Control of Soil Erosion

on the

Anangu Pitjantjatjara

Yankunytjatjara Lands

M.W.Last
March 06

Introduction

The Anangu Pitjantjatjara Yankuntjatjara Land Management Unit at Umuwa on the APY Lands received a grant from the Alinytjara Wilurara Natural Resource Management Board in 2005-06 to conduct some soil conservation work on the Lands.

Part of this work was to help solve the storm water problems at Kanpi and develop plans for mounds in both the Kanpi and Nyapari communities.

Another part of the work was to prepare a written strategy for managing soil erosion on the APY Lands. The most practical way of preparing a soil erosion strategy has been to produce two key fact sheets which sumarise the problem and the methods already developed for managing soil erosion. These two fact sheets also contain references to other fact sheets and articles which describe these methods in more detail.

Some of these facts sheets have been included in this booklet for easy reference.

Soil erosion on the APY Lands can be easily contained, provided a management plan is adopted as new land based work is undertaken. This work includes road construction, building programs and other aspects of community development.

For those wanting further help and advice about controlling soil erosion on the Anangu Pitjantjara Yankunytjatjara Lands please contact the APY Land Management Office at Umuwa.

The information in this book will also appear in the Land Management section on the waru.org website. Further copies of these fact sheets and others are available from the APY Land Management Office.

M.W. Last
25th July 06

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Control of Soil Erosion - 1

M.W.Last *
March 06

The two major types of soil erosion found on the Anangu Pitjantjatjara Yankunytjatjara (APY) Lands are caused by wind and water. Water erosion causes more damage to the environment than wind erosion, however dust resulting from wind erosion is a health hazard for people.

This fact sheet describes the nature of water and wind erosion on the APY Lands and provides visual evidence of erosion in its early stages. A second fact sheet "Control of Soil Erosion - 2" provides some strategies for managing soil erosion.

Wind Erosion

The Anangu Pitjantjatjara Yankunytjatjara (APY) Lands are located in the arid zone of Australia where the rainfall is low (75 to 250 mm per annum). The vegetation cover is often sparse and the soil surface is exposed and easily blown away by strong prevailing winds.

The airborne dust seen in this picture is being blown into a small community which is surrounded by a good stand of native vegetation.

Airborne dust causes eye irritations and respiratory problems for adults, children and babies. It also results in the loss of valuable top soil from the countryside.

Motor vehicles also generate large volumes of airborne dust as they are driven along the roads on the APY Lands. This picture of a road transport demonstrates the amount of dust that a vehicle can produce. The dust in this picture settles in the surrounding bush, however this same dust produced in communities is a health hazard for the local population.

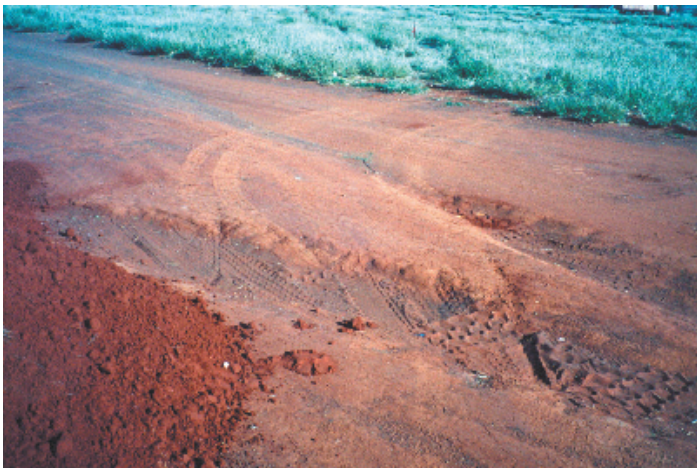
Vehicles are very effective dust producing machines and some communities are exposed to their dust for many hours each day. Although wind erosion appears to be slower acting than water erosion, it gradually lowers the road surface allowing water erosion to take control.

* This fact sheet has been prepared to provide the reader with information on the types of Soil Erosion on the Anangu Pitjantjatjara Yankunytjatjara Lands.

Water Erosion

The seasonal rainfall pattern on the Anangu Pitjantjatjara Yankunytjatjara (APY) Lands is unpedictable because it is influenced by weather systems which may come from the north or the south. Hence the rainfall received in some years is high while in other years it is very low.

Thunderstorms like the one in this picture can produce heavy rain while other rainfall events produce steady soaking rain. Large storms produce big volumes of water which flow down the creeks from the hills or across the countryside and down the roads. Although these flows of storm water are for very short periods of time they are sufficient to cause bad erosion on the Lands.



Water erosion is very common along the roads on the APY Lands because they are constructed from local soil which is easily washed away by storm water flowing across or along them.

Flows of storm water along the road in this picture have gouged out two channels which will deepen after more rain and make the road impassable.

Notice how the road suface slopes towards the channels. Every time it rains more storm water is collected by these surfaces resulting in a greater flow of water down the road. Hence the channel becomes deeper and wider.

Storm water can cause bad erosion in communities also. This picture demonstrates the erosive force of storm water as it flowed across this newly gravelled surface.

A large amount of storm water was harvested from the roofs of the surrounding buildings and car park area which when collected together gouged its way down the slope to produce this erosion.

Roofs of buildings, roads, car parks and hard surface areas in communities harvest large volumes of storm water which combine together to form a stream. Once the stream begins to flow, it erodes away the soil in its path unless storm water management principles are applied.

Soil Erosion Management Programs

Storm water management and dust control programs have been developed over many years on the Anangu Pitjantjatjara Yankunytjatjara Lands. This fact sheet has been designed to make people aware of the problem and the next fact sheet "Control of Soil Erosion - 2" provides some solutions. Also in 2000 a video/DVD was made on "Mound Building" which is available from the Environmental Health Officer at the Nganampa Health Council.

Control of Soil Erosion - 2

M.W.Last *
March 06

There are a number of strategies which have been used to control soil erosion on the Anangu Pitjantjatjara Yankunytjatjara (APY) Lands. These strategies have been very effective for managing the uncontrolled flow of storm water as well as reducing the effect of wind erosion within communities and across the Lands.

This fact sheet lists the strategies which have been used and provides references to further fact sheets and information developed for the control of water and wind erosion. More information is available from the APY Land Management Office at Umuwa.

Wind Erosion Strategies

Road Surfacing

People living in communities with dirt roads have experienced the problems caused by airborne dust as well as the pot holes which appear in the roads.

Since the late 1990's a Federally funded program has made it possible to hard surface the internal roads in six of the twelve communities on the APY Lands.

Communities like the one in this picture experienced a 100% reduction in road gernerated dust once their roads were hard surfaced with bitumen. This initiative has been very successful in eliminating wind erosion in communities on the Lands.

Vegetation Management

Strong prevailing winds and thunderstorm activity are resonsible for raising airborne dust from across the Lands and blowing it into communities and homelands causing a health hazard. Appropriate tree and shrub plantings like those seen in this picture reduce wind speeds allowing dust to settle before it enters buildings and houses.

People living in communities and homelands can reduce wind erosion by planting local varieties of appropriate trees and shrubs to slow down the speed of prevailing winds. An effective micro climate is created providing protection for those living both inside and outside their houses.

* This fact sheet has been prepared to provide the reader with information on Strategies for controlling Soil Erosion on the Anangu Pitjantjatjara Yankunytjatjara Lands. Further references are also listed.

Water Erosion Strategies

Ponding Banks

The construction of ponding banks for the management of storm water in all locations on the Lands has been very successful. The ponding bank in this picture has collected storm water from the buildings and land above it. The water in this bank soaks into the soil providing moisture for trees and shrubs rather than flow down the slope and cause gully erosion.

The construction and use of ponding banks on the APY Lands is well documented and references are recorded at the bottom of this page.

Mounds

The construction of mounds has been a very effective solution for the control and management of storm water in communities on the APY Lands. This picture demonstates the use of mounds in a housing area where there is insufficient room to construct ponding banks.

Once again the construction of mounds in communities has been well documented and practical advice is available from APY Land Management and through the Environmental Health Officer at the Nganampa Health Council.

Road Crowning

Crowning roads to shed storm water is essential if roads are to be preserved and not act as water courses for collecting and draining excessive storm water on the APY Lands.

This picture is of an access road into a community which is now crowned and drains storm water into the entrance of the ponding bank on the right. Storm water can no longer flow down this road and cause water erosion. This water is harvested into ponding banks where it irrigates local vegetation which in turn slows down wind speeds and reduces wind erosion.

Other Articles

Storm Water Management in Communities on the Anangu Pitjantjatjara Yankunytjatjara Lands.

The Use of Mounds to Improve Environments on the Anangu Pitjantjatjara Yankunytjatjara Lands.

Environmental Degredation and Rehabilitation in Aboriginal Communities and Homelands in Central Australia.

Other Fact Sheets

Mounds Improve Environments - 1

Mounds Improve Environments - 2

Storm Water Management - 1

Site Revegetation - 1

Establishing Trees and Shrubs Under Dryland Conditions

Mounds Improve Environments - 1

M.W.Last *
July 02

The Anangu Pitjantjatjara Lands are located in the far north west corner of South Australia and form part of the south western sector of Central Australia. The climate is very arid and the environment in which communities have been established is often dry and dusty. It has been a challenge to create micro-environments around houses and public buildings to reduce the effects of air borne dust.

In October 2000, a mound building program was embarked upon to improve the living conditions within the local environment at Pipalyatjara. The results have been impressive and a more detailed article is available from The APY Land Management Office at Umuwa. This fact sheet provides some information for those interested in building mounds.

1. Building Mounds

Many environmental improvement programs have been initiated on the Anangu Pitjantjatjara Lands and mound building would have to be one of the most successful. The crescent shaped mound which was being built in this picture was designed to fill an area 40 metres long by 12 metres wide. The volume of soil required was 180 cubic meters. Everybody became enthusiastically involved including the school children. The flat top on the mound (one metre high), provided a new venue for people to sit and talk. Half loads of soil were tipped on the inner side of the mound from which an undulating floor was shaped. These mounds eliminated motor vehicle access to the median strip.

2. Mound Shapes

This picture illustrates some of the shapes that can be achieved when bulding a mound system. A drum oven was installed on the inner side of the crescent shaped mound in the centre right and was used to cook the evening meal for the workers building the mounds in this stage. This mound provided a semi private venue in which to cook food and boil "billy" tea. People sat around the mounds at different times of the day talking with friends as well as being able to communicate with others through the use of hand signs.

Trees were planted on the inner side to provide future shade and shrubs were grown on the outside slope of each mound.

* Acknowledgement: This fact sheet has been generated out of a Nganampa Health Council Project on the Anangu Pitjantjatjara Lands.

3. Mounds for Meetings

Mound systems are very popular in public places especially around the community office. Communication within the community is enhanced because community members enjoy congregating in the new improved venues provided by mounds. The gentle slope which can be produced on the inner side of the mound, provides a micro-environment in which people can sit and talk privately about issues of concern.

The building of a larger amphitheatre within the mound system provides an excellent venue for public meetings.

4. Low Profile Mounds

Low profile mounds were very popular at Kalka because people sitting within them could watch their children who may be playing some distance away. The mound in this picture surrounds an outside shelter which is used as an extra living area located outside the house yard. Mounds help define living areas reducing the overall environment to a series of micro-environments which are easier to rake and keep clean.

The volume of soil used to build these smaller mounds varied between 80 and 100 cubic meters, while the larger mounds in front yards required 120 to 160 cubic meters.

5. Mounds for Extra Living Areas

Mound systems were very popular when built in the front yards of houses. In this picture the front fence was removed and a primary mound was built around some mature peppercorn trees which had been grown in the median strip. Some low undulating secondary mounds were built inside the primary mound, providing an overall venue for outside living. Visitors were able to camp in the mound system while the extended family were able to take advantage of the new user friendly environment. They sat and talked amongst themselves as well as to those walking along the road.

A new circular fence was erected around the mound system providing some securtiy for the occupants.

Mounds Improve Environments - 2

The following mound profiles were developed during the mound building program at Pipalyatjara and Kalka in 2000 and 2001. They have been produced in this fact sheet to act as a guide for those planning to build mounds in their community. More information about mounds is available from the APY Land Management Office at Umuwa.

M.W. Last *
July 02

1. High Mounds

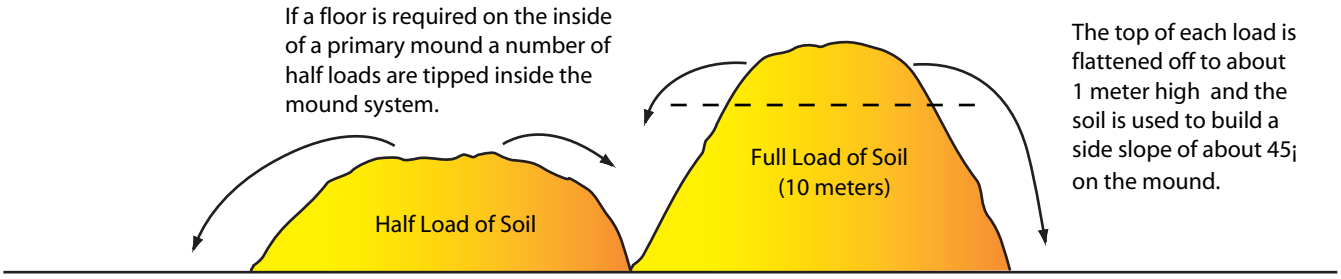


Figure 1: Before Shaping the Mound System

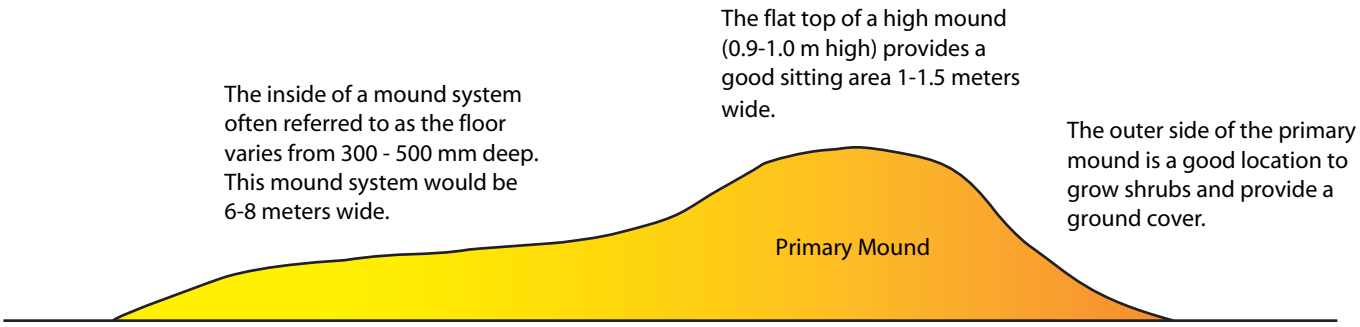


Figure 2: After Shaping the Mound System

2. Low Mounds

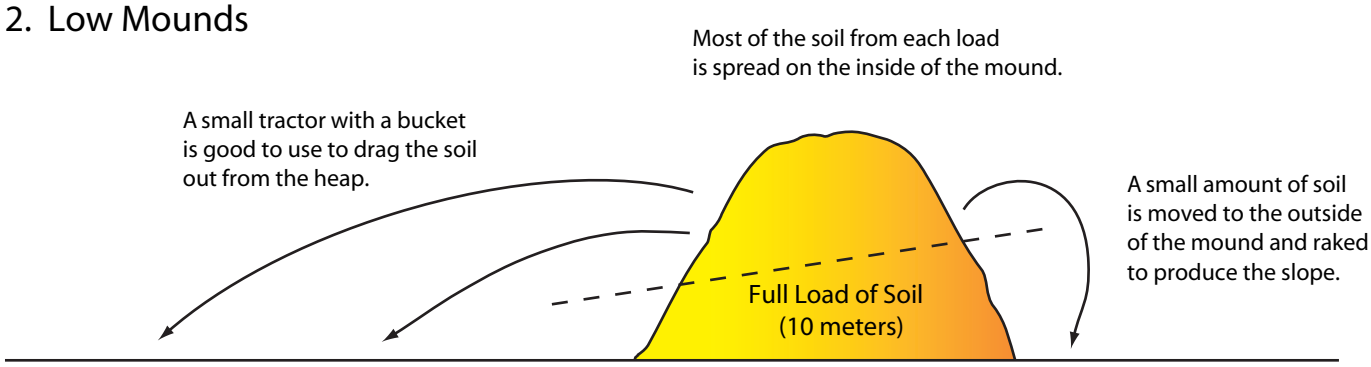


Figure 1: Before Shaping the Mound System

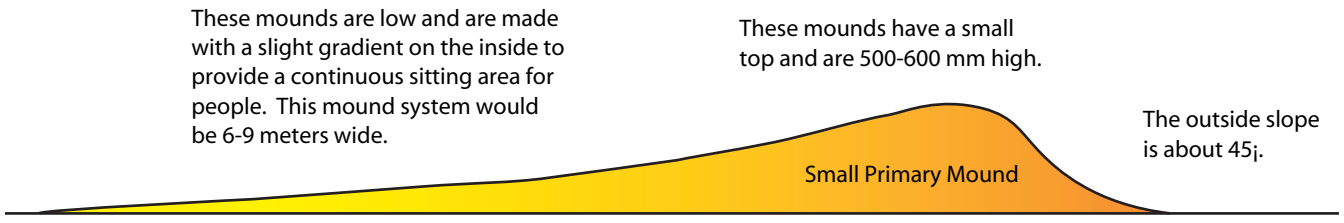


Figure 2: After Shaping the Mound System

* Acknowledgement: This fact sheet has been generated out of a Nganampa Health Council Project on the Anangu Pitjantjatjara Lands.

3. Amphitheatres

If possible a wide top (1-2 meters) is formed at the top of the Amphitheatre and a gradual slope produced on the inside for ease of sitting during meetings.

The top of each load is flattened off at 1 meter high and the soil used to build a side slope of about 45¡ on the mound. Extra soil may be required on the outside slope.

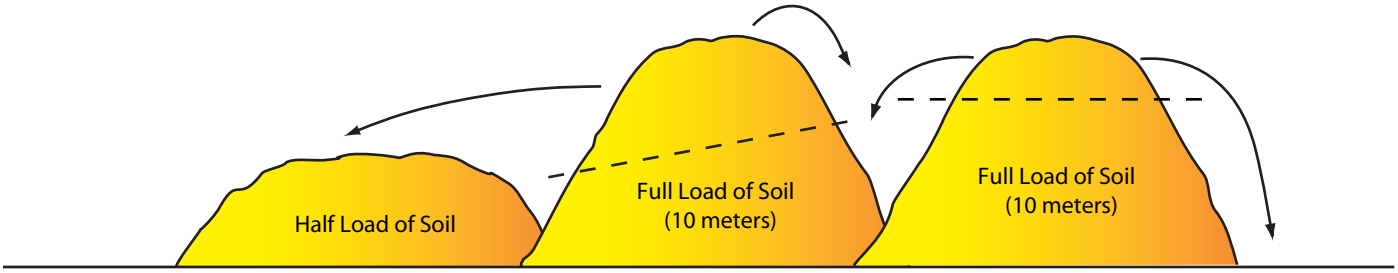


Figure 1: Before Shaping the Mound System

A small tractor with a bucket is good for dragging the soil from the heap to make the gradual slope inside the Amphitheatre. The width could be as much as 10-12 meters.

The flat top of a high mound (0.9-1.4 m high) provides a good sitting area 1-2 meters wide.

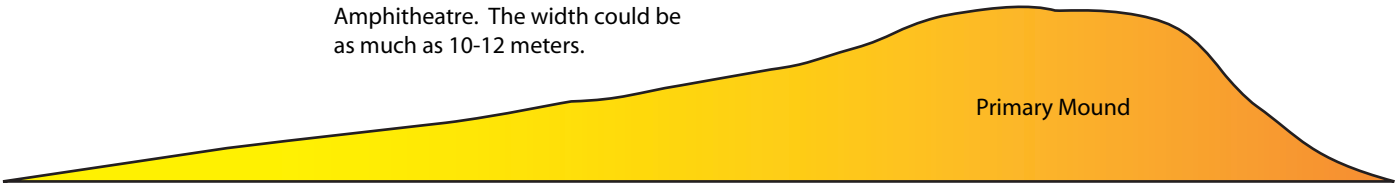


Figure 2: After Shaping the Mound System

4. Mound Combinations

Half loads are tipped on the inside of the primary mound from which secondary mounds are shaped and blended into the primary mound.

The top of the full load is dragged down to provide a gentle slope on the inside of the mound.

Soil from the top of the heap is used to build a side slope of about 45¡ on the mound.

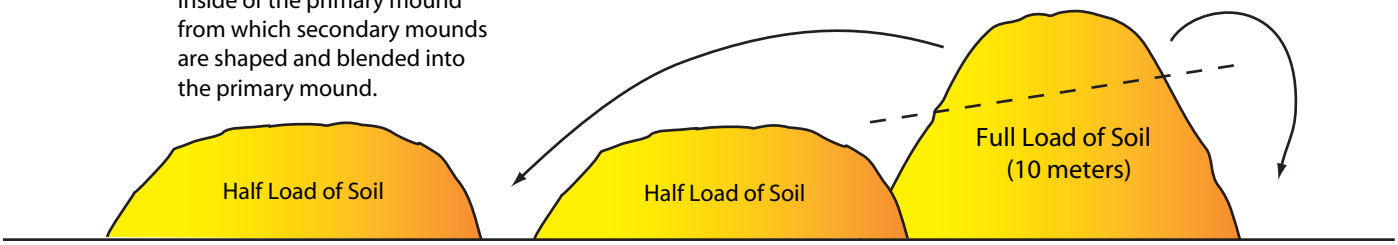


Figure 1: Before Shaping the Mound System

Secondary mounds are shaped within the primary mound and are used to form a number of different living areas. They can be 500 - 700 mm high.

This mound system can be designed to fill a front yard 30 meters wide and 17 meters deep. Always use plenty of soil.

The primary mound has a smaller sitting area about 1 meter wide and a height of 700 - 900 mm.

The outside slope is about 50¡.

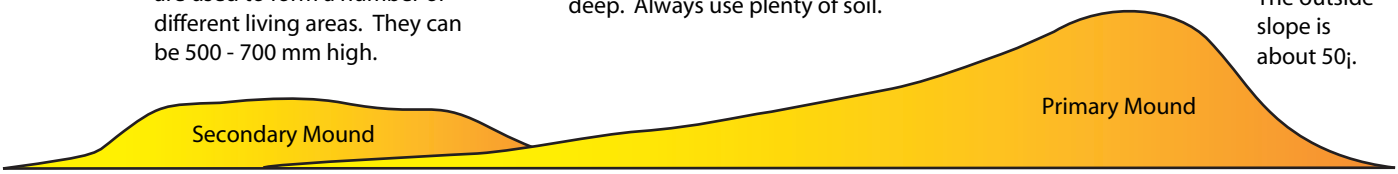


Figure 2: After Shaping the Mound System

Storm Water Management - 1

Australia is a very dry continent and storm water is a valuable resource which needs to be used wisely. This fact sheet illustrates the collection of storm water as well as its use. The management of storm water needs to be better understood in communities and homelands and the following information is a beginning to that understanding.

M.W.Last *
February 02

1. Collection of Storm Water

In this picture storm water which has fallen on the roof of the house and the surrouning compacted open areas and roads has collected in the mound. There are a number of ways of collecting storm water and mound systems are one of them.

When a community is being planned, sufficient land areas need to be set aside for the collection of storm water from roads, houses and buildings and the surrounding compacted areas.

Storm water needs to be collected and used within the community. If collection systems are absent, storm water will be permanently lost and of no benefit to the community.

2. Use of Storm Water

The mulberry tree in the centre of this picture is growing and producing fruit at the rear of a house in Pipalyatjara on the Anangu Pitjantjatjara Lands. Normally these trees would require a much higher rainfall to survive.

The storm water collected from the roof of the house in the right of the picture is sufficient to support the growth and production of fruit from this tree as well as a second tree on the other side of the house.

The improvement of the storm water collection systems in house yards would support the production of extra fruit trees and vines.

* Acknowledgement: This fact sheet has been generated out of a Nganampa Health Council Project.

3. Use of Storm Water

The mound in the left of this picture collects storm water from the house yard, the roof of the outside shelter and the adjacent compacted areas. The trees encircled by the mound benefit from the storm water collected in the mound.

Protection from the sun is essential during the long hot summers experienced in Central Australia. These trees have been grown to provide this protection.

Storm water needs to be collected and used to irrigate shade trees with in each community.

4. Collection of Storm Water

Ponding banks are also very good for collecting storm water which is shed from roads, large compacted areas and the roofs of buildings. The banks can range from 15 to 50 metres long, depending on the application.

In this picture the ponding bank collects storm water from a large compacted area in front of houses as well as part of the main access road into Kalka. Before the ponding bank was built, this storm water would normally flow out of the community.

The seed of trees and shrubs should be planted along ponding banks to assist the revegetation program within each community.

5. Loss of Storm Water

Storms are a part of the climate in Central Australia. There are many open compacted areas in communities and if there are no storm water collection systems to harvest the rain water, it flows away causing damage in many places.

This picture shows an open compacted area which collected a large volume of storm water before it flowed down the slope and was lost from further use.

People need to observe what happens to storm water within their communities. Methods of collecting storm water should be examined and a storm water management program adopted.

Site Revegetation - 1

This fact sheet has been prepared to help people engaged in the revegetation of work sites after capital works programs are completed. This includes sites which had been disturbed after the installation of pipe lines, tank sites and any other sites on sloping ground which have been compacted or disturbed during the installation process.

M.W.Last *
February 02

1. Disturbed Sites

A major part of the disturbance caused at work sites is due to vehicles and machinery moving about on the soil surface. Roads are required to access work sites and areas of land are required for operating machinery, storing materials etc. Although these land areas can be minimised, they are a necessary part of a capital works project.

The access road in the right of the picture was required to install a pipe line to the two tanks on the hill [top centre]. Once the project was completed, this road was no longer required. The compacted surface which remained, will shed storm water causing gully erosion down the slope.

2. Repairing Disturbed Sites

To improve the situation in the above picture, the compacted surface needs to be repaired so it can collect and absorb storm water before it causes erosion.

The easiest way to repair these compacted surfaces is to install mounds like the one in this picture. All storm water which drains off the compacted surface to the right of the picture is collected in the mound in the centre left of the picture. In the case of the above picture, mounds should be constructed across the road approximately ten metres apart down the slope.

These mounds are built along the contour and can be constructed by using the bucket on a back hoe to push up the mound or by carting in soil and forming the mound. Compacted surfaces on slopes should be scarified along the contour, so the fresh soil will lock into the soil surface. Ripping the compacted surface is not an effective solution for repairing disturbed sites. Mounds need to be constructed. Do not rip down or up the slope.

* Acknowledgement: This fact sheet has been generated from information collected on the Anangu Pitjantjatjara Lands.

3. Sowing Seed

Once the mound system has been installed, seed needs to be sown into the mound. This can be done when the soil in the mound is soft so the seed is caught in the soil surface. After planting the seed, the mounds need to be rolled with the wheels of the tractor or motor vehicle. This will make the mounds firm, reducing the chance of them being washed away by heavy rain.

The type of vegetation at each construction site needs to be recorded and seed of the same types need to be planted. Many sites on the AP Lands support healthy stands of Acacia and Senna trees and shrubs. These species usually produce seed in October and November depending on seasonal conditions.

Project Managers in consultation with Land Management personnel can plan ahead and arrange for seed to be collected from areas where capital works programs are to be installed.

If seed is not available, mound systems should still be installed because they will collect air borne seed and storm water, allowing the process of revegetation to proceed.

4. Collecting Seed

Seed collection is not a difficult task. As in the photograph, a pair of gloves and a collecting bag is all that is required to collect large volumes of Acacia, Senna and Eucalypt seed.

Once the seed pods have been collected, they need to be laid out on a clean shed floor or the tray back of a truck to dry. Leave the material on the floor for a few days allowing all bugs, ants etc. that have been collected to crawl away.

In the case of Acacia and Senna seed pods, the seed is easily removed from the pods by walking on them with joggers many times. A large percentage of seed becomes detached from the pods and can be easily separated from the trash. Both the seed and the trash should be saved and stored in plastic bins. The trash still contains some seed and can be spread inside the mounds.

The fruit collected from Eucalypts should be placed in a clean, well aired place to dry until the seed is expelled. Collect the seed and store

Establishing Trees and Shrubs Under Dryland Conditions

M.W.Last
May 02

This fact sheet is about establishing trees and shrubs for shade and shelter in the arid zone of Australia, under dryland conditions where regular irrigation is not possible. Native plants require sufficient moisture to develop a root system which will enable them to survive on the soil moisture produced from natural rainfall. The aim of most revegetation programs is to establish trees and shrubs which have the capacity to survive under natural climatic conditions. The techniques demonstrated in this fact sheet provide a method for establishing trees and shrubs under minimal conditions.

1. A Conventional Method

In the past, when trees and shrubs where being grown in locations remote from a reticulated water supply, establishment was difficult.

The young trees (Eucalyptus camaldulensis) in this picture were irrigated once a week with water which was carted in a 200 litre drum from the local community. Most of them survived the establishment period and are now growing under natural climatic conditions. This method is successful, however it requires the regular input of a reliable person and the availability of a vehicle and equipment.

2. An Alternative Method

In some locations it is not possible to irrigate trees and shrubs during the establishment period. The tree (Acacia ligulata) in this picture was established with 30 litres (3 buckets) of water at the time of planting and a one litre carton of Aquagel* was installed next to the root ball. This product is a high moisture yielding compound which sustained the plant for a ten week period. At the end of this period, because of the lack of rainfall, this plant was irrigated with 70 litres of water plus a second carton of Aquagel.

During the second ten week period, the rainfall was sufficient to sustain the plant and produce growth. It was therefore not necessary to irrigate or install a third carton of Aquagel. The plant is now thriving under local climatic conditions.

* Aquagel International Pty Ltd, 75 Orsmond Street, Hindmarsh SA 5007 - Tel. 08-8340 1022 - Fax. 08-8373 2814

3. Aquagel

Aquagel is a compound of biodegradable non-toxic food grade material which contains water. It is a gel which is liquified by soil bacteria to produce a trickle of water to irrigate the root system. This alternative source of moisture sustains the plant between rain periods.

Aquagel is available in a one litre carton similar in shape to a milk carton. It has a neutral pH, is safe to use and harmless to children and animals. In Central Australia, each one litre carton supplied sufficient moisture to sustain a plant for a ten week period.

4. The Method

A hole is dug for each tree and shrub and filled with a bucket of water (10 litres). The root ball of the plant is then placed in the water and the hole is backfilled with soil. A basin is then formed around the plant to hold more water. It is essential that the root ball of the plant be in contact with moist soil.

In some locations, trees and shrubs can be planted in association with storm water harvesting programs. These schemes would provide extra water for the growth of the plant.

5. Installing Aquagel

About 20 cm. out from the base of the plant, dig a hole in the soft moist soil on an angle to the bottom of the root ball. The bottom of a carton of Aquagel is removed and the hand is held over the bottom to prevent the gel sliding out as the carton is placed into the hole. Arrange the carton so the gel makes contact with the base of the root ball. The carton should be completely covered with 25 mm of damp soil to prevent animals and birds breaking open the top and eating the gel. A second bucket of water is then poured into the basin around the plant to settle the soil and provide extra moisture for root development. A third bucket of water should be applied the next day.

When using these minimal methods for establishing native plants, it is important to observe the results and make adjustments to the method where required. If significant rainfall occurs during the first application of Aquagel (10 weeks), root development of local species should be rapid. In some cases where rainfall is non existent, it may be necessary to provide extra water to the plant during the establishment period.

Other Fact Sheets for Use on the APY Lands

Planting Trees and Shrubs	December 1985
"I Want to Plant Trees"	February 1997
Tree Guards	March 1994
Planning to Water Fruit Trees	October 1994
Planning Fencing for Gardens - 1	October 1994
Planning Fencing for Gardens - 2	October 1994
Windbreaks	October 1994
Water Quality Information	November 1994
Vegetable Sowing Calendar	January 1981
Some Vegetable Varieties Suitable for Central Australia	June 1986
Drip System Layout and Dripper Spacing	June 1987
Fittings for a Simple Drip System	May 1995
How to Mulch Fruit Trees and Vines	July 1994
Mulching Materials - 1	August 1995
Earthworms	March 1995
Making Compost	April 1995
Planting Grape Vines	June 1994
Dormant Pruning of Grape Vines	August 1984
Making a Tube Trellis for Grape Vines	June 1987
Making Deciduous Cuttings	July 1994
Scale Insects	September 1994
Fungicides, Herbicides & Pesticides	November 2001
Shahtoot - King White Non-Staining Mulberry	December 1993
Planning Work - 1	July 1995
Contolling Cars and Trucks - 1	February 1996
Selective Weeding -1	March 1996
Tourism - 1	September 1995
Rabbit Information - 1	November 1995
Rabbit Calicivirus Disease	November 1995
"Where Can I Find It?"	December 1995