SOUTH-EAST DISTRICT CONFERENCE

4th-5th February, 1976

Wednesday 4th

p.m. Snowy Films

Overnight at Kosciusko Chalet

Thursday 5th

Tour of Alpine Area,

conducted by the Resident Soil Conservationist,

Soil Conservationist Mountains and Investigations Officer

SOUTH-EAST DISTRICT ANNUAL CONFERENCE

5th February, 1976

THE SUMMIT AREA WORKS PROGRAMME

A. E. R. Wild

Resident Soil Conservationist

The Snowy Mountains are unique in the world. They are largely covered with soil vegetation. Most other mountain ranges in the world are rock, which is constantly eroding to produce silt. Little erosion occurs in the Snowy Mountains range and hence there are few siltation problems.

Past mis land use in the alpine area, grazing and associated burning operations, have caused serious erosion in the area. It has been the aim of the Soil Conservation Service in association with other public bodies to control the erosion and encourage ultimate stabilisation by the re-establishment of native species.

Grazing above 1 370 m (4,500 feet) was banned on and from July, 1957 and this has aided the natural recovery of the area.

Good progress has been made in stabilisation of badly eroded areas. Since 1969 150 hectares has been stabilised and native species are beginning to re-invade the erosion pavements. Total expenditure 1969-74 was approximately $150,000.

FUTURE PROGRAMME

(a) Summit Area

It has been estimated that about sixty hectares of seriously eroded land still require initial treatment. This should be completed by 1979. Maintenance would be required until 1982. Annual expenditure of $50,000 is required to implement the above programme.

(b) Kiandra Area

Some of the old mining areas will require treatment. It is anticipated that initial treatment of these areas will commence in 1978 and be completed by 1981. Maintenance would be required until about 1985.

(c) Bulls Peaks

It has been estimated that ten hectares of seriously eroded land will require initial treatment. This area will be treated in conjunction with the Kiandra area - 1978/81.

The success or otherwise of stabilisation works in Bulls Peaks area will depend upon control of illegal grazing in the area. This area is adjacent to freehold land and boundary fences are not good. Further rabbits will have to be controlled by both landholders and the Park in the area.

ROADS - ROADSIDE VERGES AND BATTERS

The Soil Conservation Service is most concerned about the gradual deterioration of roadside verges and batters within the catchment of the Snowy Scheme. It could be said that roads and associated works constitute the largest area of severe erosion recurring within the catchment.

Maintenance of vegetation on roads and road batters was formally the concern of the Snowy Mountains Authority. A very large gang of men was employed to maintain a stable road system. Since the responsibility of road maintenance was handed over to the National Parks and Wildlife Service it has not been possible to maintain the same intensity of maintenance.

Roadside erosion and associated stabilisation works in the alpine area are unique to the area. Topography, climate and associated frost heave problem do not allow a clear solution to the problem.

Solutions must look at the problems associated with mass wasting and establishment, maintenance of exotic and native ground cover shrubs.

NOTES ON SOIL CONSERVATION FOR ALPINE AREAS, ROADSIDE BATTERS, ETC.

A. EQUIPMENT AND MATERIALS

1. HYDROMULCHER (±$40,000) - mounted on Acco 1800 International (±$30,000). The chief unit for roadside and other easily accessible sites. Sprays seeds and fertilizer with caxton paper pulp - no "sticker" additive needed. High pressure spray results in adequate adhesion. Spray distance effective to only 20-30 m.

2. RE-INCO MULCHER (±$50,000). Better than Bowie mulcher. Sprays out hay and bitumen. Lighter and more versatile off the roads than the hydromulcher. Valuable for "key"sites, top edges, patching on batters, for high altitude work and for very hot, dry or exposed sites where hay mulch gives extra protection. Also very useful where light sandy soils are exposed. e.g. F6.

3. SEED BLOWER (±$1,000). Built by the Soil Conservation Service for own use. Prototype still being modified and improved but is a valuable and useful unit already. Used on roadsides and can be mounted on four-wheel drive vehicles for off-road use. Blows dry seed and could be further developed for the introduction of legumes into grass dominant batters on State Highway No. 4 and Main Road No. 286.

4. MOTOR VEHICLES. Three ton and one ton four-wheel drive vehicles. Use is made of largest possible vehicle in order to get the job done quickly with minimum number of trips.

5. HELICOPTER. Suitable for special jobs especially if someone pays the hire cost. Far too expensive for any but exceptional conditions. Valuable for reconnaissance. If incorporated into normal works programme must be in conjunction with ground vehicles. Rapid weather changes and low density air limits their use in alpine areas.

6. CAXTON WOOD PULP. Is the best pulp available. It is made from Pinus radiata pulp in New Zealand. Caxton pulp is air dry at 9% m.c.f. Australian hardwood pulp is 37% m.c.f.

7. NEWSPAPER. Is used to some extent in New Zealand and is currently under investigation by our works team. It does appear paper must be shredded to increase surface area and hence lessen breakdown time in the hydromulcher. Further there are considerable handling problems.

8. HAY. Type matters little (i.e. grass species, clover or oats) but:-

- must break up easily for even spreading.
- free of thistles and burrs (for handling)
- free of weeds which would be harmful in a particular area.
- cost - cheapest available but consistent with foregoing factors.

9. BITUMEN. Slow breaking anionic.

B. WORKS, TECHNIQUES, SPECIES

(1) Currently we budget for about $100,000 per annum for roadside and other stabilisation works in New South Wales. This work is mostly in the Southern part of the State but recently extended north of Newcastle. The above includes monies spent on alpine works. Work at high altitudes when conditions are optimum and extended to lower elevations early and later in the season.

(2) Alpine rehabilitation on main range. Kosciusko to Bulls Peaks.

(a) Techniques are very reliable for local conditions. Average costs for alpine works including labour, all materials transport and maintenance of equipment is $1,500 per hectare. This figure includes much hand labour. In 1974/75 season fifteen hectares were given initial treatment. This area had extreme access problems. A further 122 hectares were refertilized. Cost for the season was $51,000.

(b) Works team is housed in a well equipped alpine hut clost to the main works area. Provisions are supplied by the Soil Conservation Service. This greatly reduced travelling time and cost on transport vehicles. A twelve-day work period is used, weather permitting. Four-five men and ± ten students or other casual labour generally from just after Christmas to March.

(c) Materials carted as far as possible on dozed work tracks by three ton truck and then distributed to work site by one ton four-wheel drive vehicles.

(d) Hay and bitumen are used on all initial treatments at high altitudes.

(e) It has been found most important that at the edges hay is wrapped up and over and tacked with bitumen over vegetation above.

(f) Very little contour banks or ripping used on alpine area because of hay/bitumen technique. Again, saving in costs and retention of landform nearer natural form.

(g) Stone work still used in severely eroded gullies.

(h) Philosophy

(i) Put in adequate access.

(ii) Use exotic species for quick vegetation cover. Keep these species going with fertilizer as necessary for up to ± five years. End of the period native species should be well established and exotics will decrease as fertility begins to fall away.

(iii) Having done the job for the season stabilize the track.

(i)

(I) Apply fertilizer, as convenient, throughout the season. Fertilizer may be applied before or after seeding.

(II) When conditions are right for seeding drop all else and concentrate on seeding (e.g. after rain in summer) as long as suitable conditions persist. Then stop. So on again if suitable conditions return.

(III) Mulch (hay and bitumen) as fast as possible behind seeding.

(IV) Grass and clover sown in January can be up to 10 cm high and thriving vigorously by end of March. There may be some frost damage but because of mulch, frost damage is not a serious problem.

(3) Plant Species

(a) Chief exotic species used are:

Browntop Bent

Highland Bent

Red Clover

White Clover

All these species are imported from New Zealand. They are grown in New Zealand's high country.

(b) Native Species

(i) Montia

Creeping rhizomes, succulent, dark green leaves 7-10 cm, white flowers. Very valuable at high elevations. Moderately shade tolerant and will creep up steep and shaded edge faces. Easily propogated vegetatively. Formerly the material was propogated in jiffy pots at Cooma. However, recently a more efficient propogation technique has been developed using vegetative material in the field.

Montia appears to spread quickly some area planted at 60 cm centres have almost closed in two years. Is difficult to establish on hot, dry north-eastern slopes.

(ii) Epilobium

A creeping rhizomatous species with a short flowering head. Propogation like Montia.

(iii) Luzula

A useful monocat seed or vegetatively.

Montia, Epilobium and Luzula are all pioneer species on pavement sites.

(iv) Craspedia (Billy Buttons)

Fluffy leafed compositae with large button head. Spreads well by seed both on mineral soils and on areas of thick dead grass. Case moth activity.

(v) Celmisia

Species on main range don't appear to spread much by seed - rather by expansion of existing clumps. Hence is not an important natural.

C. ROADSIDE BATTERS AND VERGES

-1- Important to control run-off - collect and transport to save disposal areas. Use adequate culverts, cut-off drains, drop down drains.

-2- Reshape top edge. Avoid undercutting. Wrap over with hay.

-3- Use hay and bitumen for top edge and for patching areas where hydromulcher technique was not successful.

-4- Grass table drains, jute mesh may be required.

-5- Grass verges and shoulders. Use short grasses not tall grasses. Keep maintenance to a minimum.

-6- Hardenbergia, Kennedia and some acacia species are useful for roadside works in certain situations. However, must be in conjunction with exotic species.

SOUTH-EAST DISTRICT ANNUAL CONFERENCE

5th February, 1976

FEATURES OF THE ENVIRONMENT ENCOUNTERED DURING THE SUMMIT AREA WORKS PROGRAMME

P. A. Keane

Soil Conservationist (Investigations)

The purpose of today's excursion into the alpine area is to familiarise you with the Summit Area Works Programme, both past and present. My particular purpose is to point out aspects of the environment in which the work is going on. It is a difficult place to work in. A number of factors see to this quite effectively. Perhaps after we have finished our tour of inspection you will appreciate some of the reasons why the work will have taken over twenty years to complete.

The inspection will proceed from the Chalet to Charlottes Pass, which is our first stopping point. Weather permitting, we will get the distant view of this beautiful alpine and sub-alpine landscape. From then on we will have stops along the way as new features become apparent.

This commentary is meant as a guide. Questions will be welcome, but we cannot guarantee to answer all queries!

0.0 km (0.0 miles)

CHARLOTTES PASS

Looking North

Below us is the Chalet and Spencers Creek. The valley is colder than where we are standing. Note the reverse "tree-line" effect along the bottom of the valley.

Bogs are common along the flow-line. Erosion was classified as "minor sheeting", but the bogs were burnt and extensively drained during grazing days. About five percent of alpine and sub-alpine area is occupied by bogs.

Notice the David Moraine at the left hand end of the valley. This is a supposed terminal and lateral moraine, depending on whose theory of glaciation you believe in.

Glaciers from the head of the valley (about where we are standing) and the lateral valleys to the right (east) are thought to have formed this large mound of earth and rocks.

The old Spencer's Creek weather station was once situated on top of the moraine. Weather is now recorded at the Chalet.

You will notice the ski-lifts to the right and left. The old chair lift to the alpine way disappears over the Ramshead Range to the east.

Looking South

We now get a panorama of the alpine area. The large plaque will help orientate you.

Mt. Kosciusko (2 224 metres) is at the head of the Snowy River, which we can see below us. To the right are Carruthers Peak and Mt. Twynam. The Soil Conservation hut can be seen to the right of Carruthers, just below the skyline.

The alpine area has been affected extensively by glaciation. The cirque between Mounts Northcote and Lee is most noticeable, as is the cirque above Blue Lake (although we cannot see the Lake).

Bare areas along the tops of ridges are snow patches. Snow lingers in these sheltered spots well into summer.

We are standing at the approximate treeline (1 800 metres). Above this height, trees cannot grow. The short growing period does not enable trees to accumulate root reserves sufficient to survive the extreme cold.

Frosts can occur here all year round. Snow cover is permanent for four to five months, but snow can fall at any time. (There was a light fall the weekend before last).

Precipitation at Mt. Twynam is 3 000 mm per annum. Winds can be strong. Evaporation is rapid at this altitude, and despite the high precipitation, droughts can occur during the year, and more expecially during summer. This year, we are experiencing a particularly dry summer. The weather has been bad. Fogs and wind have been common, but there have been beautiful, cloudless days.

Let's hope today is one of the latter!

Vegetation at Charlottes Pass is a snowgum community (sub-alpine woodland). The snowgum (Eucalyptus niphophila) is a stunted tree at this altitude. It assumes a mallee habit. Note its thin bark, and very thick, shiny leaves. These are both adaptations to the wet, cold climate.

Shrubs are common under the snowgums, as are snowgrasses and herbs.

0.8 km (0.5 miles)

We are now at the Snowy River crossing. Note the crystal clear purity of its water! On the right before we cross is a large bog.

Notice the spagnum moss (peat) along the river banks and also along the banks of Club Lake Creek.

An old shepherds hut can be seen on the interfluve between the river and the creek.

1.9 km (1.2 miles)

Look back towards Charlottes Pass. Notice the multiple bridle tracks from the Pass down to the River.

Parallel patterns of vegetation are very noticeable. These are due to alternating wet and dry areas. Shrubs and bogs occur in the wet areas. Trees and grasses occur in the dry areas. The wet areas correspond to fractures in the ground rock, a gneissic granite. Springs and seepages emerge through these cracks. Groundwater here is acid.

3.1 km (1.9 miles)

Notice the old track to the right of the present one. It has been stabilized by the Service. The old bridle track can be observed to our right practically all the way up.

On the left is a fen or permanently wet area. It is dominated by the very green sedges (Carex species). Around the edges are bogs, consisting mainly of Spagnum or peat. These peat bogs hold water like a sponge. The prickly looking shrub associated with the bogs is Richea continentis.

To the right is the main vegetation community, snowgrass-snow daisy community. Snowgrasses (Poa) are heading well this year. The snow daises (Celmisia sp.) are not much in evidence this year as far as flowers are concerned. But the other herbs, such as the yellow and

orange billy buttons (Craspedia) are in full flower. Snow daisy is distinguished by its silver-green appearance. This is a plant typical of the alpine area, with strong rhizomes occurring below the soil surface. The rhizomes are further protected by strong topgrowth.

As we proceed further up the track you will notice many areas of bog and fen, but mostly the snowgrass-snow daisy community. There are also small patches of shrubs (heaths). Of interest are the mat heaths (Podocarpus) which grow over the rocks.

Soils are mainly the acid freely draining alpine humus soils on which the snowgrass-snow daisy community occurs. Dark brown/black surface layers of loam to clay loam overlie the yellowish/orange A/C horizon. Northcote classification is Um 7.11.

Soils in the bogs are classified as O (acid). The fens are mostly Uc soils. The coarse nature of fen soils tells their story: they are the silt traps of the mountains.

4.3 km (2.7 miles)

Note Headley Tarn on the right. This is a glacial lake.

5.3 km (3.3 miles)

At this point a large snowdrift usually blocks the track. It is cleared by dozer early each works season and soon disappears.

The vegetation to the left is known as short alpine herbfield or snow drift community. The low growing herbs here are mainly plantains (Plantago sp.) and around the edges is the white-flowered montia (Neopaxia sp). This community is usually permanently irrigated from the slow melting snowdrifts. The yellow flowered herb is a buttercup (Ranunculus sp.).

As we go down the track to the Creek note the montia colonizing along the stabilized edges of the track.

5.6 km (3.5 miles)

Carruthers Creek - note the large snowdrift up the Creek. Also note the clear water (not advised for drinking).

As we go up the track look back at the land slips along the Creek.

6.3 km (3.9 miles)

All out for photographs of Blue Lake. It has been freshly dyed for the occasion.

7.2 km (4.5 miles)

CARRUTHERS HUT (and morning tea)

You may notice at the hut that the surface geology has changed. Rocks of the greater part of the alpine area are gneissic granites. arruthers Peak, and a significant part of the works area are on metasediments (phyllites, quartzites, shales). This is a narrow band, outcropping from near Mt. Kosciusko, through Carruthers and to the west of Twynam.

7.7 km (4.8 miles)

CARRUTHERS SADDLE

Photographs! This is one of the best views in the mountains (on a clear day of course). We are looking across the Murray Valley, in the distance, to the Victorian Alps.

The ridges off the main range are: to the right, closest is the Sentinel and then Watsons Crags. To the left, closest is the steep Carruthers spur, and then the Lady Northcote Spur.

Tread lightly, you are walking on one of the rare vegetation communities. This open patterned community is a feldmark.

Wind is funneled and concentrated here, creating this peculiar vegetation arrangement. Plants are killed on the windward side. They move slowly in the direction of the wind as they are blasted at one end and grow at the other. Small herbs and grasses grow in the shelter of the larger plants.

8 km (5.0 miles)

As we go up the track off the saddle notice the solifluction terracettes. These are a mass movement phenonenon. Some of the terracettes have a feldmark-type vegetation on the treads and risers. Soil builds up gradually at the base of the risers. The snowgrass-snow daisy community develops in the soil pockets. Soil develops further until the entire terracette is covered in the grass-daisy community.

9.2 km (5.7 miles)

This is another feldmark community. The particular area here is slowly re-developing. The ground-hugging shrubs are becoming larger.

9.3 km (5.8 miles)

Blue Lake can be seen on the right.

9.5 km (5.9 miles)

The Service's meteorological station. We measure rainfall, air temperatures (in the Stevenson screen), and soil temperatures.

Soil temperatures are measured at 3 cm and 9 cm under bare soil and under vegetation. Temperatures are generally higher and lower under bare soil then under vegetation. The diurnal variation is less at 9 cm than at 3 cm.

The soil temperatures are similar to those experienced under erosion pavement (bare) and those under the hay mulch (vegetation). The mulch lessens the severity of frosts, keeping soil temperatures more even than under bare soil.

12.1 km (7.5 miles)

The south face of Mt. Twynam.

Notice the refertilisation trial on the right (white wooden pegs) and the rate of regeneration trial (metal blue and red pegs).

If you look to the south we get a good view of Kosciusko. To its left are the Ramsheads. To its right is the more impressive Mt. Townsend. The Polish explorer who first climbed these mountains is believed to have mistakenly thought Mt. Townsend was the highest mountain, and he applied the name Kosciusko to it.

Note the bare snow drift areas in the catchment above Blue Lake. The amount of erosion around Twynam is very evident.

12.9 km (8.0 miles)

Last years works area. Notice the good regeneration of native species (mainly montia).

The effects of the 1973 fire in the Grey Mare Range is evident from here. The crown scorch areas stand out as pale areas in the forest vegetation.

The bare areas in the Geehi Valley are the borrow areas for the Geehi Dam.

The highest mountain to the north is Mt. Jagungal. Mt. Tate is the rock capped peak a few kilometres to the north along the main range. Mt. Anderson is the flat-topped mountain with the erosion patches.

14.3 km (8.9 miles)

From here we can see Guthega village. The mountain behind Guthega is the Blue Cow. Guthega Dam is hidden behind a ridge slightly lower down the Snowy River.

14.8 km (9.2 miles)

Below us is a bog area that was probably a glacial lake. It is now almost completely silted up. The cirque to our right (north-east face of Twynam) has a large snowdrift which reputedly lasts longer than any in the mountains.

As we go on from here you will see the erosion patches to be treated during this and the next works season. It is probably fairly obvious by now that access is one of the problems. The track has to traverse some difficult terrain.

16.4 km (10.2 miles)

Our last stop as far as this commentary is concerned.

Note the large patches of giant wallaby grass (Chionochloa sp.). This was an "ice-cream plant" during grazing days. It is now on the increase. Another species in this category is alpine celery (Aciphylla glacialis).

Most of this area is dominated by shrub (low heath). The cream flowered shrub is Kunzea muelleri. At lower elevations shrub species grow taller. You will notice we are getting down to the tree-line. There are a few trees in sheleterd spots.

From here we will ride/walk to Mt. Anderson. And then back to Charlottes via Carruthers.

SOUTH-EAST DISTRICT ANNUAL CONFERENCE

5th February, 1976

TREATMENT, TECHNIQUES AND PROBLEMS ENCOUNTERED DURING THE SUMMIT AREA WORKS PROGRAMME OVER THE PAST DECADE

J. H. Rogers

Soil Conservationist Mountains

The Summit Area Works Programme commenced very shakily in 1956/57 with the temporary erection of "Tent City" at Carruthers. Very strong winds prevailed one night virtually destroying the camp site so the works programme came to a halt at Carruthers until 1960/61 when Carruthers Hut was erected. This was the first major problem encountered in the Summit and over the past twenty years officers of the Service have evaluated works done and suggested alternatives to provide more efficient workmanship and effectiveness of work done.

The areas inspected from Charlotte Pass to Mt. Anderson will indicate the escalation of new ideas over the past twenty years. Comments may be made that change took a long time to come, but when you consider that each season's works programme only extends for 2-3 months with many working days lost because of bad weather then you may appreciate the problems encountered.

The areas seen between Charlotte Pass and Mt. Anderson do not include all the areas treated by the Service. However, you should realise from inspecting these areas what changes, improvements, problems etc. have been made in the past decade.

CHARLOTTE PASS (1 840 m)

0.0 km

Many improvements have been made to the track from the Pass to Carruthers. The edges of the track are treated each year with seed and fertilizer. Maintenance to the track each season includes regravelling, opening cross drain outlets, and reconstruction by hand of spoon drains. Species of clovers and grasses (Cocksfoot, fescue, red and white clovers, etc.) help stabilise the road edges.

1.9 km (1.2 miles)

The old bridle tracks beside the vehicle track (from Charlotte Pass to the Snowy River) indicate the extent of erosion caused by pack horses used before stocking was prohibited in the Summit Area in 1957. These tracks have been treated since and quite a few native species have established in these areas.

3.1 km (1.9 miles)

On the right hand side of the existing track you can notice a short section of old track which after realignment by the Service was treated and has recovered extremely well.

5.6 km (3.5 miles)

Carruthers Creek - one the slopes adjacent to the creek you can notice landslips, evidence of mass movement which were treated with hay and bitumen in 1971/72 works season.

6.3 km(3.9 miles)

Blue Lake to right hand side of track.

7.1 km (4.4 miles)

On the left hand side of existing track you can notice the old track to Carruthers Peak which was sown and hay mulched in 1973/74 after being used since 1964. This shows the extent to which the Service will treat all tracks in the Summit when treatment of areas has been completed.

7.2 km (4.5 miles)

Carruthers Hut - The Hut was flown in by helicopter and erected in 1960/61 works season. Elevation 2 027 metres (6,650 feet).

7.7 km (4.8 miles)

Carruthers Saddle - From here looking back towards Carruthers Peak you can notice evidence of very extensive works carried out from 1956 to 1968. Brief outline of works was as follows.

Carruthers Peak: 1956/1957

(1) Absorption and diversion banks - these were hand built.

(2) Stone retaining walls - loose stone was hand raked on the contour to impound as much run-off as possible.

(3) Wire netting and straw mulch.

(4) Bitumen and straw mulch.

(5) Stone-pitched drains.

(6) Rubble drains - to improve lateral drainage system to connect with main drainage (5).

(7) Snow fences - erected on blow-out areas, made of ringlock wire and sisalkraft.

Of course this was an experimental year, so as many methods as possible were used. It's interesting to note that 1958/59 it was decided that wire replace bitumen because (1) access for a power sprayer too difficult (2) cleanliness and ease of handling of wire; (3) difficulty of salvaging drums from rolling down slopes if dropped by plane. From 1960/61 season onwards very labour intensive works commenced with refertilising of previously treated areas for 3-4 years.

Carruthers Peak: 1960/61 - Methods Used

(1) Site prepared by smoothing, filling, fertilized, seeded, straw mulched (2-2½ ton per acre) (5-6 tonne/hectare) and pegged down with galvanised netting.

(II) Earth and rock fill banks constructed by hand for purpose of cross drainage and water disposal. Methods varied from year to year - brief explanation given on attached sheets.

9.5 km (5.9 miles)

Sentinel Basin - This area was treated during 1972/73 and 1973/74 works seasons (approximately 60 acres). Damaged peat and bog area, damaged snow drift area and two deep eroded gully lines were treated. Treatment required filling and levelling and relocation of flow lines. Water courses were treated with jute mesh and bitumen, also small rock dams and paved outlets were constructed to reduce flow velocity.

The blower was used for seed and fertilizer where access was possible. Approximately thirty acres of galvanised wire was pulled up because Zinc toxicity was causing death of all vegetation. The access track was ripped, sown, and hay mulched after the team finished the works required.

The fertilizer mixture used was prepared by Australian Fertilizers Ltd. on results obtained from pot and field trials -

270.00 kg (600 lbs)	Agricultural Lime
90.00 kg (200 lbs)	12:52:0
45.00 kg (100 lbs)	11:34:11
2.25 kg (5 lbs)	Borax
2.25 kg (5 lbs)	Magnesium Sulphate

Grass and clover species used were: New Zealand White Clover, Perennial Ryegrass, Browntop Bent and some Highland Bent and Timothy Grass.

12.1 km (7.5 miles)

If you look back towards the Catchment of Blue Lake you will notice extensive works which were carried out intially during 1968/69, 1969/70, 1970/71 and 1971/72 works seasons. The Service's tractor was used to construct banks to control run-off, areas were seeded, fertilized, treated with hay mulch and bitumen then refertilized during the following years.

The area on the right hand side of the track was treated during 1961/62, 1962/63 works seasons.

Treatment used:

Site preparation - tractor D4 smoothed, filled area, after removal of all rocks either by hand or pushed by tractor. Fertilizer and seed was then applied by hand and raked in, the area straw mulched, then pegged down with black netting. Many hours of hand labour went into the construction of large paved waterway and clearing area of rock and stone for bank construction. Mulch applied at (2-2½ tons/acre) (5-6 tonnes/hectare).

Some galvanised netting has been removed from this area. From 1967 onwards only black netting was used as observations on areas previously treated with galvanised netting showed zinc toxicity killed existing vegetation and severely affected growth of vegetation for years after.

12.9 km (8.0 miles)

North-east face of Mt. Twynam

Method: same as 1971/72 - bitumen and hay mulch. Previous fertilizer mix could not be supplied this season so 12:22 was used at 130 kg/hectare.

Some small water courses were treated with jute mesh and bitumen and some small rock dams were constructed to reduce velocity.

Seed used: 7 kg New Zealand White Clover
5 kg Perennial Ryegrass
7 kg Browntop Bent

Refertilization: 12:22

Notice the excellent regeneration of the native species: Montia.

Brief Summary of Treatment Methods used from 1961/62 to 1971/72 Working Seasons around Carruthers and Mt. Twynam Areas, Including some Explanations Why Methods Changed During this Period

1961/62

Same methods as 1960/61 except: Tractor D4 used for site preparation in Carruthers and Mt. Twynam area, black netting also used and hand construction of paved waterway. Helicopter was used instead of pack horses to bring in supplies.

1962/63

Hen's Nests treatment used - pot holes 10-15 cm deep, 15-20 cm wide were dug by mattock, rows .6 m apart, wheat sown to obtain mulch and oversown with grass seed the following season. This method envisaged wheat being a source of mulch instead of using hay but results were not up to expectations.

Soil Saver (jute mesh) also introduced for use in minor drainage lines.

1963/64

Treatment as for previous years - site preparation, seeding, etc.

(i) Merry Tiller Cultivator used to reduce hand work - but proved unsuccessful. It blocked with rocks, too light for rugged conditions, was hard on the operator.

(ii) Sill Netting used as well as black and glavanised netting. This was cheaper than black or galvanised netting.

(iii) Bitumen was used to hold down hay but the rate of application spread with a watering can was too difficult to control.

1964/65 - Carruthers Creek Catchment

Haflinger was used for the first time for supplies.

(i) Method this year incorporated use of D4 tractor fitted with dozer blade and ditching equipment to obtain suitable seed bed. The Alpine Humus soils were distributed at the same time.

(ii) Again seed and fertilizer were hand "raked in", straw mulch (6 tonnes/hectare) was held down with sill netting.

(iii) New introduction included fibre glass matting (perforated and non-perforated) with the idea to replace stone-paved drains. This was used in waterway areas after smoothing area with tractor. Problems arose after one month: wind tore sections, so that scouring would have occurred underneath instead of water running on top. The unperforated matting was unsuccessful as grass could not penetrate.

(iv) Some further work was tried using slow breaking anionic bitumen emulsion spread with watering cans.

1965/66

Same method as 1960/61.

Soil Saver (jute mesh) was used in lower areas of Carruthers Creek catchment and on the walking track.

1966/67

Carruthers Creek catchment area treated.

Preparation of seed bed as before.

Use of rock and earth fill banks for water disposal.

Sod Cutter - Sods were lifted from realignment sections of the track from Charlotte Pass to Carruthers and placed on eroded areas.

It was thought at this stage that even distribution of admixed mineralised and alpine humus soils was not beneficial. After observations the exotics were establishing better on mineralised parent material than on the admixed material. Reason probably due to non-availability

of plant nutrients.

Same method as 1960/61.

A bitumen pump was used to spray bitumen emulsion to hold straw on rough areas and adjacent to track. The greatest problem was access to areas with the pump. It was suggested this year that greater use be made of bitumen because it was half the cost of netting applied at .1 gallon/square yard.

1967/68

Treatment Method: as for previous year.

Suggested this year that the use of galvanised netting be stopped because of occasional adverse affects on native species. Only black netting used.

1968/69

Treated Area: Mt. Twynam area.

(i) Contour ripping with D4 Tractor was used to provide better seed bed preparation.

(ii) Use of bitumen was increased (.25 gallons/square yard), only black netting was used.

(iii) The use of the sod cutter was discontinued because there was insufficient earth included with the snowgrass sod and results were not very successful.

This year a grasshopper plague affected regeneration of established and recently sown areas of pasture.

1969/70 - Mt. Twynam (2197 m) (15 hectares) Blue Lake Catchment Area

Area was treated with seed and fertilizer, hay mulched and bitumen sprayed.

Also hand sprigging of "montia" carried out to assist primary colonisation.

All eroded areas were ripped with D4 tractor where possible. Previous to this season hay mulch was applied at 4-5 tonnes/hectare all season. However soil temperature checks revealed temperatures were 5-10°F lower under heavy mulch than light mulch on bare ground. This has a deleterious affect on plant growth. Therefore hay mulch rate was varied - heavy rate early and late in the season to combat frost heave because mulch has a blanket effect. In between periods were gradually

reduced to 1.25 tonnes/hectare.

Bitumen completely replaced the use of wire this season because of handling difficulties associated with wire.

1970/71

Initial treatment of thirty hectares in the Mt. Twynam area. Refertilized 19 hectares in the Mt. Twynam area. 90 kg double superphosphate used for refertilising.

Usual method of treatment used - seed, fertilizer, hay mulch and bitumen spray. Only severely gullied areas and blowouts were ripped. Most of sheltered areas were not ripped as the majority of the surface was covered with small gravel and stone. This stone has a mulching effect reducing moisture loss and preventing seed from being washed or blown from the surface. This applies also to feldmark and snowdrift areas.

1971/72

Initial treatment 28 hectares in Mt. Twynam area.

For the first time areas were topdressed aerially with 45 kg/acre double superphosphate. This proved more economical and saved much labour time. However, it was later observed results were too erratic, so hand spreading of fertilizer continued.

Clover seed was obtained from New Zealand. The establishment rate and ground cover was significantly greater than using Australian grown seed.

Same treatment method as 1970/71.

A few thousand Montia potted plants were planted in difficult deflation areas.

Single step inoculation was used instead of multi-step inoculation of clover.