Design and drawing of standard Haffir Capacity of 28320 m3

The Design includes:

- **identification and selection of the most suitable option of improved Hafir**
- **Design of potential Human and Animal pollution and contamination**
- **design of different components of improved Hafir,**
- **protection strategies/measures against**
- **soil and water conservation measures of the catchment area,**
- **Cost estimation and**
- **cost sharing among all stakeholders**
- **requirements and actions for capacity building,**
- **pollution and contamination**
- **implementation schedule etc.**

Hafir Selected Coordinate: 13.502502N, 34.926698E

Design of potential Human Population:

based on the annual population growth rate of a community to be served by the Hafir.

Pd = Pp (1 + 0.01a) y

Where:

Pd = design population

Pp = present population

a = annual growth rate of the population

y = design period/year.

Pd = 35000(1+0.01*-------)20= --------- individuals.

Total human population estimated (Pp) = ----------------individuals.

The potential livestock population: ------------------ head

40-50% of water is lost due to evaporation.

8-10% due to sedimentation and

a little less than 5% due to misuse and spillage from existing Hafir.

The remaining volume will be in the range of 35 to 47 percent.

The total volume of designed improved Hafir for Human and animal consumption is.

Select the Total population estimated is 20000 individuals. 30000 Head of Animal

Where 2 functional Hafir present in the area. The new Hafir serve 3 communities for farmers and pastoralists groups. The Hafir designed for Human and animal water consumptions.S

Equation for determination of dimensions of a Hafir for a given volume.

V = (A + A1) x (½) x (h) = ((a x b) + (a1 x b1)) x (½) x (h) = (abh) – (a+b) x (h2/n) + (2h3/n2) =

(118*48*5) * (118+48) *(2*5*5/2) +(2*5*3/2*2) = 25440 m3 **Say 28320 m3**

Where, V is volume of a Hafir, A is area of Hafir at the top, A1 is area of Hafir at the bottom, h is depth of a Hafir, a is top width of a Hafir, a1 is width of a Hafir at depth of h, b is top length of a Hafir, b1 is a length at depth h, n is vertical. height of the slope of the sides of a Hafir for horizontal distance of 1 unit.

- **The depth of the clay soil = 5m. from previous studies in area.**
  Average turbidity (NTU) in Gafarif = 500 NTU.

- **water treatment system that will be appropriate for proper reduction of the turbidity:**
  Select: Slow sand filtration systems

Hafir component:

Feeding facilities: These are structures that ease the flow of water to the Hafir with a minimum sediment load by controlling the velocity ($v \leq 1m/s$) of flow. This can be achieved through construction (provision) of weirs, drops and diversion structures.

Drainage facilities: These are structures to drain excess water away from Hafir and before overtopping the body.

Seepage control structures: These are provisions like lining of Hafirs that minimize or avoid seepage through the body or floor of Hafirs. Plastic or concrete lining could be applied as a mitigation measure provided the cost of living is not significant and affordable.

Design specification of components of improved Hafirs

The components of improved Hafir shown below drawn are:

a) Hafir Body

b) Raw water pump

c) Slow sand filtration systems (that include sedimentation tank and minimum 2

filtration units), or chemically assisted water treatment systems (that include

flocculation & coagulation systems, rapid sand filters and chlorinator etc)

d) Clear water well,

e) Clear water pump,

f) pump/generator house

g) Elevated steel reservoir and

h) distribution points

I) Animal trough (raw water is diverted to the trough before it is treated)

for the thickness of the clay soil is more than 6m

Description of Tasks and Summary of Structural specification for the Construction of Standard Hafir (Earth Works):

Dimensions of the current typical standard design for **28320m3**

capacity Hafir are:

• Top width 118m

• Top length 48m

• Depth 5m

• Bottom width 45.5m

• Bottom length 113m and

• Slopes: 2:1 for the length and one of the widths and 4:1 for the remaining width.

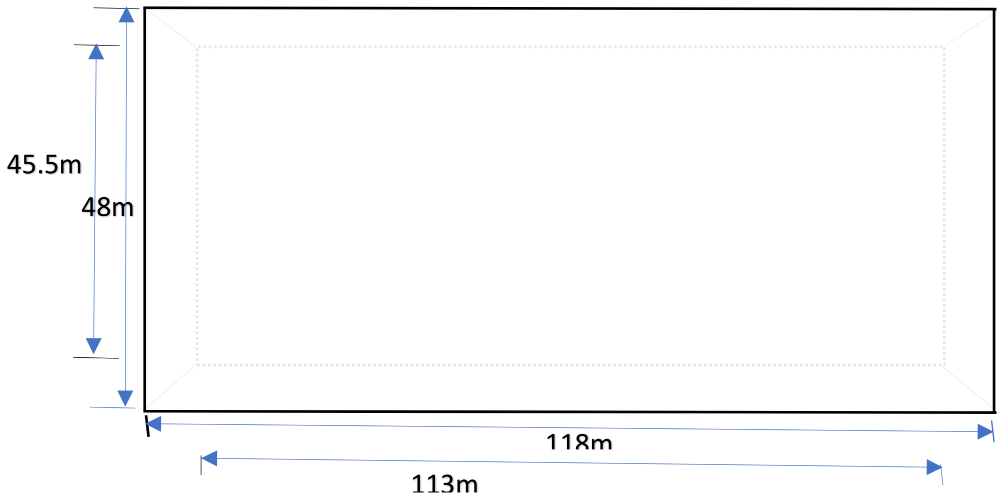
Description Total cubic meter	Length in meter	width in mete	Depth in mete	Total cubic
Excavation of 5. m depth for the Haffir reservoir	118	48	5	28320
Excavation of silt trap	60	40	0.5	1200
Digging of the inlet trench				250
Digging of the outlet trench				400
Digging of filter well and outlet well	2-meter diameter X 8-meter depth			52
Removal of part of Haffir embankment (2 sides)	10	10	2.5	500
Refill of Haffir embankment and trenches				1150
Digging of feeding canals	1000	2	0.5	1000

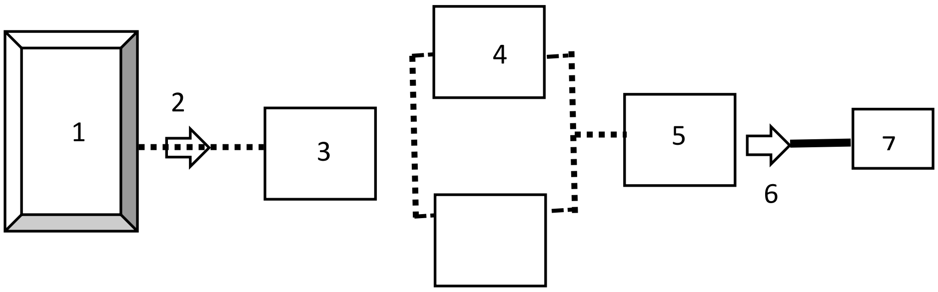
All excavated soil will be used in the Haffir embankments and wing dikes as required.

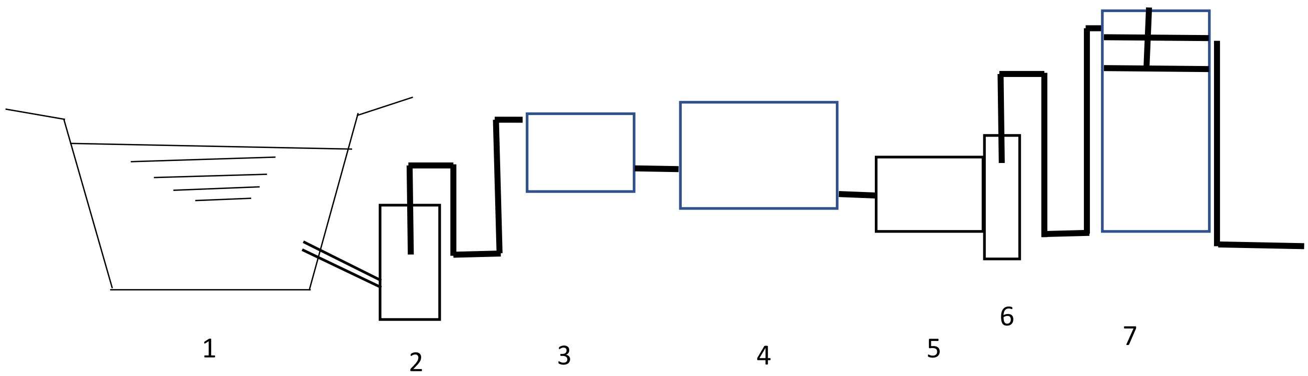
1. Haffir fence parameter 552 meters
2. Volume of re-enforced concrete works 10 cubic meters.
3. Volume of plain concrete works 5 cubic meter

Drawings

Hafir top Elevation

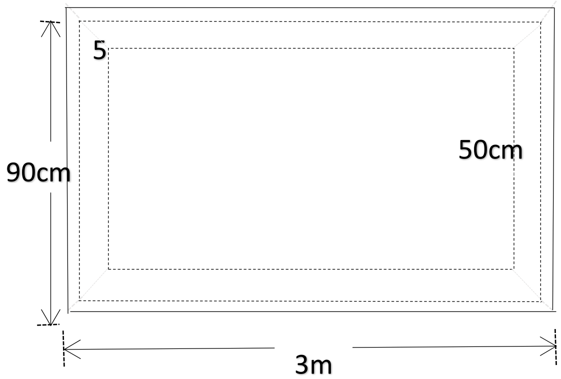




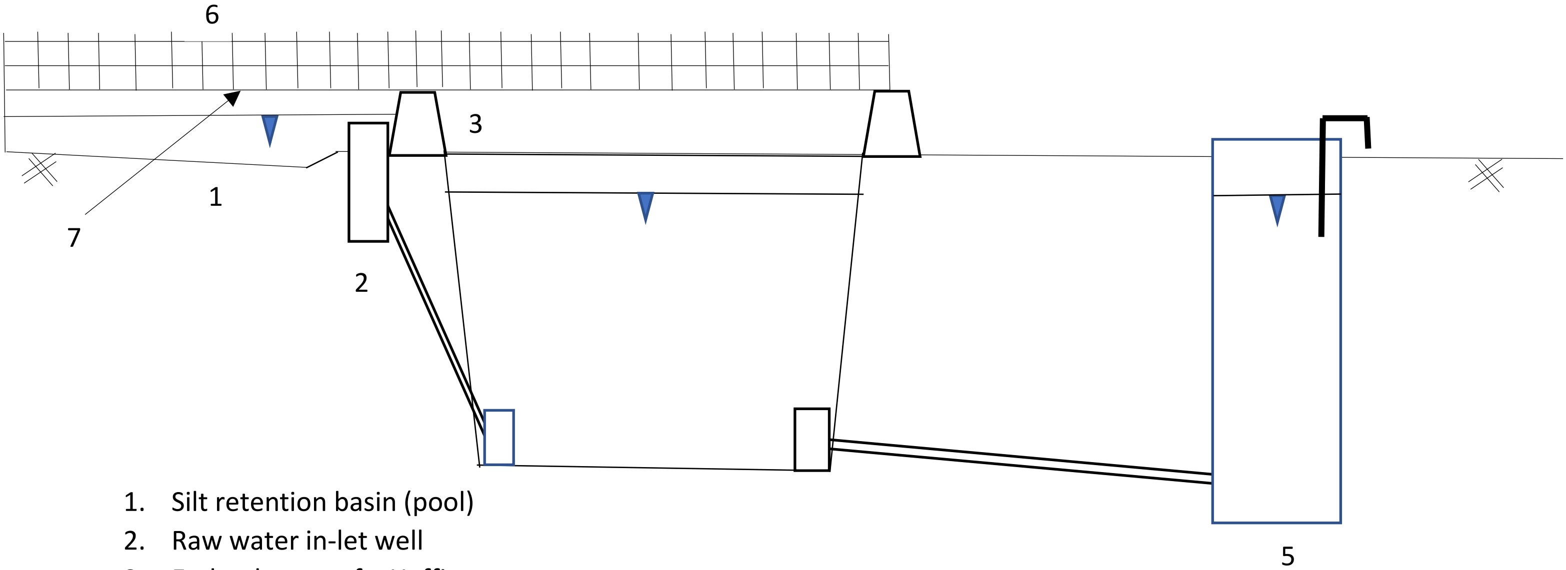


1. Hafir
2. Raw water pump
3. Sedimentation tank and/or balancing tank (or a unit of flocculant dosing set, clarifier)
4. Slow sand filter units (or rapid filter units)
5. Clear waters well (and chlorinator)
6. Clear water pumps
7. Elevated reservoirs

Steel animal water trough



Longitudinal section and arrangement of components of a Haffir



1. Silt retention basin (pool)
2. Raw water in-let well
3. Embankment of a Haffir
4. Haffir
5. Raw water abstraction well (or intake for the treatment system)
6. Fences
7. Flow diversion embankments

- Slow sand filters should function on a continuous basis for two major reasons: to build confidence among the users on the availability of quality water.
- Slow sand filters are therefore recommended where the water source is available all the year round.
- A water source that provides water for only a few months after the rainy season should be avoided.
- If there is no other option of water treatment system, the number of Hafirs should be increased to ensure that the supply lasts all year round.

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