

SOIL CONSERVATION AUTHORITY

REPORT
ON THE PROPOSED LAND USE DETERMINATION
FOR THE PROCLAIMED
MIRBOO NORTH WATER SUPPLY CATCHMENT

Prepared for consideration by the
Soil Conservation Authority
And
Land Conservation Council

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1. INTRODUCTION

Proclamation of the Mirboo North Water Supply Catchment was made on 24th February, 1965, and gazetted on 3rd March, 1965, following consideration of the proclamation report by the then Land Utilization Advisory Council.

Factors of the environment and land use discussed in the proclamation report have been enlarged upon in this present report, and together with field investigation, provide the basis for the details of the proposed land use categories following the descriptive section.

Authority officers have held discussions with the Mirboo North Waterworks Trust in relation to land use controls within the catchment, and at its meeting on 1st October, 1974, the proposed Determination was discussed. Final consideration of the Determination will be made by the Authority following consultation with the Council and other interested bodies.

Publication of the notice of Determination in the Government Gazette will bring into effect land use controls within the catchment. Formal notification of these controls will then be forwarded to landholders, local government, state and federal bodies with interest in the catchment.

The supply system

Water from the northern branch of the little Morwell River is ponded at a point just upstream from its junction with the southern branch. The Trust's pumping station, located adjacent to the weir, lifts water to the service basin, a height of 165 m, over a distance of 5 km, to the town of Mirboo North. The effective capacity of this storage is put at 2.03 ML. This represents little more than the maximum daily requirement in the summer of 1.8 ML. Therefore, as adequate detention facilities are not available, maintenance of water quality at acceptable levels is largely a catchment consideration. No additional water storage facilities exist.

A number of rural holdings are serviced from the rising main bringing the total number of people supplied close to 1,000. At present, treatment is limited to chlorination. Construction of a clarification plant is due to commence before the end of 1974.

There is a history of poor water quality from this catchment. Routine water analyses conducted quarterly for bacteriological and twice yearly for chemical determinations have shown no marked tendencies to increase or decrease. Generally values for turbidity, colour and *E. coli* levels have shown random distribution while at the same time, consistently exceeding values far in excess of those set down for potable water. This led to the introduction of chlorination of supply in 1966; and in 1970, to investigation of a method of clarification to bring the town water supply within acceptable limits. Although the objectives within the catchment area will be aimed at the protection of the water supply, the requirement for rigid control measures will to a significant degree, diminish with the introduction of water treatment.

II DESCRIPTION OF THE CATCHMENT

As a result of field investigations, minor changes to the catchment boundary have been made, bringing the total area under consideration to 814 ha. The significance of these changes is not considered to be extensive enough to warrant revocation and re-proclamation.

Locality and Area

The catchment occupies a section of the Latrobe River catchment on its southern perimeter. The offtake weir at RL 260 m is situated 100 m from the main Morwell - Mirboo North Road, approximately 5 km north of Mirboo North.

Approximately 95% of the catchment lies within the Mirboo Shire; the remainder, within the Shire of Narracan. Parishes of Narracan South, Allambee East and Mirboo are involved.

Geology

Documentation of the geological history in the Mirboo North area has centred about the bauxite deposits for which the area is noted. Bell* has described the area in some detail, incorporating this information into the revised edition of the Mirboo North Geological Map Sheet, One Mile to the One Inch Series. Within the catchment area, the following surface geology is recognised:

1. Older Basalt lavas of Lower Tertiary origin - this parent material accounts for approximately half the area of the catchment, and is the most extensively developed of the land under consideration.
2. Tertiary Sediments - gravels, sands and clays of Upper Pliocene age cover almost the remaining section of land. In some areas, these are known to overlie the earlier basalt flow. The sediments are variable in texture and unconsolidated sections range from a thin mantle to extensive deposits which have been developed for road construction. Random pockets of sand are common throughout this sedimentary section which covers basically the southern half of the catchment.
3. Quaternary Sediments - sands, silts and gravels of recent deposition. A small section exists in the north east of the catchment where surface drains have been constructed to improve the area. Similar deposits are encountered on the main northern branch downstream from where stream gradient sharply decreases.

Lower Cretaceous sediments (commonly referred to as Jurassic) from the basement rock of the area, but they do not outcrop within the catchment.

Relief

The fault trough separating two lobes of physiographic division of the South Gippsland Highlands contains the catchment on its western boundary. Within the trough, Older Basalts and Tertiary sediments have been preserved giving the area differential features each characteristic of their structural geology.

The undulating to hilly nature of the basaltic areas is continuous beyond the catchment perimeter in the west and north reaching a maximum elevation of between 567 and 590 m for a considerable distance.

Surface drainage within the basalt is shallow and only one perennial stream originates in this section where the headwaters are steeply entrenched.

Subsidiary flows to the main stream arise essentially from within sedimentary geology. Drainage patterns within this section are denser and more deeply entrenched, with slopes ranging from 30 - 40% especially about the stream approaches.

Climate

Two relatively wet and cool areas, the Strzelecki Ranges to the north west and the South Gippsland Ranges to the south east, separate the somewhat drier and milder axis of the Tarwin Valley in south west and the Morwell Valley to the north east, where the catchment is situated. Mirboo North, situated on the ridge separating the northerly from the southerly flowing streams at an elevation of approximately 400 m occupies the lowest point along this ridge from Allambee (756 m) in the west, and from Mt Fatigue (900 m) in the east. These features all exert some influence on the climatic conditions in the catchment area.

With the exception of precipitation recorded at Mirboo North, a complete range of climatic data is not available for the immediate area. Records from nearby stations have therefore been used to give a more generalised description.

* BELL G. (1959-60) - "Notes on the Bauxite Deposits of the Mirboo North District, South Gippsland". Mining and Geological Journal Vol. 6 pp 51-62.

Temperature

Temperature patterns within the catchment could be expected to approximate to Leongatha (altitude 129 m) for which long term temperature records are available. These are shown in Appendix A. However, some moderation of these could be expected at Mirboo North 26 km further inland and some 250 m higher than Leongatha. Temperatures may therefore show similar variation but with lower maxima and minima values.

Precipitation

Rainfall data for Mirboo North averaged over a period of 51 years is shown in Appendix B. The annual average precipitation of 1027 mm with few exceptions, has been recorded as rain. On a monthly basis, long term averages show a smooth distribution, 49 mm separating the highest figures for May, August and September from the lowest in January. In contrast to neighbouring stations with similar annual records, the average annual rainfall expected at Mirboo North is greater for the months of February, March, April and May, and less for the months of January and October. For these two months, the relative effect of the rain shadow is more pronounced and in late Summer, Autumn, the coastal influence is greater. Growing conditions are therefore more favourable for an early seasonal break than for an extension of the growing season over late Spring, early Summer.

Erratic behaviour of the rainfall over the period of averaging is closely related to storm incidence throughout the year. Storms of more than 20 mm/day will occur on the average 10 days per year, with the greatest incidence in March, followed by May, February and October in that order (see Appendix C). March, with a range of 293 to 5 mm, shows the greatest deviation from the mean; similar variation is noted in February, April and May.

Frequently, these 24 hour totals form the major portion of rainfall extending over a number of days. Records show that over a period of 36 years from 1937 to 1973, a total of 62 storms with an intensity of 46 mm/48 hours or greater occurred. Fifteen percent of these storms occurred in February with a further 29% occurring during the Autumn.

It would appear therefore, that whilst the late Summer-Autumn rains contribute almost one third of the annual rainfall, and can therefore be expected to provide early relief to soil moisture deficiencies, the incidence of storms introduces a hazardous dimension to the seasonal pattern of rainfall. Over this period significant areas of land may be fallow in preparation for Autumn sowing of pasture.

Growing Season

Based on statistics for Trafalgar, Boolarra, Childers and Warragul, temperatures below 10°C rather than summer drought could be the primary factor restricting plant growth. May, June, July and August in this region consistently have temperatures below this threshold value, giving an effective growing season of approximately nine months, with three months of restricted growth. Although periods of drought are not considered a major factor limiting plant growth, irrigation is used widely on potato crops outside the catchment area to maintain moisture levels at optimum growing conditions.

Soils

Soils through the catchment show considerable variation in structure, texture and drainage characteristics. These features have been reflected in the preferential development of catchment land, and are closely related to the geological material from which the soils have been derived.

Soils developed directly from the basic lava flows show typical krasnozem features. They are deep, strongly acid and friable, are extremely well structured being capable of withstanding repeated cropping on slopes up to 20%. Isolated pockets of these soils remain supporting native stands of timber; the remainder has been developed for agriculture.

Where presence of the underlying basalt has not been a significant influence in the development of the soil profile, duplex soils have been derived from the tertiary sediments. The sedimentary deposits vary considerably, and in some areas are appreciably sandy, giving rise to sandy and sandy loam podsollic soils. A representative of these soils is:-

0 - 100 mm dark grey sandy loam
100 - 200 mm grey white sandy loam
200 - 500 mm yellow sandy clay
500+ mm yellow clay

These soils are poorly structured throughout the profile except for the surface horizons where the influence of organic material is very marked.

Vegetation

Approximately half the catchment still remains under native forest, the major portion of which lies on sedimentary material. The area contains a cover of mixed species with Messmate (*E. obliqua*) and Narrow Leaf Peppermint (*E. radiata*) dominating the canopy with a low undercover of acacia species, hophbush, bracken and dogwood. In contrast, the type of vegetation found in the moister situations of the deeply entrenched drainage lines of the western sub-catchment approaches a wet sclerophyll association. Here, Mountain Ash (*E. regnans*) appears to have been the dominant species on the steeper southern slopes, especially in the headwaters region. As a result of logging and clearing, understorey species of Blanket Leaf (*Bedfordia salicina*) and Hazel Pomaderis (*Pomaderris aspera*) have become the dominant species, and little Ash remains.

Across the forested section of the catchment quality of the timber stands reflects both soil fertility and previous forest management. In the eastern section, medium quality fencing timber predominates but in the western part of the catchment, timber of milling quality with some better quality poles is found.

Acacias with an undercover of dogwood and bracken have become the predominant species where cleared areas have not been regenerated to timber species.

Improved pastures of Cocksfoot, Perennial Rye Grass, White Clover and appropriate varieties of subterranean clover cover the remainder of the catchment. Few native grasses have persisted with the type of management these areas have received.

LAND TENURE

Reserved Forest	364 ha
Alienated Crown Land	
A.P.M.	50 ha
Other Freehold	<u>400 ha</u>
TOTAL	<u>814 ha</u>

A small but significant area totally 2% of the total catchment comprises unused and unopened roads; in addition, the Trust owns a small area within the vicinity of the offtake weir and have negotiated the permissive occupancy of another small area from the FCV for erection of the treated water plant.

A mineral lease issues in 1944 for the purposes of mining bauxite in CA 96, Parish of Allambee East, projects into the catchment for portion of its surveyed area.

III DISCUSSION OF LAND USE

Grazing and Agriculture

Approximately 375 ha or 46% of the catchment has been developed for grazing and/or cropping. The major portion of this is situated on basaltic soils and consequently land use has not been a major threat to the water supply.

The soils are ideally suited to potato production, and cropping forms an integral phase of the rotation with one year in four or five currently being used by some landholders for potato production. Similar soils outside the catchment area are cropped with greater intensity.

Since proclamation in 1965, there has been a general intensification of the grazing sections of the mixed farm enterprises, and this may explain the present long rotation period. However, it is generally understood that if irrigation was permitted in the catchment, cropping of potatoes would intensify. An increase in the possibility of soil movement and colloid suspension in the water supply could then be expected.

Of greater relevance to soil conservation are the particular management techniques currently used for preparation of land for sowing. Cultivation up and down slopes with mouldboard or disc ploughs is common. Subsequent cultivations are carried out with a rotary-hoe giving the soil a tilth which significantly increases its erodibility. Although tyned implements are not favoured by the majority of landholders for these operations, as they do not achieve the same objectives, their use should be encouraged in the future, together with cross-slope cultivation.

Dairying is carried out on one property in association with cropping. Liaison with officers from the Department of Agriculture will ensure adequate protective measures are incorporated in any proposal for the disposal of dairy effluents.

Hazards to the water supply from cropping have appeared to decrease since proclamation; however, this improvement has to some extent been offset by the intensification of grazing. There are no stream frontage reserves, so riparian rights allow direct access to stream banks and beds for stock watering purposes. Concentration of stock occurs in these areas where timber has been retained about streams. These two factors, together with stream crossings, will continue to be a potential problem until alternative water points are provided and stream crossings upgraded.

The proposal to treat catchment water has, to some extent, reduce the need for landholders or the Authority to provide physical protection to perennial streams. Treatment will not, however, do away with the need to protect the sensitive spring areas from deterioration, and such areas would benefit by the exclusion of stock. Discussions with landholders, however, indicate that they may not be prepared to have these areas fenced out, as they provide both shelter and permanent water for stock. In such circumstances, land acquisition and/or provision of alternative watering points will have to be considered.

Forestry

Reserved Forest

Few timber stands remain which would provide a merchantable return from clear felling. Previous management has been predominantly on a selective logging basis, but these operations have not been carried out for some years and forest management has consisted of basic road maintenance and fuel reduction burning for fire protection purposes. The area is considered to have a low potential for native timber production as sandy and podsollic soils are widespread.

Outside the catchment, considerable areas of native forest have been, and are continuing to be converted to softwood plantations. To assist in preparing medium term management plans for Reserved Forest in the area, the Commission requested the Authority in 1970 to signify those area which could be considered suitable for conversion to pines. Following preliminary investigations of stream flow within the catchment, the Authority recommended areas which might be considered suitable initially, but final recommendations are yet to be forwarded to the Commission. Catchment hydrology appears to be more complex than initially realised, and the Authority now considers any conversion to pines or other large scale catchment works should be postponed until additional catchment and storage facilities are developed by the Mirboo North Waterworks Trust.

The main Mirboo North - Thorpdale Road, dividing the catchment basically in a N-S direction forms part of the regional fire break scheme. In Autumn 1973, a controlled burn achieved its objectives without subsequently affecting the quality of water to a marked degree.

Prescriptions for the management of forest operations within the catchment were introduced by the Commission in 1963 (Appendix D). Discussions will be arranged with the Commission to produce revised prescriptions for approval by the Authority. It is important that these apply generally to all forest operations within the catchment, and provide for establishment and subsequent management of softwood plantations.

APM Forests

APM Forests Pty Ltd have extensive forest interests outside the catchment. Portion of CA 98 in the parish of Allambee East was converted to pines in 1963, and the company would like to extend this conversion to the remainder of the allotment at some future date. It is anticipated that first thinning operations will commence this next season.

For the purposes of fire insurance breaks of approximately 20 m width are required about the plantation. Specific provisions for surface conditions of these fire breaks are fulfilled basically by cultivation or grading only. The Authority in the past has not been aware of proposed maintenance to these areas, and often inadequate provision for runoff has caused soil movement to occur. It is proposed that future operations of this nature will be covered by management prescriptions.

Other Freehold

Clearing and forest operations have been of particular concern on two occasions since proclamation. Both involved a significant reduction in protection to streams and springs. No long term problems emerged from these operations but more effective control over them would have reduced the temporary erosion hazards.

Approximately 90 ha of forest and regrowth areas are held privately (apart from APM). Pressure for development of this land for more intensive uses may increase in the future as sections can quite readily be opened up to cropping and/or grazing. Forested land around springs on CA 28 in the parish of Narracan South and CA 96 in the parish of Allambee East is considered unsuitable for any more intensive development, and a total of 17 ha is involved.

Extractive Industries

Gravels and sands within the sedimentary areas of Reserved Forest occur in sufficient quantities to make them a valuable source of road making material. Initially deposits were worked extensively, but in recent years the quality of the available material has declined and further extraction is no longer considered economical.

Approximately 1 ha is involved in total surface area from all pits. One pit in particular is a continuing source of turbid water, sufficient to produce a significant increase in turbidity of the main stream during periods of runoff. Reclamation of these areas must be given a high priority from a water quality consideration if not an aesthetic viewpoint. Stabilisation, which was to have been completed in Autumn 1964 jointly by the Commission and Shire, is yet to be carried out.

Future extractive operations would require strict adherence to a specified pattern of extraction and concurrent reclamation.

Roading

There is an intricate network of roads and tracks through the catchment. The initial subdivision into Crown allotments provided for the usual dense network of road reserves as shown on the accompanying plan (Appendix E). Fortunately, the majority of these roads have not been required for the development to reach its present intensity. Because they frequently follow impractical alignments, alternative access through the catchment has been provided by two forest roads: Samson and Ricardo Roads.

Inadequate road drainage accounts for the bulk of siltation and turbidity problems experienced during periods of surface runoff. Road batters and disused gravel pits contribute substantially to this. The view is taken by the road construction bodies that:-

- (a) sedimentation and turbidity cannot be avoided in the short term
- (b) funds do not provide for conservation works of the magnitude required to substantially eliminate the problem.

Of particular concern has been the reconstruction of the main road through the catchment during the past twelve months. This road provides the main access from the industrial areas of the Latrobe Valley to the coast. Reconstruction has brought the fill batters to within a few metres of the main stream. Subsequent slumping of these and the wash from culvert outfalls has produced stream bed deposits in excess of 1 metre of silt. Although Authority Officers during inspections and discussions have repeatedly brought the interests of the water supply to the attention of the Shire and Trust, no special techniques were adopted or considerations given to prevent deterioration of supply.

Recreation

The catchment has no special attraction for recreational pursuits. There is however an existing network of forest tracks which may attract attention from recreational vehicles. To date there has been little or no activity in this sphere.

IV CONCLUSIONS

Since a primary function of the catchment is to produce water, it is appropriate that effects of land use be summarised in relation to:

- (a) yield distribution of supply and
- (b) the physical and bacteriological quality of water.

During the course of the investigation into stream flow over the past 2-3 years, anomalies have appeared in the results suggesting that porous strata and springs intercepting the main stream are the major sources of stream flow. This has been the case irrespective of seasonal conditions or the time interval since rain last fell. Relationships between the source of flow, catchment topography or present land use are not clearly understood. It would be reasonable to assume however, that any intensive development within the upper catchment which could adversely influence the efficiency of springs and other water source areas would not be in the best interests of the water supply. This applies particularly to Reserved Forest and other sedimentary areas where extensive hard surfacing or clearing may create changes in the summer flow characteristics from the catchment.

The present output from the catchment declines appreciably during the summer and although flow has never ceased, short term demands are frequently greater than stream flow. Therefore, present management and future development may require critical appraisal to ensure adequate summer flow is maintained.

Up to the present, the development pattern through the catchment has followed a natural preference for the more intensive land use to be carried out on basaltic soils. More hazardous and the less productive parts of the catchment have generally been retained under timber cover. Overall, land development has not therefore, directly presented a long term hazard to the water supply.

During the normal pattern of rainfall, sheet flows across the catchment are not common, and deterioration of the water quality arises principally from roadside drainage, unstabilised batters and earthworks. Outside periods of rainfall, most problems are generated about stream frontages and their approaches. While access to these remains uncontrolled, crossings and stock activity will be a continuing source of turbidity and of bacteriological contamination.

Principal aim of the proposed Determination is to ensure that future changes in land use are not incompatible with water supply interests.

V PROPOSED DETERMINATION CATEGORIES

Recommendations

It is recommended that the Authority agree to the following Land Use Determination for the Mirboo North Water Supply Catchment, and that it be published in the Victorian Government Gazette as follows:-

General Provisions

The general provisions of individual land use categories are set out below and should be read in conjunction with the specific requirements and the Determination plan.

Category 1

Land to be used primarily for the protection of streams, watercourses and spring areas where:-

1. No further clearing, cultivation, earthworks, buildings or stream crossings will be permitted without the prior approval of the Soil Conservation Authority.
2. Improvements in the location and design of existing stream crossings may be required by the Soil Conservation Authority.

This category includes land within 100 metres of the offtake weir, within 20 metres or 40 metres or such other distance the Authority may require of the banks of streams, watercourses and spring areas. Most of these streams and watercourses are shown on Plan No. S-101, but the category also includes other streams, watercourses and spring areas in the catchment.

(The 40 m buffer involves portion of the main stream and the more deeply entrenched perennial streams.)

Category 2

Land to be retained as permanent forest.

(This category is composed essentially of Reserved Forest, but small sections of freehold land have been included to ensure there is adequate provision for protection of the springs rising in the headwaters region. Total area is approximately 382 ha.)

Category 3

Land suited to forest purposes. Parts of the land in this category may be suitable for pastures or agriculture, but development of such land for these purposes requires the prior approval of the Soil Conservation Authority.

(Most of this land is associated with sedimentary surface of the catchment where slopes are generally above 10% and frequently in the 20-30% range. It includes areas previously cleared, but now supporting low shrub, acacia and bracken growth.

With few exceptions, the land forms isolated sections of ownership adjacent to Reserved Forest and accessibility is often made difficult by steep approaches about streams. Up to the present, there has been few pressures for development of these areas.

Placing this land in the above category will ensure that development is restricted to those sections which do not constitute a major hazard to the water supply. Total area involves is 120 ha.)

Category 4

Land which may be used for grazing. Parts of this land may be used for cropping subject to the prior approval of the Soil Conservation Authority.

(Land within this category has slopes generally above 17%, or less where a stream is considered to warrant further protection than can be given by the stream protection zone - Category 1. Total area involved is approximately 28 ha.)

Category 5

Land which may be used for grazing or cropping. Parts of this land may be used for more intensive purposes, subject to the prior approval of the Soil Conservation Authority.

(For the most part, land in this category has slopes less than 17%. Soils are well structured throughout the profile, and with suitable management can be cropped regularly without producing detrimental effect to the land and without causing any deterioration in water quality. Total area involved is approx. 284 ha.)

Specific Requirements

While the categories described above are given as a guide to the most suitable uses of catchment land, the Authority may have specific requirements in relation to any land use.

In particular:-

1. All forest operations are to be carried out in accordance with management prescriptions drawn up or approved by the Soil Conservation Authority.
2. Prior approval is required before roadworks or any earthworks associated with dam, drain building construction or any other purposes are carried out in the catchment.
3. Prior approval is required before any land in the catchment is subdivided.

VI APPENDIX

- A. Temperature Data
- B. Rainfall Data
- C. Rainfall Frequency Data
- D. Current Forest Management Prescriptions
- E. Plan of Proposed Determination of Land Use

Appendix A - Temperature Data

Station - Leongatha (Elevation 129 m) Duration of analysis - 28 years

DATA	MONTHLY FIGURES IN °C												
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
Average maximum temperature	24.7	25.1	23.3	19.1	16.3	13.7	12.9	14.1	16.2	18.3	20.7	23.1	19.0
Average minimum temperature	11.6	12.3	11.2	9.1	7.2	5.3	4.8	5.3	6.5	7.8	9.1	10.6	8.4
Average mean temperature	18.1	18.7	17.2	14.1	11.7	9.5	8.9	9.7	11.3	13.1	14.9	16.8	13.7
Highest temperature on record	43.9	45.6	41.7	32.3	28.3	22.2	22.7	23.6	30.0	33.9	35.6	40.0	45.6
Lowest temperature on record	2.2	2.5	6.5	0	-1.1	-2.8	-3.3	-3.3	-2.5	-0.7	1.1	1.1	-3.3

Appendix B - Rainfall Data

Station - Mirboo North (Elevation 243.8 m) Period of analysis intermittently between 1899 to 1973

DATA	MONTHLY FIGURES IN °C												
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
Mean monthly rainfall (mm)	53	60	74	90	102	100	91	102	102	94	84	75	1027
Mean number of rain days	6	7	7	10	12	12	11	11	11	11	10	8	116
Maximum monthly rainfall (mm)	160	206	293	248	240	283	172	212	193	179	180	185	1516
Minimum monthly rainfall (mm)	0	2	5	10	29	25	26	37	28	9	20	13	738
Maximum 24 hour total (mm)	55	71	103	70	59	48	62	47	60	52	48	73	103
Maximum 48 hours total (mm)	59	142	136	75	93	57	78	80	60	69	62	74	142

Appendix C - Frequency Distribution of Daily Rainfall

Station - Mirboo North (Elevation - 243.8 m) Period of analysis - 1899 to 1973

DATA	MONTHLY FIGURES IN °C												
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
Rain free	81.45	72.86	72.58	64.72	61.56	61.39	64.78	65.59	65.83	65.05	70.56	76.34	68.56
0.2 to 0.5 mm	0.54	0.29	2.15	1.11	1.88	1.39	2.96	1.88	0.56	1.08	0.56	1.08	1.30
0.6 to 1.0 mm	1.08	3.21	1.34	2.22	2.96	1.94	2.42	2.15	0.83	2.42	1.94	2.15	2.05
1.1 to 2.0 mm	1.34	3.83	4.03	6.11	6.18	3.33	3.49	4.57	3.89	3.76	3.33	2.15	3.83
2.1 to 5.0 mm	5.11	6.49	6.45	7.78	7.80	10.83	9.68	5.65	7.50	7.53	9.44	5.91	7.51
5.1 to 10.0 mm	4.30	5.31	4.30	7.50	9.95	9.72	8.60	9.68	12.22	8.60	5.56	4.57	7.53
10.1 to 20.0 mm	4.30	4.42	4.57	8.06	5.65	7.50	5.91	8.60	7.22	8.33	7.22	5.38	63.43
21.0 to 30.0 mm	1.08	1.77	2.42	1.39	2.15	3.06	0.81	1.34	0.83	2.96	0.56	1.61	1.67
31.0 to 40.0 mm	0.81	1.18	1.34	0.56	1.61	0.28	1.08	0.54	0.83	0.27	0.56	0.81	0.82
41.0 to 999.9 mm	0.0	0.59	0.81	0.56	0.27	0.56	0.27	0.0	0.28	0.0	0.28	0.0	0.30

Appendix D

Copy Little Morwell River Catchment Supplying Mirboo North Management Prescriptions with respect to State Forest within the Catchment Mirboo North Forest District

1. Taking into consideration the type and condition of the stand and the silvicultural requirements of the species involved, utilization operations shall be so organized that openings in the canopy are kept to a minimum size.
2. All timber utilization operations shall be controlled by tree marking.
- 3(a) Snigging and gravel winning operations shall be suspended at any time of the year by the forest officer in charge during heavy rain and or such period thereafter as in his opinion such operations would be detrimental to water supply or forest interests.
- (b) All snigging and gravel wining operations shall be totally suspended during winter and early spring months, dates of commencement and termination of such suspension period in any year to be determined by the forest officer in charge after consultation with the Divisional Forester.
- (c) Carting on any forest road shall be suspended by the forest officer in charge during such period or periods as he considers necessary for protection of water supply or forest interests.
4. Snigging and cartage of forest produce through any running stream shall be prohibited and extraction shall be planned accordingly. As far as practicable snig tracks shall avoid steep grades. Strict attention shall be paid to disposal of drainage from roads, snig tracks and log landings to obviate erosion and the direct discharge of silt into stream channels. No log landing shall be constructed within 2 chains of any running stream or in a position likely to cause drainage direct into stream channels. No fuel dump shall be located within 5 chains of any running stream.
5. On completion of logging to any landing, and at the end of each logging season, snig tracks and cartage routes other than recognised forest roads shall be breached or barred to prevent erosion commencing and so that silt shall not be deposited from them directly into stream channels.
6. The proposed location of all roads, major snig tracks and log landings, and the standard of road, bridge and culvert construction, shall be subject to approval by the forest officer in charge.
7. Where it is unavoidable for tractors or other vehicles to cross running streams, satisfactory crossings at locations approved by the forest officer in charge shall be constructed in such manner that the stream banks are not disturbed.
8. No tree shall be removed which is growing within or liable to fall into:-
 - (a) The strip between the main Mirboo North - Thorpdale Road and the northern head of the Little Morwell River.
 - (b) A strip of one chain minimum width along the west bank of the main course of the northern head of the Little Morwell River.
 - (c) Land within 10 chains of the pumping station.

The width of any strip or section thereof along a stream may be increased where the forest officer in charge considers this necessary for effective stream protection.

9. Any heads of trees, logs or similar debris falling into running streams as a result of forest operations shall immediately be removed provided that such removal can be effected without undue damage to the stream banks.
10. Except where unavoidable by reasons of topography, no road shall be constructed on any portion of a reserved strip specified in paragraph 8 except on the approach to a stream crossing approved by the forest officer in charge.
11. Burning operations shall be restricted to a minimum consistent with silvicultural practices and the protection of the area from fire. All burning operations shall be carried out departmentally and shall be strictly controlled. No burning shall be carried out on the reserved areas specified in paragraph 8.
12. In the event of any portion of the area being damaged by fire, no salvage logging shall be permitted without prior Commission approval.
13. The establishment on reserved forest of any sawmill or of any industry for the purpose of converting timber to manufactured products shall be prohibited.
14. No camps or living quarters, whether temporary or permanent shall be established on reserved forest.
15. Adequate sanitation facilities shall be provided at all places where men are required to work and shall be located not less than 2 chains from any running stream. Location and type of construction shall be subject to approval of the forest officer in charge.
16. Any application for grazing rights on reserved forest shall be considered on its merits and approval or otherwise shall be the subject of a Commission determination.
17. Quarries and major excavations, including any associated spoil dumps, shall not be located within three (3) chains of any permanent stream, and shall be excluded from the strip described in prescription 8(a). Drainage from these activities shall be adequately dispersed and diverted to prevent the direct discharge of silt into streams, and all operations shall be subject to close supervision.

These prescriptions shall remain in force until amended by authority of the Commission and any departure from the prescriptions shall only be with the express approval of the Commission.

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