



STANDARD OPERATIONAL PROCEDURES (SOP) for CITY WELLS INJECTION – Canyon View Well

SOP-1

Initial Well Flush to Waste

1. Obtain initial measurements including static water level and flow meter totalizer readings (both magnetic water flow meter and turbine water flow meter).
2. Configure valve system to pump Canyon View Well #2 to waste. Referring to the Canyon View Well #2 Well Piping Layout:
 - a. Close Gate Valve #1.
 - b. Check Pump Control Valve to make sure it is open.
 - c. Set pressure control on Pump Control Valve so that the valve stays open until it is time to stop flushing to waste.
 - d. Check Gate Valve #2 to make sure it is open (this valve is normally left open).
3. Pump Canyon View Well #2 to waste for 1 hour to remove any iron scale or precipitate that has developed in the well piping.

SOP-2

Injection Phase – Startup

1. Obtain measurements of water levels, supply line pressure and flow meter totalizers for Canyon View Well #2. Record the static water level before startup for calculation of the maximum drawup for each injection cycle (see Item 3 SOP 3).
2. Flush injection water supply line to waste with the following steps:
 - a. Make sure that the well pump is not running.
 - b. Supply line should be flushed at 400 - 700 gpm to clear out debris and iron scale in the pipelines.
 - c. Check the Injection Throttling Valve to make sure it is closed.
 - d. Open Gate Valve #1 and flush for at least 1 hour. Water should clear with no detectable debris, sand or iron scale.
 - e. Reset pressure control on Pressure Relief Valve to normal setting.
3. Prepare to inject with the following steps:
 - a. Close Gate Valve #2.
 - b. Check the Injection Throttling Valve to make sure it is closed.
 - c. Check the pressure controls on the Pressure Sustaining/Check Valve to make sure that it is set for normal check valve operation.
 - d. Open the Air/Vacuum Valve on the injection pipeline.
 - e. Open Gate Valve #1.
4. Follow these steps to gradually reach the targeted injection flow rate.
 - a. Slowly divert injection water into well by opening the Injection Throttling Valve until the injection pipeline transitions from vacuum to pressure conditions.
 - b. Close the Air/Vacuum Valve on the injection pipeline.
 - c. Continue slowly opening Injection Throttling Valve until flow rate reaches the target flow rate. Take care not to divert water too rapidly into the well. The process of

diverting injection water into the well may take 15 to 30 minutes to reach the target injection flow rate.

- d. Back pressure at the well head should be from 5 - 30 psi.
5. Measure and record injection flow rate, well head back pressure, pressure upstream of Injection Throttling Valve, and water levels in the well.

SOP-3

Injection Phase – Monitoring

1. Monitor the following parameters daily during injection:
 - a. Injection rate
 - b. Well head back pressure in injection pipeline
 - c. Pressure upstream of Throttling Valve
 - d. Water level
 - e. Water color, turbidity, smell and taste of injection water
2. Evaluate field water quality data and confirm that there are no unusual readings (greater than 10% variation from previous or subsequent readings). Remeasure field parameters immediately if unusual readings are found.
3. Calculate the maximum allowable drawup water level for each injection cycle by subtracting the maximum drawup value (See Line #7 in Table 1 on Page 1) from the static water level measured at the beginning of the injection cycle. If the water level in the Canyon View Well #2 rises above the maximum drawup value, it may indicate possible plugging. If this occurs, contact the supervisor and consider shutting down injection and redeveloping the well (see SOP-4).

Max Drawup = SWL (Item1, SOP2 or Item 4, SOP4) - Max Drawup Value (Line 7, Table 1)
Water Level

4. Redevelop well (see SOP-4) at the end of the injection cycle to the clean well prior to storage and recovery phases.

SOP-4

Injection Phase - Well Re-Development

1. Configure valves to pump Canyon View Well #2 to waste.
 - a. Close Injection Throttling Valve.
 - b. Obtain flow meter totalizer readings (both magnetic water flow meter and turbine water flow meter)
 - c. Close Gate Valve #1.
 - d. Open Gate Valve #2.
 - e. Check Pump Control Valve to make sure it is open.
 - f. Set pressure control on Pump Control Valve so that the valve stays open until it is time to stop flushing to waste.
 - g. Turn on the deep well pumping system.
2. Re-Develop Well as follows:
 - a. Pump well to waste for 15 minutes minimum.
 - b. Measure and record water levels during pumping.
 - c. Surge the well by shutting it off, waiting for all water to finish running back down
 - d. the well (5 min. minimum) and then turning on the pump again.

- e. Pump the well to waste for 2 hours.
 - f. Note the pumped water color, turbidity, smell, and taste and record observations
 - g. every 15 minutes.
3. Calculate specific capacity (S_c).

$$S_c = \frac{\text{Average pumping rate (gpm) over 2 hour period}}{\text{Drawdown (ft) after 2 hour period}}$$

If $S_c >$ Original Specific Capacity During Test Pump (Table 1 Line 5), redevelopment was successful and proceed to Injection Startup (SOP-2).

If $S_c <$ Original Specific Capacity During Test Pump (Table 1 Line 5), continue redevelopment (SOP-4).

4. Obtain a new Static Water Level for calculation of new maximum drawup water level (See Item 3 in SOP 3)
 - a. Allow well to recover for 45 minutes to 1 hour minimum.
 - b. Record new static water level.
 - c. Recalculate maximum allowable drawup water level (Item 3 SOP 3) for next infection cycle.

SOP-5

Recovery Phase – Startup

1. Configure valves to pump to waste.
 - a. Close Injection Throttling Valve.
 - b. Close Gate Valve #1.
 - c. Open Gate Valve #2.
 - d. Check Pump Control Valve to make sure it is open.
 - e. Set pressure control on Pump Control Valve so that the valve stays open until it is time to stop flushing to waste.
2. Obtain baseline measurements including static water levels and flow meter totalizer readings (magmeter and turbine flow meter). Obtain/prepare all equipment for pump testing.
3. Conduct a 24-hour constant rate pump test to document well performance at the start of recovery. Procedure is as follows:
 - a. Turn pump on. From when the pump first comes on to 10 minutes, collect water level and flow rate readings every minute.
 - b. From 11 minutes to 1 hour collect water level and flow rate readings every 5 minutes.
 - c. From 1 hour to 2 hours collect water level and flow rate readings every 20 minutes.
 - d. From 2 hours to 24 hours collect water level and flow rate readings every hour
 - e. Flow rate readings shall be measured accurately and recorded at the same time interval as drawdown data.

SOP-6

Recovery Phase – Monitoring

1. Continue pumping at sustained production flow rate.
2. Discontinue recovery pumping when 110% of the injection volume is reached.

3. Shutdown pump and allow well to recover for at least 48 hours.
4. Conduct a 24-hour constant rate pump test to document well performance at the end of recovery. Procedure is as follows:
 - a. Turn pump on. From when the pump first comes on to 10 minutes, collect water level and flow rate readings every minute.
 - b. From 11 minutes to 1 hour collect water level and flow rate readings every 5 minutes.
 - c. From 1 hour to 2 hours collect water level and flow rate readings every 20 minutes.
 - d. From 2 hours to 24 hours collect water level and flow rate readings every hour
 - e. Flow rate readings shall be measured accurately and recorded at the same time interval as drawdown data.

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