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Central Otago Irrigation
Investigation Committee,
DUNEDIN.

6th September, 1928.

The Rt. Hon. the Prime Minister.

Sir,

The Committee appointed by the Government to inquire into and report on the position of irrigation in Central Otago has now the honour to report as follows:-

The order of reference quoted hereunder was of a wide and comprehensive nature calling for a review of the various rates charged for water, the adequacy or otherwise of the depth of water applied to the land under the various schemes, their general administration, and other correlated points of interest.

1. ORDER OF REFERENCE

(a) Whether you think the existing water rates are reasonable and that the land can bear these rates, assuming that the best use is made of the land ~~and that the best use is made of the land~~ and that the purchase price was reasonable; and if you find the rates charged are more than the land can bear, what rates for the different areas you would suggest. Also there may be individual cases which should, from the nature of the soil and other conditions, receive different treatment from the rest of the area.

(b) Whether you are of the opinion that water is being efficiently used, and that the existing basis of allocation of water on the different areas is reasonable. If not, make recommendations as to the amount of water necessary for each area, taking into consideration the class of land and its crop. Individual cases may require special consideration.

(c) Whether you think the administration of the several schemes could be improved, and, if so, what method would you suggest. If by a Board or Commission of Management, should it be appointed by the Government, or a body elected by the water users with possibly Government representation?

(d) Whether there are any other points which you think should be brought forward for the consideration of the Government?

2. GENERAL CONSIDERATIONS

Irrigation on a large scale is a comparatively recent development in New Zealand, and when the schemes or extensions thereof outlined in this report were started, what might be termed a flat rate was charged for water on each, and a uniform depth of water allocated to every acre under such scheme, but with the passage of time and the experience gained it is evident that adjustments in both respects have been and are still necessary. New Zealand is not singular in this, as in America, where irrigation schemes of much greater magnitude were in existence long before those in New Zealand, the same difficulties have been encountered, and within recent years Commissions have dealt with the same problems.

Irrigation is only one phase of agricultural development in New Zealand, and the area devoted to this type of farming is comparatively small in relation to the Dominion's total acreage under cultivation. Its relative significance, however, is important, for in the semi-arid region of Central Otago, with a rainfall of from 11 to 20 inches, the Government has embarked on the development of dry barren country in an endeavour to reclaim such land by irrigation and to establish satisfied farming communities.

Nowhere in New Zealand are found conditions similar to those pertaining to Central Otago, and nowhere are the problems confronting the settler more complex. The arid conditions prevailing in that locality, combined with the intense heat of summer and extreme cold of winter render farming, as practised in more humid

districts, a most precarious undertaking. The soils of the district are highly variable, ranging from heavy silts superimposed upon clay to light gravel of the most porous nature. It can be readily understood that where such variations exist there are great differences in the water holding capacity of the soils. The heavy soil types, on account of their greater retentivity, can be irrigated with larger flushes of water at longer intervals than is the case with the light wind-drifted soils having a gravel sub-surface.

The Committee was impressed in the course of its investigations by the large area of these light soils in Central Otago, and an examination of each individual holding has demonstrated convincingly that the present allocations of water thereon require drastic revision. Another important feature relating to the soils of Central Otago which has had a great bearing on the Committee's recommendations for a revision of the rates already charged is the variation existing in regard to their fertility, or ability to grow crops. Undoubtedly there are areas of deep mica-schist silts of high fertility which will grow crops of almost any kind most luxuriantly, but such areas are comparatively few, and already are devoted in the main to the production of crops with high "per acre" returns, such as fruit. The lighter soils - and there is a preponderance of such - have not the inherent fertility of the deep silts, many of them being extremely poor and incapable in their present condition of giving a reasonable crop in return for the expenditure involved in farming them. There has been at all times a tendency to look upon the soils of Central Otago as of first-class quality, capable of giving maximum returns to the farmers if water was applied during the growing of crops. Such, however, is not the case. There are in Central Otago limited areas of soil as rich as any in New Zealand, but, conversely, there are large areas, already served by irrigation, of inferior soil types, low in fertility and of poor water-holding capacity. To these latter the Committee has given grave consideration, realising that even with the granting of most liberal concessions the settlers thereon would have a hard struggle to

establish successful farms.

It is perhaps not sufficiently realised that irrigation is a specialised type of agriculture calling for more initiative than is necessary for successful farming under more humid conditions. More labour is entailed on an irrigated farm because of the very practice of irrigation, and as a result all crop production costs are considerably higher than is the case under normal farming conditions. In Central Otago when a selector takes up a new piece of land it is practically devoid of any useful vegetation. He has no means of securing even a small remuneration until he establishes grass and lucerne, and this naturally means the lapse of time. Finance is, therefore, an even more important factor to the new irrigation farmer than to one in more humid districts. When a farmer purchases a property for, say, £26 per acre in Coastal Otago, he walks on to a farm fairly well grassed in readiness for stock grazing, and a limited amount of working capital generally suffices his needs. The reverse is the case in Central Otago, and ample finance is absolutely necessary to carry the settler over the initial critical years. Land in this district is not cheap when the cost of water, improvements, and lapse of time necessitated in bringing a farm into production are taken into consideration.

Throughout the Committee's investigations an endeavour has been made to keep the farmer's point of view ever to the fore-front, for it is only in the solution of the irrigation farmer's problems that success can come to the various projects already in operation. The tendency in the past appears to have been the placing of too much stress on the engineering aspects of the irrigation works, without giving adequate consideration to the suitability of the land for irrigation farming. In some instances land has been served by water, the potential benefits from which are problematical, as the land is of poor quality, being nothing but gravel with very little humus. Experiments conducted by the Public Works Department do not at present indicate that these lands are suitable for, say, the growing of lucerne although possibly further experiments may prove

them suitable for clover or grasses. The fact that settlers asked for water, and were prepared to sign agreements to pay a fixed price for the water when delivered, seems to have been taken as an assumption that the land to be served by the water could bear the charge put upon it. The Committee is satisfied that sufficient study has not been made in regard to the potentialities of certain lands now included under the present schemes, and if such lands had at the outset been examined and reported upon by those with the necessary knowledge and experience to do so, they would never have been brought under irrigation.

Successful irrigation is the result of the combined efforts of the engineer and the farmer. The engineer is responsible for building the irrigation works: the farmer must pay his share of the works, and at the same time make a living from the land. The main portion of the engineer's work is soon over, but the farmer's part lasts as long as the works endure. There can be no irrigation project without competent engineers, but there will be no payment for the works now developing under them without the successful farmer. In Central Otago the irrigation works have in most cases been substantially built and maintained, but the farmers' needs have not been fully realised. The mere construction of irrigation works will not in itself make irrigated agriculture and mistakes have been made in including under the race land which is not worth irrigating, but yet settlers are expected to make homes on such country. The bulk of attention has been centred largely on engineering features, and settlers without capital have been encouraged to settle upon land which in some cases can never be expected to give a reasonable return for the money expended.

An engineer is not necessarily a trained agriculturalist; hence it follows that he has to be guided to a large extent by the farming community in the various aspects relating to the irrigation schemes and their extensions. The sound judgement of the farming community, however, can be often submerged in the desire to obtain water regardless of cost, and it is often only after acquiescence to

their request that a full realisation of the true state affairs presents itself. It would appear that the Government in some cases has been induced to undertake the irrigation of these lands through theoptimism of farmers and others as to the capabilities of such lands and their capacity to pay the existing water rate; the Committee is of opinion that in the interest of all present and potential schemes the Public Works Department should have dis-interested advisers in agricultural matters, so that prior to any commitments the 'pros' and 'cons' of the subject could be fully investigated.

3. SCOPE OF INVESTIGATIONS

At an early stage in its investigation two things appeared to the Committee as essential if irrigation farming in Central Otago were to be placed on a sound footing and if success is to be looked for; (1) drastic reductions in regard to the rates charged for water on certain lands; (2) a review of the present allocation of water to all soils with a view to adequately meeting their varying water requirements. This meant that each farm had to be visited individually, and its soil characteristics studied from a physical and fertility aspect. The Committee had also in dealing with the allocation of water to take into account the configuration of the land and the difficulties of water application.

The Government Schemes investigated by the Committee, approximately 50,000 acres, were as follows:-

Scheme	Area under Scheme (acres)	Scheme	Area under Scheme (acres)
Ida Valley	11,688	Last Chance & Extension	2,940
Hawkdun	10,000	Tarras	3,551
Galloway	2,548	Ardgour	1,474
Manuherikia	5,809	Arrow	6,000
Earnscleugh	2,106	Teviot & Extension	4,067

During the investigation requests were made that the Committee report upon Ripponvale (a private scheme) and Bannockburn

and Matakanui, (both of the latter controlled by the Vincent County Council).

The attached map (marked "a") indicated the locality of all schemes investigated.

4. REPORT ON INDIVIDUAL SCHEMES

(a) TEVIOT SCHEME

This scheme is unique in New Zealand in that it combines irrigation and electric-power generation, the source of supply being the Teviot River, a tributary of the Molyneux River.

The supply from the past few years experience and from the meagre information available appears to be ample for both purposes for some years to come: the minimum flow of the catchment area is estimated at 41 cusecs, while the dam at Lake Onslow conserves sufficient water to provide 15 cusecs for a period of 120 days, or a total of 56 cusecs.

The Teviot Power Board has a right for 26 cusecs, but the most of this is used for irrigation purposes after passing through the Power-house, although at present there is some waste at this point on account of the varying power load.

The area under irrigation on the main part of the scheme is 2767 acres, and, on the Extension about 1100 acres have been signed for, which in the future will probably be increased to about 1300 acres, thus bringing the total acreage to approximately 4067 acres. On the revised allocation of water (approximately thirty-three inches over the whole area) the water requirement will be 11,184 acre feet or approximately 5,590 day heads, or 37 cusecs, over a period of 150 days. There is thus an ample water-supply, even in times of minimum flow, for the present area and the Power Board's requirements.

Situated in close proximity to Roxburgh the country embraced within the area consists of good rolling downs interspersed with flats, all of which lend themselves to easy irrigation. The soils vary in degree ranging from fertile flats to poor shingly plains of an extremely porous nature. In the main the soils of this area are of a much more retentive nature than obtain on some of the other

schemes. This fact combined with a moderate summer rainfall enables some of the lands under the scheme to operate with less water than is required elsewhere.

In the course of its investigations, the Committee met urgent demands on the part of the settlers for a reduction in the rate of 16/- per acre for water, and a revision of the present allocation of 1 head to 150 acres. Other points which were brought under the Committee's notice were the necessity for drainage of some properties, and requests to further extend the present scheme so as to embrace additional areas of land. The Committee investigated fully the various points brought up by the settlers, and have the following recommendations to make:

(1) The adoption of the classification of land, water allocation, and rates as set out in the attached schedule.

(2) That the requested extensions of the present races to embrace further areas of land be referred to the proposed Advisory Board, (see para. 10).

No definite recommendation is made in regard to the question of damage to properties by seepage, the Committee realising that each case should be dealt with on its merits. It, however, recommends that where agreement cannot be reached between the Public Works Department and the irrigator the matter should be referred to the proposed Advisory Board, which will then act as arbitrator between the parties concerned.

(b) IDA VALLEY SCHEME

This scheme was the first undertaken by the State and from a farming point of view has proved very successful. The land in the main differs from that of other schemes, being heavier and requiring less water: this was evidently realised at the inception of the scheme as the allocation of water was on the basis of 1 cusec to 200 acres, against 1 cusec to 150 acres on most of the other schemes. Even this amount of water in some cases appears to be more than sufficient, some of the irrigators not using their full quota. The water is obtained from a dam in the Manorburn catchment, and is supplemented by various small creeks along the races. At present

some 11,300 acres are served in Ida Valley, but portion of the water is diverted over Low's Saddle to irrigate about 2,500 acres on Galloway, where the land is lighter and requires a greater amount of water.

Complete records have been kept of the water available for the past 10 years, and it is evident from these that careful observation of the supply will require to be maintained. During last season - a particularly dry one - the draw-off from the dam exceeded the net annual gain. In the previous season there was actually less water taken from the dam than the annual gain. The reverse would have been the case had the Ida Valley irrigators taken their full quota. The reason for this shortage appears to be that the gain from creeks was originally over-estimated: this probably is easily accounted for by the absence of records. The experience of the past few years has shown that the supply from these creeks has not reached expectations: the flow, from all accounts, exists in the early part of the season, but diminishes during the summer months. If some of this early water could be conserved there would be very little cause for anxiety, but under present circumstances curtailment of supplies would be necessary if two or three dry years in succession were experienced. It is understood that reports on the position have been submitted by the local Engineer of the Public Works Department.

The scheme covers two areas, i.e. (i) the original Ida Valley Scheme, under which the settlers were charged 10/- per acre per annum, and (ii) the area served at a later date over which a 15/- rate is charged. No grievances in regard to water rate were heard from those on the first area, but those on the second area feel that they are being over-charged and requested a reduction.

Most of the land is throughout of fair quality and appears to warrant the maximum charge being levied. The Committee, therefore, considers that this area should be charged at the rate of 14/- per acre per annum, as against the 15/- rate now being charged. It is not suggested that the present rate of 10/- per acre on the

original scheme be increased as current agreements limit the charge to this figure. These original irrigators were fortunate in securing agreements at an early date and at a low rate. The Committee is not disposed on that account to reduce the charge being made to the irrigators on the lower portion of the Scheme to a like amount, simply because the irrigators in the first section secured an earlier and more favourable agreement. Were such agreements not in existence the Committee would in all probability recommend a flat rate of 14/- per acre over both areas.

It was represented by the settlers on the lower end that inadequate drainage through the middle of the valley was causing damage, this being mainly due to the effect of irrigation water. It is apparent that steps will have to be taken to remedy the present position of inadequate drainage, and it is evident that this necessity was recognised when the original estimate for Ida Valley was prepared, provision for drainage being included. While it is realised that a portion of Ida Valley is suffering from the effect of excessive irrigation water and lack of drainage, the Committee does not feel justified in making a definite recommendation in regard to straightening the Poolburn to allow of freer exit of drainage water. The area of land visibly affected at the time of inspection was found to be 270 acres. The cost of straightening the Poolburn and maintaining it in good order would in the Committee's opinion be excessive when viewed in relation to the area likely to benefit thereby. A considerable amount of good would result if a moderate sum were expended in clearing some of the existing obstructions in the creek. In the case of damage resulting to land adjacent to the creek, the Advisory Board should be asked to decide what adjustments should be made.

Many of the apparent ills of irrigation in the Valley, as evinced by the intrusion of rushes in the country flanking the slopes, cannot be attributed to a rise in ground water caused by a blockage of the Poolburn. This state of affairs can be largely accounted for by the retentive nature of the sub-soil which brings the irrigation water to the surface, combined with a too lavish distribution of

water over certain sections.

In view of the class of land under irrigation in Ida Valley it is recommended that the present allocation of water namely, 1 cusec to 200 acres be adhered to. There is ample evidence to show that this allocation of water is sufficient to meet the needs of the different farms under irrigation and the Committee does not feel justified in recommending any alteration in this respect.

The Committee recommends that in regard to those schemes where water-shortage is likely to occur, and where individual settlers hold large areas of irrigated land negotiations be initiated with the object of reducing the areas signed for, thus placing the schemes on a sounder footing insofar as water is concerned.

(c) GALLOWAY SCHEME

This scheme is situated on the left bank of the Manuherikia River a few miles to the north-east of the town of Alexandra, and derives its supply of water from the same source as Ida Valley viz., the Manorburn Dam.

The present allocation of water is 1 cusec to 150 acres (or 24 inches per acre) over most of the area, as against Ida Valley's 1 cusec to 200 acres (or 18 inches per acre). The land is much lighter and requires a greater quantity of water more particularly on the flat gravelly lands, where, in the opinion of the Committee, even 24 inches is insufficient, especially in the early stages of development: the settlers have been purchasing a considerable amount of extra water, amounting last season to 1313 day heads or 57½% of the ordinary supply. Even allowing for a fair proportion of this being wasted, which is inevitable in the early stages of irrigation development when the settlers are not sufficiently experienced in the use of water, it is evident that this land could profitably use more water. As, however, the supply is limited under present conditions, as pointed out in the portion of the report dealing with Ida Valley, extra water over and above the recommended allocation cannot continue to be given to this area during dry seasons, unless more water is made available.

The area covered by irrigation agreements is 2671 acres,

portion of which is on the slopes of the Crawford Range and Olrig Terrace where the settlers are sheep farming, but on the flats dairy farming predominates. On this area, once primarily confined to the grazing of sheep, there has been a marked transition from that type of land-utilisation to dairy farming. This change in farming methods can be largely attributed to the fact that the Government established on Galloway Flat an Irrigation Demonstration Farm, the activities of which are mainly devoted to the development of dairy-farming in the district, the position being today that practically every farm on Galloway Flat has adopted dairying. This Experimental Farm has been of value to the Committee in determining the amount of water required on the Galloway lands, and the value thereto of such water. The farm appeared to the Committee to be administered on sound lines, and must certainly be of great benefit to the farmers in the district.

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The soils of Galloway are of a variable nature. Towards the foothills of the Raggedy Range heavy types are to be found these lending themselves ideally to the production of luxuriant crops. Towards the Manuherikia River the soils are lighter and of a very porous nature necessitating as can be expected, a greater supply of water than is at present allocated, and requiring more frequent irrigations than necessary on the heavier soil types. Practically adjacent to the river and on a level with it are areas which do not require irrigation, the ground level of water being sufficiently near to the surface. On this area certain features in regard to drainage and alkali will in all probability have to be studied at no distant date.

Galloway represents a section of an irrigation scheme which is in a moderately advanced state of development. The farmers on this area appear to be working on sound principles, and their experience has been of material value in the formation of this Committee's views. Many points for consideration were brought before the Committee's notice and the following are its recommendations:-

(1) That the present allocation of water, namely 1 cusec to 150 acres, should insofar as is consistent with the available water supply be altered to the allocations recommended in the attached schedules for each holding. In regard to such allocations it is realised that there is at present every likelihood that this cannot be adhered to in its entirety until, as has been indicated, further conservation has been effected, or more favourable seasons experienced.

(2) It would appear that the Department has been over-optimistic in regard to the water available for irrigation and consequently over-selling of water has resulted in bringing in a greater acreage of land than can be supplied from the available water sources. The Committee have owing to water shortage, recommended that one area of 600 acres be reduced to 300 acres. This land was served by water at a late date and is not yet fully developed. If, in future, the water-supply to the deleted area can be restored it is recommended that this be done.

It is recommended that in the meantime the rates and water allocation shown in the attached schedule be adopted.

(d) ARROW RIVER SCHEME

This scheme is in the Lake County and the area commanded by the races lies between Arrowtown and Frankton, being supplied by water from the Arrow River. It is possible also to utilise some of the water passing through the upper pipe-line for power purposes.

Last season fairly complete records of river flow were kept, the lowest records obtaining during February and March when the river fell to 39 cusecs. Allowing for race losses and say 5 cusecs for power purposes (giving about 90 h.p. which would probably be sufficient for a summer lighting and heating load in the district), there would be available 30½ cusecs which would irrigate 6,000 acres on the basis of 1 cusec to 200 acres: at present under 4600 acres have been signed for and it is not expected that more than 6000 acres will be the ultimate development. Last season was one of the driest on record in the district and during low flow in normal years

the river will probably carry a greater quantity of water.

A good demand for power for lighting and heating in the winter time is anticipated and the power aspect of this scheme should be closely investigated, as the area now estimated (6,000 acres) as the ultimate development for irrigation is less than was originally intended. This would help to reduce the cost of irrigation and at the same time supply a need of the district, which the settlers would appreciate. Although most of the area has been farmed for many years without irrigation, it periodically suffers from drought and last season, from all accounts, farmers had an anxious time. With an assured supply of water they would to a certain extent be insured against a recurrence of last season's experience. One or two private schemes are in operation within the area and appear to have given satisfactory results.

The main points brought under the Committee's notice were the water rate, which some deemed excessive, the need for classification of the land in regard to water allocation and the instability of the main race near Arrowtown. The Committee was unable to deal with the first two points, the ground being covered with snow, and the settlers asked that the inspection of the land be postponed to a later date. This can be carried out at any suitable time within the next 6 or 8 months as the scheme cannot be brought into operation until season 1929-30. Inspection of the portion of the race about which the settlers expressed some doubt indicates that in part at least it will require fluming: the work already done will, however, not be wasted, as the bench formed in making the race will carry the flume.

The Committee recommends that a complete report on this scheme be obtained at a later date with a view to land classification and any further points of interest and that further inspections of the races be made by the engineers of the Department to ensure their stability.

(e) TARRAS AND ARDGOUR SCHEMES

These two schemes are located in the Upper Clutha Valley some 20 miles north of the town of Cromwell, the Tarras being on the banks of the Clutha River, and the Ardgour lying along the left bank of the Lindis River. Both derive their water from the Lindis River and supplies are regulated by the one officer: there are in addition several private rights from the same source, but only one of these (Lethbridges, 12 cusecs) is superior to the Government's first right of 50 cusecs.

In a year such as 1927-28 there would be insufficient water to satisfy all demands in the dry part of the season, but the records for the two previous seasons indicate that most rights could be met. The following table shows the flow in the river for the last three seasons during the period from 15th January to 7th April.

Flow in Lindis River in Cusecs

	1925-26	1926-27	1927-28
January 15-21	130	91	55
" 22-28	109	94	54
" 29 - February 4	162	71	53
February 5-11	121	55	54
" 12-18	85	55	65
" 19-25	133	58	42
" 28 - March 3	330	212	44
March 4-10	150	119	45
" 11-17	148	98	45
" 18-24	114	363	60
" 25-31	119	346	55
April 1-7	149	Unrecorded	69

The area now being irrigated or recommended in the meantime for irrigation is as follows:-

Ardgour	1474 acres
Tarras	3551 "
	5025 "

On the basis of 1 cusec to 150 acres or 2 acre-feet the requirements would be 5,025 day heads or 33½ cusecs for 150 days.

These schemes have not been in operation for a sufficient length of time to enable a determination of the race losses, but it would be unwise to regard these as less than 7 cusecs in the meantime so that the total water required for diversion would be 40½ cusecs. To this, however, must be added 12 cusecs to meet Mr. Lethbridge's right, making an aggregate of 52½ cusecs. It will thus be seen that during last season's dry period there would have been a deficiency of from 7 to 10 cusecs, but fortunately Mr. Lethbridge allowed 4 cusecs of his water to be diverted into the Government race. Lower down the river 8 cusecs have, by arrangement to be diverted into Messrs. Bogg & Stacpoole's intake, but the indications are that the river makes sufficient from return flows to satisfy these rights provided efficient steps are taken to pick up the supply.

Much of the land under these schemes requires a greater allowance of water than one cusec to 150 acres, but this in dry seasons could only be provided for if extra water were given early in the season when there is an ample supply.

It is evident from the records and from local information that the past season was one of the driest for many years, so it would appear that in normal seasons there should be a sufficient supply on the present allocation.

Although the very lightest gravelly terrace lands have been shown as requiring a 36 inch supply, the Committee feels that these should in the early stages of development receive free any surplus water that may be available.

The principal requests on both schemes were for a classification of the land and a greater allowance of water when it was available. The settlers realised that in drought seasons there would be insufficient water throughout to provide extra water, but requested that free water be given early in the season when there was an ample supply.

The land varies in quality and, therefore, should in the opinion of the Committee be classified both as regards charges and water.

The Committee therefore recommends:-

(1) That the scale of charges shown on the attached schedule be adopted.

(2) The adoption of the attached schedule of water allocation. Owing however, to a diminishing summer supply there will undoubtedly be a shortage of water during the dry months and an excess during the earlier months of the irrigation season. Surplus water, therefore, should be given free up to the extent indicated in the schedule during the earlier months of the season when such extra water is available, but settlers will require to take their allocations equitably throughout the whole irrigation season, and so avoid the building up of peak demands upon the supply during dry times when those demands cannot possibly be met.

(f) HAWKDUN SCHEME

Situated in the Maniototo County in the vicinity of Naseby and Ranfurly, this scheme covers an area of 50,000 acres, although it is proposed to irrigate only 10,000 acres of that total. This area can only be considered a partial irrigation scheme, although no doubt it will be of inestimable benefit to the settlers.

The supply is obtained from creeks feeding the Manuherikia and Taieri Rivers supplemented in the dry part of the season by the Ewaburn Reservoir. Records of flow have been kept during the past season (one of the driest) which indicate that in November and December there is sufficient water for 1 cusec to cover 154 acres whilst in March 1 cusec would have to cover 351 acres.

These figures, however, take no account of the water to be supplied to miners. This, however, is unnecessary as irrigation demands take precedence during the months of January, February and March.

The irrigation agreement provides for 1 cusec to 300 acres so that it would appear that taking the season from November to March inclusive, sufficient water is available to supply on this basis. The irrigation of small areas scattered throughout such a large area of country has involved a considerable amount of race cutting, the distributaries totalling 101 miles and the main race 66 miles. Race losses, therefore, will be high, but in the above estimate of supply conservative figures of losses have been used.

The scheme is not yet in operation, although the main race and most of the main distributaries are completed thus enabling water to be supplied during the coming season to most of the area. Conditions here will vary from those on other schemes in that it is not anticipated that irrigation water will be required before the end of October.

The Committee cannot recommend any alterations in rates or water allocation as the settlers will irrigate only portions of their farms and the rate does not appear excessive apart from irrigation, the supply should be of value for stock watering.

(g) MANUHERIKIA SCHEME

This scheme is situated along the right bank of the Manuherikia and the left bank of the Clutha Rivers and extends from Chatto Creek to Clyde. The main races command an area of approximately 11,000 acres, although at present only about 5,800 acres are being developed under irrigation. Much of the undeveloped portions consists of light gravelly soils which will take many years to bring into full economic production and then only with a plentiful supply of water at a low charge. On the now irrigated area great variation is apparent, gravelly soils predominating, and the present water allocation is plainly insufficient particularly during the early years of development.

2351 HA The area at present being or shortly to be irrigated is 5,809½ acres and requires on the basis of the proposed water allocation, approximately 55 cusecs. In addition 2 cusecs are supplied free to the Alexandra Borough, whilst 18 pipe-users also are supplied

from this scheme. These latter will require for irrigation and stock-water purposes probably another 2 cusecs, or a total of 59 cusecs. Generally speaking, the flow on the Manuherikia River which supplies this scheme is 100 cusecs or over: there is thus an ample supply for the area. The Hawkdun Scheme now under construction will, however, draw part of its supply from this source, but the amount so diverted will it is considered not prejudice the Manuherikia Scheme. When the gauge at the Manuherikia intake records 100 cusecs there are roughly 20 cusecs in the creeks which will feed the Hawkdun Scheme, so that 80 cusecs should be available for Manuherikia. Allowing a race loss of 13 cusecs (the average for the 1926-27 season was 12.6 cusecs), the available water would be 67 cusecs from the river and 2 to 3 cusecs from Chatto and Young Hill Creeks or a total of approximately 70 cusecs to supply the 59 cusecs required.

Last year the river fell below 90 cusecs on two days (February 10th 82 cusecs, February 9th. 86 cusecs) and below 100 cusecs on 27 days in January and February; but even assuming 90 cusecs as the minimum and allowing a deduction of say 20 heads for Hawkdun there is still sufficient water for the above area of 5809 acres.

The main race capacity is 100 cusecs to Young Hill Creek and 65 cusecs from this point to the end of the race so that there should be no difficulty in supplying all requirements. Last year, there were two breaks in the main race, which caused considerable inconvenience and loss to many of the irrigators on the scheme, one occurring during a critical period of the irrigation season following a particularly dry spell. Loss of water at such a time is probably more detrimental on this scheme than on many of the others, owing to the lightness and porosity of the soil, and the Committee recommends elsewhere the action which should be taken to meet these circumstances.

The main complaints of the settlers apart from the loss and inconvenience caused through these breaks were the high water charges and the low allotment of water.

The Committee recommends that the lands be classified for water allocation and rate in accordance with the attached schedule.

Although the very lightest gravelly terrace lands have been shown as requiring a 36 inch supply, the Committee feels that these should in the early stages of development receive free any surplus water that may be available. Great difficulty is experienced in applying water to these lands when in their virgin state as losses must necessarily occur through the open porous gravels when first applied, and for this reason the Committee recommends that whenever possible, a plentiful supply even in excess of the proposed schedule be given to them in the "breaking-in" stage.

With regard to the breaks in the race during last season, the Committee considers that, although the Government in terms of the agreement accepts no legal responsibility, it should in some way assist the settlers, preferably by a remission or concession on their water rates. A delay in starting irrigation was occasioned by the late arrival of fluming for repairing a break which took place during last year; later two breaks occurred in the main race, one of which at a later date had again to be attended to so that there were several interruptions in the supply during the critical period; although it would appear that the settlers got the full supply by the end of the season, the evidence offered showed that they suffered from lack of water when it was most needed. This would certainly be so, as the light lands on this scheme require a frequent and plentiful supply.

To meet this special case the Committee recommends that, as an act of grace, the Department accept for the 1927-28 season from irrigators affected by these breaks (with exception of the pipe users) the same water rate as charged for the 1926-27 season, i.e. that their scale of water rates remain stationary for the 1927-28 season. The pipe users were not affected to the same extent and it is considered that a rebate of 10% of the 1927-28 season's net rate would be equitable, this also to be an ex gratia concession.

(h) LAST CHANCE SCHEME

This area lies on the right bank of the Clutha River South of the Town of Alexandra along the foot of the Obelisk Range: on the

main part of the scheme 1269 acres have been signed for, including the area known as Fruitlands where the principal industry was fruitgrowing. The land is situated at a much higher altitude than that of Manuherikia and Galloway schemes and experiences severe frost. The water is distributed over this area on the basis of 1 cusec to 200 acres, and although some settlers stated that they required a larger supply of water, the Committee is of opinion that as the irrigation season, owing to the position and altitude of area, is short, the present allocation is reasonable. Surplus water from this area is supplied to northern areas on which 1671 acres have been signed for, but this can be termed only partial irrigation, as the normal supply is about 5 cusecs. During the extremely dry season of 1927-28 the supply averaged only 4½ cusecs and fell as low as 2 cusecs for a short period. The charge per acre for this supply is only half that charged on the main scheme, but as many of the areas receiving this are small and their proportion of water on an acreage basis during very low supply would be extremely small, the settlers have been allowed to receive an extra supply at an enhanced rate. Some of the settlers on small holdings on the extension stated that the supply last season was inadequate and irregular. Naturally this would be so whilst there was such a small quantity available, and the only way to ameliorate this position would be for the settlers wherever possible to group themselves and receive their supplies in rotation. This would ensure to each farmer a reasonable flow of the water available. It has always been assumed that further areas would be brought into this extension, but in view of the small amount of water available for the existing areas it is evident that further areas should not be included. Fruit farming on Fruitlands has proved a failure and many of the orchardists have pulled out their trees and changed to pasture. This is mainly attributable to the severe climatic conditions experienced. Seasons 1926-27 and 1928 were unfavourable to these fruitgrowers who have been particularly hard hit, some of them having purchased their properties as developed orchards and now are compelled to revert to

dairying or sheep farming. These men entered on their farms with every hope of making a success of fruitgrowing and no blame can be attached to anyone for the failure: it has been pure misfortune and the Committee desires to recommend that in all cases where orchards have been or may in the future be abandoned and converted to grass the rate be varied to the starting rate of the graduated scale viz. 2/6d. per acre per annum as from 1.9.28 or from such later date as the areas may be abandoned for fruit-growing.

(i) EARNSCLEUGH SCHEME

Situated on the right bank of the Clutha River between Clyde and Alexandra, the Earnscleugh Scheme at present includes some 2,107 acres of land of varying quality.

The position in this scheme is complicated by the fact that on 343 acres water is supplied free except that a charge for maintenance and distribution is made, and that a special area receives a supply at a special rate, the settlers on which themselves maintain the supply race; the balance of the area is charged at a uniform rate for water in addition to maintenance, but there are two distinct areas even on this, one of which comprising 232 acres is known as "The Extension".

The water supply is diverted from the Fraser River, which, generally speaking, has ample to meet all needs, but in dry years may fall for part of the season to as low as 10 or 11 cusecs, thus necessitating short supplies. This, however, from the records of the past three seasons, during which the lowest flow was 13 cusecs, does not occur for any extended period.

These over the past four seasons show in 1924-25 a period of low flow from the middle of January to near the end of February, the lowest being 13 cusecs from February 8th to the 21st: of this 2 cusecs were supplied to the free-water users and $\frac{2}{3}$ cusec to the special area, leaving a balance available for the remaining 1668 acres of 8 cusecs or at the rate of 1 cusec to 208 acres; during the rest of the season the flow averaged 20 cusecs, an adequate supply

for the area. In 1925-26 and 1926-27 the water diverted throughout the season was at no time less than 20 cusecs, and averaged much higher. From the 10th February to 27th March, 1928 the water diverted from the river ranged from 13½ cusecs to 18½ cusecs and the water supplied to the irrigators from 12 cusecs to 16½ cusecs. This would indicate that in dry years the water requires to be carefully distributed and to avoid losses a grouping system is necessary. At present some of the settlers form themselves into groups, but this method could be extended with advantage.

The gravelly lands on the outer terrace require a plentiful and frequent supply of water, but as in some years it would be impossible to fully supply these whilst the river is low, it is recommended that all the spare water that can be conveniently supplied should be given these lands early in the season.

The scheme, owing to the complex conditions prevailing and the short supply of water in some seasons, presented one of the most difficult problems that the Committee had to deal with. The settlers are not unanimous as to the best methods of operating the scheme, one faction asking for a board of control over part of the area and another that the Public Works Department retain control. The free water users and irrigators on the main part of the scheme were very perturbed over the charge for maintenance, as this was not fixed, but varied from year to year; they averred that when the Board of Control administered the scheme the maintenance cost per acre was 1/6d, whereas under the Department's regime the cost rose to 3/- per acre. This latter charge the Committee has analysed and considers reasonable. The 1/6d. rate would have been insufficient to cover maintenance had not voluntary labour been availed of. Under the Board of Control, moreover, only part-time labour was employed, but with the Department a raceman has to be employed constantly and the Committee considers this essential for the proper maintenance of the races, and for water distribution.

The settlers on the main part of the scheme and the free water users feel aggrieved that the portion known as The Extension

was ever undertaken, asserting that the cost of the Extension was high on account of the long pipeline for such a comparatively small area, and that the cost of maintenance would be higher than on their own area, thereby raising the maintenance rate over the whole scheme. It would seem that there is something in their contention if renewals to the pipeline were included under the heading of maintenance, and the Committee considers that the most desirable method of charging would be to levy a fixed charge per acre which would include both water and maintenance.

The position of those irrigators known as free water users has received careful consideration. Prior to the inauguration of the Earnscleugh scheme these irrigators had enjoyed for over 15 years irrigation sufficient for their needs, but at the instigation of the Department agreed to amalgamate their rights with those of the Department in order that their then privileges might be shared by the other settlers. Any maintenance necessary was carried out in the community spirit and no expense other than that represented by their own labout and for material was incurred.

With the initiation of the Earnscleugh Scheme, however, these irrigators, who were allowed to retain the right to free water, were called upon to pay a rate to cover race maintenance, such rate eventually amounting to the figure of 3/- per acre. It might almost be represented that these irrigators are being penalised for their action in surrendering their original rights and the Committee feels that it would be a warranted act of grace on the part of the Government if to these irrigators the maintenance rate on the area covered by the free water agreement be in future restricted to 2/- per acre, and recommends that this suggestion be adopted.

The land, as on other schemes, varies in quality, that lying on the right bank of the Fraser River and along the foot of the hills being, generally speaking, first class, but there are considerable areas outside this of gravelly and stony flats of low fertility. The water rate on the area, with the exception of those supplied with free water and the special settlement is 4/8d. per

acre, in addition to a maintenance rate which last year amounted to 3/- per acre. The better lands can comfortably carry this total charge of 7/8d. per acre, and possibly more, and the Committee recommends that the water and maintenance rates be amalgamated, and an overall charge of 7/8d. per acre be made thereon. In regard to the poor lands it is doubtful if a charge of 7/8d. per acre is justifiable: similar lands on other schemes have been assessed at 6/- per acre, but as in dry seasons there is a shortage of water for a period on this scheme, and these Earnscleugh lands really require a greater allocation of water than the present one, the Committee considers that a rate of 5/- per acre would be reasonable.

With regard to the special Walcott Settlement, the Committee considers that the rate for this should be reduced to 7/8d. per acre, and the Department to undertake the maintenance. Although these settlers undertook to pay 16/- per acre, the land is of poor quality (mostly third-class) and could not possibly stand such a high rate. This settlement gets an assured supply of water at present, but with the adoption of the new rate they would only get their proportion of the available water as obtains on the rest of the scheme.

Summarising, the recommendations in regard to Earnscleugh Scheme are that -

(1) The water rate and the maintenance rate be amalgamated, and the maximum charge be 7/8d. per acre per annum, and the minimum 5/- per acre per annum.

(2) The water allocation and rates as per attached schedule be adopted.

(3) The special Walcott Settlement be brought into the scheme on the common basis.

(4) The existing arrangement allowing a double supply be cancelled by negotiations between the Department and the irrigators.

(j) RIPPONVALE SCHEME

The Ripponvale Orchard Settlement was established by the Cromwell Development Company some 13 years ago, and comprises

approximately 460 acres, the area being sub-divided into 30 allotments.

About 300 acres of the total area were commanded by water races known as the "Byron" and "Lowburn". The Development Co. acquired rights from these races and contracted with settlers to supply irrigation water on certain conditions contemporaneous with the agreement to purchase allotments.

The charge for water was originally fixed at the annual rate of 35/- per acre; the allotment was at the rate of 1/200 part of a head per acre, delivered from the main races during an irrigation season of 181 days.

Up to the eighth year following the establishment of the orchards everything pointed towards success. In succeeding years, however, the apple trees instead of making progress and shewing increased yields in line with age, perceptibly weakened in growth and yield of fruit. This is a condition of affairs which is not peculiar alone to Ripponvale, but has been experienced generally throughout Central Otago.

So pronounced was the deterioration that a considerable reduction in yield was recorded not only in the case of individual holdings but over the whole settlement. Five years ago 7,000 cases of apples were put through the co-operative packing shed, but in the 1927 season only 3,C90, and this season it is probable the total will again not exceed 3,000. Had the orchards progressed as might reasonably have been expected the output should by now have reached at least 20,000 cases.

So serious is the position created by the yield failure that a number of settlers have abandoned their holdings and those who remain are faced with considerable loss of capital even if they can carry on.

The settlers invariably blamed the failure to the lack of an adequate supply of water. A deputation of settlers waited on the Prime Minister when the Ministerial party visited Central Otago in March last. They expressed dissatisfaction with the conditions regarding the supply of water by the Development Co. and requested that the Government acquire the Company's water rights

and assume control of an irrigation scheme serving the settlement.

The Prime Minister, with the concurrence of Mr. P.R. Sargood (Chairman of the Development Co.) arranged that this Committee would include Ripponvale in the scope of its investigations.

The Committee subsequently invited the settlers to meet its members and a meeting was held in the Packing shed at Ripponvale, when there was a full attendance of settlers.

The settlers fixed on water shortage as the primary cause of all their trouble. In the course of discussion the following points were adduced:-

(1) The water-supply of 1 cusec to 200 acres was considered inadequate, and that this allocation had not even been delivered. Evidence was obtained from the Development Co. that more than a full supply had been delivered to settlers. The Committee is not in a position to adjudicate between these two viewpoints. It was stated that orchards require at least 1 cusec to 150 acres, and dairy-farming 1 cusec to 100 acres.

(2) That the main races were not kept in repair, and race losses impaired the supply of water.

(3) Some irrigators maintained that they had not recieved water during some summer months.

(4) It was claimed that the system of delivery of irrigation supply was erratic, that there were no measuring boxes, and that irrigators did not receive water in terms of the agreement.

(5) Lack of water was considered to be responsible for the state of the orchards.

(6) Complaints were made about the rate charged for water. 20/- per acre was regarded as the outside price irrigators could pay for an adequate orchard supply.

(7) That if orchards failed, resort must be had to dairying. The present areas were too small for success, and it was desired that the Government should acquire the Development Co's interest in adjoining Crown lands.

(8) It was considered that an increased water-supply could be obtained by harnessing Deep Creek. The estimated cost of this was stated as £600, and that of increasing capacity and repair to main Byron Race as £1,900.

(9) It was estimated that approximately 400 acres of irrigable land on Ripponvale was commanded by the hill races, and, as indicated, irrigators could pay a rate of 20/- per acre if given ample water.

(10) Several years ago an effort was made to purchase the Development Co's water right and races. The Company offered to accept £4,000 but negotiations with the County Council fell through.

The Committee took an opportunity later of inspecting the various holdings on the settlement. The members were impressed with the deterioration evident in most of the orchards, but the Committee is not satisfied that lack of water is the only cause contributing to their failure. In several instances the owners have succeeded in arresting the retrograde movement by green-manuring and the application of fertilizers. It was opined by settlers that, apart altogether from insufficient water-supply, a contributing subsidiary cause of failure lay in the variety of apple trees and parent stocks.

A number of settlers have pulled out their apple trees, while others are experimenting by cutting back the trees in hopes of establishing a better root-system. Even if successful in the latter procedure it will be several years until any return is obtained.

The soil is good as far as appearance goes and generally comprises a heavy silt deposit that would apparently grow anything. It transpires that these lands were formerly farmed and for years in succession were devoted to grain growing. This resulted in the soil being deprived of its natural fertility leaving it devoid of humus. It is only recently that several settlers have changed to the system of growing legumes between the trees, alternately ploughing in the green crop and resowing. Without this latter system it appears that it is impossible for settlers to get the full benefit

of water supplied, no matter in what quantity.

The Committee is of opinion that the failure on Ripponvale is largely attributable to the following main causes:-

(1) Impoverishment of the land through cultivation and cropping prior to the establishment of orchards.

(2) Neglect to recognise the necessity for green manuring and the use of fertilisers during the years following establishment of orchards.

(3) Inadequate and irregular supply of water.

Referring to the subject matter of the settlers' request that the Government should take over the irrigation scheme, the Committee proposes to view the project on purely business lines. It is not concerned with any alleged past failure on the part of the Cromwell Development Co. to carry out any conditions implied in the agreement with the settlers. It respectfully suggests that all parties should get together with a view to placing the supply and delivery of water on a better footing.

The Development Co. should make further efforts to meet the position that has arisen by reviewing the charge for water. The financial position of each settler should be investigated, and an endeavour made to give those who are prepared to persevere a fighting chance to make good. The history of the settlement shows that untoward and unforeseen circumstances have arisen leading up to heavy losses of capital. At this stage it is highly desirable that the remaining settlers and the Development Co confer and by negotiation adjust the liability both with regard to arrears, land, and water, in order to stabilise the whole position and prevent further loss of capital. It must be recognised that every settler who abandons his property represents a loss to the company, while on the other hand if an erstwhile struggling settler can be encouraged by readjustment to make good he is a source of potential revenue.

The Development company has offered to accept £4,000 for its rights, and on the initial outlay the financial results would be approximately as follows:-

Accepting settlers' statement that 400 acres could pay 20/- per acre the position would be as under:-

		Revenue	£400
Expenditure:			
5% on £4,000	£200		
5% on settlers' estimate of harnessing Deep Creek and Expenditure Main Race (£1,600)	80		
Raceman's wages and horse allowance	256		
Race Repairs (say	150		
Sundry expenses	30		
	£716		
		Annual loss	£316
			£716

The Committee inspected the proposed source of supply from Deep Creek in the Meg basin. They also traversed the main Byron Race. In its opinion any race from Deep Creek would have to traverse a difficult route, and it doubts the possibility of economically increasing the water-supply from this source.

The Committee takes the view that with a full knowledge of the conditions on the settlement, and the certainty that a loss will occur on the proposal as submitted, it is not justified in making any recommendation to the Government to purchase the Development Co's rights.

(k) MATAKANUI & BANNOCKBURN SCHEMES

These are county schemes administered by local committees set up by the County Council. Some of the irrigators on each scheme requested that their control should be handed over to the Public Works Department, alleging mal-administration on the part of local committees.

These committees once appointed cannot be altered, as there is no provision for holding elections to allow the settlers to elect their own representatives.

Both of the schemes can only be classed as partial irrigation schemes, and in part of the dry seasons there is very little more than stock-water.

This Committee does not advise the taking-over of these schemes by the Department, but recommends that provision be made for the periodical election of representatives on the local committees.

5. CHARGES FOR WATER

GENERAL

It is apparent that the existing charges for water were fixed on the assumption that all lands considered as irrigable under each scheme could bear a standard flat rate. This rate was not arrived at through deductions as to the rate-paying ability of the lands, the price of water-supply having been fixed so as to cover the estimated cost of the works and maintenance. Where irrigation has been applied to lands which were formerly farmed and either in pasture crop or cultivation, it is possible to fairly accurately assess the value of the water supply. In the case, however, of lands being brought in from virgin or natural state the ultimate benefit attainable through irrigation, particularly on the poorer soil-types, is more or less a matter for conjecture.

Admitting that the existing system of a uniform ratio of water and price in each scheme is untenable, it devolves upon the Committee to submit recommendations calculated to place the irrigators on a sound footing. In order to determine the value of irrigation water as applied to different properties the following features were kept under consideration:-

(a) Quality of land, and benefit apparent or likely to accrue from irrigation.

(b) The general layout and configuration of the country, with its bearing on the cost to irrigators of distributing water.

(c) Tho proximity of irrigable lands to the main head-race, and the outlay entailed in the construction of distributary races.

(d) The retentivity of the soil or its subsoil calling for varying water requirements.

From the points enumerated it is to be admitted that it is not an easy matter to determine accurately what any individual irrigator could afford to pay for the supply of water. The variations in conditions certainly show that a flat ratio for water-supply and price cannot be maintained owing to the different conditions obtaining on each farm. This being agreed upon the Committee had then to determine what maximum rate (exclusive of extra or special water-supply) the irrigator on the most favourable proposition could afford to pay for any allocation of water which might be deemed the proper quota for his particular property. During its subsequent investigations the Committee lost no opportunity to gain information regarding the financial results of farming under irrigation. Working balance sheets were obtained from both sheep and dairy farmers besides which practical farmers on the Committee were constantly "trying out" the possible results on individual holdings.

No section has benefited more from irrigation than occupiers of run country or large sheep farmers where the irrigation of a small portion of suitable country has enabled them to produce lucerne hay sufficient to winter a large proportion of their flocks. These farmers are in a different position to the man with the small holding entirely under irrigation and upon which his whole living depends. It would not be fair, however, to fix any rate these irrigators could probably pay as the standard for the man with the small self-contained irrigated farm. The Committee in fixing the price and quantity of water to be allocated to the different properties was not wholly guided by the present type of farming being carried out thereon, but rather by the capability of the land in regard to its crop producing capacity.

Having viewed the question from every possible angle, the Committee now recommends that gradations so far as the price of allotted water is concerned be based on a maximum rate of 14/- per acre per annum for the most favoured land. The irrigable lands commanded by each scheme have accordingly been assessed for irrigation water at rates having the above figure as a basis and

varying as appeared warranted by the circumstances surrounding each case.

When reviewing each irrigator's position for the purpose of assessing the rate proposed to be charged for irrigation water special consideration was given to the area of each holding considered to be economically irrigable. In some instances reductions in the area signed for have been recommended, and these, together with variation in the original water rate, will serve to place the irrigator in a much more favourable position. It is recommended that if the rates proposed are adopted they should come into force as at the 1st September, 1928.

6. ALLOCATION OF WATER

For precisely some of the reasons leading to the Committee's recommendation of variations in the price of water it has been found necessary to review the allocation of water under existing agreements. The Manuherikia scheme may be cited as an example to show the necessity of classifying lands for water as well as for price. In this scheme the water allocated is 1 head to each 150 acres delivered over a period of 150 days, representing a 24" supply per acre. Probably on no other scheme is there such a variation in the quality of land, this necessitating on account of the soil variations, the utilisation of different quantities of water to supply the needs of each soil-type. The Department's records of the sale of surplus water indicate that in the average season the standard allocation falls short of actual requirements. It is to be realised, however, that a large percentage of the area is only "brought in" and thus it may reasonably be expected that as development proceeds the ultimate annual water requirement will not be so great as is required in the initial stage of development. It may be assumed, however, that on certain schemes the allocation of water is insufficient. This applies more particularly to Galloway, Manuherikia, Earnscleugh, Tarras and Teviot and to a lesser degree on other schemes. Each irrigation project presents its individual problems in this respect and for this reason the

position regarding availability, allocation, and control of water has been dealt with in detail in the sections of the report applying to each scheme.

The Committee is satisfied that irrigators, generally speaking, are making an endeavour to utilise the water to best advantage, but even with the utmost economy in handling and distributing the supply the nature of the land and climatic conditions call for a more liberal allocation. It is, therefore, recommended that wherever possible the allocation of water as indicated in the various schedules attached hereto be adopted.

With a view to restricting the indiscriminate use of water during the irrigation season it is recommended that the Department adopt regulations which would apply to all schemes and provide that each irrigator will upon delivery of water distribute same to the satisfaction of the Department. Thus an irrigator would not be allowed to waste water simply because he holds the right to a given supply. Failure to properly conserve and distribute irrigation water is a loss in every way, leading to over-saturation of certain areas with attendant deterioration of the land, and to undue concentration of water which adversely affects neighbouring lands at a lower level, increasing the liability of seepage. The regulations should also provide that after being given 3 months notice an irrigator who in the opinion of the local officer in charge, fails to distribute his allocation of water in a proper manner, the supply may be restricted until such time as proper distribution is assured.

7. METHOD OF CHARGING

In the past the Department has fixed a gross charge for each acre of land supplied with water, subject to a substantial discount for payment within 14 days from due date. It is recommended that the liability of irrigators for water supply should be a net charge in the first instance, and failing payment within one month a compulsory penalty of 10% be imposed. This is simply following the practice adopted by local bodies, and would also materially reduce the clerical work in connection with the preparation of monthly

statements and annual accounts.

It is not suggested that the recommended maximum rates should operate during the 1928-29 season except where the present rate payable is equal to or in excess of the new maximum rate, but that graduated rates be arranged so that the irrigator may be placed in respect to the new rate in a position equivalent to that occupied under the present rate. As an example, assuming the recommended maximum is reached in 6 years, the gradations might be 1/-, 2/-, 4/-, 6/-, 10/-, 14/-. An irrigator paying for the 1928-29 season the fourth year rate would under the existing scale be charged 8/- per acre, whereas under the proposed scale he would be charged the 4th year rate of only 6/-.

8. EXTRA WATER.

At certain periods of the year the Department has a surplus of water in the irrigation races, which it has been in the custom of selling to irrigators at a low rate under the designation of "extra water". It is recommended that the Department continue this practice, but be given discretionary power in fixing the terms on which this water shall be supplied with a proviso that in no case shall the charge exceed 2/- per day head.

9. STOCK WATER

At the present time stock water is, wherever possible, being supplied gratis, but the Committee does not consider that such a service is incumbent upon the Department. It should, however, be supplied gratis where the water is available and its supply entails no further expenditure, and also provided such supply does not inconvenience the Department's operations. It should, however, be made quite clear to irrigators that the supply is a concession, and that they cannot acquire any right thereto, nor can stock water be supplied during the period of race-cleaning. To cover that period irrigators will be expected to arrange by storage tanks or other means for their requirements. Where the service entails additional capital or operating expenses, a charge should be made for the supply, such charge to be determined by the Department, but to be on a scale which will eventually cover the additional

expenses involved. Besides being a convenience to the irrigator, the permanent presence of water in a race is desirable in that it assists in reducing water losses during the following irrigation season.

10. ADMINISTRATION OF SCHEMES

The considered unanimous opinion of the Committee is that control of irrigation in Central Otago should continue to be vested in the Public Works Department. The Committee considers that while schemes are in course of construction it is not advisable to make any alteration in the method of administration, but is of opinion that the Department might find it advisable in the near future to seriously consider changing the status of the Alexandra office to that of a separate district office and confining its duties entirely to the administration of irrigation. It is only natural that adjustments and rectifications of minor mistakes have to be made from time to time; but when it is borne in mind that insofar as the Central Otago schemes are concerned reclamation by irrigation is in an early stage of development it is natural that mistakes would be made and it is only as experience can be gained that such mistakes can be avoided in the future.

The history of irrigation in New Zealand differs in no way from that of other and older countries where irrigation is more or less established.

In the past too much has been expected of the engineer directly entrusted with the administration of irrigation in that he has been assumed to possess a detailed knowledge of farming operations which are intimately associated with the problems of irrigation. The Committee strongly recommends that a permanent advisory board be appointed, consisting of representatives of each of the three State Departments directly interested, viz., Public Works, Agriculture, and Lands, and one irrigators' representative. The duties of such a Board would naturally come under the following headings:-

(a) Secure full and definite information as to the advisability of carrying out projected irrigation works.

(b) Closely study and report regularly upon the progress made in schemes already initiated.

(c) Make recommendations in regard to adjustments necessary in the interests of the schemes insofar as they affect the Government and the settlers.

(d) Investigate and report to the Department upon any matters or complaints referred to it by the Department or the local Irrigation Committee.

A suggestion made and endorsed by the Committee is that the irrigators on each scheme should be invited to elect a local Irrigation Committee of not more than three representatives, the duty of such Committee being to assist the Advisory Board or the administrative officers by furnishing local information in regard to requirements from a farming viewpoint of irrigated properties, and discussing with a view to easier settlement any problems or complaints submitted to it. Such a committee would, of course, have no executive discretion.

11. AGREEMENTS.

Hitherto it has been the practice to register against the land title all agreements entered into with irrigators for supply of water. There are objections to this practice which it is represented dissuades investors from advancing loans on irrigated properties. The present charges are specified in the agreement as the maximum rate, this being reducible for prompt payment. The investor, however, chooses to regard the higher rate as the actual liability upon the land which, therefore, is regarded as liable for an 18/- per acre rate whereas in the very great majority of cases the actual liability proves to be only 16/- per acre. There is also the possibility of certain lands requiring in the future a lighter supply of water, or a reduction of the area; in such cases a variation of the agreement would be necessary, as also a repetition of the detailed original work thrown upon the Public Works and Lands and Deeds Departments.

The Committee, therefore, recommends that in view of the fact that if its general recommendations are adopted, most, if not all, of the current agreements will require variation, all agreements be not in future registered against the titles; but that the original signed copy be held by the Head Office of the Department for record, and that legislation be enacted giving to the Department for the collection of debts that power now enjoyed by Local Bodies for collection of rates. It is considered that flexibility would thus be obtained without any lessening of the security.

It is also recommended that the conditions under which extra and stock water will be supplied be endorsed on the back of the agreements, so that irrigators (who should in each case be supplied with a copy of their agreements), may be under no misapprehension as to the terms of supply.

The Department should be given power, by a clause in future agreements, to vary the irrigable area or the water quota if experience shows that such is warranted. It is only to be expected that with the lapse of time some classes of land will require less water, also that the irrigator may by the adoption of improved methods of distribution be able to increase his irrigable area. On the other hand, it may be found that the response of some land to irrigation may be so limited that it would be uneconomical to continue the service, but preferable to release the water for application to more suitable land. If irrigators who have signed current agreements are not willing to accept such a condition, then the Department should withhold from them any reduction of rate recommended in this report and insist upon the exact fulfilment of the current contract.

12. INSTRUCTIONS TO RACEMEN.

It is considered that the issue of a book of instructions setting out the duties of racemen would assist in establishing or maintaining harmonious relations between irrigators and racemen. The lot of the latter is sometimes very difficult, as it is practically impossible for one man to conscientiously carry out his

detailed duties and yet satisfy individual irrigators whose views as to the proper time of supply and necessary quantity of water for their property may not coincide with the Department's instructions, which the raceman is obleged to follow. If the raceman was able to quote from written instructions he would be freed from any suspicion of preferential treatment or of putting into practice his own personal opinions. Such regulations should, however, be framed in a manner which would not hamper the exercise by a raceman of initiative and the adoption of suitable measures in case of emergency.

13. EXPERIMENTAL PLOTS

These are situated at Earnscleugh, Springvale, Tarras and Galloway, and were laid out by the Public Works Department with the object of ascertaining the most economical use of irrigation water on the varying types of soil represented, a particular feature being the use of the border-dyke system of water distribution. These plots have now fully demonstrated that this method - more particularly on the lighter flat lands - is the most economical method of utilising water on that class of land. The difficulty, however, is the initial cost of preparing the land for this system. This cost is too high to be carried out by contract labour, and the Committee has no recommendations to make in regard to the State carrying out land levelling for farmers. The Committee considers that now the objective has been attained the plots be handed over to the Department of Agriculture to ascertain if the crops obtainable therefrom will be such as to warrant the investment in this particular method of heavier initial labour charges as compared with other means of distribution.

14. WATER DISTRIBUTION

One of the most difficult features which confronted the Committee was the question of water distribution between the main races and the farms. With an unlimited water supply the matter of meeting the farmers' requirements would be comparatively simple. The present system of supply on demand, however, is unsatisfactory, chiefly because it results in low demands at times when the need

for immediate watering is not imperative, and in excessive peak demands when the weather is such that crops require liberal irrigation. In most cases the growth of crops would not be prejudiced by a more uniform rotation of watering.

The cause of the peak demands, which in many cases exceed the capacity of the races, is the necessity to the farmer of a workable flow of water, this being to a large extent independent of the actual area under irrigation, especially on the smaller holdings, and to a lesser extent on holdings of considerable size. The flow required is often many times than which would be allocated under the most generous assessment of the duty of water. The effect of a sudden dry spell, when all the farmers are asking for water at once can be readily imagined.

In most cases farmers will not pool their supply and use it in rotation, this unwillingness resulting in the races having to be run at their maximum capacity in order to ensure the most equitable distribution under such circumstances. A typical example may be cited of a fifty-acre farm of light land being allotted one cusec of water when it is obvious that a flow of two or even four cusecs would be more advantageous for economical watering.

As the capacity of the races is large enough to supply all the water necessary during the growing season, or during the period in which irrigation is required, the obvious general remedy is a more equable distribution. There is at present no power to enforce "grouping" or rotation of supplies at fairly regular intervals, the matter being one for the irrigator to decide. On only one scheme has the great benefit obtainable from grouping water been realised, and even there the principle could be extended with further beneficial results.

The Committee strongly recommends that the principle of compulsory rotation of supplies, with certain reservations, be applied to all schemes. This would automatically result in an improved service to farmers after the small initial difficulties which would probably arise had been overcome, and at the same time entail less work to the Department's employees and improve the

general relations between Department and consumer. The Committee in giving consideration to the foregoing proposes that the working arrangements should be along the following lines:-

At the commencement of an irrigation season, the date of which would not be fixed but varied according to the season, supplies would be made as at present, on demand. This would obviate the necessity of settlers irrigating when water is not required, or the forfeiture of water if not used.

When the season is fairly started, at a prearranged date, the system should change over to one based on fixed rotation supplies. This date would not necessarily be the same for all schemes, being adjusted to suit the local conditions. The whole of any one scheme would then be sub-divided into groups of irrigators, these groups being of such a size that the steady flow to the area, at the rate per acre in force for the particular land, would be that sufficient to readily irrigate the type of land in question. This amount would generally range from 2 to 5 heads dependent upon the particular type of land, its conformation and slope.

This flow would then be supplied to each irrigator in turn, the total time of a complete round of the group being based on a period sufficient to irrigate the class of land with the water available, the length of time each irrigator would receive water being based on his area and allocation to his particular type of land. This would ensure that every irrigator received a workable supply of water at intervals equal to the time taken to work around the group.

The Committee recommends that the acceptance of water at these times be made compulsory under penalty of forfeiture of that particular allocation, with the exception that the irrigator in question may arrange with another irrigator <u>in the same group</u> to take his water, and in return, to obtain that irrigator's allocation when it becomes due.

It is further recommended that when practicable, excess water be allocated to those groups which will use it, the allocation

being based upon the minimum supply, and reckoned as part of the supply to the irrigator. In this way uneven "draws" in the start of the season before grouping commences could be equalised.

There are certain holdings not suitable for grouping, i.e. small commercial orchards, small fruit, vegetables, etc. These would be best served by a steady supply or on demand, whichever is more suited to the requirements of the crop, but as the quantities involved are not large, these supplies will offer no difficulty at all if the flow to the grass lands is kept reasonably steady.

The determination of the components of the various groups offers a few difficulties, or rather, in some cases there may be a few, but the Committee sees no reason why these cannot be satisfactorily adjusted, as experience in Earnscleugh shows that a voluntary grouping system meets few real obstacles, and a compulsory system should be able to meet the obstacles that at present arise.

15. CLIMATOLOGICAL LABORATORY

The Committee was approached by a body of settlers who asked for the establishment of a combined climatological and field laboratory in Central Otago. There is no doubt that much information has yet to be collected in regard to the relationship existing between climate, soil, and plant growth, and it is surprising when everything is considered how little definite knowledge is available in this respect insofar as Central Otago is concerned. The Committee realises that irrigators need special knowledge of soils and crops with respect to their relationship to water in addition to their general behaviour for agricultural purposes. Without such specialised and general knowledge of agriculture, the irrigation farmer is not likely to achieve high or lasting success. As stated elsewhere important and indispensible as the engineering structures are, they only make the fundamental contribution to the success of water utilisation. The real test of success depends upon the ability of the irrigator himself through a long succession of years to win from the soil a comfortable and satisfactory living

for himself and his family and to meet his obligations. It is of first and paramount importance to fortify him for his work, so that he will not fail because of lack of knowledge with which to accomplish his task. To this end the Committee feels that every encouragement should be given to irrigation research work, and that greater facilities than at present exist should be afforded to the Fields Division of the Department of Agriculture in collecting and disseminating agricultural knowledge. In regard to the suggested climatological station a report in this connection has already been furnished by the Department of Agriculture, and the Committee is of opinion that this report should receive the Government's careful consideration.

16. SUBDIVISION OF PROPERTIES

It is recommended that where subdivision of an irrigated property takes place the Department should provide for reclassification of the whole area for both water and rate, cancelling the existing agreement and entering into separate agreements in respect to each separate property, with the proviso that in no case shall the aggregate rate attached to the subdivided properties exceed the former rate for the whole area.

17. CONCLUSION

Quite a number of matters affecting individual irrigators personally were brought under notice of the Committee. These were mostly complaints and requests which could be dealt with by the Departmental officer in charge, and invariably were referred to him together with the Committee's remarks or recommendations.

Although the Committee submits the foregoing definite recommendations, it desires to state that it may be necessary to vary some of the details from time to time, and for this purpose considers the suggested Advisory Board would be the suitable medium for recommending any variations that may appear necessary.

Although doubt has been expressed in a previous part of the report as to the wisdom of including certain lands in the irrigation scheme, it must not be assumed that the

any way deprecating the potentialities of the district. The area of these lands is comparatively small, and cannot in general affect the success of the schemes. The recommendations, if approved, must necessarily mean that the State will be placed in the position of having to subsidise the schemes, but the Committee is of opinion that the benefits to the irrigators and the State warrant such assistance. The establishment of many settlers on land which prior to the application of water possessed an extremely low earning capacity, must be beneficial. As an indication of the increase in production on irrigated areas, one has only to study the railway returns, which show in some cases, substantial increases since the advent of irrigation.

The Committee desires to thank all those who tendered evidence. The work has entailed a good deal of travelling and the collection of a great amount of evidence, but the Committee felt that the whole subject required careful investigation, and on the majority of the schemes found it necessary to visit every farm. This it will be realised made progress fairly slow, but was essential for an equitable classification.

The following enclosures* are attached:-

(1) Map showing the areas dealt with in report.

(2) Schedules showing suggested water charges and allocation.

The Committee wishes to place on record its appreciation of the capable services rendered throughout the investigation by Mr. A.J. Ridler in his capacity as Secretary.

We have the honour to be,

Sir,

Your obedient servants.

(Sgd.) C.J.McKENZIE (Chairman)
" R.A. RODGER
" JOHN GEORGE
" MICHAEL P. McGINNIS (Members)
" JAMES RITCHIE
" R.B. TENNENT

* Enclosures not with this copy.
(now out of date)
F.G.G. 1.10.54.