

(2) *Waikakahi Series.*

The following types have been noted :—

Type.	Description.	Origin.
5	Fine sand	Elephant Hill Stream.
6	Clay loam	Hillside.
7	Stony sandy loam	Hillside.
8	Fine sandy loam	Hillside.
9	Coarse sands with shingle to the surface*	Elephant Hill Stream.
10	Sandy loam, 24 in.*	Elephant Hill Stream.
11	Sandy loam (meadow)	Elephant Hill Stream.

* Of no agricultural importance.

The soils of this series are of miscellaneous origin, but they have the point in common that they are of recent formation. The soils are formed from alluvium deposited by the Elephant Hill Stream or by small wet-weather streams from the hillsides. The parent material is mainly greywacke, but in cuttings tertiary sandstones containing occasional deposits of shells are exposed.

The textures of the soils vary from clay loam to shingle, but as these occurrences are of only minor importance in the irrigation area they have all been included in types of the Waikakahi Series.

The lowest area in the project has in the past formed a flood plain to the Elephant Hill Stream, but since a cut has been made to the Waitaki River flooding no longer occurs and the soils are not being added to now by alluvium from the stream. This series overlies the Pike's Point Series, and at one location the old surface soil can be seen about 2 ft. below the present level.

(3) *Waitaki Series.*

Type 12: 6 in. to 12 in. stony silt loam on shingle.

The underlying material consists of shingle banks thrown up by the Waitaki River, over which has been deposited a veneer of alluvium giving rise to stony silt loams. Systems of shingle bars can be recognized beneath the soil, and the depth of the topsoil in many places is not consistent. At the present stage it has not been considered worth while to separate out such occurrences, although it may yet prove to be desirable, especially for this type, which is most in need of water, since good drainage and a lower retentive power for moisture aggravate the effects of low rainfall.

CHEMICAL AND PHYSICAL DATA.

The mechanical analyses (Table I) show that loams, especially silt loams, are well represented in the area. As silt loams are accepted as the most suitable for irrigation purposes, since they give a good balance between ease of drainage and retentive power for water, the area can be regarded as suited to irrigation. In view of the fact that local configurations favour in certain cases a high water-table, attention must be directed towards the necessity for adequate drainage to ensure the optimum conditions for farm crops. The higher the percentage of stones, gravel, or sand the more often there should be applications of water, but only comparatively small quantities at a time, otherwise there will be considerable washing of nutrients into the drainage waters.

The moistures at the sticky points, an indication of the field capacity for water, show that similar results are to be expected to those at the Levels irrigation area. Silt loams in both cases give similar figures. It should be noted in the case of the soils of the Waitaki Series that stones are sieved out before the estimation is made, and consequently in some cases the holding power for water of the soil *in situ* might only be one half of that indicated by the laboratory determinations.

The chemical data indicate that the Pike's Point and Waikakahi soils are well supplied with phosphate, while the Waitaki soils give a lower figure. Irrigation will justify the use of phosphatic fertilizers on the soils of the latter series, but field experiments will be necessary to ascertain the value of fertilizers on the other types.

There is some fluctuation in the pH figures, values ranging in the topsoils from 4.9 to 6.5. Those soils with a pH below 6.0 should repay liming for a number of crops. Percentage base saturation figures for three typical soils shown in Table III indicate that the soils have already been subjected to leaching. This depletion of bases can be made good by top-dressing.

Available potash and total nitrogen figures are normal. It is hoped that no time will be lost in laying down experiments on the different types. Furthermore, it will probably be desirable, especially on the lighter types, to have repeat experiments every five years or so, for it must be remembered that from now on the soil is to be robbed of its nutrients at a faster rate than hitherto because of losses in drainage water and greater crop yields. It is quite possible that a type showing no response now may definitely respond to fertilizers in a few years' time under irrigation management. The irrigation projects now in hand demand the establishment of a central experimental station for the study of crops, fertilizers, and soil problems attendant on the use of irrigation water.

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