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Initial Development Plans for New Land

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Carder, D J. (1982), *Initial Development Plans for New Land*. Department of Primary Industries and Regional Development, Western Australia, Perth. Report.

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ISSN 0725-847X

INITIAL DEVELOPMENT PLANS FOR NEW LAND



DIVISION OF RESOURCE MANAGEMENT

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Division of Resource Management
October 1982

INITIAL DEVELOPMENT PLANS FOR NEW LAND

PLANNING PRINCIPLES

The purpose of an initial development plan (IDP) for new land is to form a basis for orderly development of the property and to reduce erosion and environmental hazards.

It provides a basis for a more complete farm plan in the later stage of development.

It is not possible to foresee all eventualities before land is developed but the aim of an IDP is to avoid mistaken moves, which will cause environmental damage and productivity losses, and to allow maximum flexibility for further development and management.

It is recognised that the IDP is likely to be added to and modified as development proceeds but it should provide a sound framework into which modifications can be easily and logically fitted.

On paper a simple layout of rectangular paddocks appears economical, efficient and easy to understand. On the ground such a layout may ignore slopes, soil types and the direction of natural drainage. The fences of a rectangular layout may cross ridges and creeks and create small areas which are difficult to reach and to manage and which are erosion prone. It may also be difficult and costly to supply water in a rectangular layout.

Flat blocks which are to be mainly grazing propositions are most suited to simple rectangular plans but, even on these, water flows and water supplies may dictate some other plan.

The basic hazards of wind erosion, water erosion, flooding and salinisation, and of shallow or deep sandy soils all need to be assessed as far as is possible on an uncleared block.

An IDP should provide a clearing plan which takes those hazards into account and allows for further planning when ground features can be better assessed after clearing.

An IDP is not simply a fencing plan though future fencing will be related to those considerations and to water supplies.

The inter-related aspects of hazards and clearing are dealt with below under the headings of soil types, vegetation and water flows.

Soil Types

As far as possible, areas of special hazard or fragility are excluded from proposed subdivisions at the design stage. However it is not practical to have isolated excisions within blocks and it is inevitable that scattered areas of non-arable soils are included in some released locations. IDP's should identify and make special provision for those hazardous areas.

The legends of soil maps should be carefully noted especially as to what general limits are shown for depth of topsoil in the various soil classes. Those limits may however be exceeded due to under-sampling in the survey.

Very shallow soils and very deep sandy soils should not, in general, be cleared. If they occur in patches or there is otherwise good reason to clear them, they should be incorporated in special paddocks marked for very careful management.

Other soil types needing different grazing management or different intensity of cropping should be fenced separately. There is usually no real need for separate fencing of soil types needing different contour-farming treatments.

Areas too stony or too steep for safe cropping, if cleared and large enough to be grazed as separate units, should be fenced and watered, otherwise they will be lost from grazing while other land is in crop. The boundary between such non-arable land and cropping land is a good possible site for a fence.

Areas of deep sands often have good quality groundwater which should be reticulated to safer paddocks.

In most new land situations the only surface indications of possible salt encroachment are topography and vegetation types. These may be sufficient indicators for officers or farmers with experience of similar situations in longer-settled districts.

Test boring should be carried out on flat or low-lying areas and in major valleys. Saline groundwater found within three metres of the surface of virgin land may indicate a future problem. A problem is less likely on soils with 10 to 15 cm of coarse sand at the surface.

Vegetation and Clearing

In general it is more satisfactory and less costly to retain natural vegetation than to replant cleared land, but to do so requires organisation and control of clearing operations including the use of blade ploughs. Lack of control of contractors by farmers is a major problem. There are genuine difficulties, especially the time-tabling of contractors' movements and for contractors in orientating themselves on uncleared mallee country.

Control of contractors and methods of defining areas to be cleared should be stressed during the planning stage.

Generally fencing of bush areas is needed to prevent damage by stock and to allow natural regeneration. Control of vermin, poison plants and fires are important factors.

Direct sowing of trees from seed by a standard combine has given promising results in the Esperance district. It is claimed that on new land there is no need for protective fencing for the trees if they are planted in the first year of a three-year initial cropping programme.

Shelter belts

Protection from strong winds depends on the density and the average effective height of vegetation (referred to as H). A dense, wide block of vegetation affords no more, and may be less, protection than a strip consisting of two to five rows of trees and bushes. An effective windbreak needs to be fairly porous and to have bushes to fill the gaps between taller trees.

A belt of suitable vegetation affords some reduction of wind speed for a distance upwind of about $3H$ to $20H$ or more downwind. But the distances of significant wind reduction (of at least 20 per cent of wind speed) are about $1.5 H$ upwind and $15H$ downwind.

Those reductions apply if wind is blowing at a right-angle to the shelter; with lesser wind angles there is less protection. Wind speeds near ground level can increase through gaps of any kind, due to a funnelling effect, or round the ends of belts shorter than 20 to $25H$.

On many new land blocks the tallest vegetation may be mallees. Even where taller trees exist, by retention or planting, it will be seen from the figures given above that shelterbelts have limitations for broadscale protection. Careful grazing and cropping management are most important on a paddock scale and indications of proposed management policy and techniques should be taken into account when designing an IDP.

Windbreaks may have a useful role in limiting the extent of sand drift in a way analogous to the role of contour banks in providing successive barriers to water flows. This may appear a counsel of despair but even good management may fail to secure adequate groundcover in drought years or in a late start to the growing season.

It is not easy to quantify the benefits to plant production of shelter. Considerable increases have been recorded in crop and pasture production even in situations where wind erosion was not a problem, but this gain was partly offset by loss of production from the area covered by the shelterbelts.

More positive aspects of vegetation belts include the protection of stock, especially calves, lambs and off-shears sheep; and protection of homesteads, yards, dams and roads.

There are indicators but as yet no precise guidelines as to what proportions of catchments should be retained in native vegetation to reduce risk of salinisation. The most likely major recharge areas for groundwater include high-level deep sands, lateritic breakaways and rocky outcrops. It is in these situations, generally in the upper third of a catchment, that retained vegetation would be most beneficial for reduction of groundwater entry and erosion control.

Planning for the individual block should include non-clearing of those features. At the whole catchment scale the question of whether the upper parts of the landscape should be included in a land release is one that the planning authorities, and those in a position to advise them, should consider deeply.

If there are to be land releases in districts with more than 600 mm average rainfall, parkland clearing and strip clearing on the contour are likely to reduce recharge. Present indications are that 20 to 25 per cent of the total areas of catchments would need to be left under native vegetation.

More intangible aspects include the appearance and amenity of the landscape and the provision of 'niches' and 'corridors' for birds and wildlife.

The major situations for non-clearing thus include:-

- * areas of hazardous soils, including these too shallow, too deep and too wet, and major groundwater recharge areas where these can be identified.
- * major windbreaks and contour tree strips for wind erosion control or for water control (see next section).

Other options for non-clearing or tree planting which should be considered include:

- * around the homestead, including sheds and yards;
- * shelter areas for off-shears sheep, lambing and calving;
- * along major fence lines, especially laneways which are normally double-fenced and only occasionally grazed;
- * along farm boundaries, especially used road reserves. The boundary fence could be set back 20 or 30 or more metres, with a firebreak if necessary on the property boundary. Trees left or planted between the boundary and the set-back fence would thus be fully under the farmer's control. This is a system suggested and favoured by many farmers.

Water Flows

Storm water runoff increases following clearing, a fact which has relevance for water supplies and erosion hazard. Creeks and other natural drainage lines existing in virgin conditions will carry bigger flows when the land is cleared.

Cleared light land tends to run water mainly from intense summer and autumn storms. While light land is less prone to shed water it is naturally less resistant than heavy land to water flows and these are most likely to occur in summer when vegetative cover is likely to be depleted.

A crucial aspect of initial development planning is to try to visualize the likely effects of increased water flows according to district, soil types and other conditions. It involves questions of the treatment of natural drainage lines, possible future contour systems, the likely farming system and consequent ground cover in summer until the next growing season.

The concept of uncultivated grassed waterways, many of which are expected to carry overflow from dams or from contour systems, was developed in the older farming districts for situations where natural drainage hollows were well-defined and reasonable ground cover could be expected to last until the opening rains. These were districts where rotations were commonly 1 crop in 3 years or wider.

Those requirements for safe unfenced water ways may not be fulfilled in many of the remaining development areas or in marginal-rainfall districts whether on new or old land. Natural hollows may be broad and ill-defined, soils sandy and incoherent and pasture cover minimal for much of the summer and autumn when intense storms are likely. Legumes may be poorly established or non-persistent.

Where one or more of those conditions exist, the concept of unfenced grassed waterways (really un-grassed waterways) should be questioned, especially for receiving the discharge from contour banks.

For such situations, long-term alternatives which should be considered are:-

* bush waterways

but these must be wide and in very deep well-defined hollows otherwise storm water will find easier paths outside the bush.

* fenced waterways to preserve ground cover

but these must meet the other criteria of coherent and stable soils and have sufficient cross-sectional capacity.

* a 'no waterway' layout

in which the whole paddock area is cultivated across between level absorption banks, contour sills or contour bush strips. Where contour sills cross the bottom of the hollows, so far as these can be judged, the sills can be surveyed at a higher level or these sections built as conventional contour banks. With either technique, runoff water is diverted to the main sections of contour sills on the flanking slopes.

The 'no waterway' layout is best allied with a policy of minimum cultivation for cropping. It may be applied to the upper parts of the landscape with more conventional waterway layouts lower down, but not vice-versa.

At the IDP stage those long-term alternatives should be considered, a plan devised to keep options open and a clearing and development programme agreed with the farmer.

A crucial factor is whether, or at what stage, blade ploughs should be employed. Regrowth of natural scrub is virtually impossible after blade ploughing but is usually possible after the initial burn or even after a first crop if a conventional plough is used.

Delayed use of the blade plough leaves options open for alternative treatments of broad indistinct valleys. The whole area can be cleared, burnt and disc ploughed. The first crop can be put in between contour guide lines surveyed after burning, if considered necessary. Control of poison plants is thus possible over the whole area.

With greater visibility after clearing, and possibly evidence of water movement during the first crop, a decision can be made about waterway or no waterway treatments, bush waterways or contour bush strips. With the agreed treatment marked out on the ground, the cropping areas can be cleaned up by blade plough.

Contour sills should not be surveyed until the ground surface is smoothed and settled down, in or after the first pasture year.

Basic Subdivision

Most blocks are divided by one or more of the natural features already discussed, especially:

- . creeks or more minor watercourses and waterways;
- . different soil types which cannot safely or productively be farmed in the same way;
- . rocky or other non-cropping areas;
- . areas of trees suitable for shade or shelter.

Such features provide the basic outline for sound planning of clearing and subdivision fencing.

The boundaries between those natural features, and lines along and just above the 'high-water level' of watercourses and waterways, are possible basic subdivision fence lines.

They divide the block into 'natural paddocks'.

In the final outcome it may not be convenient to use all the natural boundaries as fencelines but they form a sound starting point for an IDP.

'Natural paddocks' are seldom completely enclosed by natural boundaries and some will be too big so that further subdivision is needed.

An IDP may go no further than defining clearing areas and identifying 'natural paddocks'. However at some stage planning of further subdivision will be needed as discussed in the following sections.

Further Subdivision

The extra subdivision fences needed will cross otherwise clear or cultivable ground. On sloping land the best positions for these fences are:

- * along the ridges
- * straight downslope
- * on or near the contour.

As farm roads and firebreaks generally follow fences, ridge crest positions allow easy dispersal of water from them. Few ridge crests are level so that roads and firebreaks along them will consist of up hill and downhill sections.

Water dispersal is easiest when roads and firebreaks are at a right-angle to the contour, that is following ridge crests or straight downhill.

The worst fence positions are those diagonally across slopes. Water cannot readily be dispersed from the upper side of roads or firebreaks following such fences. Water can accumulate on long stretches and cause erosion.

Contour fences are generally winding and difficult to strain on rolling or broken country. On more uniform slopes they can be surveyed in straight sections of reasonable length along approximate contours.

Thus on sloping land contour fences will probably be a minor component compared with fences along natural boundaries, including waterways, along ridge crests and running straight downhill.

If contour farming should be needed, a downhill fence forms a convenient boundary at one end, or both ends, of contour lands (the sections between two contours). A waterway (naturally downhill) may form the other end of a contour land.

On flatter land the fence plan should conform to natural boundaries, especially possible water flows and water supply distribution. If drainage should become necessary this, and the direction of water flows, will follow down whatever slope there is or will be directed to safe and convenient water disposal points.

It is not possible to state an ideal paddock size as it depends on the size of the property and the types of enterprises. Paddock size is often a compromise between large paddocks for cropping and a certain minimum number of paddocks for livestock enterprises.

Raceways

Fenced races are particularly liable to erosion, by water or wind or both, unless carefully planned. If a raceway is considered necessary it should:

- . conform to the principles already given for fences, roads and firebreaks, singly or in combination;
- . include a formed-up road with spur drains, except possibly on near-contour sections;
- . be wide enough to allow for safe dispersal of water from road drains and possibly to include a strip or strips of uncleared vegetation or planted trees;
- . follow least-erodible soil types. (A ridge crest position may often provide suitable soil types).

Economy in Fencing

Economy in fencing can be achieved in two ways; by careful planning from the IDP stage onwards, and by modern fence construction techniques.

Conservation fence planning usually involves no more than 15 per cent extra length of internal fencing compared with a rectangular layout. That does not take into account double fencing of bush areas. In any case, conservation planning produces a layout which is more efficient, convenient and safer in the long term.

Modern techniques enable economies in materials used and in time and labour costs in erecting fences. The techniques include:

- . constructing end (strainer) assemblies according to sound engineering principles;
- . using fewer, lighter posts which are driven into the ground rather than set in augered holes;
- . more droppers (wire spacers) with amended attachment methods;
- . high tensile wires at regulated tensions;
- . electric fences should be considered in many situations.

Conventional gateways can be replaced by drive-over or lift-up sections of fence which will cater for the widest machinery and allow easy stock movement. These accesses are convenient and offer the possibility of reducing gateway erosion hazards.

Homestead

The home site is a personal matter but some general criteria should be observed.

All-weather access to a Shire or main road is vital in case of emergency. Forming up and gravelling will overcome access problems to an otherwise suitable site.

It may be advisable for the distance to a public road to be too far for a straying small child but convenient for school-age children, with possibly a view from the house to the school-bus stop and of approaching visitors.

Proximity to SEC and Telecom services and to scheme water, if any, is important as connection costs are high.

A well-drained site with some slope is preferable for homesteads to avoid problems with foundations and septic systems. Heavy clay sites, especially those with 'crab-hole' topography, should be avoided.

Friable loams are ideal for gardening but sandier soils can be improved or loam carted in. Deep sands are likely to blow about where continually exposed and are poor and difficult to improve for gardens, paths and roads.

It may be possible to take advantage of existing bush for shelter and shade, at least temporarily.

The domestic supply is usually rain water from roofs of the house and sheds. A house site somewhat lower than the sheds will allow a gravity feed.

Water for the garden, septic system and other uses usually come from a dam or bore. A dam too close to the house is a hazard for small children and a breeding place for mosquitoes.

There are references on methods for calculating water needs and supplies.

Possible hazards in siting a home include water overflows from dams or creeks and possible salt encroachment on low-lying sites. Granite outcrops often creak and groan with temperature fluctuations and some have slight natural radio-activity; they may be more pleasing at some distance from the home.

Sheds and Yards

All the considerations for a home site apply to sheds and yards but there is the extra question of whether yards should be near the house or centrally placed for the paddocks.

A central position for yards can reduce the time and distance of stock movements, and it can be a decided advantage to have cattle yards out of earshot of the house, especially if they are used for weaning. But yards and sheds near the house have advantages of quick access and ability to see visitors and control unwanted ones.

A useful compromise is to have portable or subsidiary yards placed centrally or nearer the further end of the property from the house.

Sheltered areas near the house for lambing or calving would be an advantage unless all paddocks have shelter.

Drainage and erosion problems frequently occur around sheds and yards and may not be overcome simply by good siting. A well formed-up circuit road with spur drains or connected to storm water or diversion drains to a safe overflow area is recommended. It also aids carting materials and stock to and from the farm and is generally a good investment.

Water Supplies

Efficient grazing is possible only if sufficient water is supplied to every paddock. If paddocks do not have water, gates have to be left open and trampling by stock is likely to cause erosion.

Central supplies in paddocks may seem ideal but this is not always possible or desirable. If the supply is a dam (excavated earth tank) it will need an overflow waterway which would make a central position less convenient for cropping. A supply near a fence line will enable two or more paddocks to be watered from the same source.

Troughs and other watering points should preferably be on high points. Stock tracks converging on water points will then tend to radiate and disperse runoff water whereas they concentrate runoff if the supply is in a low spot.

Where there is no obvious source of water, vegetation types and local advice will provide a guide to holding clays for dams.

For dam sites with no obvious catchment, or a catchment with a sandy surface, there are the options of:

- * a graded 'roaded' catchment, where the natural surface slope is greater than 1 in 200 and sandy overburden is less than 45 cm, or
- * a flat-batter dam, with integral clay-covered catchment, for flat sites with deeper overburden.

On heavier soil types the natural catchments of dams may be increased by diversion banks.

Dams should preferably be sited in mid-slope positions, avoiding sites just below gravel hilltops or ironstone 'breakaways' and in the bigger drainage lines. Leaking clays are often associated with lateritic gravel or ironstone.

Sites directly in drainage lines may be affected by salt encroachment as development alters the hydrology of the district. Such sites are also more prone to siltation and pollution by manure and organic debris moved by storm water and to possible breaching of the dam walls.

A site near a drainage line but above storm water flows may be suitable. Water may be led to the dam by a diversion bank which can be made so that severe flows spill over the bank and do not affect the dam.

When potential dam sites have been identified they should be test-bored to determine the depth of good quality clay and freedom from sub-surface sand seams, rock or saline groundwater. Test holes should be 90 cm deeper than the proposed dam. If sandy surfaced, the nearby catchment should be test-bored to determine depth to clay.

Except for ring tanks and enclosed flat-batter dams, every dam should have a spillway and vegetated waterway all the way to a creek or uncultivated watercourse. This means that no part of the overflow system may be cultivated. An overflow waterway is thus a barrier to cultivation and a potential fence position. It should be decided whether to clear the waterway and establish pasture or leave it under natural vegetation.

PLANNING METHOD

1. Determine the location number(s) of the block and relevant lithograph or map.
2. Obtain a stereo pair of contact prints of the air photographs of the block and/or a photo-enlargement (mosaic if necessary) and mark the block boundary on all photographs .

For very flat blocks a photo-enlargement only may be sufficient but in most case stereo photos will be needed to interpret slopes and land forms. Step 3, below, assumes the need for stereo interpretation.

Details will differ in the planning process, in the mode of co-operation with the farmer and at what stages ground inspections are made, according to individual situations and approaches, but the following steps are recommended.

3. Mark the main natural features on one stereo-photo with coloured wax pencils while viewing the photo-pair stereoscopically:
 - . all natural drainage lines and water flow lines;
 - . high points and ridge crests;
 - . extensive rocky or stony areas;
 - . boundaries between very different soil types (distinguished by vegetation and with the aid of a soil map if available);
 - . boundaries of possible problem areas (e.g. wet or low-lying);
 - . special areas of vegetation for preservation.

4. Mark planning features on the second stereo-photo:

- . sites, or potential sites, for the house, sheds and yards;
- . possible dam sites or other water supply points using vegetation patterns as indicators of suitable soil types and of available catchments;
- . areas likely to need special management, such as steep slopes or deep sands. Mark by letters and/or cross-hatching.

Wax pencil marks can be easily changed or removed using a moistened rag. A conventional choice of colours would be:

blue	-	flow lines and water supply points
brown	-	ridge crests
red	-	soil or problem area boundaries
green	-	vegetation boundaries, windbreaks etc.
yellow	-	man-made features such as fences, roads, buildings and management notes.

5. Transfer both sets of information to the enlarged photograph or mosaic. The patterns on the photographs make this quite an easy task by eye.

The enlargement is then covered with a durable clear plastic overlay on which extra notes during ground inspections and further planning stages can be marked.

6. On the overlay, experiment with a basic fencing and clearing plan and work out a sequence of clearing and development for at least the minimum requirements for an IDP (see check list following).

A clear plastic 'dot grid' overlay offers a convenient method of estimating areas of irregular shapes on photographs and plans.

There should be a District Office policy on keeping records of IDPs.

INITIAL DEVELOPMENT PLANS

CHECK LIST

ADMINISTRATIVE

Name, Address(es), Telephone(s) Access

Litho No. Location No.(s).

Air photographs; stereo pair, enlargement to 1:10,000 or 1:20,000.

Plastic overlay(s).

GENERAL OBJECTIVES

- 1.(a) To avoid making development mistakes, that is, early moves which will be hard to rectify later.
- (b) Maintain flexibility of planning options.
- (c) Establish the basis for a stable productive unit.
2. Identify hazards, problem soils/situations.
- 3.(a) A stable natural-drainage system.
- (b) Identify possible water supplies.

FARMER OBJECTIVES

Policy/attitudes of the farmer. Based on an interview, ascertain:-

- * Present stage of clearing (if any).
- * Available plant and policy about contractors.
- * Proposed enterprises and their relative importance.
- * Proposed cropping and pasture policy.
 - in the development phase
 - foreseen general policy
 - paddock size(s)
 - retaining native vegetation
 - type and possible location of homestead, sheds, yards
 - type of fencing.

AIR PHOTO (STEREO) AND MAP INTERPRETATION

- * Identify features/hazards outside the block which may have influence.
 - e.g. catchments, drainage lines, culverts, rock outcrops, unstable areas, wind funnels.
- * Identify features inside the block
 - vegetation types (including poison plants if possible)
 - soil types, especially shallow soils, deep sands
 - general topography : high and low points, ridges, rock outcrops, natural drainage lines, flat low-lying areas.

Note that stereo viewing tends to exaggerate heights. Also that most published soil and contour maps depend largely or wholly on photo-interpretation : considerable errors can be made and even good interpretation can be shifted in relation to block boundaries in the course of map production. All sources of information should be treated with caution. The appearance of vegetation on air photos may be affected by previous fires.

GROUND INSPECTION

As much as possible, check stereo and map interpretation of important and of vague features, especially:

- whether ridges are sharply defined or gently convex
- whether natural drainage lines are well-defined on the ground, their width and headward extent.

Try to assess possible road and laneway positions.

PLANNING

This stage, or the decisive parts of this stage, must be carried out in company with the owner/manager.

Some experienced officers aim to produce an IDP which is nearly as detailed as a farm plan for an already-developed farm, but that is not required for all IDPs. Assessing a block under natural vegetation is bound to have considerable areas of uncertainty, especially as to the extent of some soil types and the location of possible water supplies.

Minimum Aims

1. Identify areas to be retained in natural vegetation
 - (a) by not being cleared (these should be delineated on the ground by firebreaks or other markers).
 - (b) by being chained and burnt, perhaps cropped once but not blade ploughed (that is leaving the option to allow to regrow).

It is better to err by making such areas too big at first as they can be trimmed back later.

2. Identify the first area to be cleared or a sequence of areas.

Generally consider for clearing first

- (a) the more stable soil types
- (b) the lower parts of the block where water is likely to run or to accumulate.

This approach has the advantages of bringing the better soils into production early and of stabilising areas which may have to cope with water flows before the contributing areas are cleared.

But the better native vegetation is likely to be on those soils so that it is important to make sound decisions about which bush areas to preserve.

How to treat natural drainage lines and waterways is an important and difficult question.

Generally for drainage lines:

- (a) if well-defined with good capacity - leave under bush
- (b) if wide and ill-defined - probably clear but not blade plough (that is, leave options open)
- (c) if flat and possibly salt-prone - consult research officers as to options (a) or (b).

Note that clearing areas are not necessarily paddocks and may ultimately be sub-divided on different features. Try to persuade the farmer to postpone internal fencing as long as possible.

- 3. Try to establish an access pattern through the block.
- 4. Try to identify some alternative possible water-supply points.

COMMITMENT

Make a commitment for follow-up or further planning visits.

MAPS AND AIR PHOTOGRAPHS

Maps

Outline maps of land releases showing location boundaries, and maps depicting simple soil-type boundaries are available from the Land Board.

All other maps and air photographs may be ordered from:

The Central Map Agency
Department of Lands and Surveys
Cathedral Avenue
PERTH WA 6000

Location boundaries of blocks, accurately drawn to scale, are shown on Department of Lands and Surveys '80 chain lithos' and, only for some districts so far, on coloured cadastral maps with a scale of 1:50,000 or 1:25,000.

The 80 chain lithos, so called because they are at the old scale of one inch to 80 chains, or 1:63,360, are still commonly the basis for location boundaries and land titles and for ordering air photographs. They are available as black and white diazo prints on which the information is updated to the date of ordering.

For ordering the lithos themselves or air photographs, the number of the lithograph, shown on its lower right-hand corner, should always be quoted in full, e.g. 123/80.

Enquiries are often made about the availability of contour maps. A new series of metric maps based on the Australian Map Grid (AMG), especially the 1:50,000 sheets, is intended eventually to cover all agricultural districts and to show natural contours at 10 metre vertical intervals. Even with the latest map-making techniques, the contours shown are not sufficiently accurate to substitute for actual ground survey of contour farming layouts if such are needed.

The planning methods described do not rely on having contour maps and can be successfully carried out without them.

Air photographs

Air photographs of new-land locations will show:

- * the distribution and types of native vegetation
- * natural drainage lines (creeks, hollows and lakes, if any)
- * general land forms (with the aid of stereoscopic viewing).

These are all important features to be taken into consideration in development planning.

Enlargements of air photographs make excellent base maps for planning and management purposes, and these also can be ordered from Central Map Agency.

Department of Lands and Surveys air photographs are generally flown at a scale of 1:40,000 or 1:50,000. Contact prints of the original photographs measure 23 cm by 23 cm and give approximate cover as follows:-

	1:40,000	1:50,000
Sides	9.2 km	11.5 km
Area of view	8,500 ha	13,200 ha

Air photography is carried out in flight paths or 'runs' which usually alternate in west-east and east-west directions. The field of view of photographs in adjacent runs overlaps by 30 per cent and that of adjacent photographs in each run overlaps by 60 per cent. Two prints from the appropriate run enable a 3-dimensional image of the property to be obtained through a stereoscope. These may be adjacent prints in a run or, more usually these days, a print from either side of the photograph centrally placed for the property. Photographs from more than one run may be needed in a few cases.

For stereo viewing separate contact prints at the original scale are required or, if the original photography is smaller scale, enlargements to about 1:40,000 scale can be ordered.

For use as a map, enlargement to 1:10,000 scale, with 1 cm on the photograph representing 100 m on the ground, is convenient though with smaller scale originals enlargement beyond four times involves some loss of detail.

If more than one photograph is needed to make a photo-map, they can be fitted together as a 'mosaic' by hand or preferably on request by Central Map Agency. The Agency can also mount it on a stiff backing, in which case it needs to be collected from Perth.

Photographs to be used unmounted are best ordered on double-weight paper with a glossy surface. Matte surfaces can be ordered for marking photographs with lead pencils or inks.

Photographs for self-help pasting to a backboard can be ordered on single-weight paper.

If stereoscopic cover is required, this should be clearly specified; glossy contact prints are normally used.

For anything except contact prints the cost will vary according to the work involved and materials used, as in making enlargements, or mounting on cardboard backing, or matching two or more photos along join lines before mounting to make a single picture (mosaic) of the whole property.

Presentation of information

Send photos to:

Name

Address

Sent account to (if private order):

Name

Address

PHOTOS REQUIRED TO COVER:

Area or property of (Name)

Location No's

Approx.....km (north, south, east or west) of
as shown on sketch below copies from litho No. (siding or townsite)

SERIAL NUMBER OF PHOTOS AND OTHER
MARGINAL INFORMATION (if known)

PHOTOS REQUIRED: As mosaic or singly

ON PAPER: Single weight or double weight (Cross out whichever
does not apply)

SURFACE: Matte or glossy

SCALE REQUIRED

NUMBER OF COPIES REQUIRED

SPECIAL INSTRUCTIONS

Signed

WATERCOURSES AND WATERWAYS

Creeks which can not be crossed when cultivating are obvious natural boundaries. Uneroded depressions which can easily be crossed by machinery pose a more difficult problem as they are likely to carry larger flows of water when properties are developed.

Most erosion gullies in the longer-settled districts would not exist if farmers had avoided cultivating such hollows and depressions.

These depressions and the origin of possible water flows can usually be picked out on air photographs and should be given an early inspection on the ground. Floodways and culverts under bordering public roads should also be marked onto the photographs.

The following options are not equally viable and a 'non-waterway' system may be preferable.

The options are:

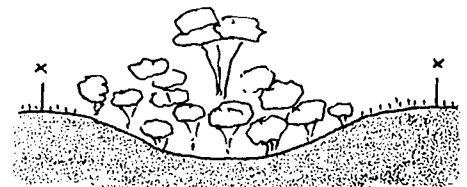
- * bush waterway
- * pastured waterway
- * banked waterway
- * artificial waterway or drain
- * deep excavated drain

* Bush waterway -

Advantages:

(Cross-section)

- . the position of the waterway is permanently marked so there is no danger of it being ploughed by mistake
- . damage by vehicle and stock tracks impossible or less likely
- . provides stock shelter
- . aesthetic value as it may be one of the few places with tall trees on a light-land block.



Disadvantages:

x (possible fence positions)

- . close ground cover may be poor and insufficient to resist water flows, though it may be possible to improve the cover by broadcasting pasture and superphosphate
- . loss of grazing compared with open pasture
- . windblown sand and stubble can build up in the bush and direct runoff on to cultivated land
- . overflow can also occur if the hollow is not well defined or is too narrow.

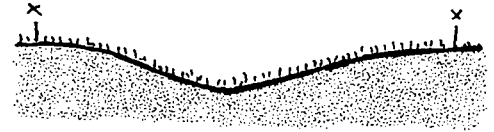
* Pastured waterway -

(cross-sections)

A natural depression cleared and pastured.

Advantages:

- . flow into and along waterway not restricted
- . no loss of grazing
- . good ground cover, especially in winter.



Disadvantages:

- . ground cover can be poor in summer and autumn. If this is likely, reconsider (see page 6).
- . can be ploughed up by mistake
- . can too easily be used as a road resulting in erosion of vehicle and stock tracks.

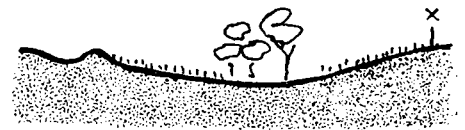
* Banked waterway -

Small levee banks can be constructed along one or both sides of pastured waterways to protect the waterway from cultivation and vehicle movements. Spoil for the banks should generally be obtained from the outside of the waterway.

Attempts to reduce the width or increase the capacity of bush or pastured waterways by levees can be a recipe for disaster in intense storms.

Disadvantages:

- . entry of water from outside may cause problems if levee sections are long
- . possibility of erosion along the banks and where the spoil has been removed.



Large levee banks intended to confine big water flows should not be considered without engineering advice and comprehensive surveying.

x
| (possible fence
positions)

* Artificial waterway or drain -

(cross-sections)

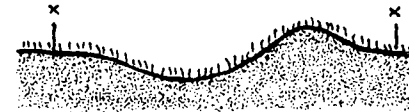
An area banked or shaped or both, to carry small water flows across places where no flows would occur naturally. May be used to connect sections of bush or pastured waterways or as a separate unit.

- . Banked only (with spoil for the banks from the outside).



This method requires sufficient capacity and exact alignment at right-angles to the natural contours. As the soils are not formed in natural hollows they may not resist water flows unless very well pastured. Usually needs fencing on both sides.

- . Shallow U-section channel (with spoil on one or both sides).
- . Shallow W-section channel (two parallel channels with spoil formed up between them).



U and W-section channels may be constructed by a power grader or smaller ones by a disc plough. If by grader, it is usually advisable first to strip topsoil from the construction area, stockpile the topsoil and respread it on completion of shaping the subsoil. Exposed subsoil is difficult to revegetate.

* Deep excavated drains

Steep sides are liable to collapse and the large amount of spoil is usually a problem. These and other forms of drainage need specialist advice.



All artificial waterways and drains need special design and survey to assure correct gradient and capacity.

Constructions involving big flows of water, and any changes to the direction and volume of water flows which affect neighbours require specialist technical and legal advice.

x
| (possible fence positions)