

issued for the year 1891, and since published annually by this department. These tables also contain tidal differences which make them available for all the important harbours on the eastern or Atlantic coast of Nova Scotia.

TIDE GAUGES, AND TIDAL STATIONS ESTABLISHED.

In order to decide upon the most suitable points at which to erect the tide gauges, the advice of Mr. T. O. Mendenhall, Superintendent of the United States Coast Survey, was asked, which he kindly gave; and Mr. Carpmal also visited personally a number of localities along the Lower St. Lawrence and in the Gulf, at such times during the following season as his other duties would permit. At this time also the ill health and subsequent death of Lieut. Gordon, removed him from further participation in the work, and left it entirely on Mr. Carpmal's hands.

The points considered most suitable for the erection of the first gauges were Father Point, Southwest Point of Anticosti Island, and the harbour of St. John, N.B.; and the sites which have been chosen for three additional gauges since purchased, were the Magdalen Islands, St. Paul Island, C.B., and the harbour of Quebec. For the purchase and erection of these gauges, an appropriation of \$10,000 was placed at the disposal of this department in each of the fiscal years of 1891-1892, 1892-1893, and 1893-1894; but the actual expenditure in the first two of these fiscal years was little over one-fourth of the appropriation voted.

The tide gauge itself consists essentially of a cylinder in an upright position, which is made to revolve by clock-work, once in 24 hours, and around this cylinder a sheet of graduated paper is placed. The tide, as it rises and falls, causes a float to move up and down in a vertical pipe, which communicates by a suitable opening with the sea. This float is connected by a fine wire with the wheels and gearing of the gauge, in such a way as to cause a pencil to move up and down on the cylinder in exact accordance with the movements of the tide, but with a much reduced range. The combined effect of the motion of the pencil and the rotation of the cylinder, is to trace on the paper an undulating curve which represents the tidal wave itself on a reduced scale. From this curve the height of the tide, the times of high and low water, and all the other elements required can be measured. Also, as high water is an hour later each day, the curves showing the tides on successive days will fall behind each other, and the gauge may therefore be allowed to go on making its record for a week on the same sheet without confusion of the curves. Alongside of this recording gauge, a 'sight-gauge' is placed to check the record on the other, and also to furnish a datum from which to measure the height of the tide. For this purpose there is a second vertical pipe, and a float with a staff upon it, which moves up and down with the tide itself. If the range of the tide is great, a steel tape passing over a pulley is used instead of the upright staff. The readings of this staff or tape need only be taken twice a day at convenient hours, and the corresponding points marked on the continuous record.

In placing such an appliance in position to record the tide, it is evidently necessary to secure the whole range of the tide within the vertical pipes. On ordinary beaches this can only be done by setting the whole appliance out in the water beyond the line of low tide; or else by placing it on shore and leading the tide to it by a trench or piping. It is this that occasions the chief expense in erecting the gauges in posi-