An Introduction to Anti-Silt Measures on Up-country Irrigation Elas.

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INTRODUCTION.

A very interesting Paper was read by Mr. J. S. Kennedy at the last Engineering Conference on the "Evolution of Scientific Development of Village Irrigation Works in Ceylon"; and notes explained the method of investigating and improving village tanks in the dry zones such as the Northern and North-Central Provinces. The New Irrigation Policy of 1932 was not inaugurated exclusively for the benefit of the dry zone of Ceylon, where shortage of water is the chief obstacle to paddy development. Its main objective was an extensive improvement and extension of paddy cultivation throughout the whole country.

With this wider object in view the wet zone of the island presents its own difficulties, but offers compensatory advantages. In the first place the climate of the higher altitudes is healthier than the low-country and, therefore, more attractive to the cultivator. The districts are more thickly populated, which is an attraction in itself, and provide better marketing facilities. Still more important, in an irrigation sense, is the fact that the supply of water in the wet zone is generally unlimited. The problem to be settled is the proper control rather than the supply or storage of this natural asset.

In this Paper the word "Ela" has been strictly confined to the meaning of "Irrigation Channel" as to keep it distinct from "drainage line" for which the same word "Ela" is commonly used by the Sinhalese.
HISTORY.

Early methods, applied by the villagers were such as to erect stick dams across streams or oyas at suitable places high above the levels of the lands which were intended to be turned into paddy-fields or gardens. From these stick-dams water was diverted from the oya along a channel or ela, cut in many cases along very steeply falling slopes, to their fields. The cultivators, having no scientific help at their disposal in those early days, cut these elas without consideration for gradient or best possible trace, and in consequence these channels caused an enormous amount of work in the way of maintenance and, in many cases, due to bad scours and breaches in the bunds, had to be abandoned.

The stick-dams placed across the streams were invariably washed away during the wet season in spite of frequent strengthens in the form of large boulders firmly packed together by elephants or otherwise. Small streams, named kanduras, dolas or aras, crossing the elas created an additional amount of work and worry to the cultivators because, simultaneously with the breaching of the stick-dams by floods, the bunds of the elas were often scoured away. All these unfortunate occurrences with which the villager had to contend, did not help or encourage him to take up and cultivate more land than was absolutely necessary for the production of enough food for himself and his family to eke out their meagre existence.

Very primitive methods for crossing the kanduras were employed by placing hollowed-out tree trunks or semi-circular kitul troughs across these breaches preventing the kandura water from entering the ela. This was a very sound method, as not only was the extra water from the kandura kept out, but also the more damaging sand and boulders. Unfortunately the sides or banks on which the troughs rested were soon eroded and these breaches became wider and unmanageable. The other method of dealing with these crossings was to construct a heavy bund protected with stones at these junctions and by this means divert the kandura flow along the channel. This resulted in large quantities of sand and boulders, which constantly were brought down
from the steep surrounding country, being deposited in the ela and these were again factors which led to the breaching of the latter.

In this connection the report of the Soil Erosion Committee, Sessional Paper No. III of 1931, which gives actual figures and facts of the amount of soil which is annually being washed down the hillsides, especially from clearings such as tea and rubber estates and chenas, should be read.

EARLY METHODS OF EFFECTING IMPROVEMENTS.

As the value of the extensive fields under the Up-country elas was recognised, technical assistance on larger schemes was asked for from Government and works of improvements were commenced by the Public Works Department in the last Century. The methods adopted consisted of constructing permanent dams or anicuts across the rivers in place of the old stick-dams and replacing the temporary wooden troughs by steel ones on masonry abutments. The design of the anicut was of the gravity section type with one or more planked bays or scour-gates which, as the name implies, were provided to allow for the ejection of sand and silt, which had accumulated above the dam during the season when water was required for the fields—the scour-gates being closed during that period.

Although the method of lifting the planks in the scour gates for ejection of silt and sand, even if carried out with the maximum care and frequent application, would have greatly alleviated the silting trouble, it has been found to be absolutely impracticable for the following reasons:—Firstly, it is almost impossible to approach these scour-gates during flood times. Secondly, planks could only be lifted from the top and this operation, during periods of shortage of water, could not be performed as the required head of water would have been lost. Even if the lifting of the first or top planks had been possible, only the top 6" of silt near the gate itself would have been removed. Another reason which condemned the above method was that several men were required to lift the planks, but most villagers not understanding or appreciating the advantage gained by the lifting of the planks did not show sufficient interest to do this.
A head sluice with plank control opening for the ela was also provided to prevent the oya water from entering the channel during the close or non-cultivation season and to give the villagers an opportunity to clear the ela from weeds and silt which had collected during the period of issue of water. In many cases these head walls had been constructed without studying individual hydrographic conditions, and, therefore, were not high enough, with the result that silt-laden flood water overtopped them and entered the ela. This is a fact which is too much in evidence on some of the larger Major Irrigation Works restored during the last Century.

(See plate No. II—Photo of Badulupitiya Ela.)

This method of providing permanent structures, which withstood the forces of the river instead of the temporary stick-dams could, therefore, only be considered the beginning and should not have been regarded as the final solution of the troubles experienced by the cultivator in connection with his elas.

The most important point that had been overlooked was to devise a method of preventing the ingress of sand and stones into the ela. This cannot be efficiently prevented at the intake, but must be dealt with in the head-reaches of the ela itself. From experience it has been found that any number of scour-gates in the anicut cannot completely dispense with all the silt and sand carried down the river in flood times. The discharge through the intake of the channel will always act as an outlet for the silt-laden river flow, and in consequence silt will be deposited along the ela.

As above mentioned, the wooden scour-gate planks in the anicut, which were generally of the following dimensions 6" × 3" and varying in length according to the width of the openings, could only be lifted one by one from the top. It was soon realised that this method had to be reversed and that the important point was to provide an opening at the bottom of the scour-gate without reducing the head of water to eject sand and silt collected above the dam. The ordinary lifting gate would suggest a solution, but this method could only be adopted on schemes of major importance, where over-head bridges or run-ways
were provided and which allowed for suitable lifting gear to be fixed. Typical examples are the sluice gates at Nachchaduwa, which are of the lifting type, but at the same time only intended for flood discharges and not for silt ejection purposes.

Some important channels in the Low-country show, judging by the actual position of the inlets or off-takes, that the silt question, which plays an important factor in the cost of maintenance, had been considered in recent years. The anicut or tekkum, which was constructed in ancient Sinhalese times out of large masonry stones and is 600 feet in length and 14 feet in height, (maximum), across the Aruvi Aru in the Northern Province must have formed above it a long stretch of deep water soon after its construction. Realising that this dam across the stream would hold up all the heavier materials that would be brought down, the off-takes to the channels were sited considerable distances upstream from the dam. This method must have been quite effective until the silt accumulated to such an extent that the stream, even far above the off-takes, became silted up practically to the crest level of the dam, with the result that large quantities of silt, sand and debris found and still find their way into the channels.

The above method would indicate that it could be made effective if scour-gates or sluices were inserted in the anicut wall, but this, from experience of other similar cases, has been found not to be the case owing to the fact that those gates would have to be closed during that part of the wet season when water would be required down the channels, and in consequence silt would collect in varying quantities according to the nature of the catchment. Even if the gates were allowed to be controlled and opened from the bottom to deal with the surplus water, it would only produce a local relief once the silt had accumulated.

From experience it has been proved that low-level-silt-escapes in anicuts cannot possibly deal with all the silt and sand which is brought down by a stream for the simple reason that the required head of water limits the size of the openings, with the result that when the low-level-silt-escape is open only a clear-water hole, which assumes the shape of a funnel, is thereby created above the anicut.
METHODS ADOPTED DURING RECENT YEARS.

From experience and study of this important silt question, it has been found that the following provision must be made to give the cultivators an adequate and clear water supply for their fields, and to reduce maintenance charges to the absolute minimum.

A. THE ANICUT.

The dams or "anicuts" as constructed now-a-days are generally of the gravity or of the buttress-with-bays design, the latter preferable for economical reasons.

(See plate No. 1 showing an ideal anicut with silt ejection devices.)

In either of these, provision must be made for two or three plankered bays. The planks which are made of reinforced concrete should be removed during the close or non-cultivation season to allow the river bed above the dam to be cleared of most of the accumulated sand and debris. Below the plankered bays small controlled openings 18" or 12" in width by 3" in height — two for each bay—should be provided. This would allow for a continuous discharge of silt and sand during the cultivation season if sufficient head of water can be maintained at the anicut. The openings are of the above small dimensions and two in number, so that better control can be exercised on the head of water required and for easy manipulation. It might be suggested that a device could be adopted by which one plankered opening covering the whole length of the bay could be inserted and operated by a small lifting gear, so that the opening could be adjusted according to requirements. This would no doubt be an easy solution, but cannot be adopted on village elas owing to the capital and maintenance costs-involved. For this reason, a small design has been evolved which is economical in cost and easily operated, and which, above all, has been made "fool-proof". That is to say, although the door or gate can be opened and closed it will be impossible to remove it entirely from the structure. The latter must be taken into consideration, as in
most instances where wooden planks are used they have been invariably lost or removed for other purposes.

(See plate No. 5 for actual design of low-level-silt-escape.)

The anicut wall, before joining the "Inlet Sluice", should turn at right angles and assume a position parallel to the river flow. This parallel wall must be long enough to allow for the insertion of a scour-gate and low-level-silt-escape; the latter should, if possible, always be open, because it is this outlet which deals with the first discharge of the heavier silting materials which would otherwise enter the ela.

B. THE INLET SLUICE.

This sluice consists of an opening, somewhat larger in size than the one actually required for the supply, through a head-wall or abutment and has the only function to prevent excessive flood water and debris from entering the channel. To effect the latter an iron-gird has been placed and fixed across the opening, but no planks or gate is necessary at this point of the ela. The abutment has been set back from the anicut, as explained before, to allow for a scour-gate with low-level-silt-escape to be constructed at right-angles to the anicut face, and as close to the "Inlet Sluice" as possible. The L.L.S.E. should be open whenever possible as the suction effected by the latter creates a clear-water pool immediately in front of the "Inlet Sluice". To allow the L.L.S.E. to be open as much as possible, the scour-gates must be made thoroughly leak-proof. The planks which are placed in the scour-gates have, in consequence, been made to key into each other by means of beads and grooves.

(See plate No. 6.)

The height of the "Inlet Sluice" wall or abutment should be at least one foot above the calculated normal High Flood Level over the anicut to ensure against over-topping. The opening for this sluice being larger than the required size has the effect of allowing more water to pass than is actually needed and, therefore, the latter can be ejected again with all its silt at some suitable place in the ela as explained in the next paragraph.
C. THE SILT REACH.

This is the most important item in the silt question, and is the first portion of the ela below the "Inlet Sluice", varying in length according to the natural features of the river bed and banks. It has to be mentioned here that this section of the ela just below the dam has, of necessity, a masonry or concrete retaining wall as bund, as no earthen embankment would withstand the flood rush at this point. This wall has generally to be carried along the ela to such a place, where damage from floods cannot be done to the bund by virtue of its high elevation above the High Flood Level of the oya. It has to be built on solid rock skirting the river bank, and, as the rock level along this line is in most cases lower than the required bed level of the ela, the deep portion thus created between the latter and the rock level and between the retaining wall and the rock face of the bank forms an ideal elongated pit or "silt reach" in which silt and sand can be collected. If no suitable rock is present on the river bank the pit will have to be lined with either concrete or masonry.

To prevent the silt from escaping into the ela provision must be made for a second sluice which will be called "Head Sluice", with sill at the same level as the "Inlet Sluice". A scour-gate with a low-level-silt-escape has to be inserted in the retaining wall as close to the junction of the latter with the "Head Sluice" as possible. It is very important that the low-level-silt-escape should be very close to the "Head Sluice" as in the case of the "Inlet Sluice", as a vortex will be created immediately in front of the latter and all suspended materials such as leaves, etc., will be drawn through the escape, and only comparatively clear water will be allowed to enter the ela. The sill of the "Inlet Sluice" and "Head Sluice" should be kept at the same level in order to reduce the velocity of flow in the "Silt Reach". This will have the result that sand and silt will be deposited and ejected through the low-level-silt-escape. The retaining wall crest being of the same level as the anicut should slope or be stepped up to the top of "Inlet Sluice". This will prevent flood water from the river backing into the "Silt Reach", but at the same time will allow surplus water which has been forced through the "Inlet Sluice" under a flood head to spill back into
the river and consequently not enter the ela. To make the "Silt Reach" more efficient it could be divided into several pits with their own scourgates and low-level-silt-escapes in the retaining wall by means of cut-off or profile walls constructed transversely across it, the levels of which should again be the same as that of the sluice sills.  

(See plate No. 1.)

D. THE HEAD SLUICE.

As above mentioned a secondary sluice is absolutely necessary at the end of the "Silt Reach" to break the velocity of the flood rush and to create a definite cut-off wall between the "Silt Reach" and the actual ela. The sill level is kept at the same height as the sill of the "Inlet Sluice" in order to form a still water basin.

This sluice must be provided with a controlled opening to the required size and the best and cheapest method for this, in case of village elas, is the ordinary lifting planked type, as one by one the planks can be lifted according to requirements and in every case the surface water only is drawn into the ela. In this connection it has been found that the wooden planks are often missing, and as the latter must be operated frequently for the control of the required amount of water, replacement is necessary at Government expense. To prevent this nuisance in the future, a simple device has been designed on the line of the low-level-silt-escape allowing for operating and storing of the planks, but preventing entire removal from the structure.

The "Head Sluice" wall has to be built high enough for storage of the planks and this height will, in most cases, be quite sufficient to prevent any overtopping by flood water in the "Silt Reach", as the retaining wall of the latter acts as a spill at anicut crest level. For more important schemes provision could be made for drop gates, opening from the top with suitable lifting gears. Entrance into the "Silt Reach" of flood water from an extraordinary high flood, which might even overtop the "Inlet Sluice" wall cannot economically be prevented, but will not enter the ela, if the "Head Sluice" wall has been constructed or raised to a specific H.F.L. previously recorded at this site.

(For design see plates Nos. 3 and 4.)
OTHER SILT PREVENTIVE METHODS.

Having dealt with the silt at the inlet of the channel, other sections of it will have to be considered. Further silt troubles are generally experienced along the elas especially in the case where the ela runs along the lower slopes of estates which practise clean-weeding. Under the rules of the Soil Erosion Committee estates must provide contour drains with silt collecting pits through their land, but this method naturally only concentrates the flow in the direction of the drain, which will have to, and generally does, discharge into some existing kandura, dola or ara. These kanduras are mostly dry during the dry season, but become veritable streams in the wet monsoon, and where these streamlets or kanduras cross an ela great trouble is generally experienced.

To deal with this question, several points will have to be taken into consideration:—

(a) Is the kandura water required to augment the ela supply?

(b) Is the run-off from the kandura not required to replenish the ela supply or owing to its silt carrying property, and is there sufficient head-way between the designed ela bed and the bed of the kandura to allow for the maximum run-off from the kandura?

In the case of (a) the only solution to safeguard the ela is to construct a strong retaining wall across the kandura on rock foundation. A part of the wall will have to act as a spill with crest at F.S.L. of the ela. The pit formed in front of the retaining wall, due to the difference in levels between the actual ela bed and the scoured out kandura bed, makes an ideal silt depositing chamber, whilst the surplus water spills back over the retaining wall into the stream. The entrance of the ela to, and its exit from, the pit must be kept to the actual designed level, for which purpose cut-off walls either in concrete or masonry must be constructed. Provision will have to be made for a scour-gate with low-level-silt-escape, either one or two, in the retaining wall, through which any silt deposited in the pit can be ejected. The above method is generally called an "Over-crossing".

(See plate No. 2 (B).)
In the case of (b) three methods are involved:—

If there is sufficient head-room between the ela and kandura bed, the latter can be crossed by a trough, and the structure is commonly known as an "Under-crossing". But when there is not sufficient clearance, the trough will have to be replaced by a pipe allowing for discharge above and below it—called a "Combined Over and Under-crossing". Care must be taken in the latter case to allow for adequate anchorage in the design. Use of low-level-silt-escapes has also been made at the above two structures for ejecting silt from the ela itself, i.e., immediately before the ela flow enters the structures.

(See plate No. 2 (A) & (C) 2A (D).)

The third method where the kandura run-off must not enter the ela owing to its silt-laden nature, but cannot be discharged below the ela as in the case of the trough or pipe method, a culvert has to be built across the kandura bed to deal with the ela flow. The upstream bed of the kandura will become silted up, in consequence, to the top of the culvert level and the latter will assume the function of a spill, but care must be taken to construct the abutment walls above the H.F.L. of the kandura over the culvert. This structure is also known as an "Over-crossing".

(See plate No. 2A (E).)

Although kanduras are responsible for a great amount of silting and breaching of elas, silt is also brought down into the channel at practically every section of it from lands above, as, for instance, from chenas which do not possess contour drains. Clearing of this silt from the ela is effected by the following methods:—

(a) If a suitable rock foundation is available a few feet below the ela bed after a particularly bad silting section, the bund should be replaced by a retaining wall with a spill at F.S.L. to deal with the surplus water and a scour-gate with low-level-silt-escape. The portion of the ela adjoining the retaining wall should be made into a definite pit lined with concrete on all sides. Silt will be arrested and deposited in this pit and can easily be
ejected by occasional operations of the low-level-silt-escape. These structures will at the same time discharge any surplus water brought down from the higher adjoining lands, and should, therefore, be constructed at frequent intervals, say every 500 feet, especially in cases of badly-silting elas.

(See plate No. 7 (A).)

In this connection the writer would like to quote a specific case. On November 4, 1933, a severe rain-storm of only one hour's duration—intensity of rainfall 3" in an hour—was experienced in the neighbourhood of Badulla on the hills above the 4th mile of Alut Ela, a Major Irrigation Scheme. Soon after the commencement of the torrential rain, the slope of the hill-side, which is covered with patna grass and village gardens, resembled a sheet of water which, bringing with it large quantities of silt and sand, entered the ela along its entire length of the 4th mile. The Ela, although having a bed width of 3' to 4' and a strong bund about 5 feet in width on the top—the latter being incidentally a U.D.C. maintained path—and a height of 4 feet above the bed of the ela could not cope with this run-off and breached in six places with resultant damage to paddy fields and property. Some of the breaches assumed a depth of 20 feet with a breadth of 40 feet. The cause of the breaching can be directly attributed to the absence of adequate spilling accommodation with silt ejection devices. The total spilling facilities before the breaching were only 14 feet long without any low-level-silt-escapes for the discharge of sand and debris. If spills and low-level-silt-escapes had been present at intervals of 500 feet when the storm occurred, the necessary expense to Government for the repairs and the inconvenience to the cultivators could have been avoided.

(b) If rock cannot be found, ordinary concrete lined pits, say 2 or 3 deep, 10 or 12 feet long and with breadths according to the designed bed width of the channel will meet the case. The desilting of these pits unfortunately demands the application of manual labour, but much less
trouble is involved in the silt removal from them, as compared with the desilting of long sections of the ela.

(See plate No. 7 (B).)

GENERAL REMARKS.

(a) Design of Ela. The entrance of silt-laden flood water from adjoining hill-sides into every section of an ela augments its supply which increases proportionately to its length. This fact must be considered in designing the required channel section. It should be understood that every Up-country ela is a drain as much as any contour drain on an estate and should, therefore, be capable of carrying the extra flood run-off from the hill-sides; but as no ela can be economically designed to do this, and as this design would ultimately become an absurdity after a certain length, outlets or spills for discharge of flood water must be made at frequent intervals.

The distance between these outlets will have to be determined after carefully studying each particular case.

(b) Design of L.L.S.E.: An unlimited run-off from a perennial stream, i.e., when the discharge never goes below the maximum quantity of water required for cultivation, opens the question of the design of the size of the low-level-silt-escape opening.

If the supply to the ela through the "Inlet Sluice" could be so regulated to be constant for practical purposes, a L.L.S.E. or orifice could be designed to deal with a continuous discharge from the "Silt Reach" or ela itself and thereby ensure a clear water supply; but to make the latter possible, the design of the channel must allow for the additional quantity of water. The above suggestion is generally not applicable in many elas, but the method of opening and closing the ordinary L.L.S.E. with controlled gate should prove no great hardship to the cultivator. In fact, if the benefit gained thereby of ejecting silt and of freeing the villager from his hard task of removing sand from
the ela, is really understood and realized a happier state of affairs should make itself manifest with the incentive to bi-annual cultivation.

In conclusion, the writer wishes to express the hope that this Paper will be considered an introduction only and will lead to a further study of this most important question of ejection and prevention of silt from irrigation elas.
METHODS OF CROSSING KANDURAS WITH SILT EJECTING DEVICES

UNDER CROSGING

SECTIONAL ELEVATION

OVER CROSING

HALF DOWNSTREAM ELEVATION

HALF UPSTREAM ELEVATION

COMBINED OVER AND UNDER CROSING

SECTIONAL ELEVATION

PLAN

SECTIONAL ELEVATION A-A

METHOD 1 - DETACHED WALL WITH SMALL AND LOW LEVEL SILT ESCAPES TO BE USED WHEN KANDURA WATER IS REQUIRED TO AUGMENT SUPPLY TO BLS. IN MOST SITUATIONS AHEAD-WARD FOR KANDURA FLOW BETWEEN HIGH FOUNDATION AND BLS RES.

METHOD 2 - DETACHED WALL WITH SMALL AND LOW LEVEL SILT ESCAPES TO BE USED WHEN KANDURA WATER IS REQUIRED TO AUGMENT SUPPLY TO BLS. IN MOST SITUATIONS AHEAD-WARD FOR KANDURA FLOW BETWEEN HIGH FOUNDATION AND BLS RES.

METHOD 3 - PIPE TO BE USED WHEN KANDURA WATER IN CROSSED WALL IS INSUFFICIENT. PIPE IS PLACED AND DETERMINED THE PRESENT SITUATION IRC. ADDitions TO EXISTING WALLS MUST BE ALLOWED TO OVER TOP THE PIPE.

DIVISIONAL IRRIGATION OFFICE
BANDARAWELA, AUGUST, 1952

J. J. M. S. D. W. M.
METHODS OF CROSSING KANDURAS
WITH SILT EJECTING DEVICES

OVER CROSSING

UNDER CROSSING

METHOD B - SUITABLE TO BE USED WHEN KANDURA WATER IS NOT REQUIRED TO AID IN ELA. SUPPLY AND OXING TO SALT-BEARING NATIVE.

METHOD A - TRIMN IN BOXES TO BE USED WHEN SUFFICIENT HEAD ROOM AVAILABLE.

DIVISIONAL IRRIGATION OFFICE
BANDAGAVELA: END. 1970
FULL SIZE DETAILS OF GROOVES AND PLANKS FOR HEAD SLUICES

SECTIONAL PLAN B-B

SECTIONAL PLAN A-A

DIMENSION OF PLANKS 6' X 6' X VARYING LENGTHS

<table>
<thead>
<tr>
<th>Total length of plank for 15' opening</th>
<th>15'</th>
<th>18'</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dd</td>
<td>1-5'</td>
<td>1-11/2'</td>
</tr>
<tr>
<td>Dd</td>
<td>5'</td>
<td>8'</td>
</tr>
<tr>
<td>Dd</td>
<td>2-3'</td>
<td>5'</td>
</tr>
<tr>
<td>Dd</td>
<td>2-6'</td>
<td>5'</td>
</tr>
<tr>
<td>Dd</td>
<td>2-9'</td>
<td>5'</td>
</tr>
<tr>
<td>Dd</td>
<td>3-2'</td>
<td>5'</td>
</tr>
</tbody>
</table>

FLOW

This line to be always in level with top of opening.

ELEVATION

PLAN 41

SHED A

DIECO

DIVISIONAL IRRIGATION OFFICE

BANDARAWELA, 31ST SEPTEMBER 1933

ARCH.DIECO.
FULL SIZE DETAILS OF GROOVE FOR 6\times2\text{ft} REINFORCED CONCRETE PLANKS

SHOWING PROPOSED WATER TIGHT JOINTS BETWEEN PLANKS

\[ \text{SECTIONAL PLAN} \]

\[ \frac{3}{4} \text{ Clearance at each end of block} \]

\[ \frac{3}{4} \text{ Inch B.S. Rods} \]

\[ \frac{3}{4} \text{ Inch Reinforcement Rods} \]

\[ \text{SECTION B.B.} \]

DIVISIONAL IRRIGATION OFFICE
BANDARAWELA  26TH FEBRUARY 1934

Agg. D.I.E.C.O.

\[ \text{REPRODUCED FROM ORIGINAL ORIG. DESIGN A.A. 34} \]
Anicut showing water at crest level with Low Level Silt Escapes discharging surplus water below planked bays.
Showing Inlet Sluice, Retaining Wall, Silt Reach and Low Level Silt Escape.
Head Sluice

NEW METHOD

Showing proper River Control with Head Sluice and Lift and Silt Collector devices.
New Type Head Sluice

L.L.S.E.E. in action ejecting silt and surplus water

Shows control of water issue and silt ejection of Left Bank Channel.