Kearl Seepage – Investigation Results

May 5, 2023

Background

During regular water sampling and surveillance on May 11, 2022, discolored water was discovered north of Drainage Pond 4 (DP4) area by a Kearl environmental contractor. As the source of the water was unknown a technical team was assembled to investigate the source and determine mitigation and containment measures.

Kearl Hydrogeology and Environmental Teams conducted field surveillance and desktop review of aerial imagery and noted additional areas of interest north of the North Overburden Disposal Area (NODA), north of West External Tailings Area (WETA) and west of Water Body 3 (WB3). This designated team further investigated the surface water, with a specific mandate including:

- Identify and implement mitigation measures
- Understand potential for environmental impact to key receptors
- Understand the source/pathway of the water

In addition to this response team, a team was established to investigate the root causes of the surface water, which was later determined to be seepage.

Additional water and soil sampling and vegetation and wildlife assessments were conducted for the areas of interest as part of the initial investigation. In addition to environmental monitoring, Imperial drew down the water levels in perimeter ponds and ditches and initiated a geochemistry study to help inform on the source of the water. Findings included:

- No measurable impacts to the Firebag River, the Muskeg River, or Waterbody 3 were detected
- No impacts to wildlife or fish were identified

Water sampling results indicated key indicator parameters of industrial wastewater, which was reported to the AER. An Action Plan was developed and submitted to the AER that described the work that had been conducted to date and additional plans to confirm source/pathway and geochemistry studies. Once the source and pathway were understood a Source Control Action Plan that outlined mitigation and containment measures was completed and submitted to the AER.

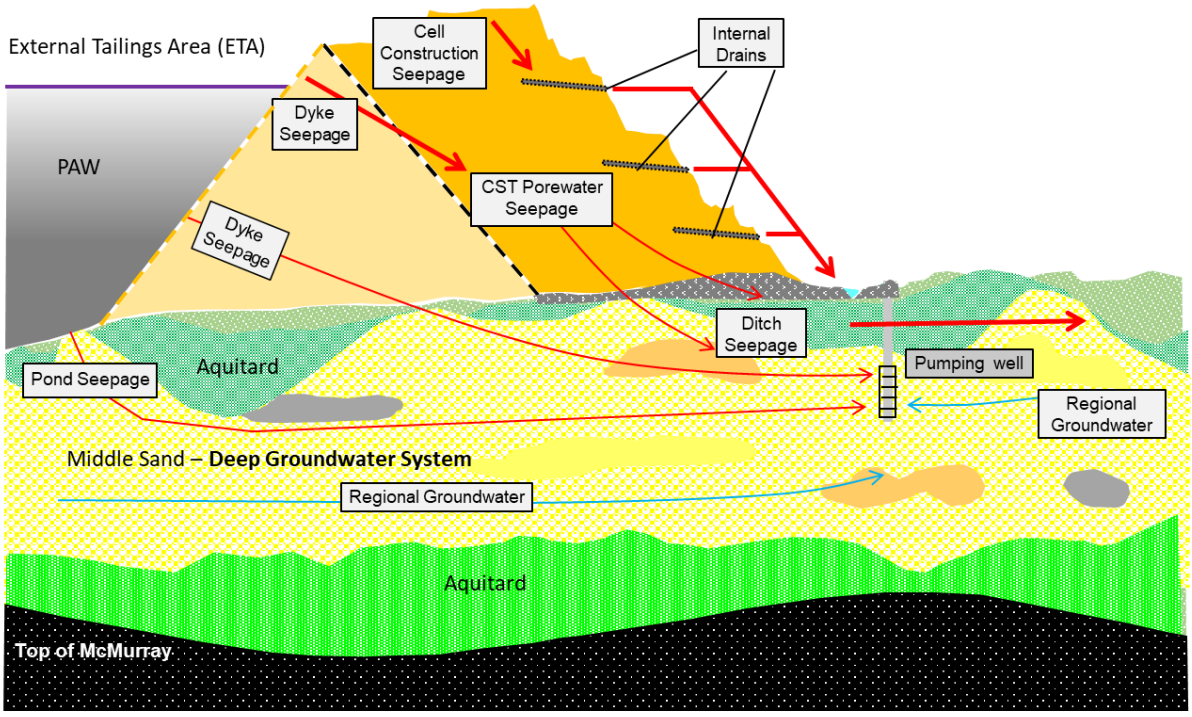
Investigation Findings

The investigation team determined that a shallow subsurface pathway from on-lease industrial wastewater sources bypasses the existing deep groundwater Seepage Interception System (SIS), which resulted in in the off-lease release.

Construction methods for on-lease infrastructure, such as roads, piping infrastructure, and the ETA dyke itself, placed sand fill material which created an unexpected pathway through shallow groundwater systems. This permeable sand fill layer allowed industrial wastewater from on-lease sources to flow above the elevation of the SIS detection and pumping wells, eventually appearing at surface.

Identified potential sources for the industrial wastewater include:

- Dyke seepage: process affected water moving through the tailings dyke
- Pond seepage: process affected water moving through the base of the ETA structure
- Cell construction seepage: run-off from the dyke construction process
- Coarse Sand Tails (CST) pore water seepage: fluids released from the CST stream
- Ditch seepage: process affected water from site water collection ditch infrastructure



The SIS is designed to detect seepage of industrial wastewater via regular sampling and monitoring for known chemical markers. Once detected, pumping wells are activated to return the affected water to the ETA for ongoing storage and for use in the production processes. The SIS design did not account for a shallow groundwater seepage mechanism via the sand fill layer placed during construction, and therefore did not detect nor capture the industrial wastewater as it flowed off lease.

In addition to the sand fill layer, shallow discontinuous in-situ aquitards (Quaternary glacial sediment) are present in the vicinity of Kearl's north lease boundary. These aquitards have a low hydraulic conductivity that can restrict the flow of liquids from the shallow groundwater systems to the deeper areas where the SIS is located. At the time of the system design, Imperial's hydrogeological models did not fully represent the extent of these layers.

Solutions to Prevent Recurrence

Ongoing Monitoring

Monitoring of the surface and ground water seep locations has been enhanced and is ongoing to ensure understanding of water chemistry and that mitigations are effective, as well as that no impact to local wildlife or the watershed is occurring.

Flow Interruption and Fluid Collection

Design upgrades and infrastructure improvements to the SIS have been completed, with 142 additional monitoring/pumping wells added to the system since the initial discovery and characterization of the seepage locations.

Surface and shallow ground water interception trenches, complete with water return pumps, have been constructed in the identified off lease pathways. Three of four locations have been completed, with the fourth under construction. This work is expected to be completed by the end of May. These trench systems are designed to interrupt and collect the flow industrial wastewater within the shallow groundwater system, preventing off lease flow. Water collected from these individual trench systems is returned on lease for storage and process use.

A shallow well point vacuum system has been installed in the vicinity of the WB3 seepage location. This technology is designed to dewater shallow systems and is well suited for the area around WB3 and the suspected industrial wastewater source.

Impermeable ditch liners are being designed and installed in identified locations within the ETA collection and surface run-off ditches to prevent source water seepage to shallow ground water pathways. Installation of this material requires access in the summer construction season (July completion).

Ongoing Technical Actions

In addition to the shallow groundwater pathway created by placement of the construction fill material, Imperial is continuing to study seepage mechanisms, including investigating the potential for a deep groundwater conduit to shallow groundwater systems.

Additional mitigations are also being evaluated to prevent industrial wastewater seepage from leaving the Kearl lease boundary. Determination of the need for additional measures will depend on the efficacy of the installed wells and trenching systems, as measured by the ongoing sampling and monitoring programs that have been initiated.