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Submission to the House of Representatives Standing Committee on Environment and Heritage

I intend to address my comments to the issue of “best practice methods of preventing, halting and reversing environmental degradation in catchments, and achieving environmental sustainability.”

At a conference on salinity at the University of Western Australia on 24 July 1999 the Hon. Phillip Pendal MLA put the salinity issue into perspective as follows.

If one third of the State’s heavy industrial infrastructure at Kwinana was found to be at risk of collapsing into a previously unknown underground cavern, there would be a huge Government response. There would be a Royal Commission, there would be a major corporation established to fix the problem as quickly as possible and whatever funding was necessary would be provided.

Today, one third of Western Australia’s agricultural infrastructure is facing imminent destruction by salinity. The cost of addressing this threat is estimated by the State Government to be in the order of $3billion. The current annual budget allocation is $11million. At that rate of funding it will take more than 270 years to accumulate sufficient funds and the land will be long gone.

Governments, both State and Commonwealth are not recognising the magnitude of this problem.

A significant symptom of this lack of perspective is the ad hoc manner in which the Government agencies are approaching the issue.

As a professional involved in catchment and farm planning for 15 years I find it strange that there is no standard for land management planning methodology in this country. This is particularly strange because most of this planning work is undertaken by Federal and State Government Agencies. Such organisations are usually the first to adopt formal standards and procedures for their activities.

Instead we see Different agencies adopting different approaches to their land management investigations and planning.

Most of the difference between these organisations is in their different focus on remedial measures.

In some states the focus is on “Break of Slope Revegetation” where the focus is on revegetation of “discharge areas” and the discharge areas are identified by the topographical break of slope. (Discharge areas can be caused by dozens of other factors.)

In other states the focus is on revegetation of “Recharge Areas.” These are often identified by aerial photo interpretation and ground truthing and rely mainly on identification of soil type. (Almost any soil type or land unit can act as a recharge area and this can vary throughout the year.)

In Western Australia the Department of Conservation and Land Management (CALM) has a focus on commercial forestry to the exclusion of all other measures.

Agriculture WA (AgWA) has a broader approach to land degradation and salinity management but has a bias against engineering/drainage solutions.

The approach of each organisation varies with the scientific or professional culture of that organisation.

In the private sector there are plenty of contractors offering landcare services, each one with its own specialty and bias. Each one claims to have “the best solution”. All of these remedial actions are applicable to particular sites and circumstances, unfortunately they get promoted for all sites and all circumstances. This is particularly prevalent amongst earthmoving contractors.

The Government agencies are not immune to this. By default, In the absence of a rigorous approach to acquiring and interpreting appropriate data, the Government Agencies are irresponsible. They promote ‘standard solutions’ which are often not only inappropriate but in fact, in many situations, counter productive.

What the Commonwealth and State agencies have in common is a lack of a standard and rigorous process for land management planning in agricultural areas.

The basis of such a standard should be the identification and qualification of the information used for land management planning. Many of the data sets (maps) used in WA for farm and catchment planning have been captured at too large a scale to be accurate enough for planning on ground works, particularly at a farm or paddock scale.

The National Land and Water Resources Audit is a step in the right direction. Amongst its aims is to;

- Ensure that data is readily available to audit participants (Commonwealth and State Government agencies);
- To form a framework for ongoing assessment and analysis of trends; and
- to the greatest extent possible, provide a reference data set for community decision making.

However, the audit Work Plan also states “The types of data and the formats in which it is made available, will be targeted to the information requirements of Commonwealth, State, Territory and regional agencies with responsibility for resource management.”

In the absence of a rigorous and standard methodology, how do we determine these information requirements?

In a table at the end of the National Land and Water Resources Audit Work Plan the map scales of the data sets are defined. They range from 1:2,500,000 to 1:25,000.

The usefulness of these data sets needs to be clearly spelt out. Data at these scales is only suitable for regional or catchment scale use.

The completion of this stage of the process of establishing an Australian Standard Methodology for Land Management Planning would show a glaring lack of data suitable for planning on-ground works at a farm or paddock scale.

I am proposing the development of this Standard Methodology as a solution to a problem. Unfortunately, therein lies a threat.

The process of establishing an Australian Standard requires wide ranging consultation with the stakeholders and participants in the 'industry'. This means that due to the domination of the industry by the various Government Agencies, their representatives would dominate the committee assigned the task of developing the standard.

The risk in this process is that the status quo might be enshrined in the standard.

One should not underestimate the intensity of opposition that this proposal will generate. It will fly in the face of a lot of history and entrenched ways of doing things.

The use of some types of data has been actively opposed by some State Government agencies. The principal subject of this opposition has been Airborne Geophysics. The application of Airborne Geophysics to land management planning has recently been assessed by the Commonwealth. The following two paragraphs are a quote from the executive summary of the National Report of the National Airborne Geophysics Project by;

R. J. George [1], R. Beasley [2], I. Gordon [3], D. Heislers [4], R. Speed [5], R. Brodie [6], C. McConnell [7] and P.W. Woodgate [8].

1. Catchment Hydrology Group, Agriculture WA
2. Gunnedah Research Centre, Department of Land and Water Conservation, NSW
3. Catchment Processes, Department of Natural Resources, QLD
4. Centre for Land Protection Research, Department of Natural Resources and Environment, VIC
5. Catchment Hydrology Group, Agriculture WA
6. Airborne Geophysics Group, Australian Geological Survey Organisation, ACT
7. Catchment Hydrology Group, Agriculture WA
8. Land and Water Resources Research and Development Corporation, and Natural Resource Systems, Department of Natural Resources and Environment, VIC

"For the first time airborne geophysics has been successfully used to develop a comprehensive picture of the landscape, at the surface and below ground, in selected catchments from around Australia as a vital outcome of this the National Airborne Geophysics Project.

The overwhelming benefit of airborne geophysics technology is its ability to produce images of features in the surface and sub-surface of the catchment which provide significant information about the soils, geological structure, groundwater processes, and salt distribution. It does this in a way that no other system can do. Maximum value is obtained <u>when used with complementary information</u> drawn from conventional sources like bore hole data, air photo interpretation and the analysis of satellite images. Catchment managers now have access to a powerful tool for use in development of management plans and for broad scale reconnaissance."

Two of the recommendations of the above report are as follows:

“1. **Wider use of airborne geophysics:** The systematic and coordinated collection of airborne geophysics over land at risk of dryland salinity is recommended with the following qualifications:

· These areas should initially be similar to the environments trialed in this study to ensure the robust application of the beneficial results of this trial with the geology of the area being a key determinant.
· Priority should be given to areas where mitigation programs are likely to lead to the greatest preservation of productive potential and the maintenance of community values.
· A cooperative approach using matching State and Commonwealth funding is preferred.
· Modest contributions from landholders should also be sought on a fee-for-service basis to ensure a good level of commitment.
· Areas flown in individual surveys should generally be larger than 20,000 ha to achieve economies of scale and contain sufficient macro-features that may affect landscape dynamics.
· Specific consideration be given to geological factors of the survey area to determine the most appropriate system (company) and geophysical tools (magnetics and /or radiometrics and /or AEM).

9. **Core datasets:** To maximise the potential for sound decisions when preparing farm and catchment salinity management plans, it is recommended that a minimum core suite of datasets be used. These datasets include bore hole data, aerial photos, satellite imagery, maps of terrain, maps of geology and meteorological data with the airborne geophysics data used to value-add these data where appropriate.”

See Appendix for a more detailed list of data types.

The majority of farmers in Western Australia already have a farm plan, however there is a very low implementation rate. Professional surveys carried out on behalf of Agriculture WA have shown that the main impediment to implementation, after lack of funds, is lack of confidence.

A much higher level of confidence can be provided by using a full suite of data sets in a technically sound manner through a standard process. This standard process will produce correct solutions, not standard ones.

The basic data requirements as set out in the Appendix and the technical specifications for those data sets should be the basis upon which a National Standard Methodology should be established.

SUMMARY

- ***Governments, both State and Commonwealth are not recognising the magnitude of this problem.***

- Under-achievement in the fight against salinity in Australia is both a symptom of, and a reason for the lack of a standard and rigorous process for land management planning in agricultural areas.

- I am proposing the development of this Standard Methodology as a solution to the problem. Unfortunately, therein lies a threat. The risk in this process is that the existing low standard might be enshrined in the Standard Document.

- One should not underestimate the intensity of opposition that this proposal will generate. It will fly in the face of a lot of history and entrenched ways of doing things.

- **Core datasets:** To maximise the potential for sound decisions when preparing farm and catchment salinity management plans, it is recommended that a minimum core suite of datasets be used. These datasets include bore hole data, aerial photos, satellite imagery, maps of terrain, maps of geology and meteorological data with the airborne geophysics data used to value-add these data where appropriate."

- The basic data requirements as set out in Appendix 1 and the technical specifications for those data sets should be the basis upon which a National Standard Methodology should be established.

Appendix

BASIC DATA REQUIREMENTS

Introduction

The following list of datasets and their descriptions are largely taken from Nulsen, R., Beeston, G., Smith, R., and Street, G. (undated) "Delivering a technically Sound Basis for catchment and farm planning". (Unpub).

Effective catchment and farm planning is not a trivial task and it can only be done with adequate knowledge, understanding and quantification of the biophysical processes operating within the catchment. Fundamental to the planning process is access to appropriate data detailing the biophysical characteristics of the catchment.

Fourteen datasets have been identified which, when interpreted, will provide the necessary information for planning. These datasets relate to the biophysical environment, and we acknowledge that economic and social data constitute another strata required for implementation of the biophysical plan. These datasets are listed in priority order as a broad guide to their relative role in catchment management.

Basic Datasets

1. Topography and drainage patterns

Topography is most useful as a Digital Elevation Model (DEM) and is of primary importance for designing the integrated surface water management in a catchment. The DEM is also essential for predictive modelling and should show direction of stream flow. In dissected terrain, 5m contour intervals may be adequate, but in relatively flat landscapes at least 1m contour intervals are required. Soft photogrammetry technology is available which enables rapid creation of 1m (or better) contours.
Topographic data can also be collected in the course of airborne geophysical surveys using the difference between the radar and barometric altimeters. The resultant DEM will not be as accurate as that from soft photogrammetry.

2. Air photos

Air photos serve as the base for all mapping and subsequent overlays in the planning process. They are also essential in initial interpretation for soils, geology, land form, land use, drainage patterns and land degradation. For most farm planning the preferred scale is usually about 1:10,000 and these should be ortho-rectified to ensure geometric accuracy and coincidence with other datasets. For catchment mapping at regional scale 1:25,000 to 1:50,000 is considered appropriate.

3. Drainage patterns and surface water quality and groundwater depth and quality

Watertable depth and quality, in conjunction with topography, geology and the geophysics, provides the basis for developing an understanding of the hydrogeology of the catchment. It is used to determine the current status of the catchment water balance and can provide a monitoring tool to measure the success, or otherwise, of the catchment plan. Long term water level records are invaluable in inferring recharge processes and responses to changes in land use. In most catchments the water level data are more important than the quality data. Bore hole data provide useful information on level and quality (including salinisation).

4. Multi-spectral data

Satellite and airborne multi-spectral scanners (MSS) give information about existing surface conditions. Interpreted using appropriate mathematical analysis, LANDSAT, SPOT, and airborne MSS data can provide a measure of the productivity of the agricultural and native vegetation; define the extent of other factors limiting vegetation growth; and indicate areas of existing salinity, waterlogging and wind erosion.

In addition, within paddock variations in yield and gross margins can be mapped. Over time such data provides a record of vegetation changes and have been successfully used to map salinity in some cases.

5. Magnetics

Line spacing <200m, sample internal of <10m dependent upon the geology of the catchment and intended use. Magnetometers measure variations in the earths magnetic flux. These variations are interpreted to provide details of the geological structure of the basement rock and identify dykes, faults, shear zones etc which may exert significant control on groundwater flows within the catchment and between topographic catchments. The interpreted magnetic data are an essential component in developing a hydrogeological understanding of the catchment.

6. Radiometrics

Line spacing at <200m, sampling <60m dependent upon the geology of the catchment and intended use. Measures natural gamma radiation due largely to the radioactive isotopes of K, U and Th. Because K, U and Th react differently to weathering and erosion, the radiometric maps can be related to relict, erosional and depositional landscapes. Airborne radiometric surveys can be conducted at the same time as airborne magnetic surveys and therefore the additional cost is small.

7. Geology

Regional Geology
Geology provides the basic underlying structure of the catchment and an indication of the likely characteristics of the aquifer materials. The degree of geological similarity between catchments dictates the transferability of interpretations of the hydrogeology. Many geological maps are derived from air photo interpretation and ground inspection with limited drill or geophysical data. The geological logs of drillholes form part of this dataset.

8. Electromagnetics (EM)

Line spacing <200m dependent upon the geology of the catchment and intended use. EM measures the conductivity of the regolith and, depending on the system used, a three dimensional conductivity distribution can be created. In some landscapes the conductivity is largely controlled by the salt content of the regolith and its groundwater. The salt distribution reflects the hydrogeological processes that have prevailed in the regolith. Thus ground based EM or airborne EM (AEM) in conjunction with other datasets, and particularly the magnetics, can be used to develop an understanding of the hydrogeology of the catchment.

Single frequency ground based EM systems (EM38, EM31, EM34) are limited essentially to a fixed depth of penetration, but they are very applicable when high resolution is required over small areas.

Airborne systems (SALTMAP, DIGHEMLandcare, QUESTEM) are applicable over large areas.

9. Climate data

Comprehensive climatic data provides the design basis for many aspects of the plan. While averages and ranges of the standard climatic variables of rainfall and temperature are basic to the agronomic/vegetation options available for a catchment, the probabilities and magnitude of extreme events are critical for designing works, such as grade banks, waterways, drains and levees, which will protect the land resource. Pan evaporation, wind direction and speed are also useful

10. Soils – Land Management Units (LMUs)

Soil-type information constitutes a primary dataset. For farm planning, the data needs to be at the appropriate scale (minimum 1:20,000, preferably 1:10,000). LMUs are an interpreted combination of soil type and topography. When used in conjunction with climate, LMUs provide the basis for assessing risk of a number of forms of degradation (eg. acidity, wind and water erosion, waterlogging, structure decline) and determine the range of land use options available (eg. crops, pastures, trees, drainage, soil amendments).

11. Land Use

Land use describes the manner (actual use; eg. cropping, grazing etc) and purpose (permitted use; eg. freehold for agriculture, leasehold for grazing) of land. It is essential for understanding the management activities that are shaping landscape processes.

12. Vegetation cover

Vegetation cover maps should provide data on the floristics (species), structure (height and density) extent, quality of remnant and planted vegetation. They should also identify riparian zone vegetation and remnant vegetation that may be worthy of protection by fencing or by revegetating the fringes. Together with land use, it forms the basis for understanding water use in the catchment. Vegetation cover data is the basis on which to build an understanding of ecological function and a re-vegetation strategy. Most of this information can be extracted from multi spectral data of satellite imagery or from air photos. At catchment scale 1:100,000 to 125,000 may be sufficient, while at paddock scale 1:10,000 to 1:25,000 is preferred.

13. Cadastre

The cadastre define property boundaries and land ownership or vestment and provide the base location data for all GIS datasets doing with roads and hydrology.

13. Road networks

Made roads (type) determine access. Unmade, gazetted roads can provide valuable vegetation corridors which can be incorporated in the management plans.

14. Flora and Fauna

Mainly related to areas of remnant bush on farmland and in public reserves.