Hay River, NT, Solid Waste Facility March 2019 Fire and Spring Freshet Environmental Monitoring Program

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Outline

- Background
- Incident
- Emergency Response
- Water Management
- Water Sampling Plan
- Selecting Environmental Quality Guidelines
- Other Considerations and Challenges
- Overall Findings
- Going Forward

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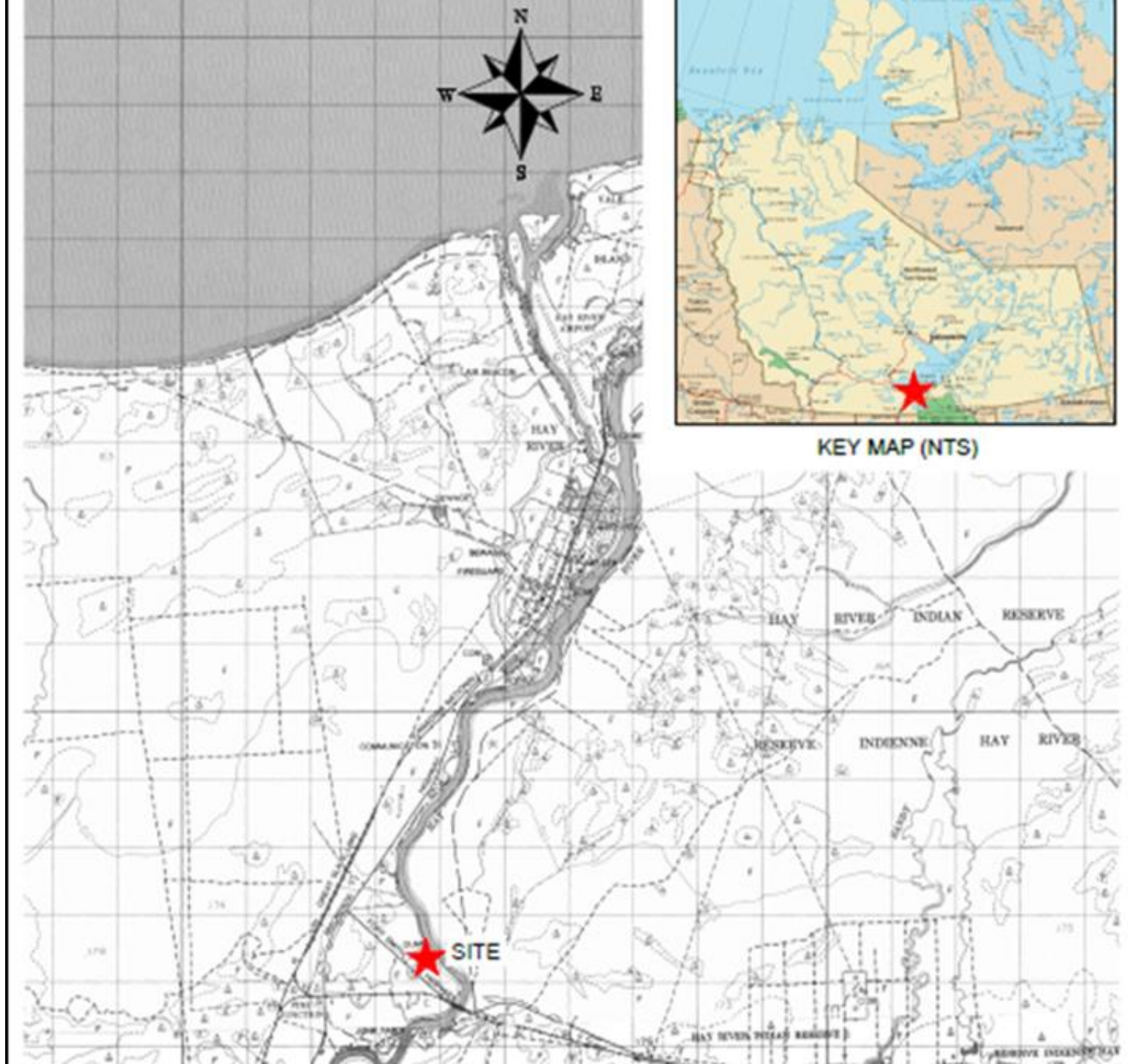
Background

- Town of Hay River located on south short of Great Slave Lake

- Landfill located south of Town, 10km upstream



Background

- Landfill operating since 1973, 100-150 meters south of river
- Household, commercial, industrial waste: metal, tires, synthetic products, oils, lubricants[1]

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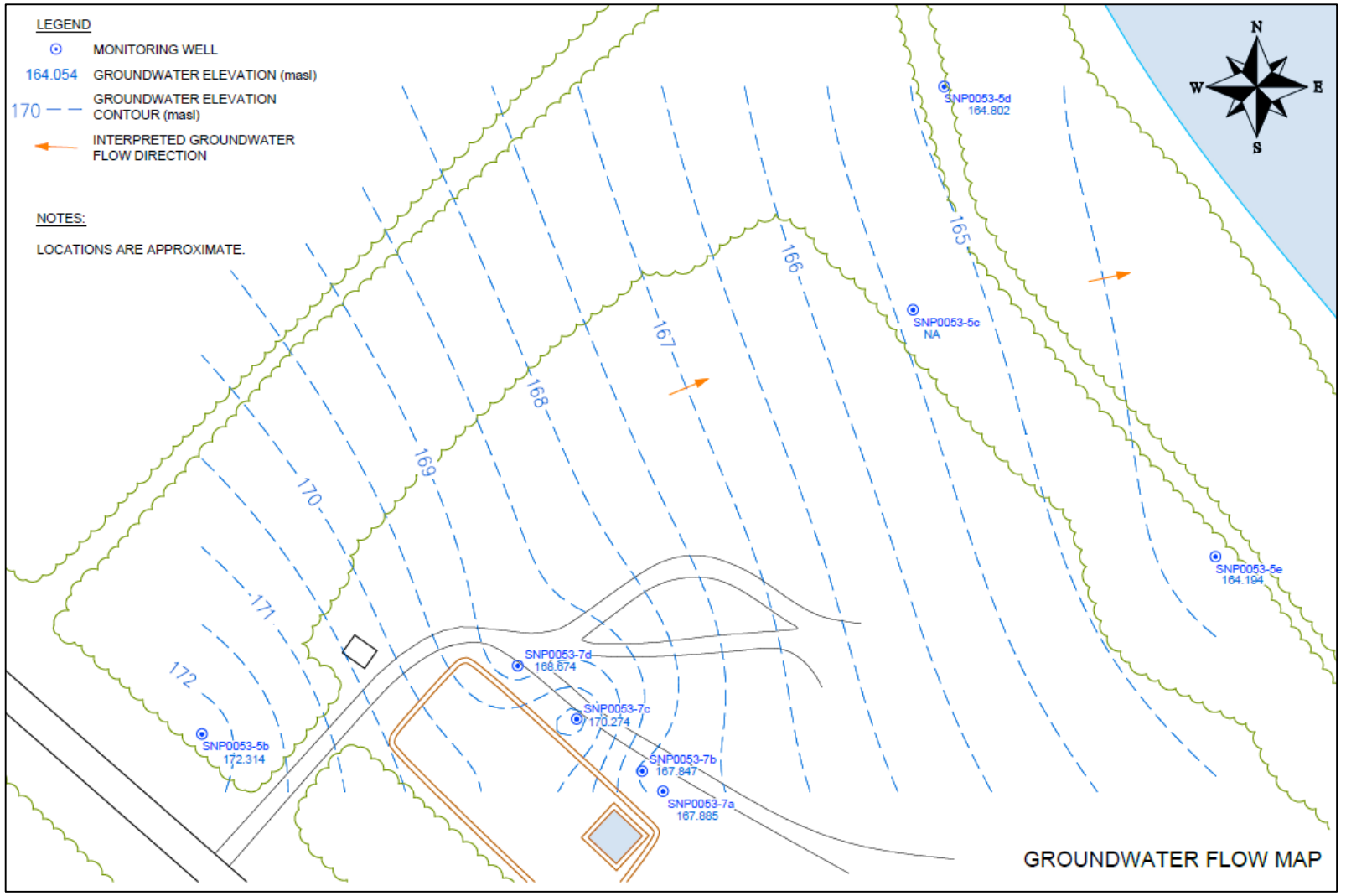
Background

- Groundwater monitored by wells built in 1999[2]
- Three wells between landfill and Hay River, one well hydraulically upgradient



Incident

- Fire occurred on east portion of facility
- Location historically used to dispose of metal material

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Emergency Response

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Water Management

- 700m3 water in two east ponds
- Interim control – cycled water from ponds to fire

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Water Sampling Plan

- Opportunities included: onsite ponds, groundwater wells, locations along Hay River

- Initial focus was to evaluate worst case scenario (ponds, drinking water, Hay River receptors)

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Water Sampling Plan

- Surface water locations along Hay River
- Drinking water identified as SW-4

Water Sampling Plan

Contaminants of Concern:

- Aromatic and petroleum hydrocarbons
- Volatile organic compounds (VOCs)
- Chlorinated VOCs
- PAH
- PCB
- Dioxins and furans
- Total and dissolved metals

Routine water chemistry also included

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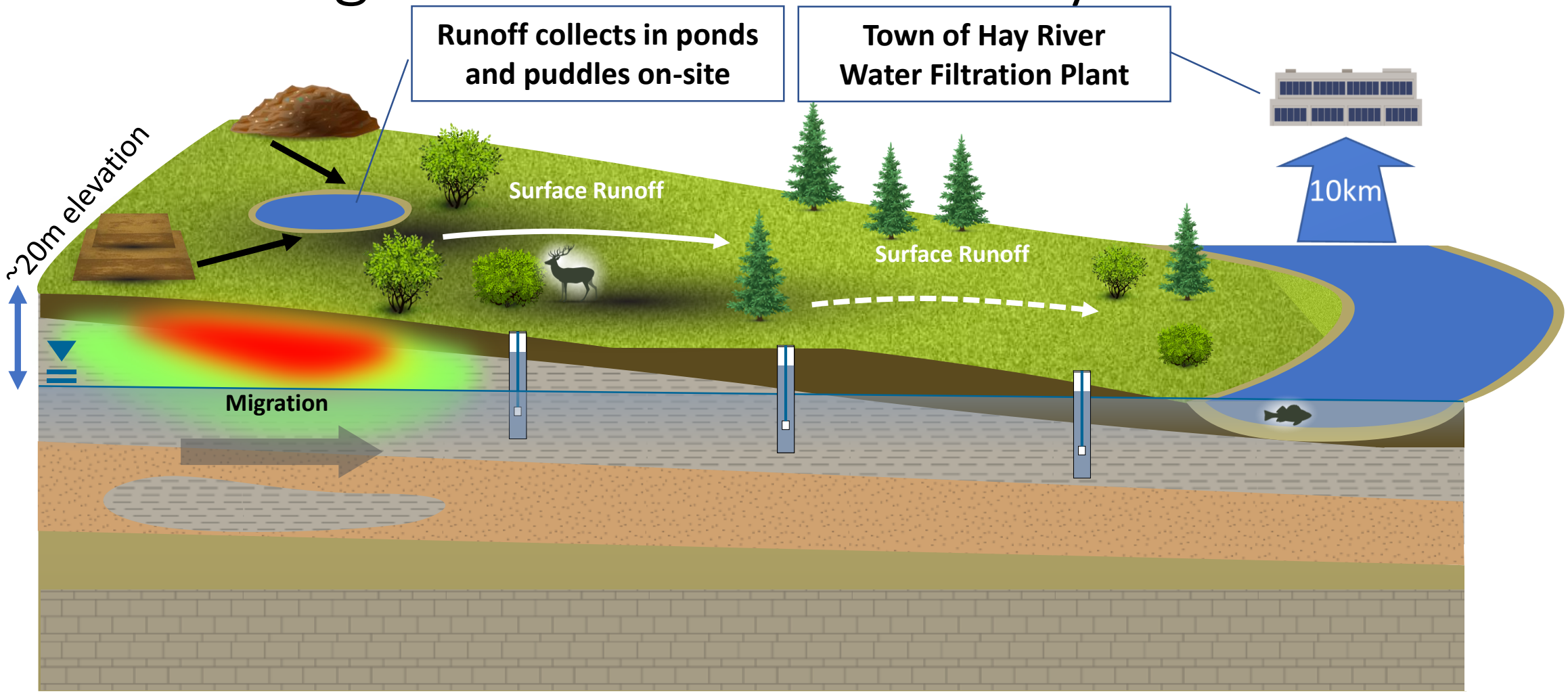
Selecting Environmental Quality Guidelines



Selecting Environmental Quality Guidelines

- Focused on potential residual impacts to public health and the environment after fire exterminated.
- Occupational exposure and air inhalation excluded as these were addressed during the emergency response.
- Guidelines initially required for the following receptor and pathways:

Human	Ecological
Drinking water (Hay River is potable supply for town)	Eco-contact (i.e., plants and invertebrates)
Fish consumption	Freshwater aquatic life (FAL)
Direct contact (i.e., emergency response)	Livestock / Wildlife watering
Vapour inhalation (i.e. emergency response)	

Selecting Environmental Quality Guidelines

- Guidelines required for the following media that were collected and/or monitored at the site and surrounding areas:
- On-site:
  - Surface water collected in puddles / ponds
  - Groundwater monitoring wells
- Off-site:
  - Groundwater monitoring wells (i.e., hydraulically upgradient and downgradient)
  - Surface water runoff
  - Surface water (i.e., Hay River)

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Selecting Environmental Quality Guidelines

Environmental Monitoring Data	Recommended Guidelines	Rational
Surface water (i.e., runoff or puddles and ponds) from Site	Alberta Surface Water Quality Guidelines (GOA 2018)	Alberta surface water quality guidelines represent a single source document and compilation of federal guidelines (i.e., CCME) and recent updates from other jurisdictions (e.g., BC MOE)
Groundwater from the landfill and surrounding area (i.e., between landfill and river)	Federal Contaminated Sites Assessment Program Interim Groundwater Quality Guidelines (GOC 2016a,b)	These guidelines provide benchmarks to assess risks to ecological receptors (i.e., invertebrates and plants) via direct contact (i.e., eco-contact) and migration of groundwater from the Site to the nearby river.
Surface water from Hay River	Alberta Surface Water Quality Guidelines (GOA 2018)	Alberta surface water quality guidelines represent a single source document and compilation of federal guidelines (i.e., CCME) and recent updates from other jurisdictions (e.g., BC MOE)
Surface water near Hay River Water Treatment Plant Intake	Health Canada Drinking Water Quality Guidelines (HC 2017, 2019)	Benchmark used to assess drinking water quality for Canadians and assumed in the interim that guidelines would also be protective of fish consumption

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Other Considerations and Challenges

- Natural verses chemicals of concern related to the fire / landfill were identified by establishing surface water background:
  - Dioxin and furan
  - Background exposure point concentrations based on maximum concentrations in the preliminary stages of the monitoring and shifted to the 95th percentile when more data were available (e.g., 5 or more data points).
  - 8 COC detected without guidelines - 1,1,2-trichloroethane, 1,2,4-trimethylbenzene, 1,2-dibromoethane, 1,3,5-trimethylbenzene, Chloromethane and trichlorofluoromethane
  - Explored other jurisdictions for guidelines (e.g., BC MOE, US EPA)
- Calculated %change for parameters spatially and temporally to identify positive, negative or neutral trends.

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Other Considerations and Challenges

Chemical	Drinking Water Guideline [ug/L]	Reference / Comment	Aquatic Life Guideline [ug/L]	Reference / Comment
1,1,2-trichloroethane	3	BC MOE (2019; Drinking Water	4.7	OMOE (2019). O. Reg. 158 Table 9
1,2,4-trimethylbenzene	56	EPA R9 RSL tapwater	NA	--
1,2-dibromoethane	0.5	BC MOE (2019); Drinking Water	12,000	GOC (2016) adopted from OMOE (2010)
1,3,5-trimethylbenzene	40	BC MOE (2019); Drinking Water	NA	--
Chloromethane	190	US EPA (2018) R9 RSL tapwater	NA	--
Trichlorofluoromethane	1,000	BC MOE (2019; Drinking Water	2,000	OMOE (2019). O. Reg. 158 Table 9
Dioxin and Furans	1.2E-04	AEP 2019: Alberta Tier 1 Potable GW (Table B1), Natural area (Based older exposure limit of 1E-08 mg/kg/day)	NA	--
Dioxin and Furans	3.0E-05	US EPA (2009): National Primary Drinking Water Regulations	NA	--
PCB	9.4	AEP 2019: Alberta Tier 1 Potable GW (Table B1), Natural area	NA	--

Other Considerations and Challenges

- Adjusting FAL guidelines based on toxicity modifying factors (e.g., hardness, pH).
- Large number of chemicals without guidelines – used qualitative trend observations to characterize risk (i.e., <D.L., negative trend).
- Most guidelines are long-term based as short-term guidelines are not available.
- Based on the fate and transport of contaminants monitoring will be required to evaluate residual / persistent impacts (i.e., focusing on sediment or depositional areas in river).

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Overall Findings and Trends (Surface Water)

- Most changes in concentrations for metals were less than ± 10%.
- Organics (BTEX, PHC, PAH, VOC) showed exceedances at the Site, but dramatically dropped in river adjacent to the Site and remained non-detect near the Town.
- Detected several VOC compounds (e.g., 1,2-dichloroethane, 1,2,4-trimethylbenzene, styrene, PCE) at site but concentrations below available guidelines.
- Naphthalene exceeded the guideline in adjacent river but showed a reducing trend when compared to previous measurements.
- Background total TEQ ranged from 3.40 to 3.49 pg-TEQ/L. The total TEQ at the Site was about 3 to 6 times higher and adjacent concentrations in the river were within background ranges indicating the dioxins and furans were likely contained to the site.
- No PCB detected.
- No detectable impacts at drinking water source.

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Overall Findings and Trends (Groundwater)

- PHC at downstream monitoring wells were below guidelines or non-detect; however, benzene and toluene at downgradient wells.
- Data showed some off-site migration of chlorinated compounds (e.g., 1,2-dichlorobenzene, cis-1,2-dichloroethene, trans-1,2-dichloroethene, MTBE and vinyl chloride); uncertain, whether these concentrations are routine or a result of the fire or both.
- Overall chlorinated VOC showed decreasing trend after fire.
- PAH were below guidelines and largely non-detect.
- Numerous exceedances for metals at downgradient wells for cadmium, mercury, aluminum, arsenic, boron, chromium, cobalt, copper, lead, manganese, selenium, silver, titanium and zinc, but showed decreasing trend.
- PCB non-detect and dioxin and furan were detected but below guidelines.

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Going Forward

Two questions:

1) Has the fire changed the groundwater chemistry below the landfill

2) As a result of the fire, and previous fires, are there any effects on the long-term ecological health in the river, and human health

Purpose

1) Determine need for mitigation strategies

2) Identify potential data gaps / drive further assessment

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Thanks for your time, open to questions

References

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