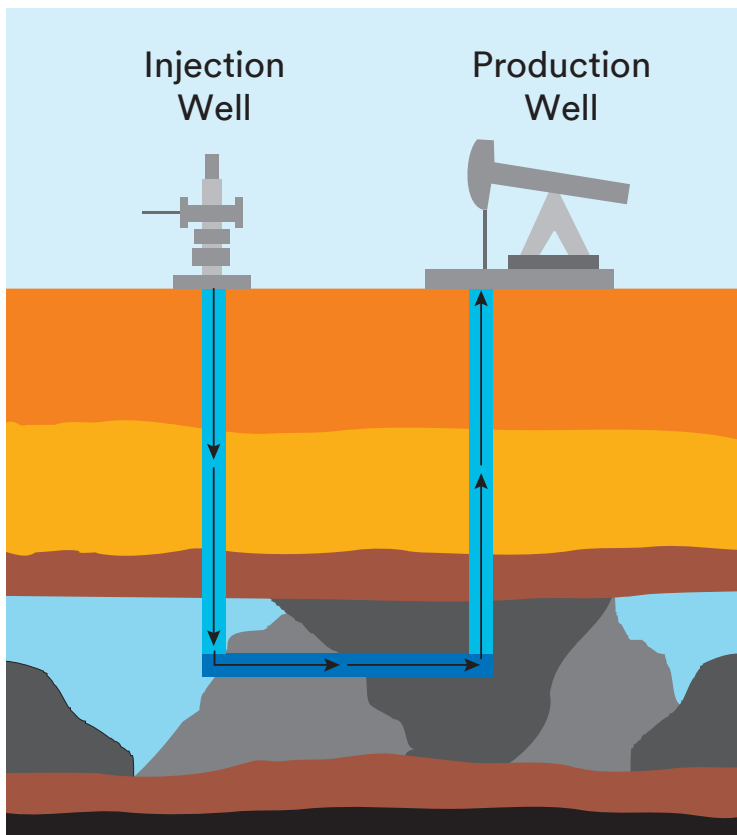


# The filtration that keeps it flowing.

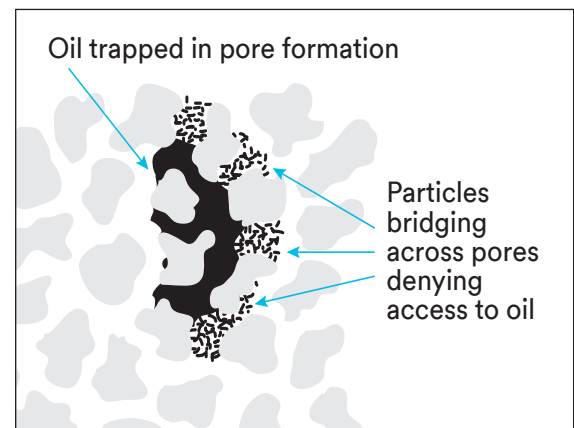
Using waterflooding, or water injection, for enhanced onshore oil recovery can provide up to 40% additional oil production. The quality of the injected water is critical in the effectiveness of waterflooding operations in oil recovery, and requires a filtration system capable of removing particles that can plug well formations.

Injected water must be treated so that the oil and particulate content is reduced to sufficient levels to prevent potential clogging of the reservoir well pores and subsequent loss of oil production.

## Injection Well Example



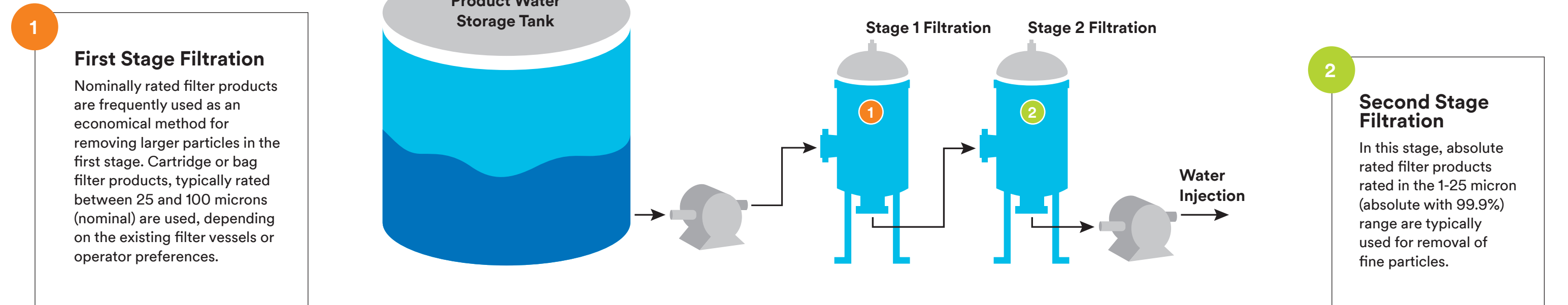
## Formation Pore Plugging Due to Particles



Waterflooding can increase reservoir pressure and “sweep” oil to the production well.

# Let increased production take center stage.

A two stage process often provides the most cost-effective filtration solution.



1

## First Stage Filtration

Nominally rated filter products are frequently used as an economical method for removing larger particles in the first stage. Cartridge or bag filter products, typically rated between 25 and 100 microns (nominal) are used, depending on the existing filter vessels or operator preferences.

2

## Second Stage Filtration

In this stage, absolute rated filter products rated in the 1-25 micron (absolute with 99.9%) range are typically used for removal of fine particles.

**3M™ DF Series Filter Elements (for Bag Vessels)**

**3M™ Micro-Klean™ RT Series Filter Cartridges (for 2.5" Cartridge Vessels)**

These filter elements feature longer service life and holding capacity than conventional nominally rated bag filters. DF Series elements can be used in existing bag housings with specially designed baskets.

- Greater than 60% more filter surface area proving up to 3-5X more service life and 2-3X more dirt holding capacity compared to most commonly used standard bag filters
- Innovative filter element and basket geometry reduces the potential for element rupture and downstream fluid contamination

Polypropylene depth filter cartridges featuring rigid extrusion bonded technology.

- Enhanced contaminant holding capacity for longer life compared to 2.5" diameter depth cartridges
- Consistent particle removal efficiencies throughout filter life
- Low initial differential pressure

**3M™ High Flow Filters (for New Installations)**

**3M™ 500 Series Bag Filters (for Bag Vessels)**

**3M™ Betafine™ XL Series Filters (for 2.5" Diameter Cartridge Filter Vessels)**

These large diameter (6.5") cartridges in 40" and 60" lengths feature high-efficiency polypropylene microfiber media.

- Compound radial pleat design yields a large amount of filter media surface area per cartridge
- High flow rates up to 500 gpm (per 60" cartridge) reduces elements needed and the size of housing required—lowering capital investment
- Twist-to-Lock feature provides a positive indication of proper sealing

Multi-layer polypropylene bags for use in Size #2 bag housings.

- High efficiency blown microfiber media provides higher particulate holding capacity than standard bags
- High oil-absorption capacity
- Transport/bypass layer design optimizes flow and filter life

These cartridges are constructed with high efficiency polypropylene media using 3M Advanced Pleat Technology.

- Absolute rated media helps remove fine particles (as small as 0.2 microns)
- 3M Betafine cartridges are available in various micron ratings
- Available in various micron ratings

# Filtration Solutions for Waterflooding Operations

	Product Name				
	3M DF Series	Micro-Klean™ RT Series	3M™ 500 Series	Betafine™ XL Series	3M™ High Flow Series
<b>Filtration Stage</b>	First Stage	First Stage	Second Stage	Second Stage	Second Stage
<b>Filter Housing</b>	Bag (requires special basket)	2.5" Cartridge	Bag	2.5" Cartridge	High Flow
<b>Materials of Construction</b>	Polypropylene or Polyester	Polypropylene	Polypropylene	Polypropylene	Polypropylene
<b>Micron Ratings</b>	1 - 200(nominal)	1 - 70 (nominal)	2.5 - 48 (absolute 99%)	0.2 - 70 (absolute >99.9%)	1 - 70 (absolute >99.9%)
<b>Dimensions</b>	Size #1: 7" D x 16" L Size #2: 7" D x 30" L	Diameter: 2.5" Length: 10", 20", 30", 40"	Size #2: 7" D x 30" L	Diameter: 2.5" Length: 10", 20", 30", 40"	Diameter: 7.0" Length: 40" & 60"

<p><b>Product Selection and Use:</b></p> <p>Many factors beyond 3M's control and uniquely within user's knowledge and control can affect the use and performance of a 3M product in a particular application. As a result, customer is solely responsible for evaluating the product and determining whether it is appropriate and suitable for customer's application, including conducting a workplace hazard assessment and reviewing all applicable regulations and standards (e.g., OSHA, ANSI, etc.). Failure to properly evaluate, select, and use a 3M product and appropriate safety products, or to meet all applicable safety regulations, may result in injury, sickness, death, and/or harm to property.</p>
<p><b>Warranty, Limited Remedy, and Disclaimer:</b></p> <p>Unless a different warranty is specifically stated on the applicable 3M product packaging or product literature (in which case such warranty governs), 3M warrants that each 3M product meets the applicable 3M product specification at the time 3M ships the product. 3M MAKES NO OTHER WARRANTIES OR CONDITIONS, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OR CONDITION OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR ARISING OUT OF A COURSE OF DEALING, CUSTOM, OR USAGE OF TRADE. If a 3M product does not conform to this warranty, then the sole and exclusive remedy is, at 3M's option, replacement of the 3M product or refund of the purchase price.</p>
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