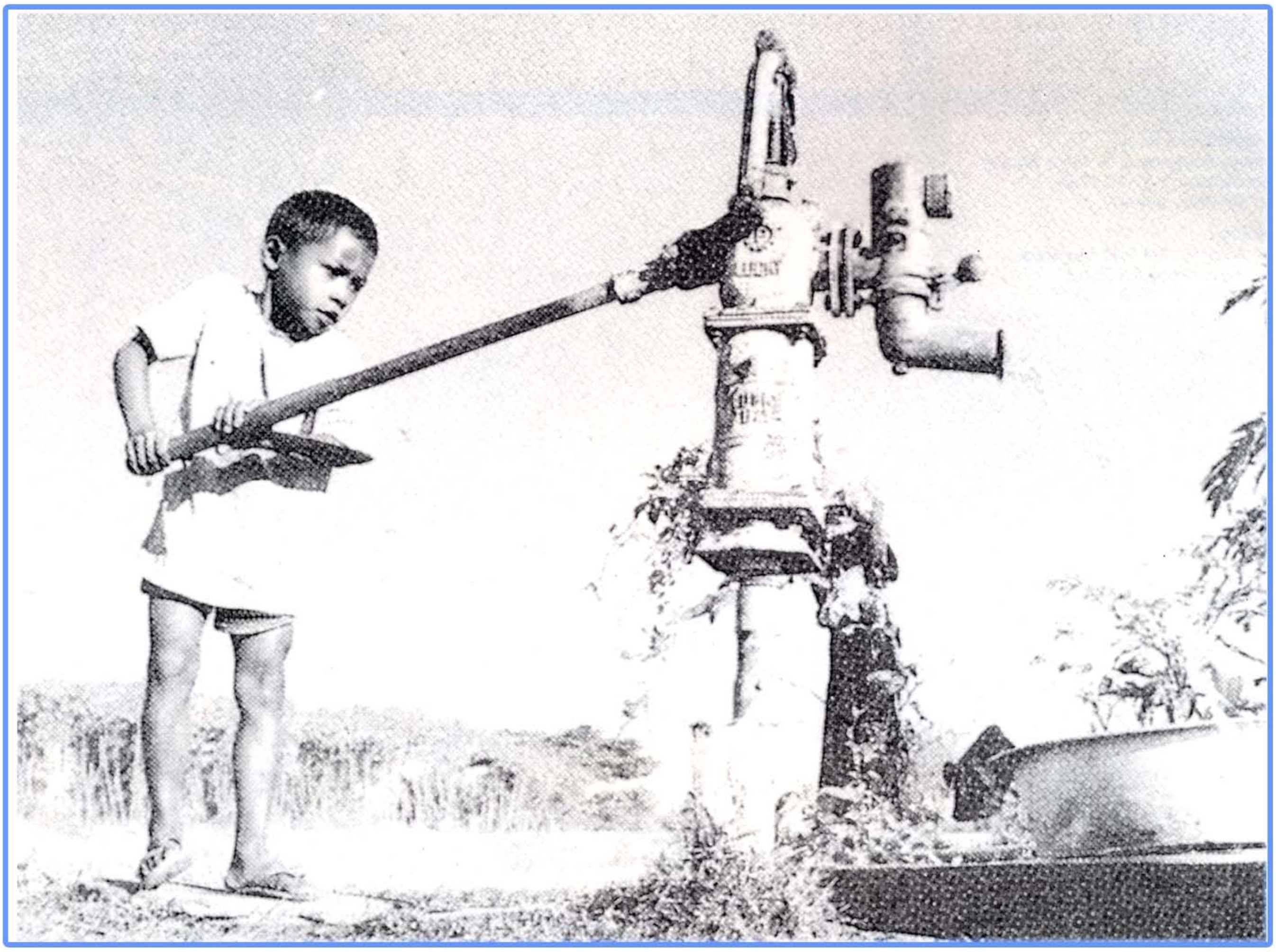
WATER-THE SOURCE OF LIFE



Without water there is no life. Human or animal, tree or plant. Nothing but the arid outback that has characterised the interior of our vast continent for thousands of years shows this better.

Now water is unlocking the outback, putting it to work in the service of man. Where once was only scrub and bush there are now sugar farms and cattle properties. And in other areas, water for man and machine is making possible the wresting from the ground of vast resources of minerals. No substance surpasses water for its vital contribution to Thailand's development as a major trading nation. And in helping to provide the millions of gallons of pure water needed every day for agriculture, industry and the home, Thai Sure Screen has played a worthy part. The pictures show something of what has been done so far. Much remains to be accomplished by future generations

INTRODUCTION

Need to its location, the most important factor affecting the efficiency of a waterwell must be the choice of the well screen.

We at Sima-Aree Engineering Co., Ltd. are proud to have become the manufactorer of wedge wire water well screen and mining screens. From the beginning we have concentrated on producing the right screen for the right job at the right price and delivering it on time.

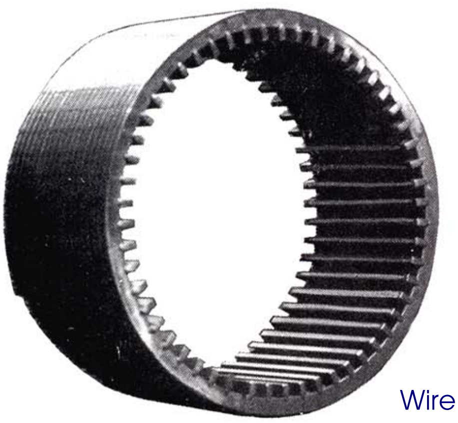
Only one design and specification of screen from a choice of very many can achieve the proper development of a well and the maximum available output of sand-free water over long periods of time.

Three photos of resin bonded gravel screen. Photos A and B depict damaged screen and by doing so provide a visual interpretation of the basic screen construction. A shows bond over a perforated metal base whilst B shows bond over slotted a P.V.C. base.

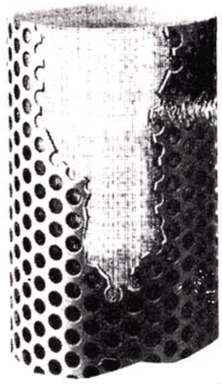
A

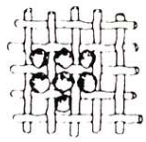
A

B



Wire wound screens.

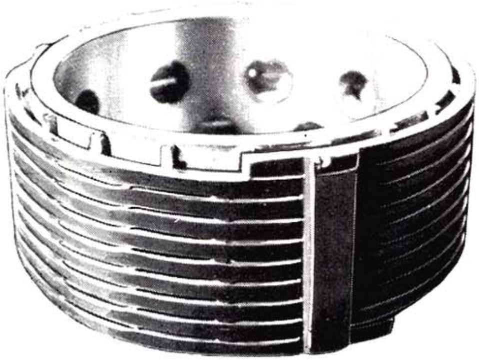


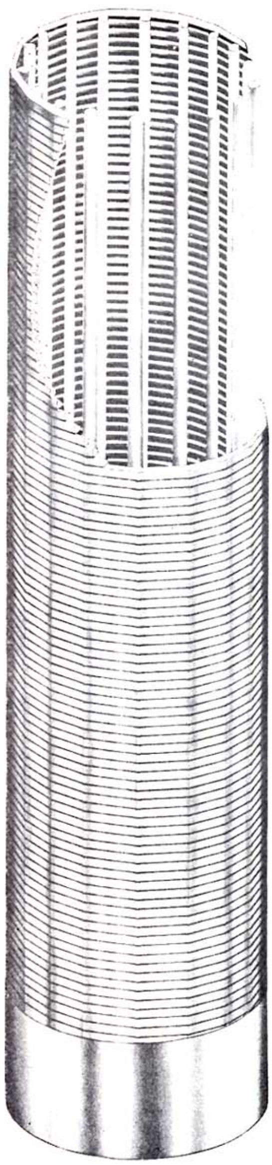


Gauze or
punched plate

Wire mesh screens.

Wire wound pipe base screens.





Proforated or punched screens.

TYPE OF WELL SCREEN

Essentially there are four types of well screens.

1. Wire Mesh screens.

Some of the earliest screens manufactured were made out of stainless steel and bronze wire mesh, wrapped around a coarse slotted or perforated metal tube, then braised or welded down a vertical seam.

They were found however to be weak under backwashing and bore developing pressure and subject inlet openings in the wire mesh.

2. Perforated or Punched Screens

Sheet metal punched into louvers or holes and then rolled into a cylinder, has been widely used in some areas for developing water supplies from unconsolidated sediments. The screens have a low open area, but it is butter than slotted casing.

The worst feature or this form of screen is that it is virtually impossible to develop, since water backwashed out through the screens loses most of its energy in circumferential motion between the slots. High pressure jetting is non effective and thus, the screen is only useful where clean, very coarse aquifers exist which do not require development.

In comparing this form of screen with others, it is essential to take into account the cost of extra lengths required, the extra diameter of the gravel packing necessary.

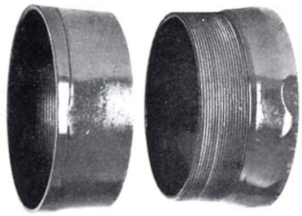
3. Resin Bonded Gravel Screens

These screens are made up nor mally of coarse, well-rounded quartz gravel, 25 mm thick or more formed around a metal frame and bonded by a resin compound which is poured into a mould, which coats the gravel and bounds the pebbles at their points of contact. This form of screen has little tensile strength, but normally has adequate hoop and column strength. It can only be used in bores drilled with clean water, as it is virtually impossible to develop.

4. Wire Wound Screens

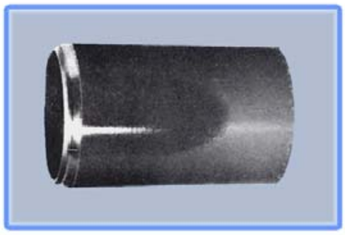
The screen consists of a wedge profile wire of various dimensions, resistance welded to a cylindrical body made up of various numbers and cross sections of longitudinally arranged metal rods which are in turn, welded onto cylindrical ring couplings at either end.

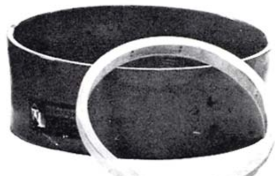
The tensile strength of the screen is dependent on the number and cross sections of the vertical support rods, whilst the column strength is dependent on the same rods, plus a factor dependent on the profile of the wrapping wire and the depth of the resistance weld. The hoop strength of the screen is dependent on the wrapping wire, the screen slot, and the frequency of coupling rings.



By virtue of the process of manufacture, the slot aperture is constant on any one screen, but can be varied by small degrees to make screens to suit any given sand or gravel size.

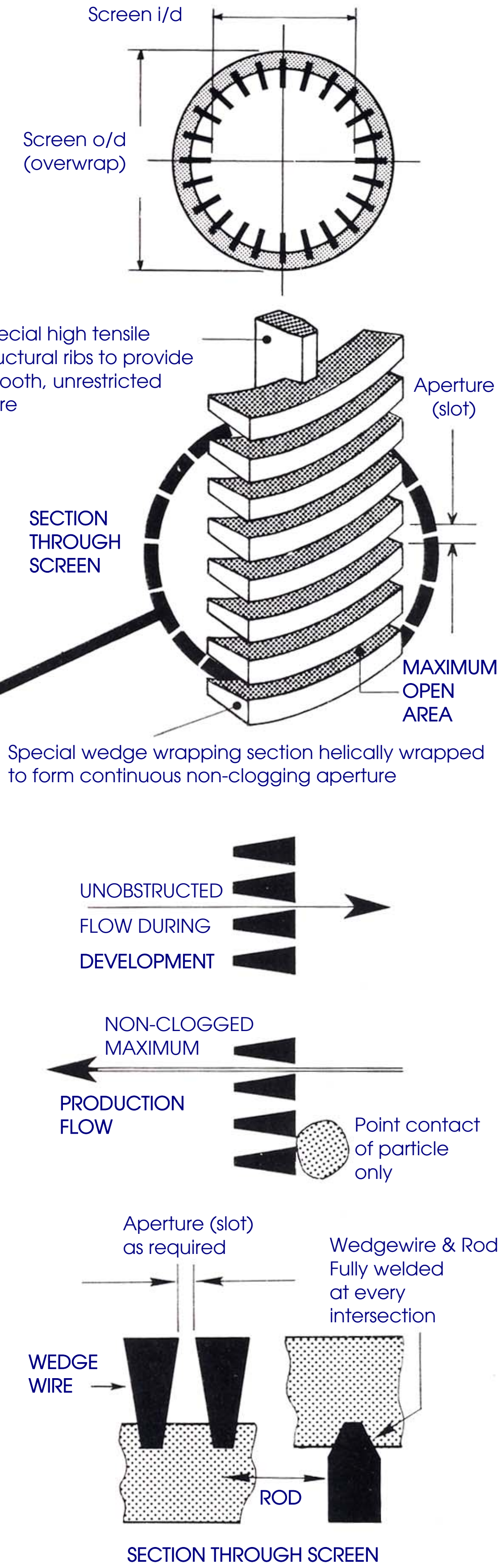
The wrapping wire has a so-called wedge profile which is flat in the outside and produces an expanding slot on the inside. This shape both facilitates jetting and backwashing operation and avoids the screen being clogged by fine particles.





Dependent on the strength require ments of the screens, the open area for water entry this form of screen, is maximized, compared to those of other screen varieties.

With all the variations possible, continuous aperture wire wound screens are the best designed, most efficient, and for normal applications, the most economic unit currently available for use in wells drilled to extract high volumes from unconsolidated sediments.


Screen i/d
Screen o/d
(overwrap)
Special high tensile
structural ribs to provide
smooth, unrestricted
bore
Aperture
(slot)
SECTION
THROUGH
SCREEN
MAXIMUM
OPEN
AREA
Special wedge wrapping section helically wrapped
to form continuous non-clogging aperture
UNOBSTRUCTED
FLOW DURING
DEVELOPMENT
NON-CLOGGED
MAXIMUM
PRODUCTION
FLOW
Point contact
of particle
only
Aperture (slot)
as required
Wedgewire & Rod
Fully welded
at every
intersection
WEDGE
WIRE
ROD
SECTION THROUGH SCREEN

SELECTION OF WELL SCREENS

1. Material Selection

The first factor to be decided when selection a screen is the material of which it should be constructed. Commonly, screens are made in AISI Type 304 and 316 stainless steel, mild steel, galvanized mild steel. The selection of the material will depend on the life required in the bore, the type of water which is likely to be encountered, the depth at which the screen will be set and the other materials being used in the bore.

Equally the success of this material in sodium chloride brines and brackish waters, reflects the much lower bi-metallic corrosion between mild steel casing and stainless steel, compared with that between the apparently more durable Cusilman Bronze and mild steel

Type 316 stainless steel is only used in very aggressive waters and where an equivalent non-corrosive casing material is used. The initial cost of the material is high, but the life in such situations is the important factor.

The internal dimensions of the screen will therefore be similar to those of the production casing, and will depend on the friction losses which are considered permissible in this bore at the designed yield and/or the size of pump which is to be run.

All continuous slot aperture screens manufactured have greater tensile strength than column strength and hence, if long lengths are to be run, it is best that they be run and held in tension.

Metallurgical specification of screen materials in %

MATERIAL NAME	SPECIFICATION	C	Si	Mn	Cr	Mo	Ni	Ti	Cu	Fe
Stainless Steel	A.I.S.I. 304	<.08	< 1.00	< 2.00	18.00-20.00	-	18.00-12.00	-	-	< 72
	308	<.08	< 1.00	< 2.00	19.00-21.00	-	10.00-12.00	-	-	< 69
	316	<.08	< 1.00	< 2.00	16.00-18.00	2.3	10.00-14.00	-	-	< 68
*Cusilman Bronze		-	3.00	1.00	-	-		-	96	-
Monel		.3							Balance	
		2.0								
		2.5								
		0.024								
		0.5								
Galvanized	SWRM 6	0.08	-	0.60	-	-	-	-	-	-
Carbon Steel	SWRM 12	0.10-0.15	-	0.30-0.60	-	-	-	-	-	-
	SWRH 62A	0.59-0.66	0.15-0.35	0.30-0.60	-	-	-	-	-	-
	SWRH 72A	0.69-0.76	0.15-0.35	0.30-0.60	-	-	-	-	-	-

1.1 Mild Steel Screens

Mild steel screens are Commonly used in hard, low salinity waters where the corrosion index is low, where it is desirable to keep expenditure to a minimum. Mild steel screens are commonly manufactured only in light pattern construction.

1.2 Stainless Steel

Type 304 is the most widely used material for screens, both in brackish water and acid water installations. It is a high strength material and after pickling to produce a passive surface against corrosion, the screen have shown good life characteristics.

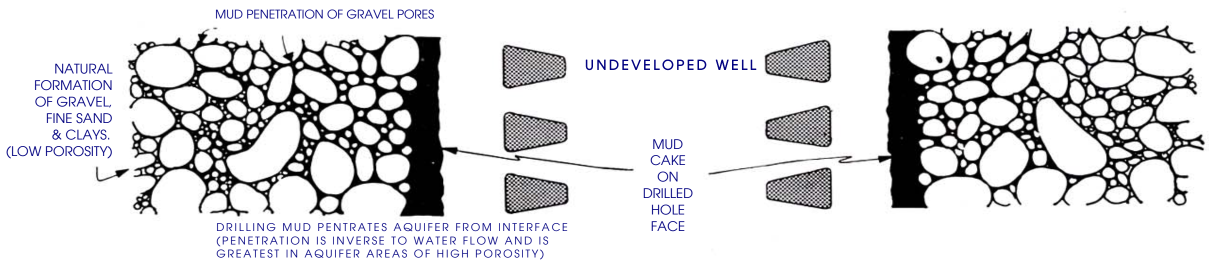
Given accurate and detailed water analyses, reputable screen manufacturers will normally guarantee thier materials against corrosion for periods up to 20 years.

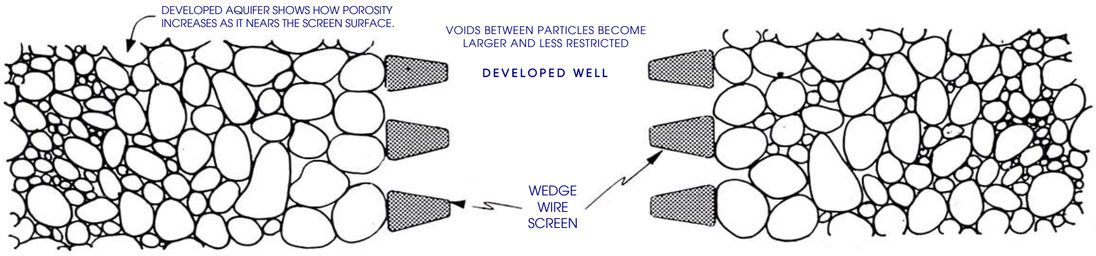
2. Dimension of the Screen

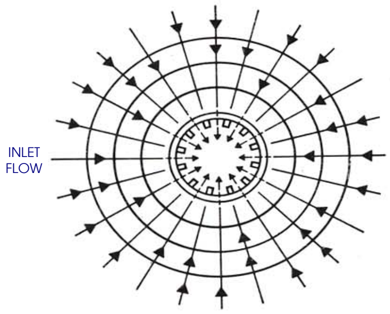
The factors involved in this decision are the yield required and bore design.

It is always advisable where possible for the screen to be internally flush with the casing being used, as this minimizes the possibility of damage to the screen due to objects being ropped down the bore during development, or in later usage.

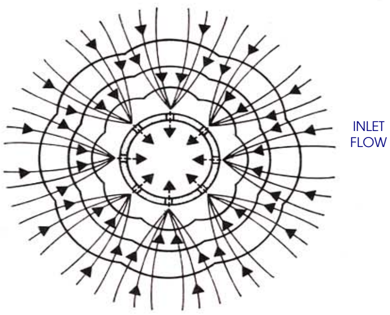
The radial collapse strength of the screen specified for a particular job, should not need to be more than the hydrostatic pressure euqivalent to the maximum drawdown which can reasonably be expected during drilling.



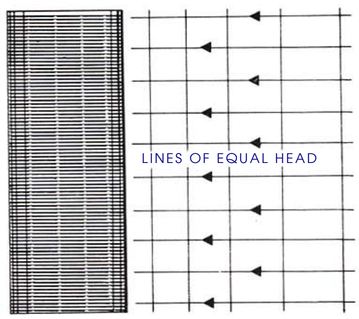




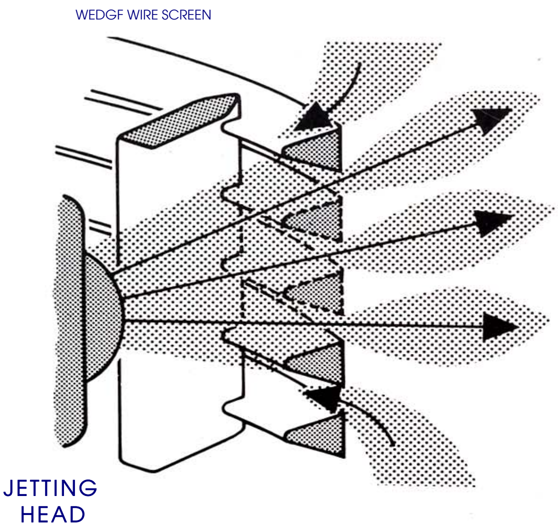
LINES OF EQUAL HEAD
FLOW PATTERN OF CONTINUOUS SLOT WELDED WEDGE WIRE SCREEN

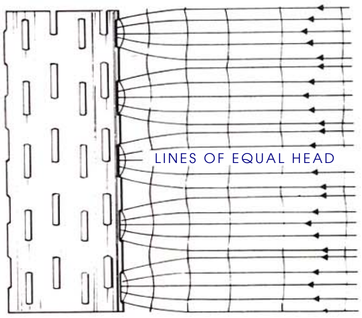


LINES OF EQUAL HEAD
FLOW PATTERN OF PERFORATED CASING.

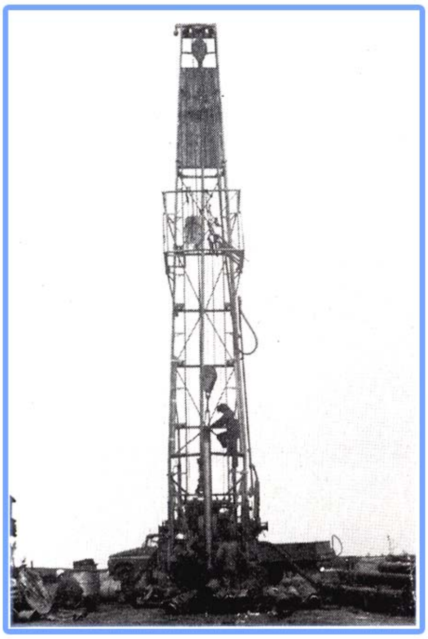


CONTINUOUS SLOT WELDED WEDGE WIRE SCREEN

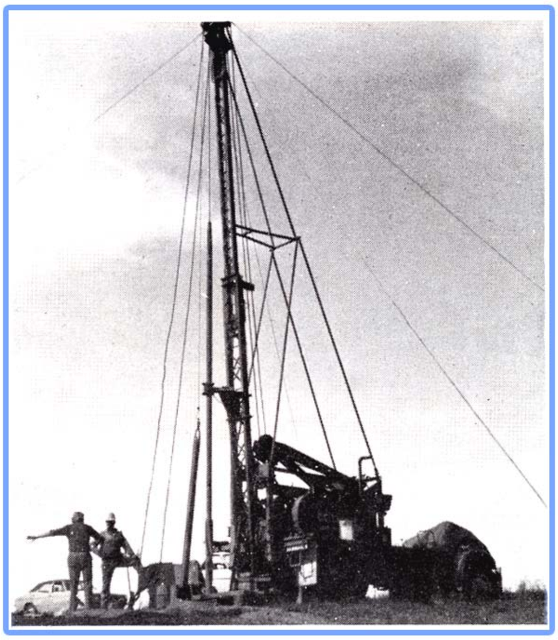




SLOTTED OR PERFORATED CASING



Direct rotary drill – screen installation



Cable tool percussing drilling

3. Aperture Selection

The most critical decision made concerning the screens to be used in any particular well, is that of the aperture or slot opening size. A principal aim of the construction is to develop a circumferential zone around the screen which has a higher permeability than the aquifer itself. The aperture selected is entirely dependant on the grain size analysis of samples collected during drilling.

Having selected the aquifer zones and sited the screens in depth, it is necessary to study the size distribution of the sand grains, not only for the zone to be screened, but also for any sand zones which overlie the selected zone.

A general guide to aperture selection is as follows :

Coefficient of Uniformity	Overlying Bed	Aperture Size % Retained of Aquifer Sand
>6	Firm	30
>6	Soft	50
>3	Firm	40
>3	Soft	50

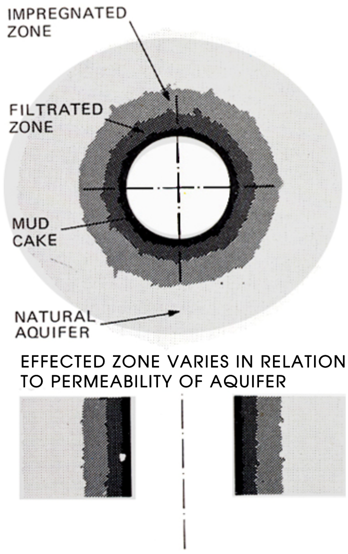
4. Length of Screen

The length of screen necessary depends on the thickness of aquifer available and then on the quantity of water required . Walton lists the following relationships and we have found these to produce virtually trouble-free bores.

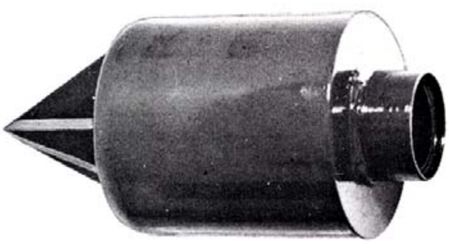
Optimum Entrance velocity m/minute	permeability m/day
3.66	>293.5
3.53	293.5
3.05	244.5
2.74	195.6
2.44	146.7
2.13	122.3
1.83	97.8
1.52	73.4
1.22	48.9
0.91	24.5
0.61	< 24.5

5. Economics

The ultimate economy of a well however, does not depend on initial capital cost, but on the long term operating and maintenance costs.



Aquifer structure developed in the immediate surroundings of the bore-hole



INSTALLATION OF WELL SCREENS

The generally accepted criteria for a good screen installation is as follows:

(i) a seal between the blank section at the top of the screen and the casing.

(ii) screen slots in position opposite the aquifer section for which they were designed

(iii) blank bottom on the screen sump to prevent sand entry and possible downward movement of the screen.

Four methods have been developed for positioning screens and these are described.

1. Pull-Back Method (Figure A)

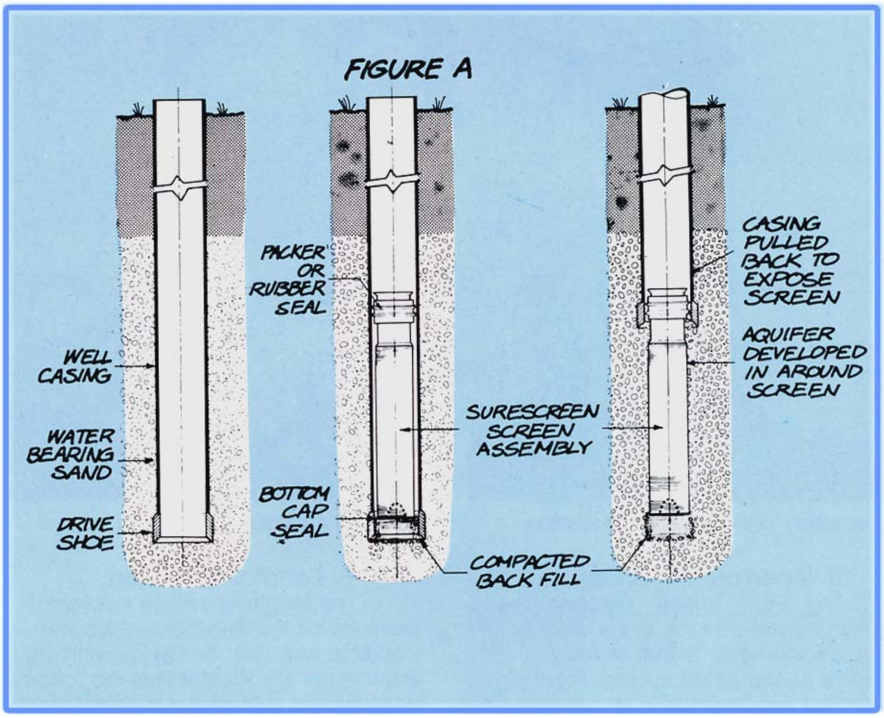
This method is commonly used with cable tool plants and is probably the most accurate method for positioning the screens, because the sand samples are collected through the bit; this method ensures a high quality sample for correct selection of screen aperture and position.

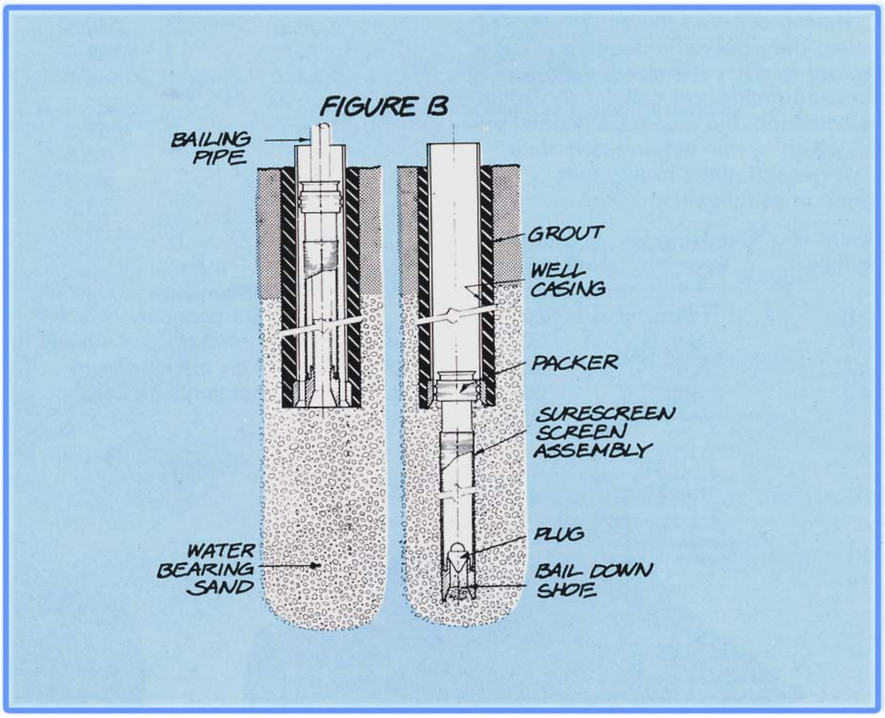
The application of this method is limited to ground conditions where the casing can be taken to the full depth and pulled back.

2. Bail-Down Method (Figure B)

The first step is to drill and install casing in its permanent position, by grouting or otherwise, sealing it in the drilled hole.

The well screen, fitted with a bail-down shoe or an open sleeve at its lower end, it let down through the casing in telescope fashion. The screen as-sembly is sunk into the aquifer below the casing by operating the bailer and drilling tools through a screen, or through the bailing pipe. The object of the bail-down method is to remove sand from below the screen, so that the screen will settle down as the sand is displaced.





3. Wash-Down Method
(Figures C & D)

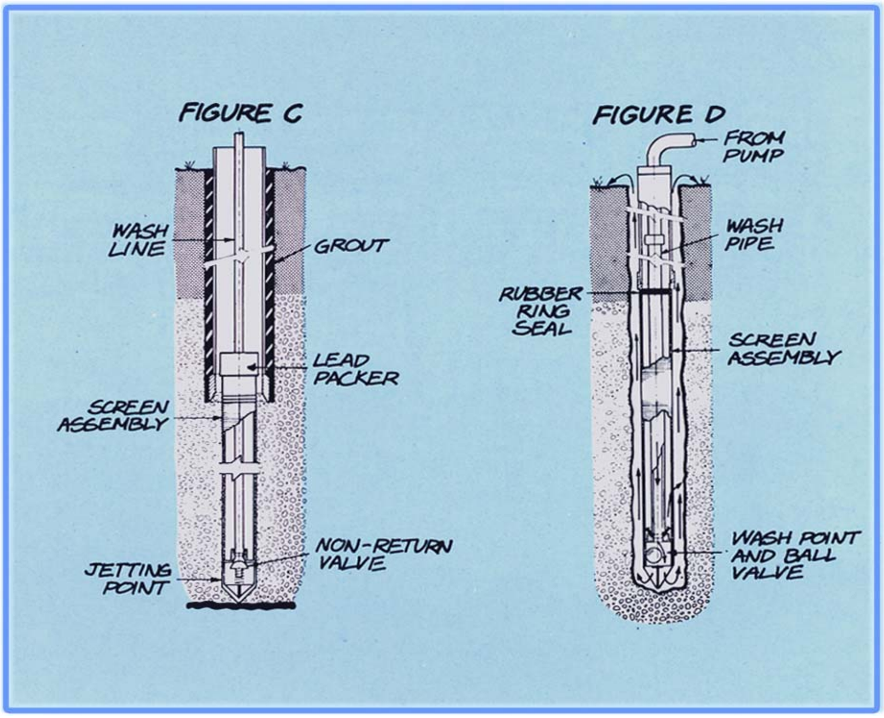
This method is mainly used when the hole has been drilled by a rotary rig.

In this method, the top hole casing is set to the desired depth and grouted as in the previous methods.

With the casing in place, a pilot hole is drilled through the formation below to obtain samples and to check the depth of a hard base for the screens. The screens, with a non-return valve at the bottom, are connected to a wash-line.

When the screens are in position, the wash-line is uncoupled and washing continues inside the casing to remove any accumulations of fines and to start development.

Leakage of wash water around the lower coupling (say 5%) flows out through the screen and prevents fine sand passing into the screen during the jetting operation, thus minimizing the possibility of the wash pipe becoming "locked" inside the screen.



4. Screen Set in Open Hole
(Figure E)

This method is used in cases where the bore has been stabilized by drilling mud and is therefore used more with rotary rigs.

The hole is drilled past the required depth and back-filled with aggregate. The screen is then run after being connected to the drill pipe with a left-hand thread and a non-return valve.