparation of a paper or report. Not only will this list have up-to-date names but the spelling of the name and the authority will be standardised and according to current herbarium practice.

It is rarely accepted by most non-taxonomists that many plant identifications are only an "educated guess". In the case of the species rich WA flora there is great morphological variability which is still being documented and for this and other reasons, WA taxonomists do not have the knowledge base to identify many taxa with 100% certainty. In other words there is a high error rate with plant identifications.

Our knowledge of the flora is advancing very rapidly. CALM botanists are continually revising identifications of the specimens incorporated into the collections. If an incorporated specimen is incorrectly identified it will invariably be picked up and correctly determined, the corrected specimen then passes back through the databasing operation. When any published taxonomic account of WA flora appears any misnamed specimens are re-determined or new determinations are made on the specimen sheet and in the databases. If some of the re-determined material is a voucher for a particular project then it is easy to see how information can be updated and made available to the researcher.

One of the most productive benefits of the vouchering system is that any field herbarium or other reference collection of plants can be managed so that the names of each voucher are current. The databasing system has revolutionised the management of ancillary collections such as the one at CALM Manjimup. The reference collection there consists of a single collection for each species collected to date in the region. Every specimen is represented by a barcoded "parent specimen" which has been incorporated into PERTH and which can be scrutinised by herbarium users. In many cases because of the Australia-wide activity relating to the Flora of Australia project the specimen may be sent on loan for specialist study at another herbarium. Alternatively a visiting specialist botanist may visit PERTH to study herbarium material and will spend some time checking determinations and renaming specimens. The Manjimup duplicate specimen has a note of the unique PERTH barcode number and any name changes, name corrections, etc, initiated in PERTH can be sent to Manjimup and entered on the specimen. With this system botanical researchers can access material with current names. The protocols developed for Manjimup and for the Reference Herbarium in Como is being introduced by a number of field herbaria, Landcare Conservation Groups and others who need access to reliable names of WA flora.

CIT

ATTACHMENT 5

BOTANIC GARDENS AND STATE HERBARIUM

DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES — IT PLANNING 1996/96

ACTIVITY Objective/Description		
Update and integrate ~~databases and make more user friendly~~ information systems The tasks in this project are described in 5.2.3, 5.1.1, 5.1.4, 5.1.5, 5.3.3, 5.3.4	Group	Botanic Gardens
	Ref No	7.1.2
	Benefit to	
	Cap. Cost	
	Rec. Cost	
STRATEGY Business Plan Ref. Addresses points 1,2,3 of the Group objectives	Cost Ratio	

KEY ACTIVITIES

Action No.	Branch	Responsi-bility	Task Description	Jul 96	Aug	Sep	Oct	Nov	Dec	Jan 97	Feb	Mar	Apr	May	Jun	97/ 98	98/ 99
1			Establish a Project Steering Committee, appoint Project Manager, develop a business case														
2			Upgrade TITAN DBMS	▒	▒	▒											
3			Upgrade Plant Biodiversity Information System (TITAN)				▒	▒	▒								
4			Update Living Collections Information System (TITAN)							▒	▒						
5			Develop Library Information System													▒	
6			Access to DENR systems (GIS, LOTS, DCDB)	▒	▒	▒											
7			Data interchange ADHERB/CENSAP/NRG Survey & Flora													▒	
8			Examine ways of disseminating information using current technology									▒	▒	▒			

Indicate Due Date: ▒

DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES

IT PLANNING 1996/96

ACTIVITY Objective/Description		
Introduce barcode facilities Supports Group Objective 1.	Group	Botanic Gardens
	Ref No	7.1.3
	Cap. Cost	
	Rec. Cost	
STRATEGY Business Plan Ref. Introduce efficiencies into current operations		
	Benefit to Cost Ratio	

KEY ACTIVITIES

Action No.	Branch	Responsi-bility	Task Description	Jul 96	Aug	Sep	Oct	Nov	Dec	Jan 97	Feb	Mar	Apr	May	Jun	97/ 98	98/ 99
1			Develop a business case							▒	▒	▒					
2			Acquire and install hardware and software													▒	
3			Obtain relevant training														
4			Introduce to loan/exchange procedures														
5			Introduce to labelling in the nursery														

Indicate Due Date: ▒

DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES — IT PLANNING 1996/96

ACTIVITY Objective/Description **mplement new systems** As described in Sections 5.1.6 and 5.1.2 of the SITP (UNFUNDED)	Group	Botanic Gardens
	Ref No	7.1.4
	Cap. Cost	
	Rec. Cost	
STRATEGY Business Plan Ref. Addresses points 1,2,4 of the Group objectives		
	Benefit to Cost Ratio	

KEY ACTIVITIES

Action No.	Branch	Responsi-bility	Task Description	Jul 96	Aug	Sep	Oct	Nov	Dec	Jan 97	Feb	Mar	Apr	May	Jun	97/ 98	98/ 99
1			Establish a Project Steering Committee, appoint a Project Manager, Develop a Business case for each project.													▒	
2			Database and scan the collections of Botanic Gardens and State Herbarium for use in information packages													▒	
3			Produce a data register of museum artefacts													▒	
4			Database the print and stamp collection														▒
5			Develop a nursery catalogue index system														▒
6			Extend use of sign engraving in the Botanic Gardens													▒	
7			Information dissemination by way of electronic media													▒	

Indicate Due Date: ▒

DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES — IT PLANNING 1996/96

CTIVITY Objective/Description nplement DENR Corporate Systems Concept, Masterpiece, Online Procedures, Recfind.	Group: Botanic Gardens Ref No: 7.1.5 Cap. Cost: Rec. Cost:
TRATEGY Business Plan Ref. Supports objectives 1,2, and 4 of the Group objectives	Benefit to Cost Ratio:

KEY ACTIVITIES

Action No.	Branch	Responsi-bility	Task Description	Jul 96	Aug	Sep	Oct	Nov	Dec	Jan 97	Feb	Mar	Apr	May	Jun	97/ 98	98/ 99
1			Establish a Steering Committee and identify a Project Manager to coordinate IT activities														
2			Implement Concept	▒	▒	▒											
3			Implement Masterpiece	▒	▒	▒											
4			Implement Online Policies and Procedures													▒	
5			Implement RECFIND								▒						
6			Implement end user reporting tool									▒					
			Obtain relevant training	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒		

Indicate Due Date: ▒

DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES — IT PLANNING 1996/96

ACTIVITY Objective/Description		
Upgrade hardware at Botanic Gardens and State Herbarium and install Local Area and Wide Area Networks PC replacement program	Group	Botanic Gardens
	Ref No	7.2
	Cap. Cost	
	Rec. Cost	
STRATEGY Business Plan Ref. Addresses points 2,3,4 of the Group objectives		
	Benefit to Cost Ratio	

KEY ACTIVITIES

Action No.	Branch	Responsi-bility	Task Description	Jul 96	Aug	Sep	Oct	Nov	Dec	Jan 97	Feb	Mar	Apr	May	Jun	97/ 98	98 99
1			Extend LAN link to other Offices					▒									
2			Upgrade HP Server, printer, scanner													▒	
3			PC Upgrades program and additions including Microsoft Office software **(Unfunded)**													▒	▒
4																	
5																	

Indicate Due Date: ▒

DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES — IT PLANNING 1996/96

ACTIVITY Objective/Description		
Engage IT Systems Officer	Group	Botanic Gardens
	Ref No	7.3
	Cap. Cost	
	Rec. Cost	
STRATEGY Business Plan Ref.		
Facilitate IT planned Projects and activities		
	Benefit to Cost Ratio	

KEY ACTIVITIES

Action No.	Branch	Responsi-bility	Task Description	Jul 96	Aug	Sep	Oct	Nov	Dec	Jan 97	Feb	Mar	Apr	May	Jun	97/ 98	98 99
1			Develop Job Specification and obtain approval for ASO5 level	▒													
2			Call position on temporary year by year basis or contract appt	▒													
3			Appoint IT Systems Officer (If necessary)			▒											
4																	
5																	

Indicate Due Date: ▒

Marchant, N.G. (1996). Vouchering Science, in *SIDNEWS, Science and Information Division Newsletter* 2(2). Dept WA Department of Conservation and Land Management.

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