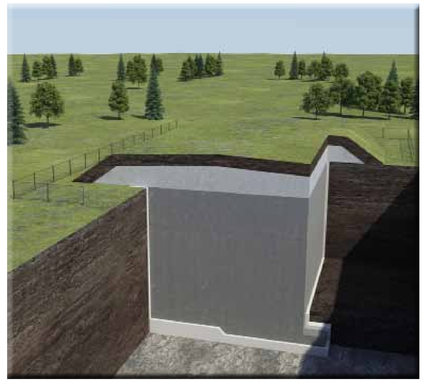
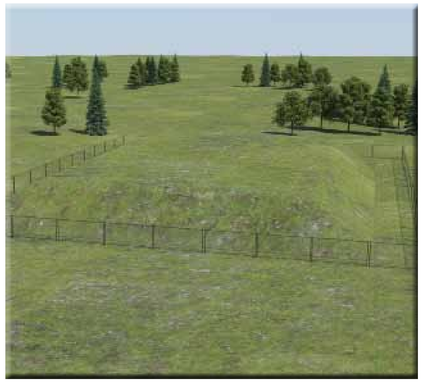
Understanding long-term performance
WR-1 Decommissioning

The timeframe of the assessment includes consideration of what is occurring now (current phase), the timeframe during which the proposed project would actively occur (closure phase), and the predicted lasting duration of the proposed project (post closure phase).





CURRENT PHASE

CNL has been studying the Whiteshell Laboratories site for decades. Recently, CNL has been enhancing knowledge of the project site through a variety of mechanisms, new equipment, adding a new network of boreholes for ground water monitoring and bedrock analysis, and characterization of the reactor. Historic and new data are building a thorough picture of the environment surrounding the project site.

CLOSURE PHASE (2019 - 2023)

The following activities are included in the closure phase:

- grouting of below grade structures and systems
- removal of above grade WR-1 building structures and systems
- installation of an engineered cover over the grouted WR-1 building area
- final site restoration
- installation of monitoring equipment

POST CLOSURE AND INSTITUTIONAL CONTROL PHASE (2023 - 2323)

Post closure activities are anticipated to start in 2023 as the site is prepared for institutional control (ongoing monitoring). Institutional control is part of the post closure period and will last approximately 300 years; however, modelling of groundwater for assessment purposes considers a much longer timeframe, spanning 500,000 years. The modelling timeframe is consistent with CNSC Regulatory Policy P-290 and ensures that "the assessment of future impacts of radioactive waste on the health and safety of persons and the environment encompasses the period of time when the maximum impact is predicted to occur". In post closure, the main scenarios assessed are the following:

- normal evolution scenario
- disruptive scenarios

NORMAL EVOLUTION SCENARIO

The Normal Evolution Scenario considers what is likely to happen within and around the grouted facility in the future.

Normal Evolution:

- includes eventual glaciation across the site
- assumes that after the site is released from institutional controls in a few hundred years and beyond, people live on the grouted facility's site

DISRUPTIVE SCENARIOS

Disruptive or "what if" Scenarios are unlikely scenarios that are used to test how robust the in situ decommissioning is.

Human Intrusion: *What if* someone accidentally drilled a deep borehole into the facility and brought waste material to the surface?

Open Borehole: *What if* one of the existing deep site characterization boreholes was not sealed or the seals failed completely?

Containment failure: *What if* the grout breaks down earlier then expected?

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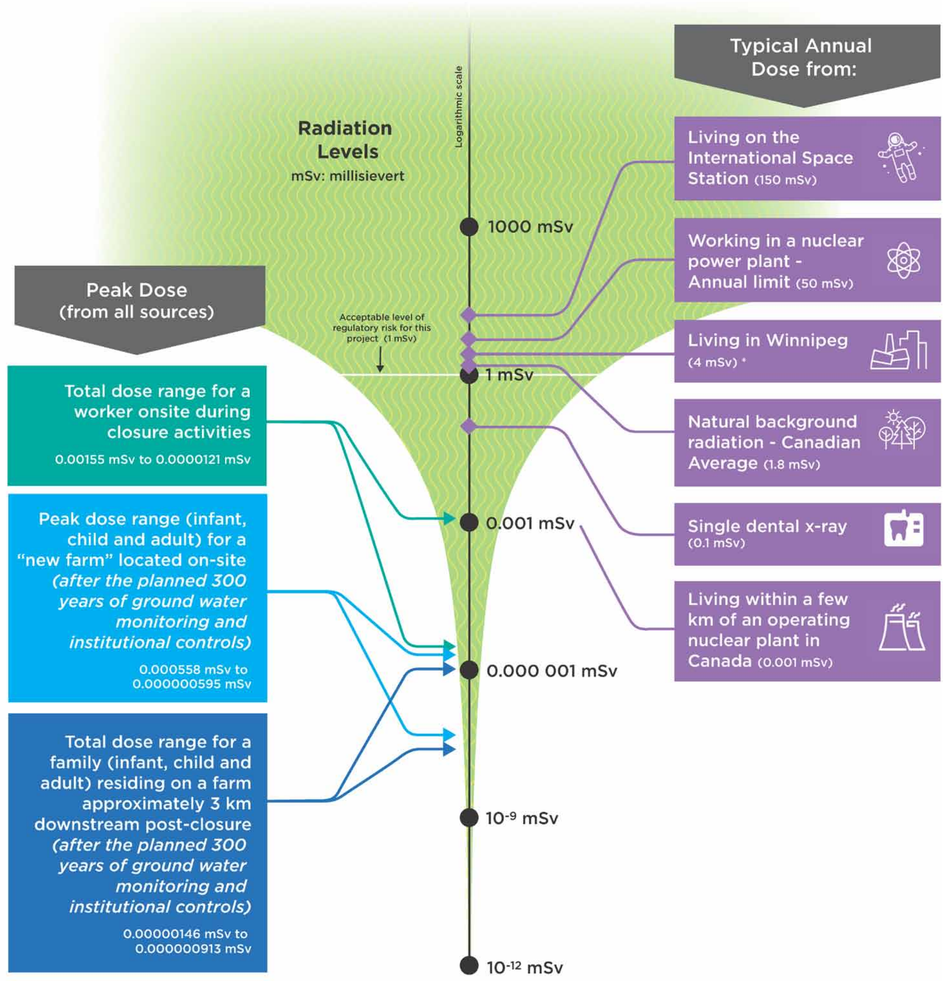
RISK TO ECOLOGICAL AND HUMAN HEALTH

As part of the project, an Ecological and Human Health Risk Assessment was completed. The purpose of the assessments was to predict and assess the risk to relevant human and ecological receptors resulting from exposure to radiological and non-radiological substances expected to be released throughout the closure and post closure periods of the WR-1 Project.

Peak Dose Ranges from Project



The environmental assessment recognizes the long-term nature of the project.

Environmental Assessment - Valued Components
WR-1 Decommissioning

Valued Components (VC) refer to environmental features that may be affected by a project and have been identified to be of concern by CNL, scientists, government agencies, Aboriginal peoples, or the public.

The list of VCs selected for the WR-1 Project considered a number of factors, including:

- presence, abundance and distribution within, or relevance to the area associated with the project;
- potential interaction with the Project and potential vulnerability to the effects of the project;
- species conservation status or concern (e.g., rarity, uniqueness);
- ecological and socio-economic value to communities, government agencies and the public (including the outcomes of public engagement activities);
- traditional, cultural and heritage importance to Indigenous people;
- legally recognized and afforded special protection by law, regulation, or policy; and,
- experience with similar projects.

Valued Components

Physical Environment

Geology
Groundwater quality and flow

Aquatic Environment

Fish and fish habitat

Land and Resource Use

Winnipeg River
Land tenure
Outdoor recreation and tourism
Cultural and archaeological sites
Traditional land and resource use by Indigenous people

Atmospheric Environment

Air quality
Climate change

Human Health

Public health
Worker health

Ecological Health

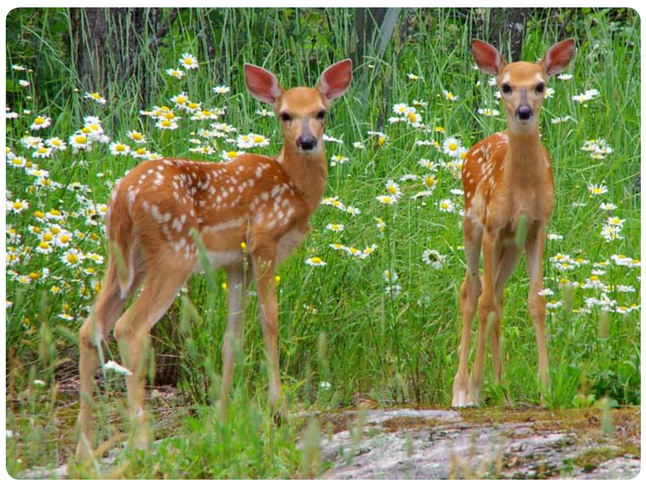
Terrestrial Invertebrates (i.e., earthworm)
Terrestrial Birds: American Robin, Barn Swallow, Loggerhead Shrike
Terrestrial Plants: grass and shrubs, blueberries
Terrestrial Mammals: Meadow Vole, Common Shrew, Snowshoe Hare, White-tailed Deer, Red Fox, Little Brown Bat
Fish: Carmine Shiner, Lake Sturgeon, Walleye
Benthic Invertebrates (i.e., snails)
Riparian Birds: Horned Grebe, Trumpeter Swan, Mallard
Riparian Mammals (i.e., mink)
Aquatic plants (submerged and emergent macrophytes)

Socioeconomic Environment

Employment and Income
Government finances
Community well-being
Public safety
Business opportunities
Community infrastructure and services

Surface Water Environment

Surface water quality and flow



Terrestrial Environment

Barn Swallow; Little Brown Bat; Northern Bat
Golden-winged Warbler; Snapping Turtle

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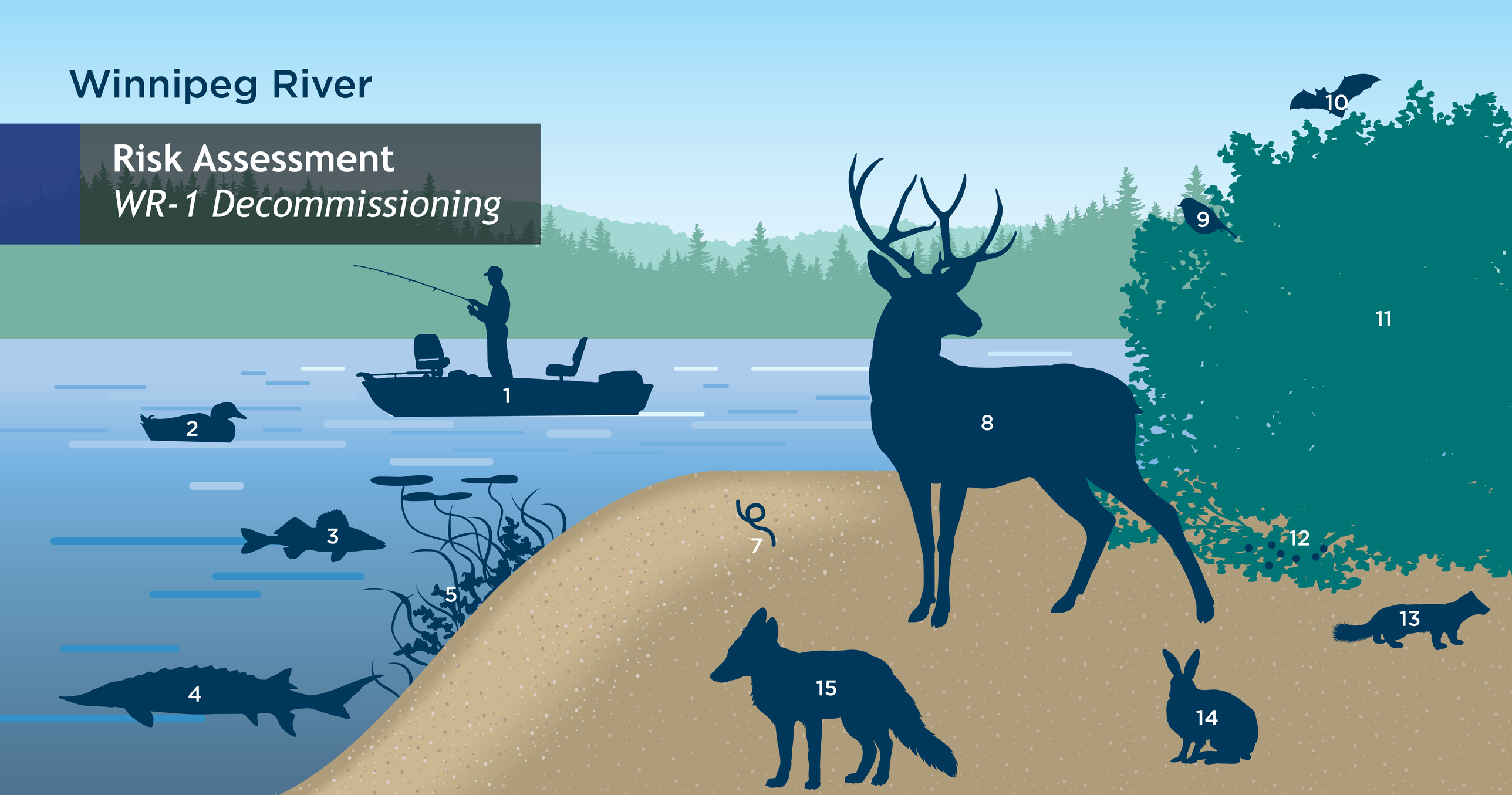
Winnipeg River

Risk Assessment
WR-1 Decommissioning



Sample Species Considered in Ecological and Human Health Risk Assessment Scenarios

1. Human
2. Mallard
3. Walleye
4. Lake sturgeon
5. Aquatic plants
6. Benthic invertebrates
7. Earthworm
8. Whitetail deer
9. Robin
10. Little brown myotis
11. Grass and bushes
12. Blueberries
13. Mink
14. Snowshoe hare
15. Red fox

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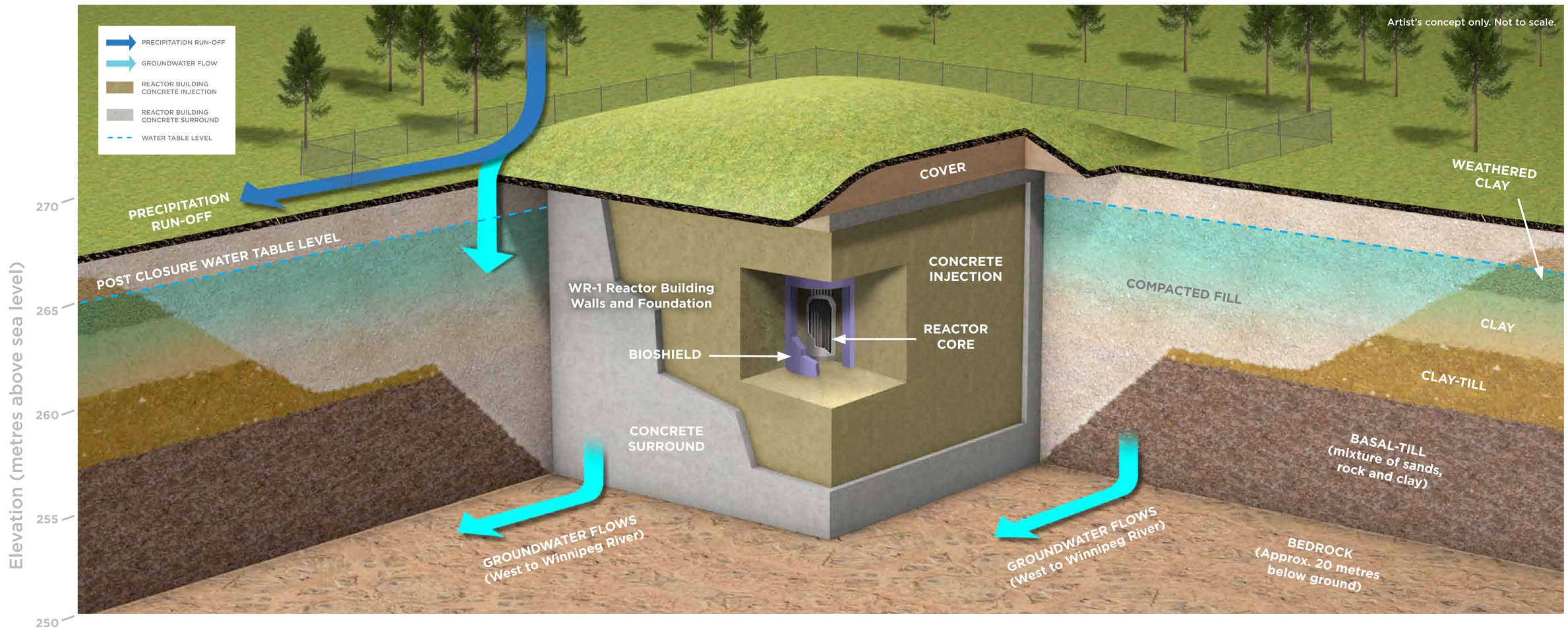
Hydrogeology
WR-1 Decommissioning

Hydrogeology is recognized as an important component of the environment that may be affected by the project and changes to hydrogeology could, in turn, lead to effects on other valued components (VC) selected for assessment. Acknowledging that changes to hydrogeology are considered to be important aspects of the natural and human environment, hydrogeology is referred to as an intermediate component. Results of the analysis of changes in measurement indicators for hydrogeology are provided to other disciplines for inclusion in their assessment.

CNL Whiteshell WR-1: Excavation, Foundation and Ground Water Flow — Projected Post-Decommissioning



The Environmental Assessment considered both groundwater quantity (i.e., the groundwater flow patterns and discharge rates and the groundwater table elevations), and groundwater quality (i.e., the peak solute loadings of contaminants in groundwater). A series of monitoring wells were installed to characterize these aspects of groundwater as they exist today, in addition for long term monitoring purposes.

Mitigation and Monitoring Measures

A multi-component final cover system will be installed to mitigate moisture infiltration into the reactor facility, which will limit the release of solutes into groundwater.

Preliminary modelling predicts that the contaminant release to the Winnipeg River reaches a maximum activity in the 100 year timeframe following decommissioning. This peak occurs at levels that are protective of people and the environment. A post-decommissioning monitoring program will be implemented for a period of 300 years that will provide sampling and analysis objectives and procedures for testing the groundwater quality in the vicinity of WR-1 Reactor Building.