Low Operating Head Polishing Sand Filter – LHPF
Summary of Technical Description

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The Low Operating Head Polishing Sand Filter (LHPF) exhibits the same particulate removal ability of slow sand filtration, operates similar to the BioSand Water Filter and incorporates a unique clean-in-place system that has the same simplicity of design and operation as that used in pressure sand filters. (A description of the BioSand Water Filtration technology may be found in the paper 'New Horizons for Slow Sand Filtration'.) The LHPF is simple and inexpensive to design, construct, house and operate. The LHPF is readily adapted to work with other treatment technologies. The LHPF does not use any consumable components and produces very little wastewater when cleaned.

Low Operating Head Polishing Sand Filters, alone or in combination with other treatment technologies, may be effectively and inexpensively used to remove:

1. Pathogens including helminths, parasites, bacteria and viruses (100% removal of helminths and parasites, 90 – 99% removal of bacteria and viruses).
2. Inorganic and organic particles (may require small dose of inorganic coagulant prior to filtering).
3. Iron (may require chemical treatment prior to filtering).
4. Manganese (may require chemical treatment prior to filtering).
5. Heavy metals including arsenic, mercury and lead (may require chemical addition prior to filtering).
6. Fluoride (requires pre-treatment).
7. Dissolved organic chemicals including toxins (may require pre- or post- treatment depending on water quality).
8. Dissolved solids when used with membrane technologies. The LHPF provides excellent pre-filtration.

Individual filters may be designed with capacities ranging from as little as twenty litres per hour to greater than one hundred and sixty thousand litres per hour. Treatment plants may use many individual filters in systems to achieve desired treatment capacity. (Largest treatment plant considered is approximately 15,000,000 litres per hour.)

The LHPF is compact and inexpensive to construct. The height of very small filters will be less than one meter. Very large capacity filters may be two meters or more in height. Construction may employ concrete walls, stainless steel, medium density polyethylene plastic and fibre glass. Stainless steel systems can be designed to be welded or bolted together on site. Fibre glass tanks may be designed to be delivered in one piece or assembled on site. All internal piping and equipment and external piping is supplied with the filter.

LHPF's may be manually or automatically operated and cleaned.

The LHPF uses a unique filter bed with the same or better filtration characteristics of that used in traditional slow sand filtration. The LHPF is cleaned by fluidizing the surface of the media bed and eliminating resulting wastewater. This is achieved by employing a media bed that performs as those used in slow sand filters and incorporating an underdrain and backwash system similar to that used in pressure filters.

The flow of filtered water is controlled using a 'weir-type' outlet system (outlet standpipe) connected directly to the filter underdrain system similar to that used with traditional slow sand filters. During normal operation the flow of water into the filter and the maximum depth of water over the filter bed are established by mechanical float valves attached to the raw water inlet pipes within the filter itself. The flow of water into the filter cannot exceed its production. The combination of permissible maximum head on the filter bed and restricted flow rate eliminates the risk of compaction of the top layer of the media bed. The erosive power of untreated water entering the top of the filter is eliminated as the water enters the filter.

Once it is determined that filter production is unacceptably low, filter production is isolated and backwash water is allowed into the underdrain system. Treated water is used for backwashing. An air-vacuum control valve attached

to the top of the outlet standpipe ensures that the filter produces treated water with the outlet under atmospheric pressure and backwashes under full backwash pump pressure. The backwash of a LHPF is intended to break up the surface layer only (where virtually all of the material is collected) and resuspend captured material.

The media bed used in a LHPF consists of at least five layers (depending on scale of filter) of differently sized crushed quartzite (silica) each meeting the material characteristics required for slow, rapid or pressure sand filters as stated by the American Water Works Association (AWWA). The upper two layers or filtering layers use uniform graded media that meet or exceed the specifications for slow sand filtration. The top layer provides most of the filtering action. The bottom three layers of the media bed or underdrain allow uniform vertical flow, downward and upward, through the filtering layers while filtration is in progress and even distribution of the water across the entire bottom of the filter bed during a backwash. The depth of the underdrain may vary with filter capacity while the depth of the filtering layers is constant.

The wastewater produced during the backwash process is removed using perforated pipes located along and attached to the interior walls of the filter. The perforated pipes are attached to a siphon spillway system that also acts as an emergency overflow system. It is advisable to divide the entire filtration plant into equal segments that can be cleaned independently and successfully using lower capacity distribution pumps and produce flow rates and volumes of wastewater that can be economically evacuated and disposed of. The LHPF may be put into production immediately after cleaning without any need for filter to waste.

The design, operation and cleaning of the LHPF is unique and patents are pending. LHPF technology is available through Oasis Filter Ltd., Calgary, Alberta, Canada.

The LHPF technology may be used in a wide range of applications in the municipal, industrial, oil and gas and agricultural sectors.

The LHPF technology is appropriate and sustainable in virtually all cultural and economic environments.

Recent application:

Stavely - Alberta, Canada

1. Town of 700 people.
2. Application is manganese, hydrogen sulphide, and sulphate reducing bacteria removal.
3. Sustained capacity is 50,000 litres per hour, in six independent cells.
4. Only chemical requirement is sodium hypochlorite.
5. Manually operated.
6. The dimension of one cell is approximately 4m x 4m x 2m high.
7. Requires Alberta Operator Level 1 to operate.
8. Backwash water is disposed of in town lagoon.
9. Commissioned May 2007.