

A Propositional Brief About Making Simultaneous Irrigation & Drainage Applying Underground Construction in Cultivation Field

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Abstract — Precipitation is not the only main factor in creating problems in a catchment area. Areal feature, characteristic, topographically, along with vegetation cover & etc. of the concerned area is the defining or the factor for any problems along with cultivation. Owing to this fact several decisions are always taken for its mitigation purposes as well. And ultimately, due to improper system, the entire areas become as water-filled or of deficits resulting to poor intensity of cultivation as a whole.

Irrigation facilities are to facilitate & operate the irrigation procedure efficiently by swift mode of removal & supply/addition of harmful & costly water from & to its fields respectively.

The non-useful & also at the same time the defining (irrigation) water due to its unequal distribution always creates the entire catchment to be proclaimed as 'water-logging areas'. Consequently, the living as well as non-living resources of the water-logged areas then start to becoming suffered by the severe rotten effects of the water-logging. It, with its humorous presence, whenever caused in so, is required to be stopped immediately - this problem of water-logging is a particular problem in the (bad) quality & operation of drainage facility. Unnecessary & unusual use of water is thereby to be kept to almost zero.

On the other hand the poor irrigation results from the non-performance of the useful water in the irrigation system of working. Inefficiency in the cultivation outcome becomes the result of country's economy ultimately. Thereby, as a whole the entire irrigation procedure needs to be equipped with a system that should provide the both operation of Cultivation & Drainage together on better & effective mode of functioning.

In this study a system of irrigation has been described with lots of (possible) innovative methodology which could make the both operation (Cultivation & Drainage) of the irrigation simultaneously - it has constructional, materialistic & mathematical application in order to bring out mosts from it. This system of irrigation has been here termed as 'CD system', broadly which is, the 'Cultivation & Drainage' system together hereby described as the system of entire irrigation.

Also, apart from the response of its tidal upstream (due to dam or river location & etc.) hydrologists often ponder more concern also on the ground-water behavior control of which may also be regarded as to be an indirect aimful cite of this study with regards to sustainability on all across underneath the G.L of the land-scape. Although this methodological CD system is now a propoitive study at this stage of its first productive introduction but it gives lots of its outputs once it's established & made up of the one & beyond as it's been discussed here & that is the far most goal of this study for long-reaching goals of this future irrigation system.

Index Terms — Cultivation, Drainage, Filter Pipe, Irrigation deficit, Pipe drain, Root-zone-depth, Tile-drain, Underground chamber, Water-logging

I. INTRODUCTION

Crop's requirement of water during the period of needful situation causes a great concern to its people (Nordic) as well as to the subjecting authorities. Be it regarding the deficiency formed by the lesser supply of water to a field or the submergence its crops due to the huge subsidence in the ability of the ground's quality. This excessive water may come from nearby dam as well as reservoir's outlet & finally goes to cause flooding on its downstream. The rush of water is bound to happen due to formation of excess water in the irrigation field & it then starts to flow above the High Flood Level (H.F.L.) through various hydraulic structures in the irrigation field. Crop-fields, subjected to this excess water by any ways, are often required to be made up of such so as to become a good & harm-free field of enriching & sufficient outputs.

Apart from the scenario of aboundness of water, scarcity of water is another point of concern with regards to the crop's yield. Lowering down of the Ground Water Table (G.W.T) is a most often cause for the insufficiency in the availability of water in the field which thereby results to increase the cost of irrigation. It is gravely to think the fate of the fields during the summer season. Submersible pumps although play the responsible vision in putting the solution-making attempts, to some extent, towards solving the

problematic causes of such.

Most fields of the cropping nature therefore often gets affected by either or all of following causes of concern:

- Occurrence of higher or less rainfall.
- Insufficient/excessive supply of irrigation water for the needs of crop.
- Atmospheric and/or seasonal calamity.

Keeping this scenario of most of the irrigation fields, this research paper has discussed & given a 'proposition' - kind of report, about making the entire irrigation system, subjected to drainage concern & improvement of cultivation, into the one system that shall solve the entire stated irrigation problems into better prospects. This paper may be considered as the paper of beginning which keeps unfolding the various beneficial sectors of it in its succeeding. As this study deals with to satisfy & materialize several prospective areas of research the methodology as discussed in this study may include or improve with the ever-so-existing system of irrigation.

This study has been presented here as a report of a prospective irrigation system that may be created & established for making the effective irrigation & the economy, in a completely different way. The way is the supply of irrigation water through underground piping arrangements & drawing back of them, the useless &

excess-to-become unusual water, to the underground storage by the same establishment. This paper-report completely, at this stage of description, is fully a report of such way of irrigation system which has been described with anticipation. Because the irrigation system has not yet been established anywhere. Thereby, this paper may be recognized as a proceeding giving another idea of (possible) irrigation simply, & this study is described with this aim so as to have its meaning of description understood with rational knowledge of self-innovation.

II. GOALS OF THE STUDY

Every Research Study has certain philosophical objectives to accomplish rationally. Keeping these goals in views, research studies usually go on through different formulative mechanisms & various philosophical proceedings of progressive nature of its own kind to form a fundamental basis or such of implementive. Like that, this study has also definite goals & been described by the related details of the philosophy.

The prospective views of this study are indeed numerous by usefulness. This usefulness will become clearer once traversed through its prospective visions towards the field of its 'effective' application.

In general, there are following main views (goals) having been discussed inside this prospective research study. Each of the goals (or sub-goals) is discussed with brief description to fulfill the aim. The entire aim is to prepare field as well as to establish irrigation as system of operation to make the cultivation particularly better in a better & different way. The goals on its large-scale are –

A. Simultaneous cultivation & drainage:

This study is mainly of reaching at this very target. There is a set of appurtenance & its establishment described & to be achieved in the cultivation field so that the valuable cultivation shall be made to be possible along-with its drainage facility (underground) built within itself as a singular structure. This means how the entire service of 'cultivation' & 'drainage' should have to be undertaken together has been discussed – the 'drainage' means the underground seepage also that always make burden to its field as water-logged quantity, leaching, disturbance on underground soil, underground contamination & etc. Its suitable arrangement of passage has been discussed for making the 'desired' simultaneous function of it with the cultivation. Also, the soil-layers, below G.L, for making the cultivation shall be discussed of how it to be prepared in making the irrigation effective. In doing both the function, the related arrangements so required are as follows –

i. Making a flexible & self-controlled G.W.T

The availability of irrigation water of cropping is cost-effective & it requires its utilization by very good mode of usefulness. Here, the underground water level, which is known as G.W.T, shall have to be prepared by using its suitable materials about its existence. Here its preparatory methodology is to be given by this descriptive report. Formation of such G.W.T, once developed, shall be able to get used as flexible as a self-control device. This G.W.T., after formation (artificially) on desired basis, is termed as 'D.U.D' curve. Nature of such prepared G.W.T curve is also possible to be made to any shape & size (of desired basis) to operate it on human wishing, rather than on natural.

ii. Shape & size of Conduit:

Configuration of the conduit to be used for the purpose of the simultaneous functioning requires to get

explained constructionally, along-with its essential attachments. Not only the conduits' configuration, its composition, mode of functioning along-with its useful components have been explained in this study.

iii. Irrigation filter of field:

The soil-layers need to be given the certain preparation of formation in order to make the G.W.T or D.U.D. to get it served better so that the soil-medium of the field-soil become working as like a filter(or packed material). Its procedure needs to be discussed & attained at with better prospects on innovation is given in this study. It should be with regards to 1(i) & 2 so discussed, for better irrigation of stable creativity upon the field-soil.

1) *Philosophy in fundamentals:*

So far this study is concerned, there'll be the innovation in making the soil-layers for cultivation of the CD system. By not to strict mentioning it is to be mentioned here that there must always be the creative implementation well apart from the one stated in this study. Indeed, it's basic instinct although for any new & prospective innovation. By the way, the required items in this segment of discussion are explained here as follows –

i. Homogeneity of stratification:

It may be regarded as giving the 'irrigation filter of field'. This study is aiming at making a certain cultivation oriented field in the CD system that must have to be prepared with care & proper soil-materials. The gradation & characteristics of the soils pertaining to the conduciveness to form the G.W.T (of dominable kind, the D.U.D) as well as to make the efficient cultivation effectively have been discussed towards making its constructional processes in the field. In this regard, the distribution of soil-layers should be given the priority which must be a function of homogeneity & quality of stratification within the cultivation system below G.L & as such owing to this, the characteristics of the 'desired' G.W.T shall become flexible & self-controlled.

Of how to design & make the thickness of each soil-layers of the field needs to be achieved is to be discussed. In this regard, the general flow-fundamentals as have been remain unchanged. The soil-medium under subjection of the CD system should thereby be made up.

ii. Flow mechanism:

This may be a kind of formation generated spontaneously by the one stated in 2(i) above & vice-versa. After the conducive preparation of the soil-medium with regards to the satisfactory implementation of various soil-index properties, homogeneity & etc., the passing through flow mechanism of the soil-medium shall also to be become of a 'desirable' or 'designed' kind in return of forming such. This means the flow mechanism shall not be like the natural basis of flow; its flow shall be made to follow its surround formation of the CD system as such. As said, the suitable characteristics of soil-formation may also be prepared & done after deciding the formation & pattern of flow (i.e., the flow mechanism) to be passed through the soil-layers.

3) Mode of use (of the CD system):

Materialistically, there shall be the following goals by mode of use of its constructional application –

A. With/without the use of the Lifting Pipe of the Pipe Drain facility.

B. With/without the preparation of the soil-medium as the irrigation filter of the field.

None of these under use either, shall bring the CD system to natural formation of field-soil indeed.

III. METHODOLOGY

Motion creates diversity. Diversity is the 'Life', above all. And, lives don't walk on the floor of the constant nature (of factors!). Where there is 'Life', there must be the motion (i.e., the evolution). Motion is basically the driving force of evolution & not the vice-versa, strictly. Motion, although, has a reciprocal relation with the Life's 'Death'. To most of the cases, without the 'motion', everything becomes full of leisure filled with monotonous rhythm. When this tune of monotony persists so longer, tendency of the motion of life goes on through the diminishing Sun like it moving backwards against the motion of earth or 'Life' as rapidly as it never to (you) towards the 'Death' - either 'Life' tends to remain on the constant motion which also over the long time starts to opening up wings of the death or the complete death governs over the 'Life' Either. Therewith, the Motion is very important, even on every minute parcel of elapses. By the way, the question comes - what is 'Life'? How the motion of the Life be kept retained for long? In a general sense, the meaning of Life may differ from here to there by variety but in this paper the 'Life' means the certain 'state' which gives continuous growth of various different significances. In this field of 'Life', there should be nothing about of monotonous genre of elapse or the 'Death', even at its extreme; otherwise the lives get the fortune of death. There'll thereby be always the creation, creation & creation of different degrees evolving out on all its comfortable (!) whiles of presence in order to get out of the riddance. To every corner in the world of the 'Life', even 'blackish' tendency of the 'Death' hardly comes to eyes. So, the 'Life' is Life. There is 'nothing' to be of its substitute.

Every pulse of life is worth. Because, (once) get removed out of the Life, the 'Life' never exists. And, it's quite ridiculously terrific to live life without the so-called definition of 'LIFE'. Now, the beauty of life is that everyone has to win over to achieve & remain within the region of the 'L - i - f - e'. This is quite a struggle... isn't it? In fact, whoever wants to die before the 'Death' comes to take over (them)? ... Although exceptions are not included & categorized here due to the power of majority & the particular likeness over 'LIFE' by individual. Now, it's the while to decide & to do impact on, very strictly & seriously, to choose the Life from Death or vice versa - it may also be by continuous mutual interchangeability.

'Whiles' or 'pulses of life' are the boss of its ownness over all, in general. Neither it has been abided over ever nor it listens commands except itself. It's a function of energy. It's the extreme power of comfort & sadness over the degree of its utilization. But it always gives opportunity & shows the paths for betterment. This betterment is the 'Life' & it, although, is subject to variety by formation. Whoever & at what the situation one is, it always beckons the path of movement to get landed on the progressive paths of life. 'Come... follow this way' or 'why don't these works be accomplished? 'isn't it the right one to make (yourself) now on motion?' - This is the type & mode of the talks the whiles say always. Once the path of this betterment is fixed/decided, the motion also takes its position to rotate depending on several variable influencing factors. Realization of 'how the journey will be after having landed on such' then starts & a kind of adventure its passenger experiences. The 'whiles' then make one engaged into the path-breaking paths of the betterment. Then this motion gets its variability of continuous nature. The accumulation of all these minutely small to smaller motions creates although nothing, rather than remaining as slave only - because, those are not independent. On a large scale of

such type of motion, it is the rotation of our planet Earth. Isn't it ...?...! Now, with this philosophical perspective it's to be thought about the condition of the Earth's composition during its rotation throughout years. Not even a single smaller particle is said to be remained as 'inert', under the casting carpet of the rotational motion of Earth. From the birth to the 'death' of each & every of the 'particular' Life of Earth, it traverses with lots of experiences & gives implications of various motions of different intensity on its close particles or masses. With the movement of the planet Earth, each constituent becomes accustomed with this evolving motion of its rotation. Through such evolutionary motion the 'inert' (!) particles also fall into the struggle of the 'Life' & shows the ruling abidance as a proof. Particles of physical nature of the Universe as well as of the little tiny planet 'Earth' are always subjected to this severe motion. Inside picture of each of the worlds is also similarly proven with the similar behaviors by intensity of scale so far as validity of the law of conservation of energy exists. The terrestrial effects are also not to be essentially ignored as for its scaling effects over the pervading layers. By the way, the 'motion' as we've here discussed is having the effects over the sustainability of entire resources, of water flow particularly, & thereby maintaining the 'Life'.

In this study, about how the entire irrigation & its useful water used for cultivation purpose, may be kept under control by providing certain establishment of constructive arrangement, both scientifically & technologically, has been discussed. The arrangement has the basis of engineering & scientific view-point of forming so which shall finally disclose its advantage of use in the modern days cultivation.

In order to give little quantity to approximation understanding of the study of the motion through the particulates is essential. Drainage study is also required to be studied in determination of maintaining an effective irrigation system. The field of irrigation where a philosophy has almost become a proverb which is '*no waste never to be wasted out*' has been arranged or equipped with certain innovative construction equipment that will make it up of so. This entire arrangement has the main theme & goal of this study & that is to make the cultivation field effective for undergoing both the function, irrigation & drainage, simultaneously - these shall together make water-loss minimum & utilize the farmers' hard labors round the years by giving a healthy status of theirs' sweet & hopeful lands.

It's a general instance at every field to get views at the drainage system besides various methods of cultivation. Somewhere pumping water flowing through small, narrow ditches, drains etc. to the field, somewhere flowing of pumped water through tubes to distant fields, even somewhere facility of Tile-drains (underground) to remove out the water from fields if the fields become water-logged - these are the scenes of drainage for doing the irrigation effectively. Study of this paper has described an integrated 'constructive' system by which the irrigation & its associated drainage shall be possible to be done in a more better way with having multi-purpose targets.

Let's first discuss about the drainage facility given in general to most of the irrigation fields. There are the following pattern of drainage facility -

(a) Surface Drainage:

It is that type of drainage which facilitates the surface run-off, return-flow etc. of the respondents to the formation of the surface water to flow through the surface storage structures above the G.L, is meant to cause the run of the flow flowing under the

atmospheric pressure. The portion of surface water, depending on the availability of the water-table, goes to the alternate entry & exit through joining into the Ground Water Flow (G.W.F) & the Surface Water Flow (S.W.F) alternatively and/or respectively. It is mostly provided as open channel used for either flow- conduit or the usual surface storage. As because of the kind of surface water or surface-flows are stored or transmitted through it, these drainages are called as 'Surface Drainage'.

In this study, surface drainages to be used may be the channel-flow (rectangular shaped or else) receiving the discharges from the source such as Pipe Drain, Channel storage (chamber storage) etc. as discussed. The drainage paths from the inlet/outlet of catchment area under the irrigation system to its channel storages may also be of this kind.

(b) Sub-Surface Drainage:

The seepage flows, after having passed through the soil-medium by lesser atmospheric pressure, say for the water-logged catchment area, become arrested, collected & ultimately flow through the 'medium of conduit' (i.e., the Pipe Drain) underneath the G.L on all across the soil-mass. This underground conduit is called as the 'Sub-Surface Drainage'. It is the most use of concern, in this study.

In this study, sub-surface drainages used are the structure of the Pipe Drain (placed underground) receiving the seepage through the encompassing soil-medium & discharging it into the Drain or to the drainage paths of outlet of the catchment area. Also the Pipe Drain used for the supply of the useful water to crops in the fields are of this kind. This both operation may be called as 'drainage' but this study has segregated this purposely by the name 'Cultivation & Drainage', i.e., the propositive CD system.

The Basic differentiating acquaintance of these kinds of drainages rely firmly only on its subsequent 'defining' function of itself & the mode of its use, not by the pattern & type of the materials used of it. The characteristic flows to be flown through each of the drainages are also quite significantly marked & separated in the CD system, by their own formative identity influenced by them indeed.

Now regarding irrigation, this paper has discussed a propositive & innovative method of irrigation process. It includes the constructional attachments & its suitable placing & establishment to serve water to the irrigation field. The irrigation & drainage system together is hereby termed as 'Cultivation & Drainage' or 'CD system'. Now this CD system of irrigation process is discussed in the following -

Let's it is started with a picture shown in the Fig.1. This picture has shown the sectional detail of the underground drain subjected to G.W.T below G.L of a catchment area. The drains may be of perforated kind on its top surface (above center or as such). It may be quite similar to Tile-drain used for draining out water from a water-logged field but in this case the drain shown is not as similar as that of the conventional tile-drain type; it should be more of a tile-drain pipe by size, dimension, preparation etc. as discussed in its section of discussion. This drain shall have multi-purpose uses. Here, in this study this drain is termed as 'Pipe Drain' which is completely, & by integrity, a new type of formation of drain of innovation - its first introduction is described here in this study. Also, there is a pipe called here as 'Lifting Pipe' which may be with perforation to be provided vertically (Fig.1) with the laid-down pipes (i.e., the Filter Pipe mostly). This pipe shall not only give the underground flow's journey the facility to reach to the fields but also provide the water (particularly the pore water) to get passed through its

perforation into it to go into the underground grid-line system of CD & finally into the Chamber (Fig.4).

The schematic diagram of Fig.2 describes a plan-view of the network of inter-connected Pipe Drains (underground) of a typical catchment area. The entire picture is for an exemplary purpose only. The Pipe Drains get connected together forming the grid-lines. Along the grid-line of the network, attachments of the Pipe Drain & its appurtenances have been given. These are - Lifting Pipe, Pipe Drain, Filter Pipe, Valve, Chamber, insulation joints, anchorages & etc. It is entirely underground construction. On all along the grid-line of drains, numbers of the junctional position occurs which requires attention for the provision of essential valves, gates etc. The water to be supplied for irrigation shall go to the irrigation fields through these underground Pipe Drains (& finally by Lifting Pipe). And, the excess water including the water of water-logged areas shall come down enter into the drain & flow back through these underground Pipe Drains to get disposed of to Outlets - entire operation to be done by pumping and/or suitable arrangement underground. Although there may be the provision kept for a separate set of underground pipes for undergoing the back-flow from the cultivation fields to the source by the nature & quality of water. Also, along the Pipe Drain there should be a different type of pipe to be connected as the drain proceeds to the irrigation fields. Let's these attachments of pipes to the Pipe Drain be called as 'Filter Pipe' which shall be the immediate respondent to the irrigated fields. Length & diameter of these pipes may be different. The 'Filter Pipe' along-with the 'Pipe Drain' shall be under the control from the underground structure called as 'Chamber'. The section of such filter pipes to be used in this purpose has been shown in the Fig. 3 & the Chamber in the Fig.4. This entire operation may also be done by making its suitable arrangements from above the G.L connecting to it.

As shown in the Fig.3, filter pipes are having its top portion cut off from its original dimension & have layers of covering over its top open surface. This shaping has been given to the filter pipe to function with the purpose of cultivation by the underground supply of water. The layers to be given from the rim of the cut position of the pipe towards its top include perforated dish, screen mesh & carpet of cotton. Here may also be imparted with any suitable purposeful objects by layers. These layers/covers are to prevent the entry of soil-particles except water into the pipeline or CD system. These filter pipes are called here as 'Proportionate' Drain or by 'Half-top cut-off' drain if the half is separated by cutting from the center position of the pipe. The cultivation field in this regard from say, G.L upto the location of the underground pipes should have to be prepared to serve as 'filter' or simply as 'irrigation filter', under this system (CD system). As the supplied water is coming from underneath up towards the G.L in the CD system, the overlying soil-layers of the pipes have to be formed/ designed in such a way that the sufficient water the roots of the crops can sufficiently extract from the (saturated) soil-mass. Degree of saturation of the overburden soil-layers depends on the type & amount of crops to be irrigated. Above the filter pipes, free-spaces of certain magnitude are to be allowed for the supplied underground water to remain & stay thereon for required period of irrigation in order to make & enhance the sufficient cultivation. Let's this allowable space be termed as 'roots' life' or simply 'RoL'.

In irrigation system the crops shall uptake water by the capillary action of forces through their root-zone-depths & the underground filter pipes along with its adjoining allowable free spaces filled up by the water

given by the CD system shall keep supplying the water particles to the capillary pores as well as the roots of the crops. It is to be mentioned here that the variability must always come with regards to the several factors such as the allowable free space, Filter pipe's dia, overall depth of irrigation etc.

Thereby, in doing this entire system of operation effectively, there may be the following three divisions constructionally & scientifically -

- The establishment for supplying the water into the Pipe Drains as well as Filter Pipes.
- the preparation of soil-layers for irrigation at the cultivation field, including the RoL.
- Provision & interconnection of the Pipe Drain with the Filter Pipe.

Each of these divisions is described in the following -

a. Establishment

The CD system should preferably be a pressure system. There'll be several types of pumps installed (in Chamber or elsewhere suitably) for generating pressures for the water to go up to at the field's surface.

At this position of the CD system, certain structural establishment is necessary to be provided for making the network pipes under control & operation. This structure is here termed as 'Chamber' which regulates the water-flow to & from the irrigation fields through the pipes, by gravity or pumping or by combined gravity & pumping. Fig. 4 has shown the plan & sectional view of the Chamber & its associated attachments. Only Pipe Drains should take their entry & exit at the Chamber while enhancing their duty to run the water-flow through the grid-lines of the network. It thereby regulates the come-and-go of the entire underground drainage properly with justified improvement in efficiency & speediness of the entire CD system.

The Chamber works like drop-manhole. The adjustment of levels of the different Pipe Drains is to be done & executed at the Chamber. There must be number of such Chambers in CD system under a catchment area. To adjust the different sizing of the various drains at the entry & exiting of the Chamber, the Chambers act as the mediator in doing the level-adjustment of the through pipes.

Also, there'll be attachments along the running drain-lengths at the position of changes of configuration in the pipes ; these attachments may be consisting of short pipes either in different sizing & shape to regularize the come-and-go through the Chamber & its pipes effective. These attachments are the location of changer of pipe's dia & as such & this may be embedded into masonry/concrete works in order to avoid the pressure. Therewith, the entire set-up of the CD system, of the Chamber particularly, has to have the range of flexibility in imparting the selectively compatible pressure inside the flowage system of the underground drain-pipes & should thereby make the flowability of the Pipe Drain on a better mode of control effectively & suitably.

The best precautionary arrangements are although to be needed at the location of increase or decrease in pressure of water-flow. Besides, the pipes should be free from the effects of the water-hammer provided the drainage system is made up of so. The materials used for the establishment & its attachments should be hard enough, corrosion-resistant, durable & may be made up of the material different from its adjoining pipes/structures. Leakage of any smaller magnitude at this place may create the devastation to larger extent.

b. Preparation of soil-layers, including the RoL

The depth of cultivation of irrigation field, under the CD system, should be depth of the soil-layer between G.L & the underground pipe generating from the Chamber. This depth of layers of soil shall be under subjection of watering given by the underneath piping system of the CD system. Now, the soil-medium resting in this depth shall need to be prepared accordingly to make the cultivation realistic. Degree of stratification of the soils of the soil-medium becomes its basis & also the required soil-index properties to be given to. Again it's to be said that the variability is the word to be followed here on a more diversified scale. The subsequent depths of the soil-medium may be treated as like the convenient filter subjected to water for getting it purified. Like that, here this depth of cultivation is under the similar type of definition which is here termed as 'irrigation filter' - the filter prepared for making irrigation/cultivation. In this case, the subsequent layers of soil depend on different factors such as type of crop, season, type of soil, crop-quantity, land-area, level of G.W.T etc. In the making of the soil-layers compatible & useful to the cultivation by the CD system as said, the G.W.T shall also become operated, controlled & designed so far as the soil-layers are concerned. The level of the groundwater may be in this way brought to up & down using proper soil-materials & by useful handling of the CD system as described. The G.W.T under the CD system may thereby be termed as 'D.U.D' curve or the 'Down-up-down curve' which shall be possible to be formed by the application of this study's CD system.

As the entire irrigation is through the under-ground facility, care must be given in selecting the depth (or sub-depths) of soil-layers on which the valuable crops shall keep blossoming out to make remarkable farmer's smile.

Another defining point of thought is the RoL. This is the free space made to be available above the Filter Pipe(Half-top cut-off) to get the water particle sucked by the capillary action of roots of crop. The gradation as well as the required soil-indices of soil-medium shall thereby have to be provided by the required essential magnitude to the soil-depths of the soil medium in order to make the upward journey of water particle from the Filter Pipe towards the G.L. Now, regarding the stabilization of the entire soil-medium, it is not to be a so-of-so matter once the upward passage of water is done through the soil-layers; it's always to be followed after the satisfactory made up of the soils' ability to make cultivation with such. Therefore, the property distribution of the 'desired' soil-layers is required to be 'defined' subject to the availability(by suction ability) of the water through the root-zone-depth by capillary action - the RoL quantification may/may not be required with severe attention.

C. Provision & inter-connection of Pipe

The pipes emanating from Chamber are called here the 'Pipe Drain' & the pipes just below the irrigation field are the 'Lifting Pipe' & 'Filter Pipe'. The distance between the Chamber & the irrigation field may be quite a long one, although there may be intermediate Chamber on this (long) distance. The attachments are at the changing points in the configuration of pipes on all along the grids.

It is very general to provide the Pipe Drain with greater diameter in size as it's emanating from the inlet/outlet of the Chamber. Lengths of the Pipe Drain may be suitable selected, like its diameter. It's neither perforated kind nor having any proportionate cut-off in configuration. Its completely full size pipe & flow shall be given into it for running full across its diametrical section. There may be variety on running full condition if the land is subject to gravitational advantage. At a

suitable distance from the Chamber the Pipe Drains shall end & from this end the Filter Pipe may start to feed the water to the cultivable lands. At the junction care should always be cautiously provided. It also have to be decided/designed how much irrigated area a Filter Pipe shall be able to feed on.

The Lifting Pipe should always be in great inner connection with the Filter Pipe & Pipe Drain at its connecting joints. Its size, length etc. depends on the particular design basis. This pipe may be perforated or may not be and also, this pipe may be covered up with a mesh covering in order to facilitate the water movement by any direction.

The Filter Pipe, which shall only be provided as the proportionate drain-pipe. Size & shape of these pipes may be suitably selected. The location of these pipes shall decide the depth of irrigation to be provided at the field. The RoL value shall depend on the factors like shape & size of pipes (Pipe Drain & Filter Pipe indeed), irrigation depth, design elements of the soil-layer, crop type etc etc.

As shown in the Fig.4, the inlet & outlet Chambers are connected by the three exemplary drain/pipes; its number may vary. Each drain/pipe consists of the Pipe Drain at the first & Filter Pipes at the end of the Chambers. Incidentally, the fields shall be existing at suitable places on this length in between the Chambers. Section A-A gives the showcase of various components of Chamber structure & its inter-connected adjoining. The line of drain/pipe flow which has provided with the entire assembly of various covers as has been shown in the Section Y-Y & by the Fig.3 & Fig.4 has been marked by arrow here. In the section, it is getting to have views of the 'under-drain' provision below the drain/pipe on all along parallel to the above drain/pipe line (see also Section Y-Y). It is additional arrangement given & shown to make the same purpose but with more sophistication – in this case, only through pumping, the water shall also follow the underground movement as has been discussed for the CD system without it. Ports are given at suitable places to make the access through on all through invariably (see also Section Y-Y). Valves along the drain/pipe (although not shown in figure) are to be given to regulate & make the flow under control inside the pipe/drain as these are provided at inlet & outlet of the chamber.

In the section Y-Y, the three drain/pipe which was generated out from the Chamber systematically, it has become of the proportionate figure of the Filter Pipe (along with the cover) as explained as shown here. This means, the Section Y-Y shows the position of the sectional view of the conduit just below the irrigated fields. The under-drain which run on all along the inter-connected length of the conduit (drain/pipe) in between the Chambers is shown with the schematic sizing. The ports are shown with dotted lines. Along the circumference, geo-polymer or such kind of impermeable material has been given to make the irrigation & drainage operation of the CD system viable & durable. The construction if made by masonry should properly be given with the stable base.

Now the CD system implies to perform the irrigation & drainage simultaneously. In doing so, the drainage of water, as explained, the entire Chamber & its connected drain/pipe should also have to bear with & furnish its entire function satisfactorily. Say, during water-logging, the water above the G.L should also have to pass through the given irrigation system by the dutiful operation through Chamber & its inter-connected drain/pipe. There'll not be necessary of draining out the water from the water-logged areas by the Tile-drain provided conventionally for the water-logging purpose. In this regard of water-logging, the

entire catchment areas subjected to the CD system of operation may be washed through by applying fresh water on all along (to remove the leaching effects), after the water from the water-logging areas have been removed totally – this application of fresh water should be applied from top above the G.L.

In summary, the procedure of the irrigation & its required drainages may be explained as follows –

Process of the CD system: The steps required, systematically & sequentially, to undergo the said system are –

I. Backward motion

i. For draining out water from irrigation field, the stored/stagnant water of the field above G.L should be sucked/dragged into the Filter Pipes through the Lifting pipe & then into the Pipe Drain; pumps of the Chamber may be operated if required – it may be termed as the 'backward' motion of the CD system.

ii. The saturated soil/the field-soil after the drained water has been removed/the soil affected by the water-logging effects should be cleansed/washed by applying fresh water on the fields through the Lifting Pipe from the Chamber through the underground pipes ; and, then the same water (mixed up with wastes, chemicals etc) shall also have to be collected back into the Filter pipes as well as the Pipe Drain system through the perforation of the Lifting pipe or by the underground piping system or by the both of the Lifting & the underground pipes of the CD system. Then the entire water (which becomes wastewater due to leaching/contamination with field soils) so collected by the backward motion the should be sent to the Chamber & from there to the disposing outlets.

II. Forward motion

i. For doing cultivation, the CD system shall supply the irrigation water to the fields through the underground piping system; should be possibly by pumping on mosts, merely it may be by gravity.

ii. The irrigation water while passing through the interconnected various pipes such as Pipe Drain, Filter Pipe & Lifting Pipe etc. to reach to go up to the field's surfaces it should always be kept in mind that the integrity should never be lost at anywhere along the journey of the water from the Chamber to the field using the underground pipes – the structural & constructional flexibility with stability shall ensure this 'forward' motion of water from the Chamber for a long lasting future of the CD system.

In this way, both the irrigation & drainage operation of the CD system is possible to be done by the constructional methodology as discussed in this study. Lot more research windows are available in this methodology which are the utmost field of future scope of this study.

IV. MATERIALS USED

After the elaborative explanation of the CD system, it is now about the materials to be used in this study going to be the discussion of its following –

1) Pipe Drain:

This is the basic useful mode of conveyance in the CD system. The conduit which is used for the conveyance of seepage or water through itself is called as the Pipe Drain. These pipes are the immediate parts of the Chamber on one side & the Filter Pipes on the other side in the underground system as described. These pipes may be perforated, to some extent, on its top-surface & should be durable & pressure resistive by nature.

2) Filter Pipe:

This pipe is provided from the end of the Pipe Drain up to the irrigation field. These are open on its top surface in this study, although this one may be 'proportionate' by nature & also durable indeed.

3) Lifting Pipe:

It is the immediate pipe of the CD system to the ground-surface of the cultivation field or it is the pipe letting the water from the Chamber to reach at the surface of G.L./ground-field. Its dimension & necessarily required functional elements is solely dependent by the designer's choice.

4) Proportionate cut-off:

It is the innovation over the pattern of pipes used. Let's it be described in general for conduit. Conduit of regular general shape & size may be modified by providing a ratio which is the measure of having an effective area of flow in itself. The ratio is here termed by the 'Proportionate cut-off ratio'. The term/value of the ratio expresses it directly. This ratio defines the proportionate ratio of the cut by the part to its integrity. It offers the proportionate dimension of the conduit for the flow to pass through itself. This cut-off ratio is of several types, namely, Half-top cut-off, 1/3rd cut-off, 2/3rd cut-off & so on, depending on the amount of cut in the ratio of depth proportionately.

For information, the 'Half-top cut-off' is mostly preferred because of its ability of coverage to make the reception of the incoming water particle under the governance of the G.W.T curve into the conduit itself. The cutting edge may be either the half of the upper-half of the conduit or exemplarily, the simple semi-circular pattern for a circular or spherical conduit - it's solely on the desirable basis of suitability. The shape of the Pipe Drain may be of any geometrical figure as of one type has been shown with this study in its figures. This cut-off conduits thereby facilitates suitability of flow as per the required needs.

In the use of the particular suitable cut-offs the subsequent conduits should be provided with encasing arrangements above the rim or top-level of the cut-off of the conduit itself in order to prevent the entry of soils into it. As the portion above such conduit of cut-off format is almost open & completely surrendered onto the soil masses above it, here is the proposal of such encasing arrangement on & above the top of the cutting edge of the conduit of *proportionate cut-off* kind - the top cover of the 'proportionate' conduit to be made by Screen (mesh) followed by Perforated Dish. There may also be some other suitable intermediate protection in this top-cover of the conduit. A schematic depiction of this arrangement has been given in the Fig.3 & Fig.4.

5) Chamber & miscellaneous:

It is a underground structure discussed in the 'establishment' segment earlier. The entire CD system is under the operational control of this structure. It has various appurtenances as shown in the Fig.4. Location of this structure shall depend on varyingly desirable factors & be selected with views of its proper functioning. This structure may also be operated from far-distances or from above the G.L., using suitable miscellaneous attachments.

The conduit used may be of different shapes - circular, polygon, rectangular, square or any desired configuration. Corresponding cut-off should be furnished proportionately, as well. In this literature, the concerns basically target on towards making the underground CD facilities to be well-conveyed & to be hassle-free from possible operational troubles. In doing so, the Fig.1, Fig.3 & Fig.4 may be consulted with &

should be of its propounding configuration, alongside always, indeed, for making the goals of this research study more & more rationalized & usefully operationable under any terrestrial working condition.

V. PRECAUTIONARY & PREVENTIVE MEASURE

- No component in together or part should disturb the flow-mechanism in the conduit.
- To how far the efficiency of the CD system itself to be given priority should be carefully thought of.
- The components which are of 'optional, frictional & alternative nature' should be taken care of precautiously.
- Junctional attachments are always welcome but to the satisfactory stability & requirements.

VI. CONCLUSION

This study has numerous mode of application. The Lifting Pipe may not be used for the water from the Chamber to reach at the G.L's surfaces. If the soil-medium lying above the CD system is properly prepared & designed, then it would be more than that of the utility of not only the use of the Lifting Drain, but it'll make the entire irrigation to a revolutionary mode which may then create new modes of the innovative irrigation application.

The value of slope of the conduit(drain/pipe) depends on various flow characteristics such as discharge to be flown, velocity, frictional feature & size of drain/pipe, proportionate flow-depth ratio, 'proportionate' cut-off factor, successive adjustment on the links of drain/pipe overally etc. in relation to the structural stability of the alignment of the entire network of the Land-drainage system.

Whatever the slope of the ground's level-line on the G.L itself is, the 'designed' bed slope of the underneath Pipe Drain may often be a separate individual identical nature of its ownself. The difference in the pattern or the parallelism of these two kinds of bed-slopes is very independent, self-featured & self-oriented by its own nature of formation from each other. Although, this may also be the same to some places of territory. It's better if the profile of the flow-line of the Pipe Drain under the G.L is established with the level as similar as that of the R.Ls of the G.L above it - it'll keep the entire CD system more balanced & well-workable.

The estimation of the 'depth of cutting' of the under-laid conduit(Filter Pipe/Pipe Drain) (of the profile) is determined after the sloping of the conduit is fixed. This value of the 'depth of cutting' gives the 'profile' of invert level of the pipe/drain or the flow line in the conduit, pressure in each successive position of longitudinal as well as the connected latetals, etc. as required to be depicted. The profile also shows the amount of soil to be excavated at the successive positions of the conduit below the G.L on the total run of the conduit itself. From this, the total load of soil to be resting on, carried & entertained by the conduit gives a knowledgeable measure to keep the entire system of conduit at the desired alignment on & above the G.L with stability concern. The resting soil above the system of CD should have enough resistant to total settlement & overall compatibility with to resist & counteract the effect of consolidation & differential moisture factors during the entire service run of the conduit & its interconnecting attachments - the overburden soil should be prepared with having of such compactness & the concern of safety. It's then the judgement & decisive thought of the 'design & planning' to reach at the outlet of the entire catchment area without much troubles under the service

correctly.

Vacillation in taking the factorial decision should always be avoided - if so, precaution must be offered at its beginning stages of the process of the design as well as its subsequent constructional implementation for creating a well-balanced & liveable land-drainage system which is the CD system here.

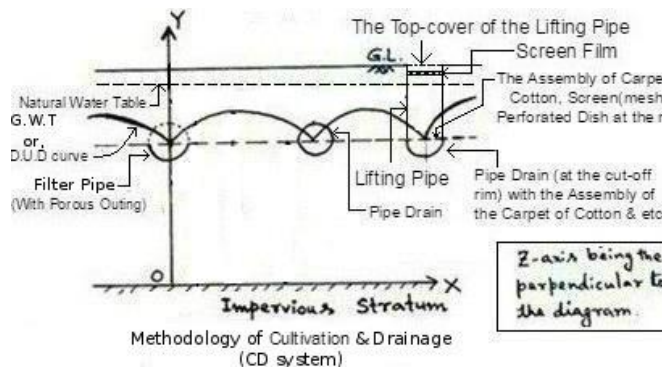


Figure.1: Cultivation & Drainage System

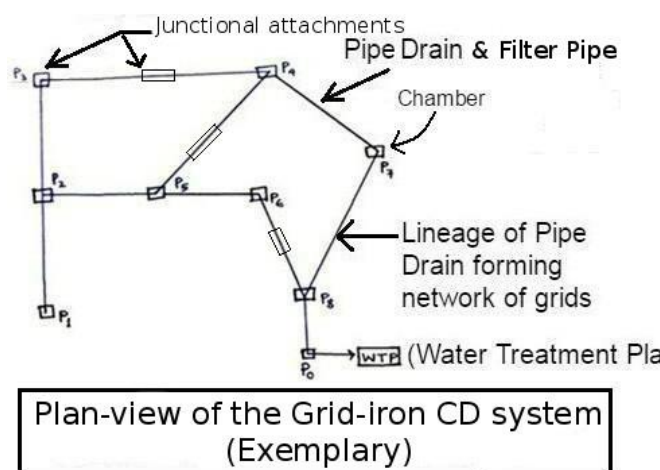


Figure.2: Exemplary Layout Plan of the CD

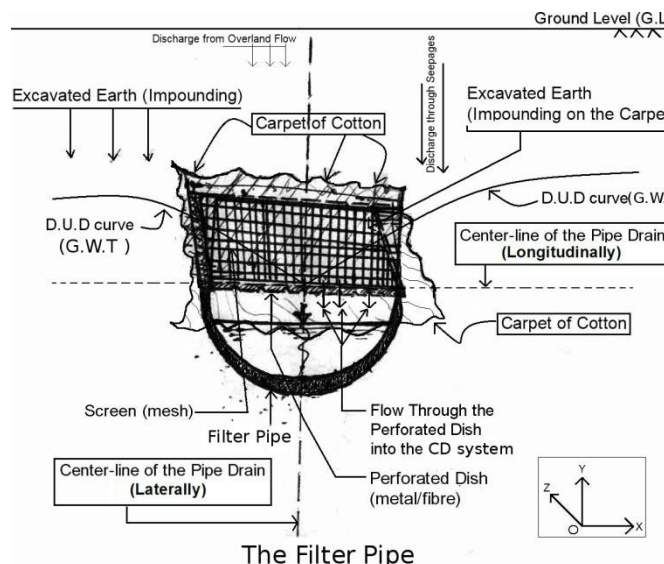
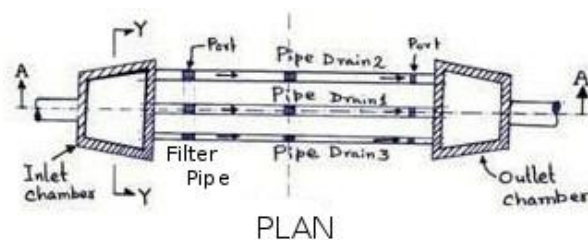
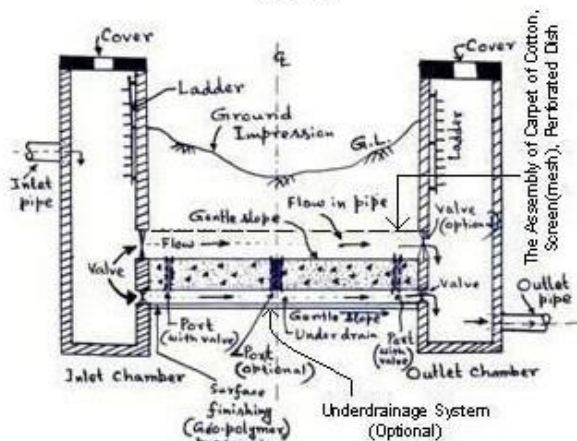


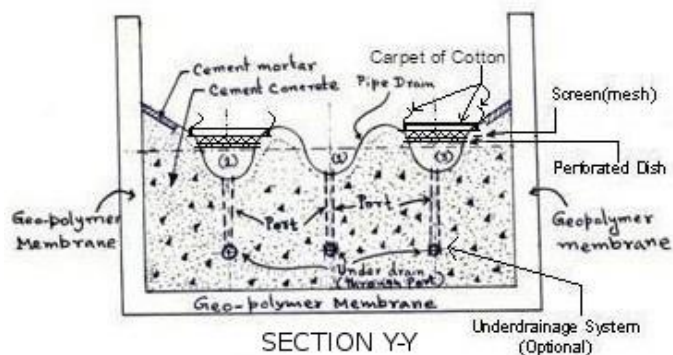
Figure.3: Apertenance of the Filter Pipe



PLAN



SECTION A-A



SECTION Y-Y

The Chamber

Figure.4: The Chamber Detailing

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