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Irrigation Solution

• WATER SUPPLY

SYSTEM DESIGN

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Ethiopia Omo river 2500ha irrigation project design based on center pivot irrigation system

Rainfine Irrigation Design Institute
Dalian China

Catalog

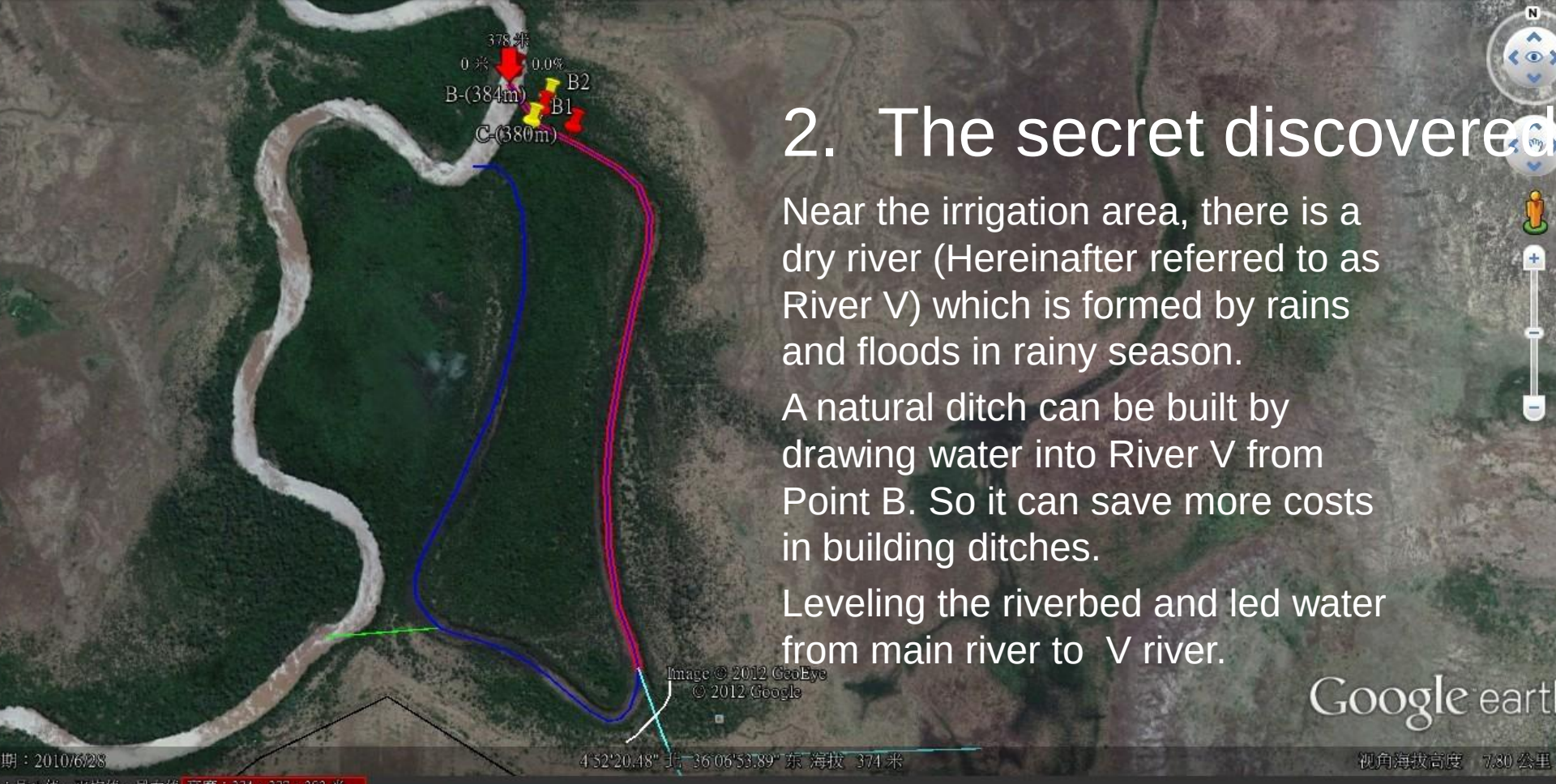
1. Guide line of the design:

(1). Taking in water from the nearest ditches into the irrigation area.

(2). Constructing the ditches, restraint gate, pump station and pipelines and other facilities for the three irrigation areas.

(3). Using the natural riverbed to reduce the investment cost of ditches.

(4). Two shift working of the center pivot irrigation machines can minimize the water pipes diameter and the total flow of the pump station.



2. The secret discovered

Near the irrigation area, there is a dry river (Hereinafter referred to as River V) which is formed by rains and floods in rainy season.

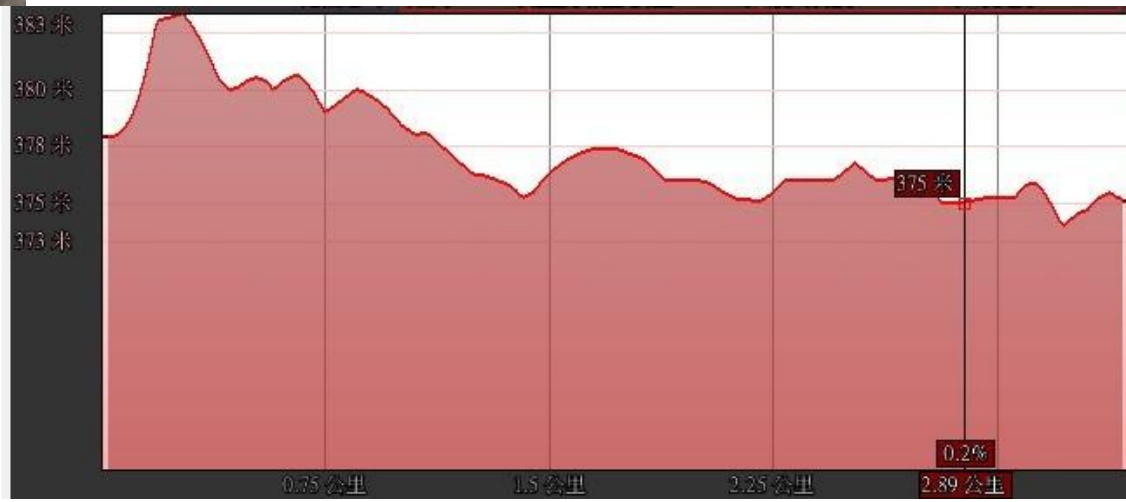
A natural ditch can be built by drawing water into River V from Point B. So it can save more costs in building ditches.

Leveling the riverbed and led water from main river to V river.

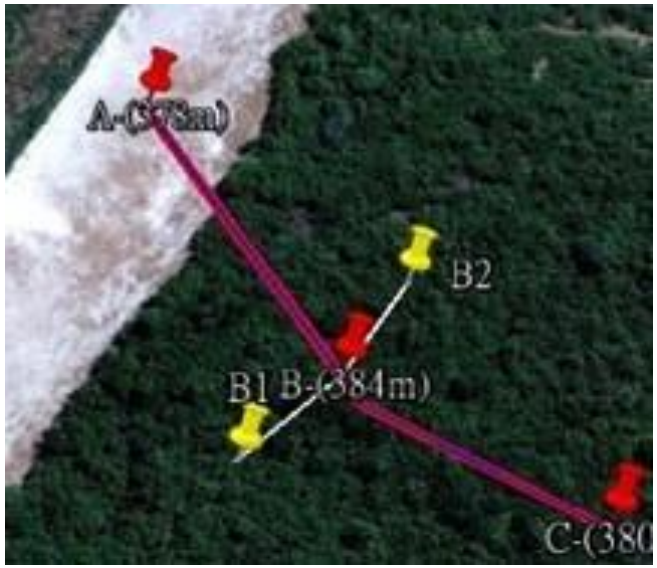
2.1 Drawing water schematic diagram 1

Contour map of River V：

It is feasible to drawing water from river based on the height difference between the water entrance of River V and the artificial ditches. But Point B is an obstacle will impede water flows into the River V.

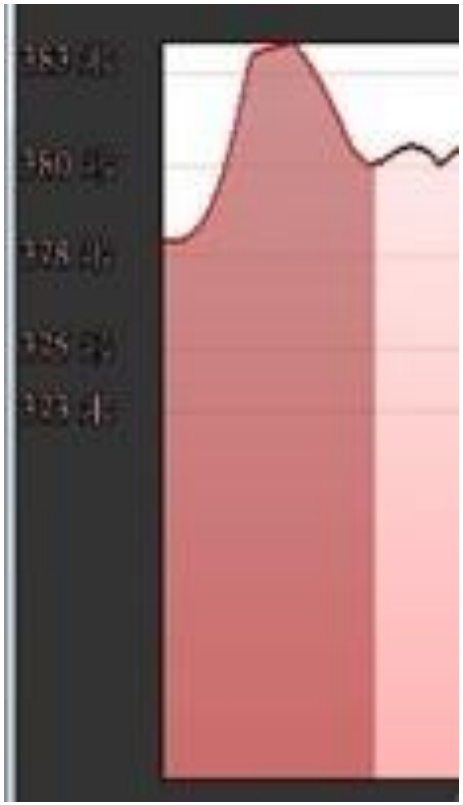


2.2 Drawing water schematic diagram 2

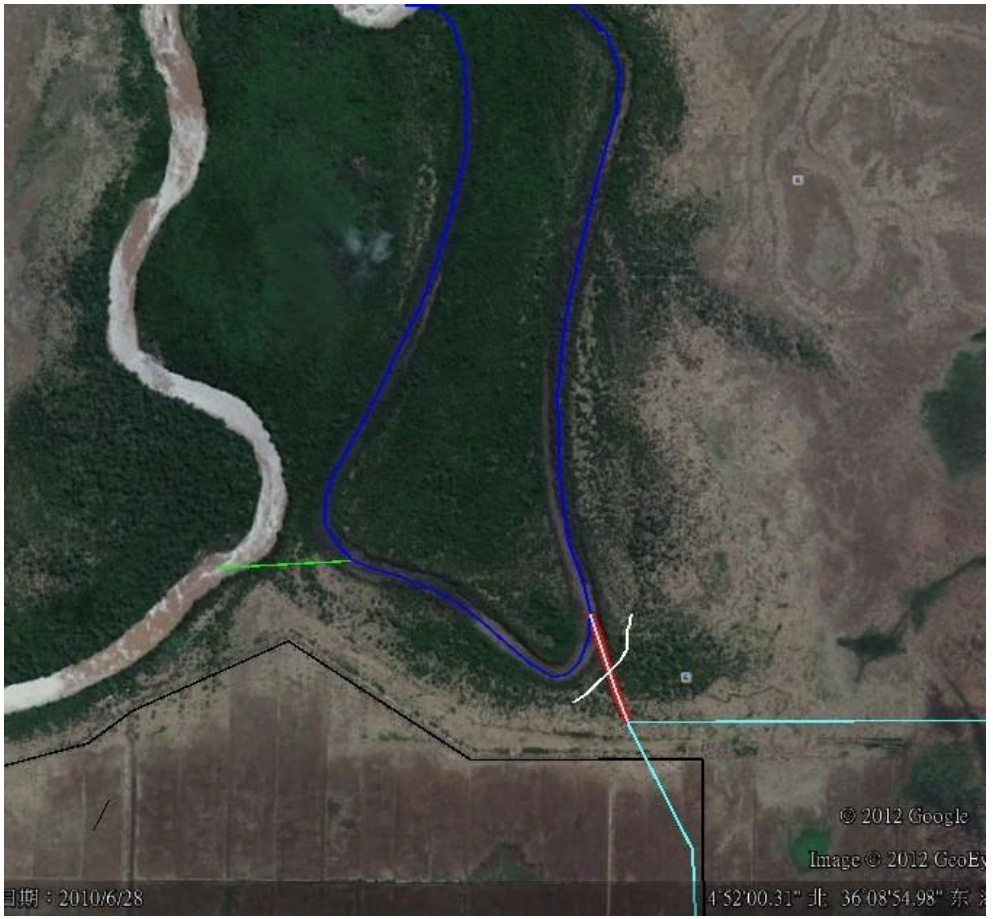


The red selected area in right scheme is the contour map of the left map.It shows B is the highest point. (Elevation 384m)

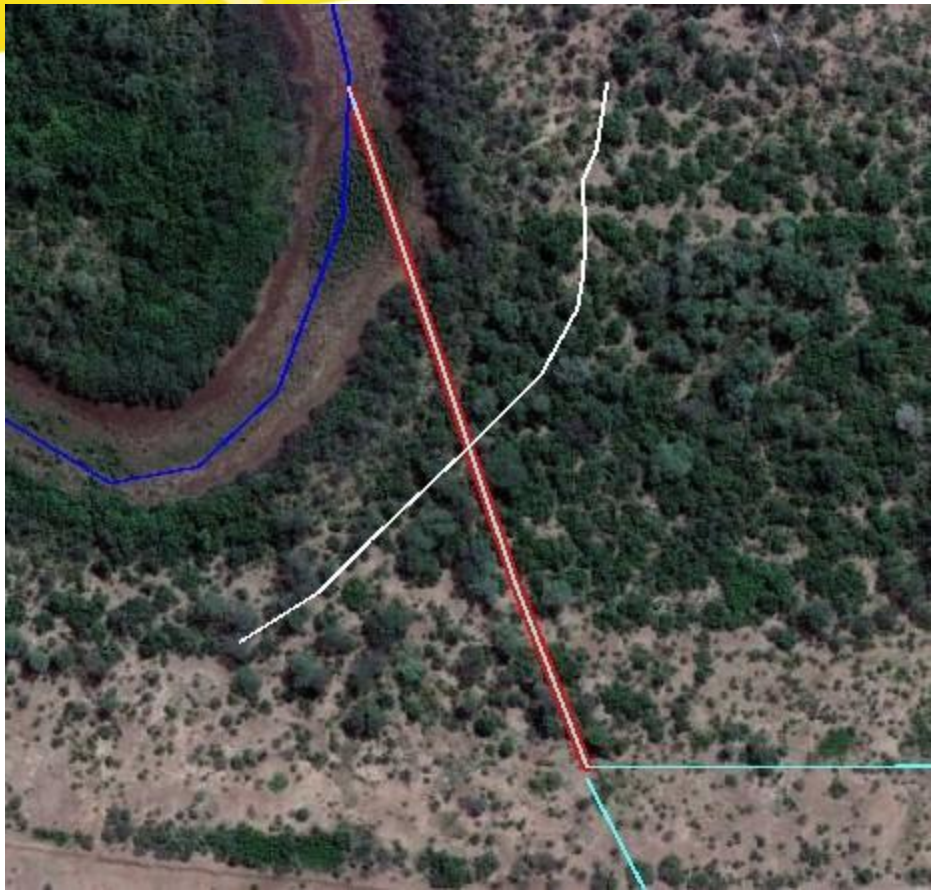
Drawing water into River V by punching through out Point B.



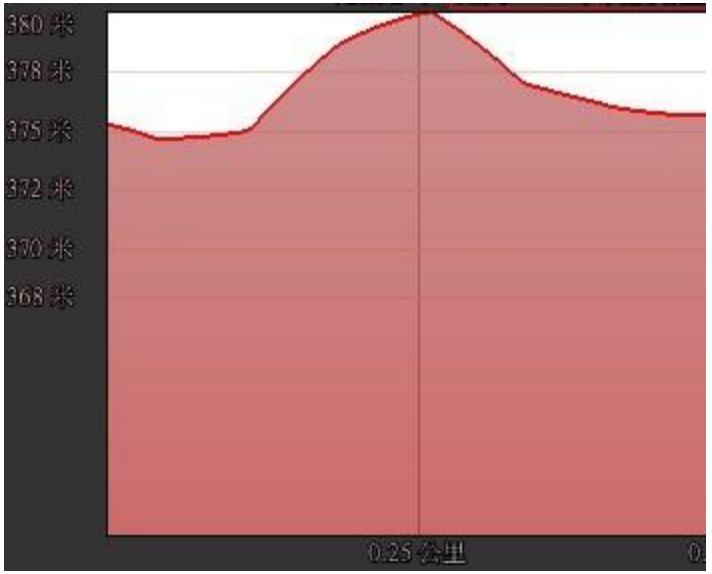
2.3 Drawing water into the V riverbed

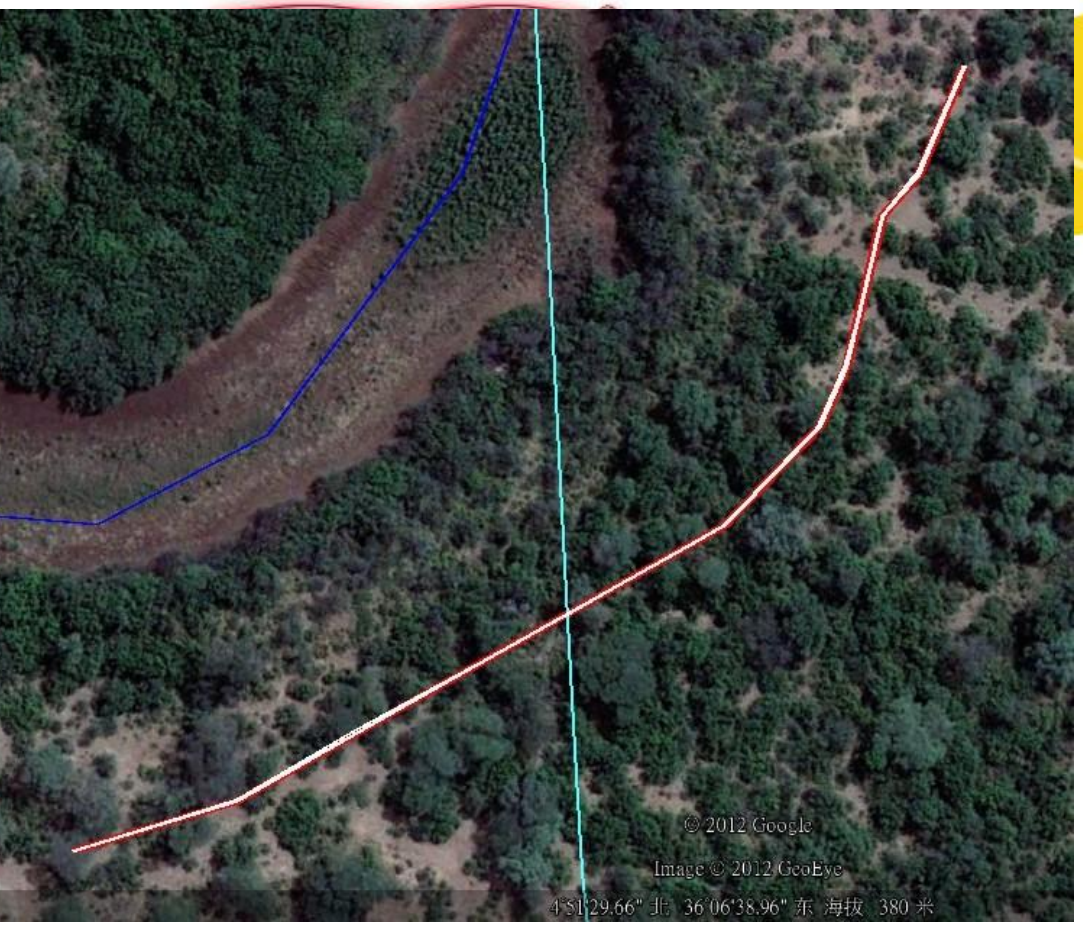


2.4 Drawing water into the artificial ditches



The below scheme is the contour map of the left map.It shows that there is a slope(white line) blocking the water between River V and artificial ditches. (Elevation 380m)





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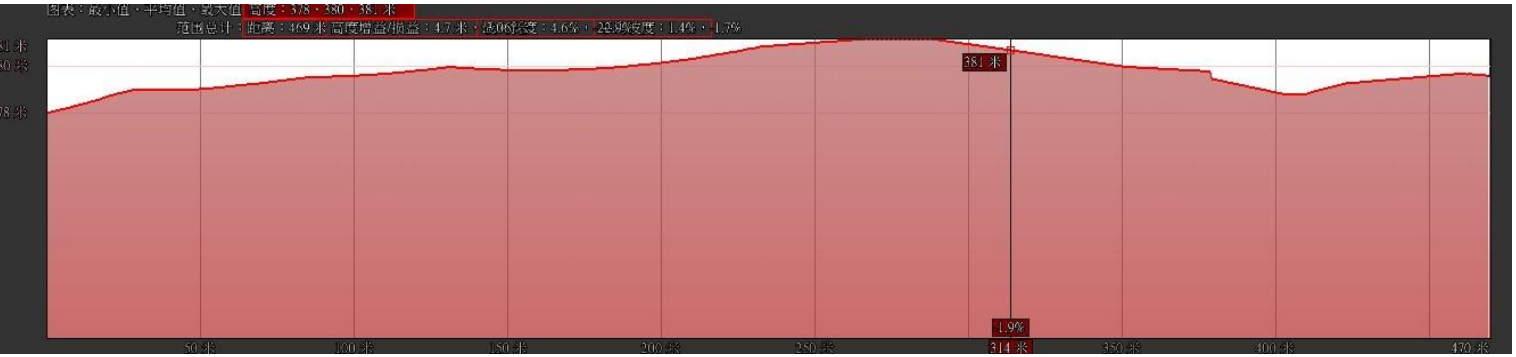
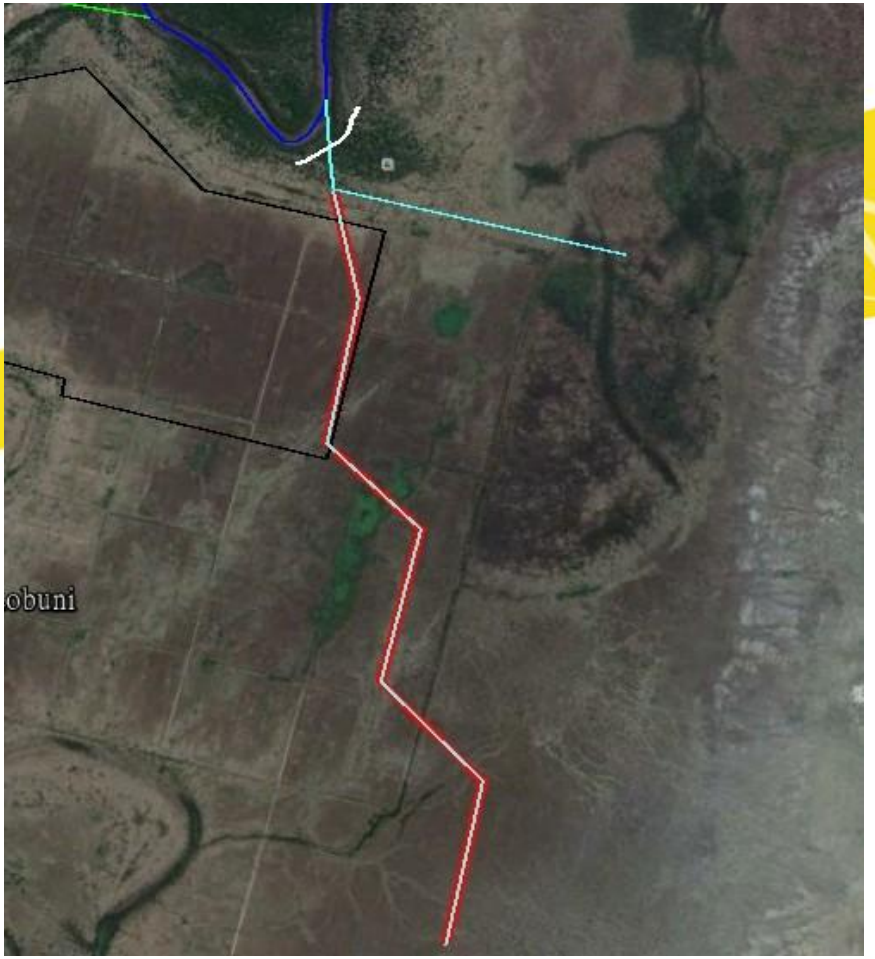
2.5 Drawing water into the artificial ditches

We can build a restraint valve at this slope for controling the flow and also preventing the flood.





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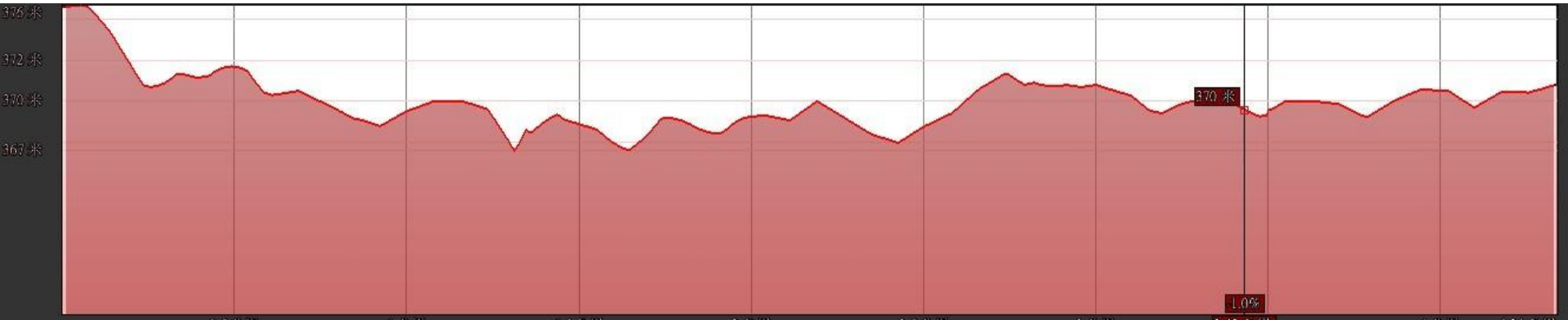
2.6 Drawing water into the artificial ditches

There are two artificial ditches, the first one supplies water for the NO. 1 and 2 irrigation areas and the other supplies for No.3 irrigation area.

It is very favorable for building ditches in this area based on the topography. And if necessary, the booster pump can be used.

Booster pump is cheaper than ordinary pump station.



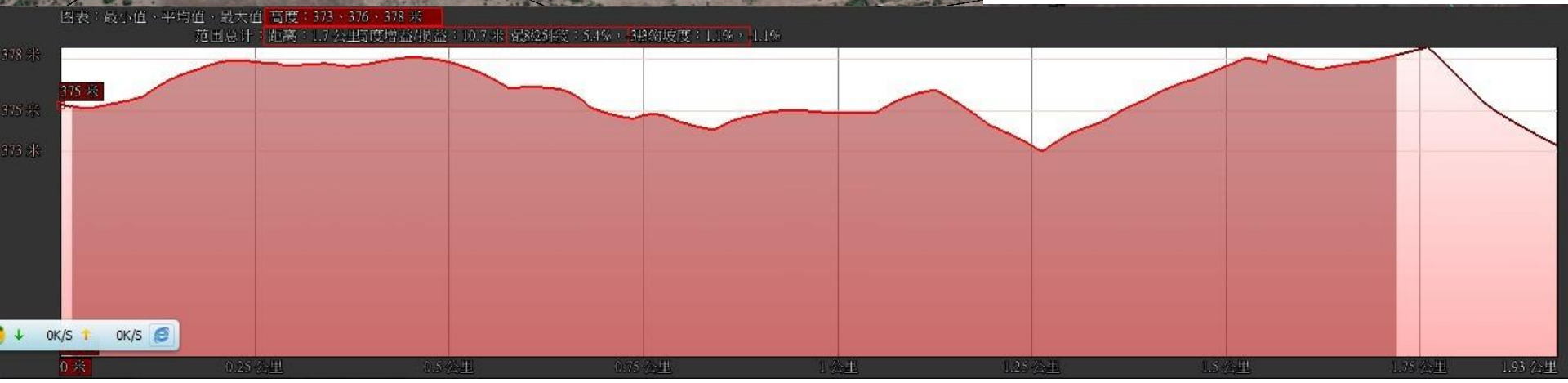
2.7 Drawing water into the artificial ditches

2.8 Floods discharge in rainy season

Drainage is needed for preventing damage caused by the floods.

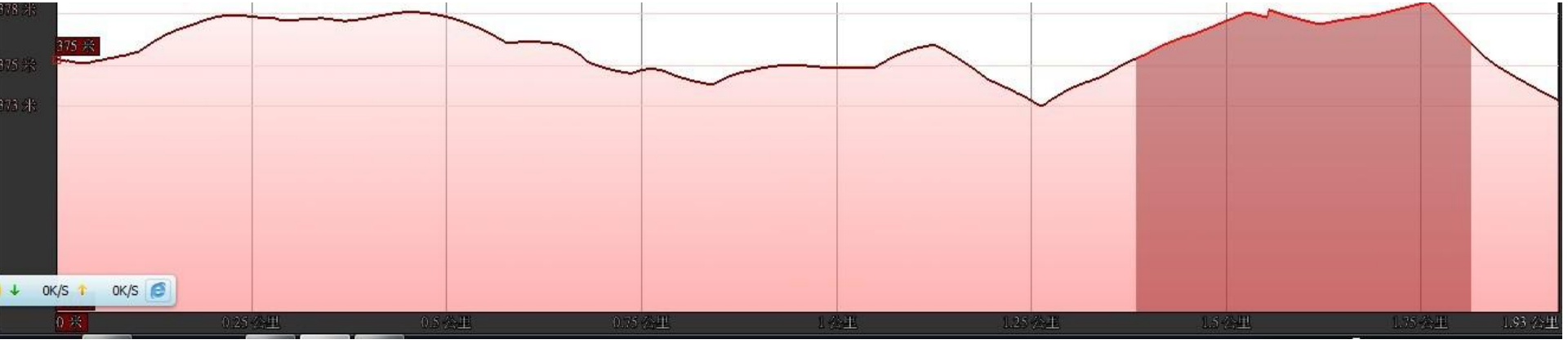
The contour map shows the left side (green line)elevation is 375m and the right side(red line) is 373m.

If we build a restrict gate in write line, it will control the flood in rainy season.



2.9 Floods discharge in rainy season

Elevation of red area is 378m. It will be under the waterline in rainy season and over the waterline in dry season. This can discharge water in rainy season and store water in dry season.



3. Water intake from main river

The picture shows the water intake from main river.

Water can be led from here into the artificial ditches from rivers.

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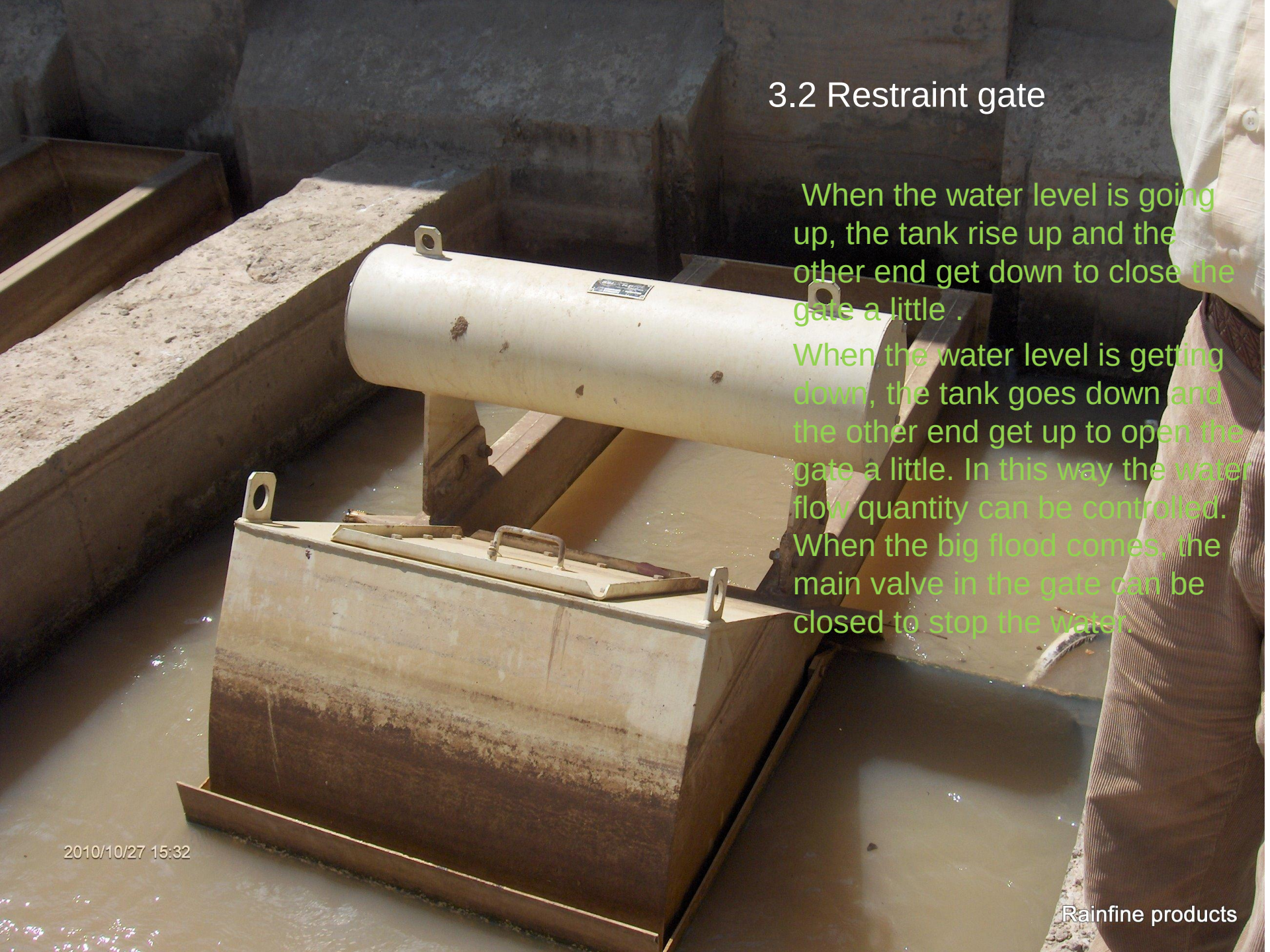
3.1 Restraint gate

The restraint gate at the entry of artificial ditch can control the water volume effectively.



3.2 Restraint gate

When the water level is going up, the tank rise up and the other end get down to close the gate a little .

When the water level is getting down, the tank goes down and the other end get up to open the gate a little. In this way the water flow quantity can be controlled. When the big flood comes, the main valve in the gate can be closed to stop the water.


3.3 Restraint gate
The water flow into the main artificial ditches through the restraint gate and flow to the pump station.
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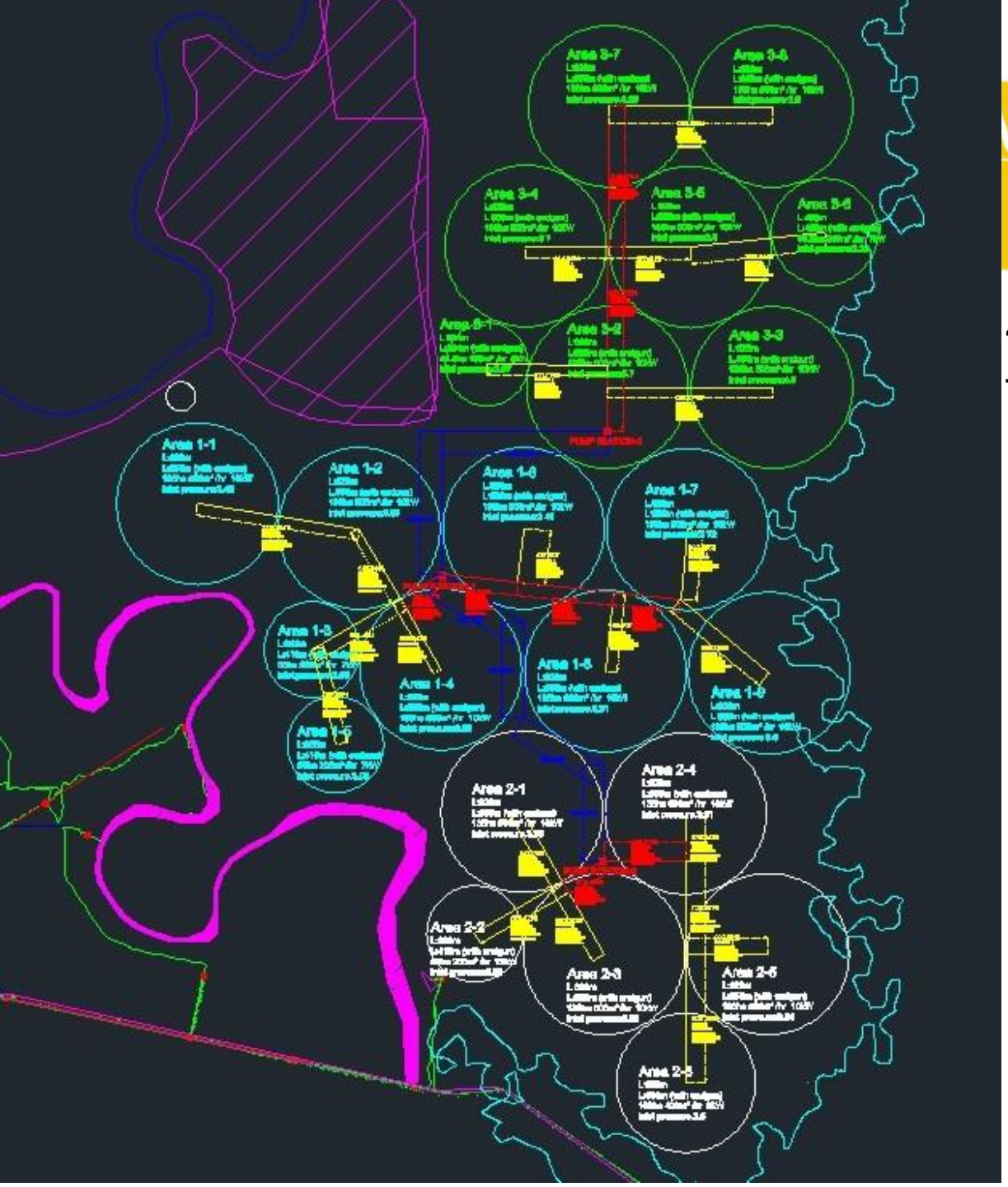
3.4 Artificial ditches



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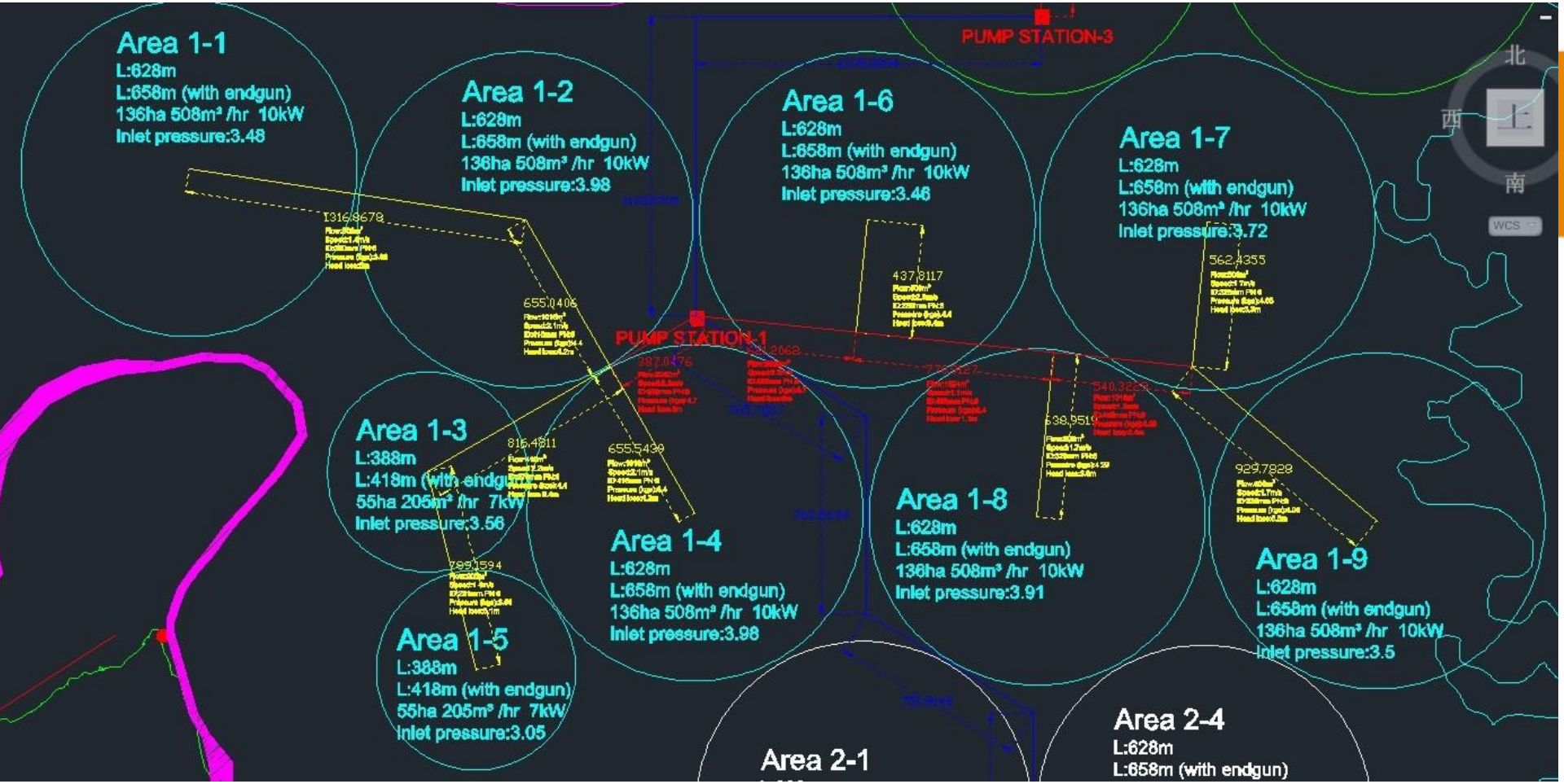
4. Pivot machine design for irrigation areas

The pivots works in 2 shift, This idea can reduce the diameter of the water pipes and the size of the pump station. By our calculation, the total water requirement for this area is 5228m³/hr



4.1 No.1 irrigation area

9 pivots in all, 7 of them cover 136ha each, 2 cover 55ha each, Total coverage: 1062ha.

Total water demand: 2032m³/hr

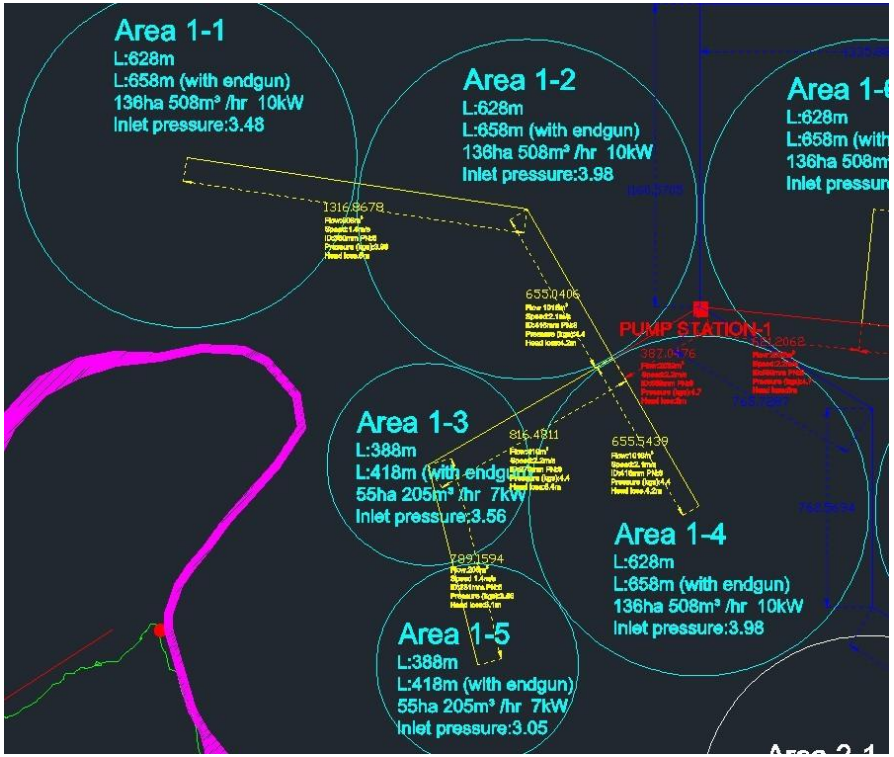
No.1 pump station is built in the center of the irrigation area.

This design can reduce water supply volume and the size of the water pipes, it can also lower the pressure losses and thus reduce the pump power and lower energy costs.

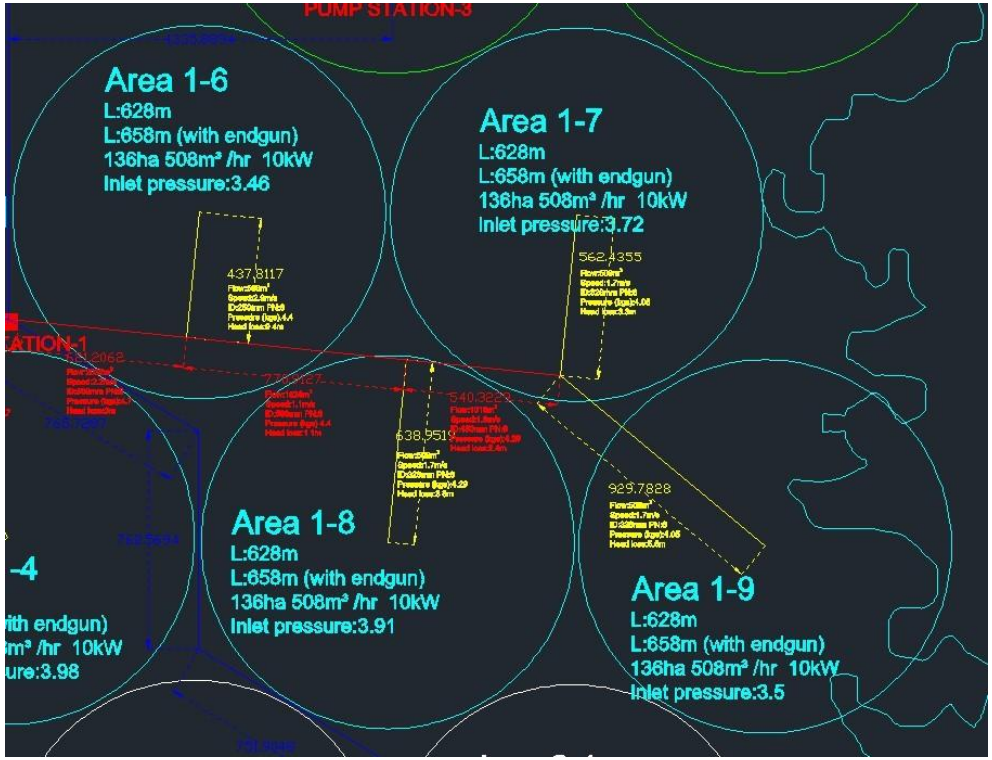
4.2 No.1 irrigation area

No.1 irrigation area is divided into two regions, west and east regions, by two shift working of the irrigate machine, the investment of the pump station can be much more reduced.

West（1-1/1-2/1-3/1-4/1-5)



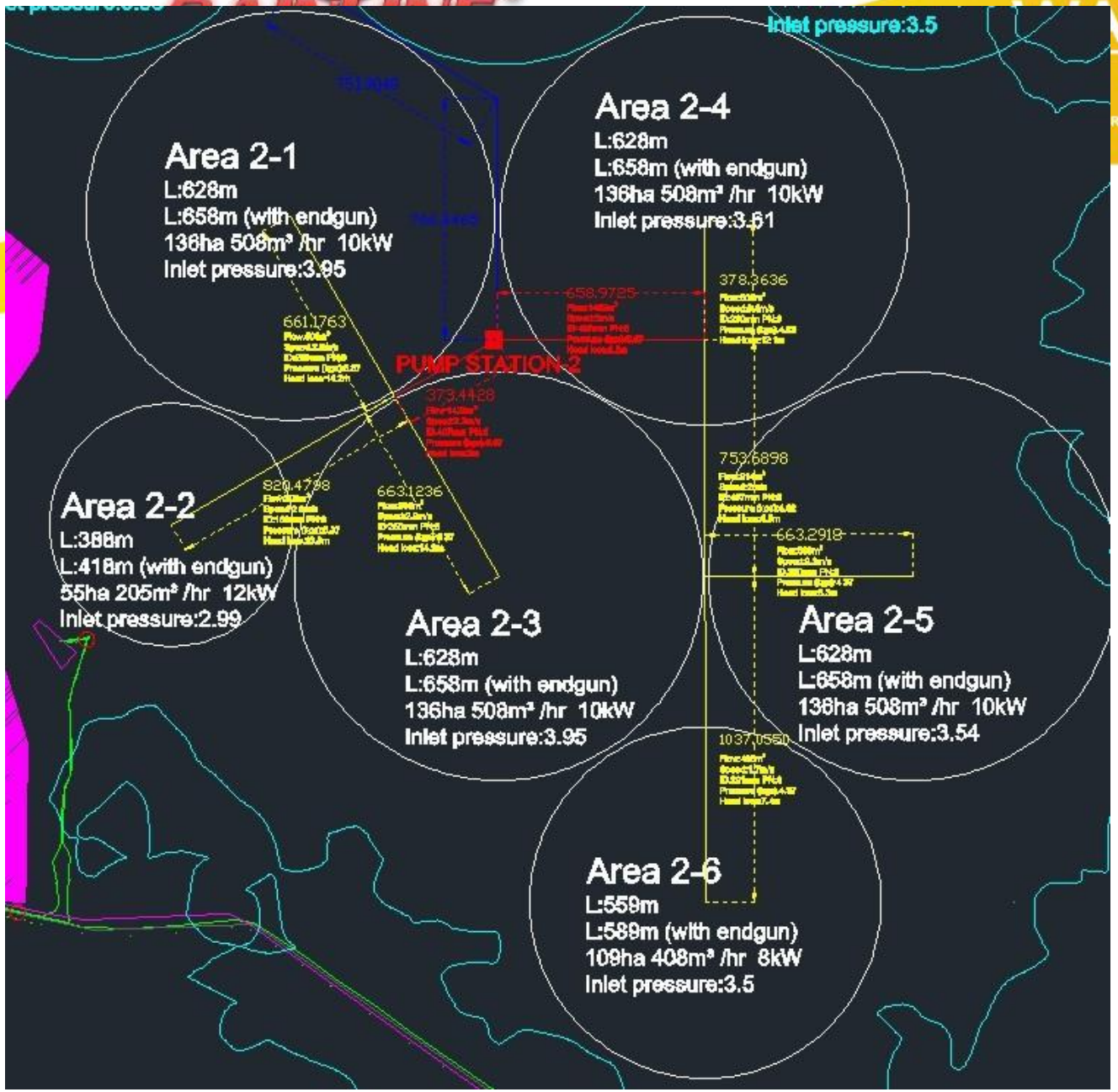
East(1-6/1-7/1-8/1-9)



4.3 No.1 irrigation area

No.1 pump station is built beside the artificial ditches with a water reservoir under it. So the water can be pumped directly.

Pump station No.1



4.4 No.2 irrigation area

6 pivots in all, 4 of them cover 136ha each, 1 covers 55ha, 1 covers 109ha

Total coverage: 708ha

Total water demand: 1424m³/hr

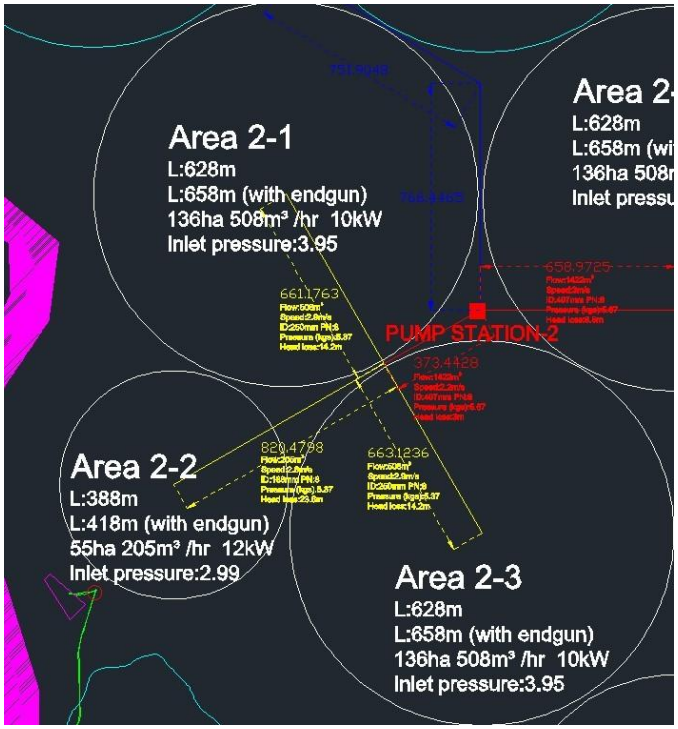
No.2 pump station is built in the center of the irrigation area.

This design can reduce water supply volume and the size of the water pipes, it can also lower the pressure losses and thus reduce the pump po wer and lower energy costs.

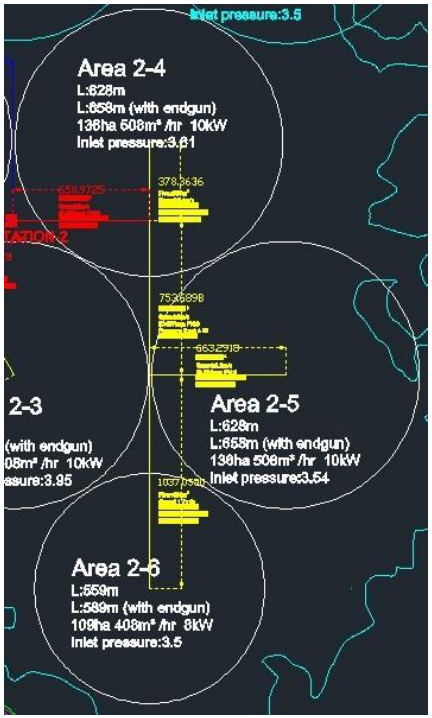
4.5. No.2 irrigation area

No.2 irrigation area is divided into two regions,west and east regions, by pump station and irrigate in proper order. This divide can reduce the investment of the pump station.

West（2-1/2-2/2-3）



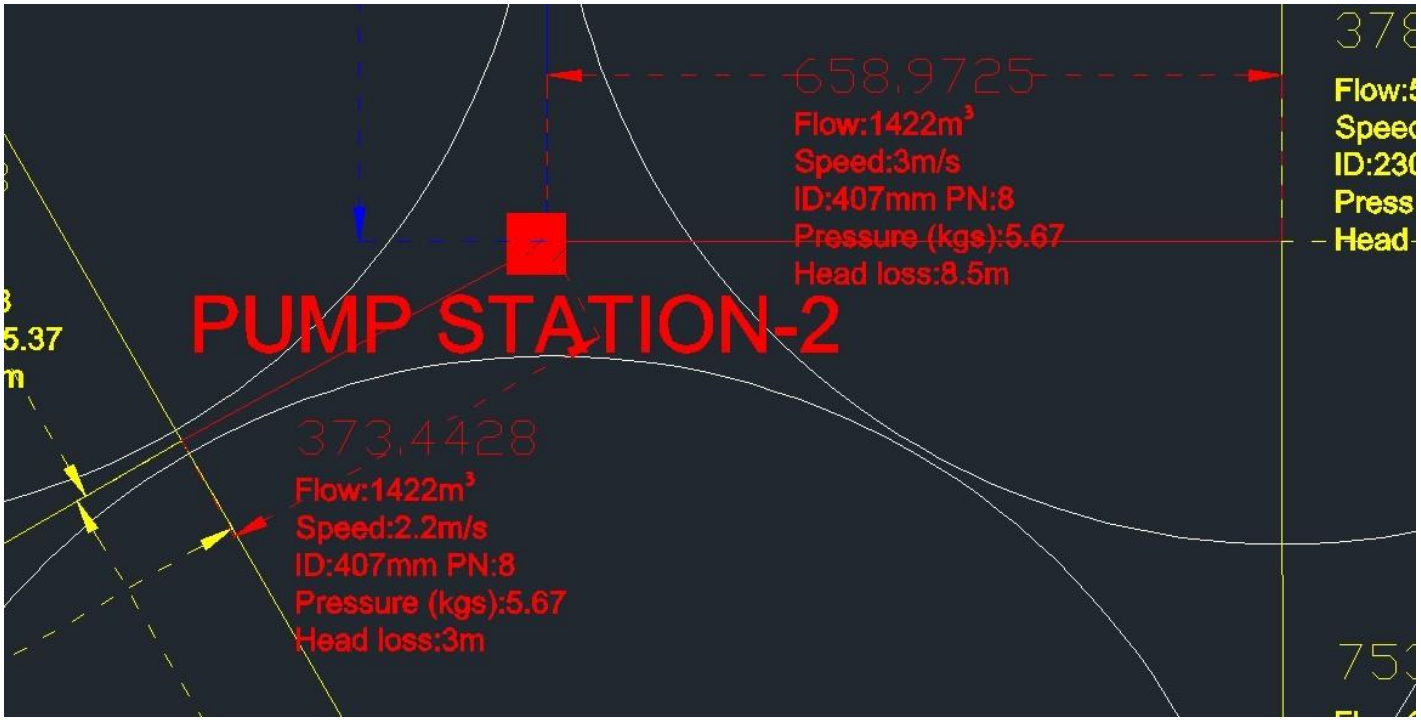
East(2-4/2-5/2-6)

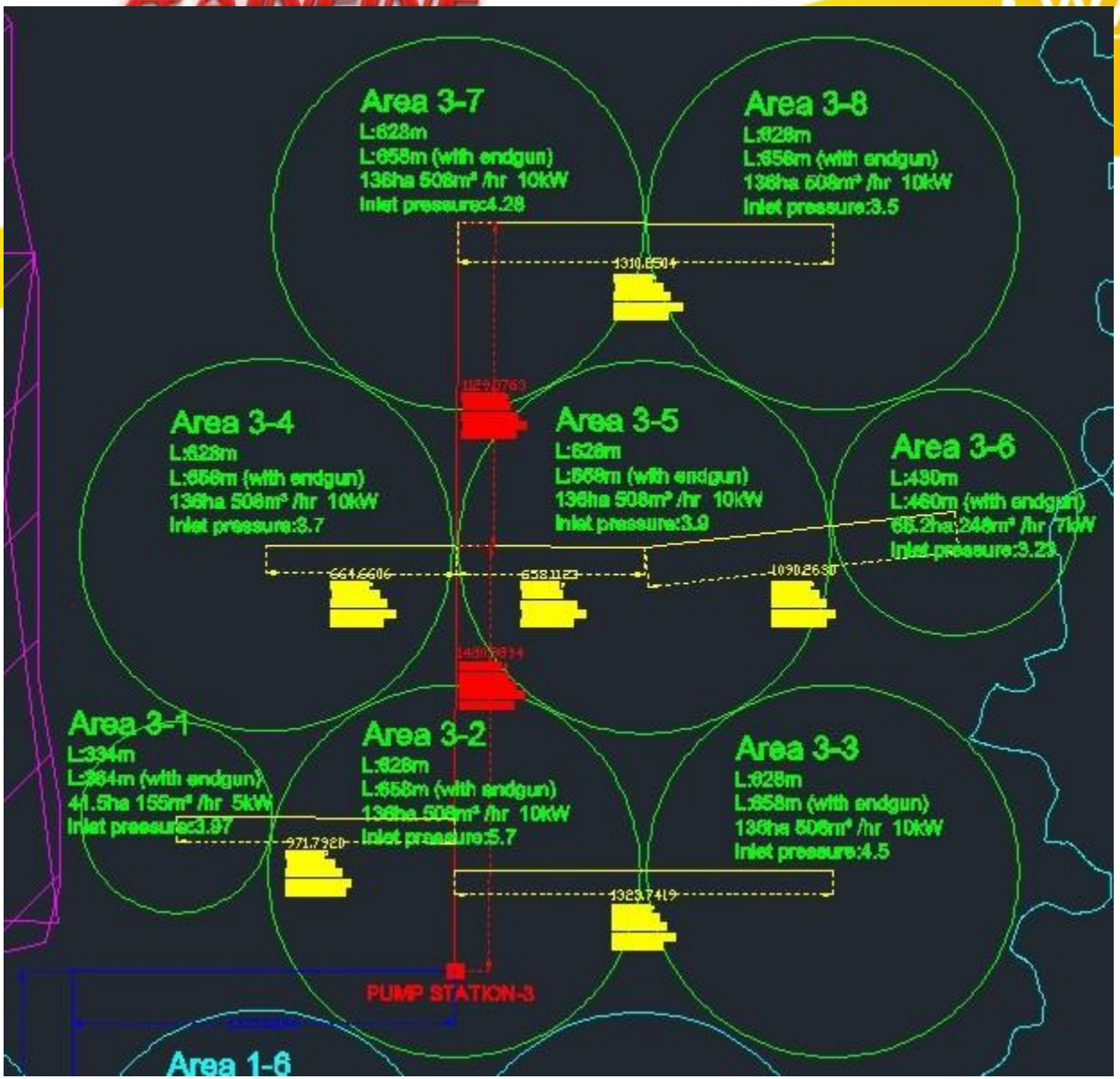


4.6 No.2 irrigation area

No.1 pump station is built beside the artificial ditches with a water reservoir under it. So the water can be pumped directly.

Pump station No.2





4.7 No.3 irrigation area

8 pivots in this area, 6 of them cover 136ha each, 1 covers 41.5ha, 1 covers 66.2ha
Total coverage: 924ha

Total water demand: 1772m³/hr

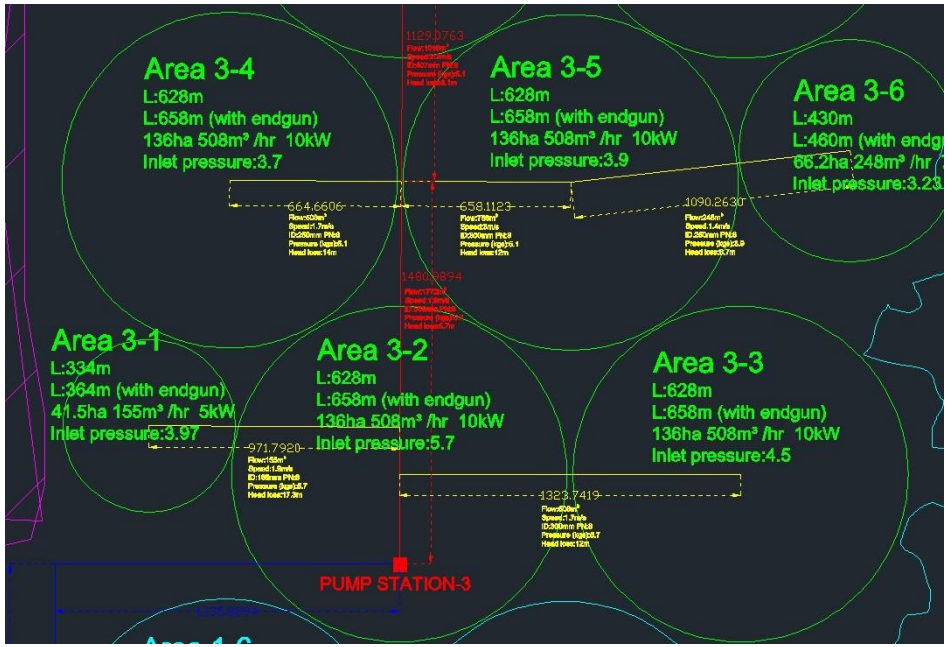
No.3 pump station is built in the center of the irrigation area.

This design can reduce water supply volume and the size of the water pipes, it can also lower the
pressure losses and
thus reduce the pump power and lower energy costs.

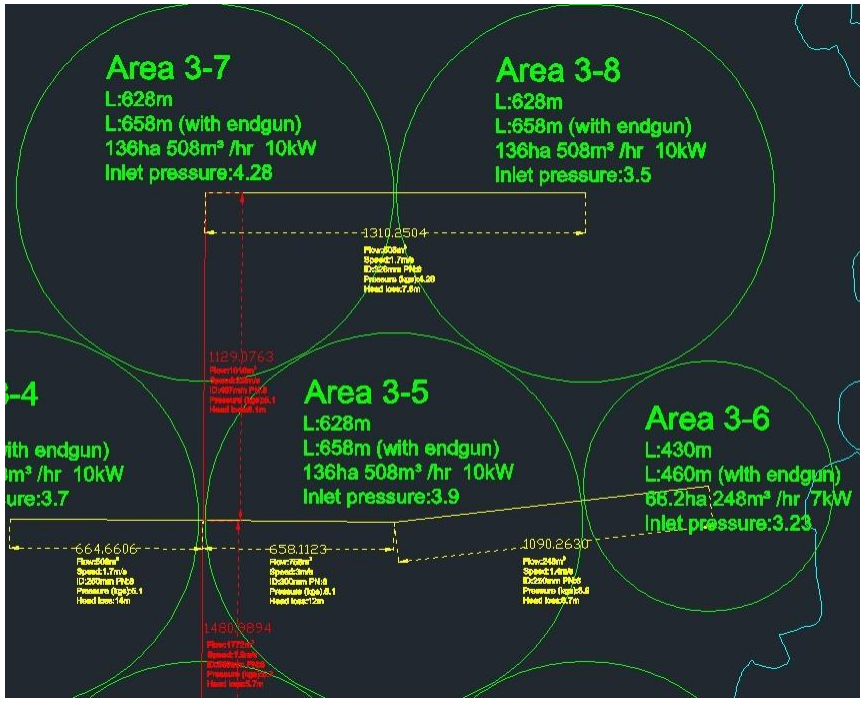
4.8 No.3 irrigation area

No.2 irrigation area is divided into two regions, north and south regions The pivot can work in two shift.

South（3-1/3-2/3-3/3-4）

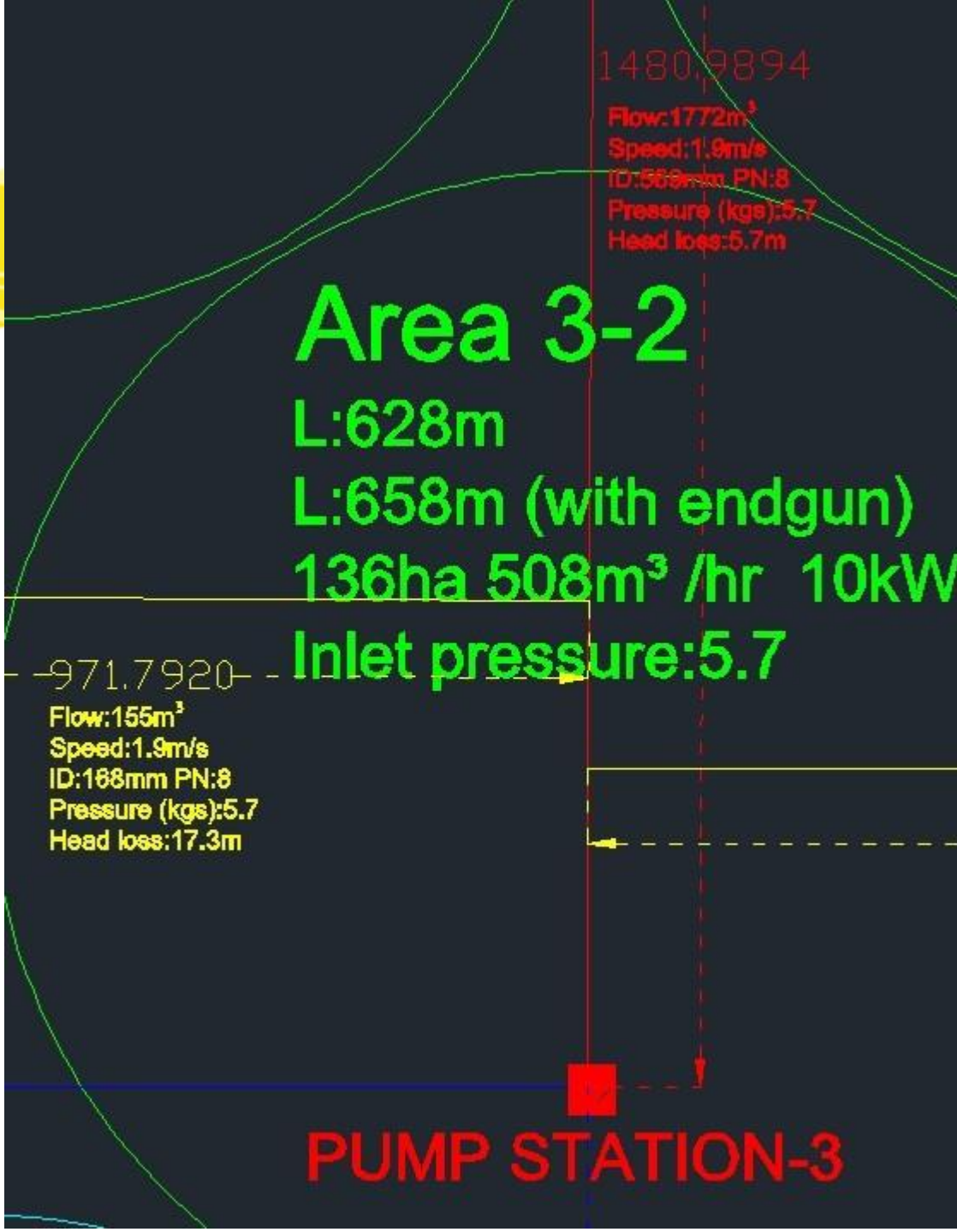


North(3-5/3-6/3-7/3-8)



4.9 No.3 irrigation area

No.3 pump station is built beside the artificial ditches with a dam under it. So the water can be pumped directly.



Pump station No.3

5. Ditches and pump station

The picture shows the water conservation project .

The area in this picture is similar to our project, both of them are drawing water into the artificial ditches from natural rivers, then pumping to all the irrigation areas.

5.1 Pump station

Filtration systems

Water pumps

Power supply systems

Water hammer protection system

5.2 Ditches to pump station

Water dam under the pump station. Outside the entrance of the pump is equipped with filters.

Water dam can provide sufficient water.

There is a ladder on the top of pump station is for the maintenance workers to clean-up the filters.

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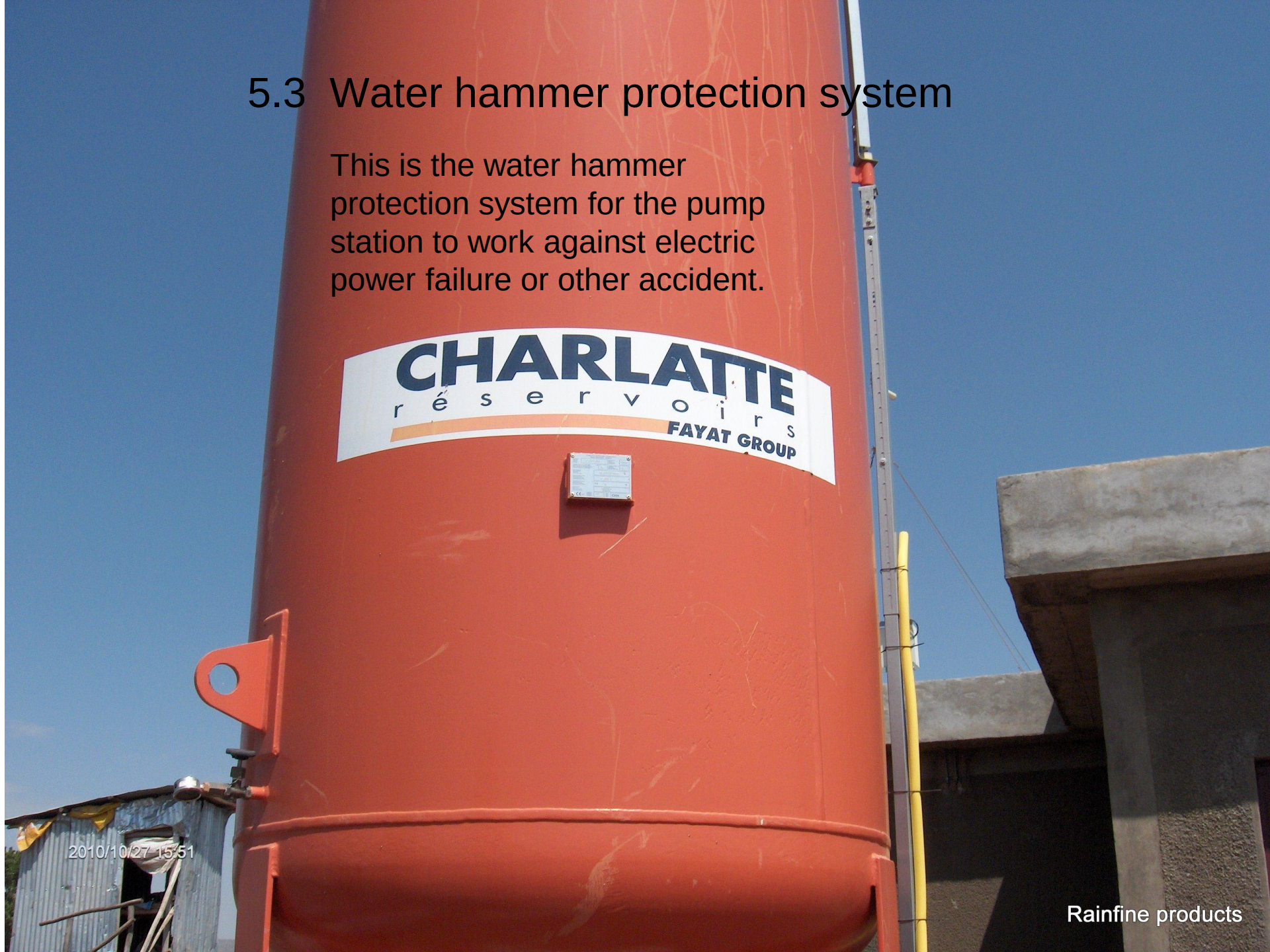
5.3 Water hammer protection system

This is the water hammer protection system for the pump station to work against electric power failure or other accident.



Thank you for your attention

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