

Small Modular Reactor Development Project

REGIONAL SITING CRITERIA AND SCORING INPUT

REGIONAL EVALUATION PROCESS (REP) APPENDIX A

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1. BACKGROUND

SaskPower operates a fleet of power generation facilities in the province of Saskatchewan. SaskPower's Generation Asset Management and Planning (GAMP) division maintains the long-term power supply plan and develops options to meet Saskatchewan's future electricity demands. One such future supply option under consideration is nuclear power from Small Modular Reactors (SMRs). SaskPower is early in the planning phase of a project with the goal of constructing an SMR for connection to the grid by 2034.

SaskPower is in the process of selecting and evaluating potential locations for an SMR facility. Study areas of interest were identified by compiling and applying technical, regulatory, and utility requirements under a regional assessment. Technical requirements were developed based on analysis of three different SMR technologies: 1) Boiling Water Reactor (GE-Hitachi, BWRX-300-300 MWe/unit), 2) High Temperature Gas Cooled Pebble Bed Reactor (X-Energy, Xe-100 – 80 MWe/unit), 3) Molten Salt Fast Reactor (Terrestrial Energy, IMSR400 – 195 MWe/unit). Subsequently, and following an extensive evaluation in collaboration with Ontario Power Generation, SaskPower selected the GE-Hitachi BWRX-300 for first potential deployment in Saskatchewan.

The regional assessment resulted in preliminary siting requirements or criteria that has been further developed, refined and validated through internal workshops at SaskPower. This process has been used to inform data acquisition and the development of spatial Indicators (spatial indicators are how the criteria is represented on a map) to be used by the GoldSET® decision-support tool. GoldSET® is software that allows multiple spatial indicators to be overlaid within the regional maps to analyze the region. This analysis was expanded to include additional non-technical risks and factors including environmental and social considerations deemed important for siting the SMR facility.

2. PURPOSE

This report documents the process of developing and evaluating spatial indicators to be used by GoldSET® to determine areas (and sites) of highest suitability for locating up to 600 MW of nuclear power from SMRs based on multi-criteria analysis of technical, environmental, and social and cultural criteria.



The scope of this document focuses on siting requirements based on the assessment by the SaskPower SMR Project Team¹. SaskPower intends to also follow a Regional Evaluation Process (REP), which is an approach to consider multiple levels of key stakeholder inputs in the site selection and evaluation process. The REP provides an opportunity for the stakeholders to be active participants and have awareness of the technical basis of project decisions. Feedback and potentially new spatial information important for siting the SMR may be incorporated to the siting study to further refine the site selection process.

3. APPROACH

The following section provides an overview of the approach used in preparing the SMR siting indicators.

3.1 DATA ACQUISITION AND PROCESSING

The preliminary list of indicators corresponding to environmental, social and cultural (social/cultural), and technical siting criteria was compiled and documented including the following attributes for each:

Table 1: Indicator Attributes

Attribute	Description
Indicator Name	A short working title of the indicator.
Indicator Theme	The primary theme (environmental, social/cultural or technical) where the indicator has been grouped. Some indicators may appear in different forms under other themes. For example, watercourses may be grouped under the environmental theme as a key ecosystem component, but may also have attributes which are technical considerations, such as watercourses as suitable sources for cooling water. Both perspectives are valid considerations for SMR siting.

¹ In this report, the SMR Project Team is in reference to those supporting SaskPower’s Small Modular Reactor (SMR) Development group. The work in this document was completed by SaskPower and external consultants, namely, Calian Group Ltd. and Golder Associates Inc.



Attribute	Description
Indicator Intent	A single sentence describing the primary intent of the indicator is provided. This describes the general direction and behavior of the indicator on siting using language such as, avoid, minimize, prefer, or maximize proximity or encroachment to the indicator.
Description	A detailed description is provided typically consisting of an overall explanation of the indicator, what it is intended to represent key attributes, and any other specifics that may be pertinent to SMR siting.
Data Source	The source reference of the data is provided including the origin or provider of the raw data and/or how it was derived.
Layer Pre-Processing and Comments	The GIS processing steps needed to convert the raw spatial data into the indicator are described including buffer criteria and specifications.
Geographic Extent	A map image of the indicator shows the extent of its spatial influence. Other information such as buffering or distance decay effects including suitability direction are also depicted. This represents how site suitability (or preference for a site) increases or decreases gradually with its distance from a given feature.
Exclusion Versus Suitability Criteria	This defines whether the indicator will be used as an exclusion (i.e., no-go) area where SMR development is prevented, or if it will be viewed as having some level of suitability (or constraint) for development. Suitability is expressed as a normalized score ranging from high (score = 100) to non-suitable (score = 0)



Attribute	Description
Buffer Criteria	<p>Various types of buffers may be added to indicators to modify their geographical extent beyond the original indicator polygon. The distance and direction of the buffer is at the discretion of the decision-maker(s).</p> <p>Types include:</p> <p><u>Simple Buffer</u>: A prescribed amount of distance is added to the original data polygon.</p> <p><u>Decay with Distance</u>: A buffer is added to the indicator polygon such that the suitability decreases from 100 to zero with distance. This creates a behavior that “closer is better”</p> <p><u>Increase with Distance</u>: A buffer is added to the indicator polygon such that the suitability increases from zero to 100 with distance. This creates the behavior that “further away is better”.</p>
Weighting	<p>The weight of the indicator for SMR siting is expressed on a normalized linear scale as a percentage ranging from 10% (low weight) to 100% (maximum weight).</p>

3.2 GOLDSET® AND ANALYTICAL HIERARCHY PROCESS (AHP) ANALYSIS

GoldSET® is a purpose-built decision support tool based on ArcGIS™ software. The tool uses multi-criteria spatial information to produce a map of suitability for SMR siting, as shown in Figure 1.

Analytical Hierarchy Process (AHP) is an established technique for organizing and analyzing highly complex decisions based on mathematics and human psychology and has been used extensively since the 1980s [1]. AHP is most often used in a group setting where experts from a wide range of perspectives estimate and build consensus on the relative importance of factors (indicators).

Rather than addressing a problem as a whole, AHP deconstructs the problem into smaller sub elements, each of which can be more easily understood and analyzed independently. The AHP approach provides a comprehensive and rational framework for:

- Structuring a decision problem;
- Representing and quantifying its elements;

- Relating those elements to overall goals; and
- Evaluating alternative solutions.

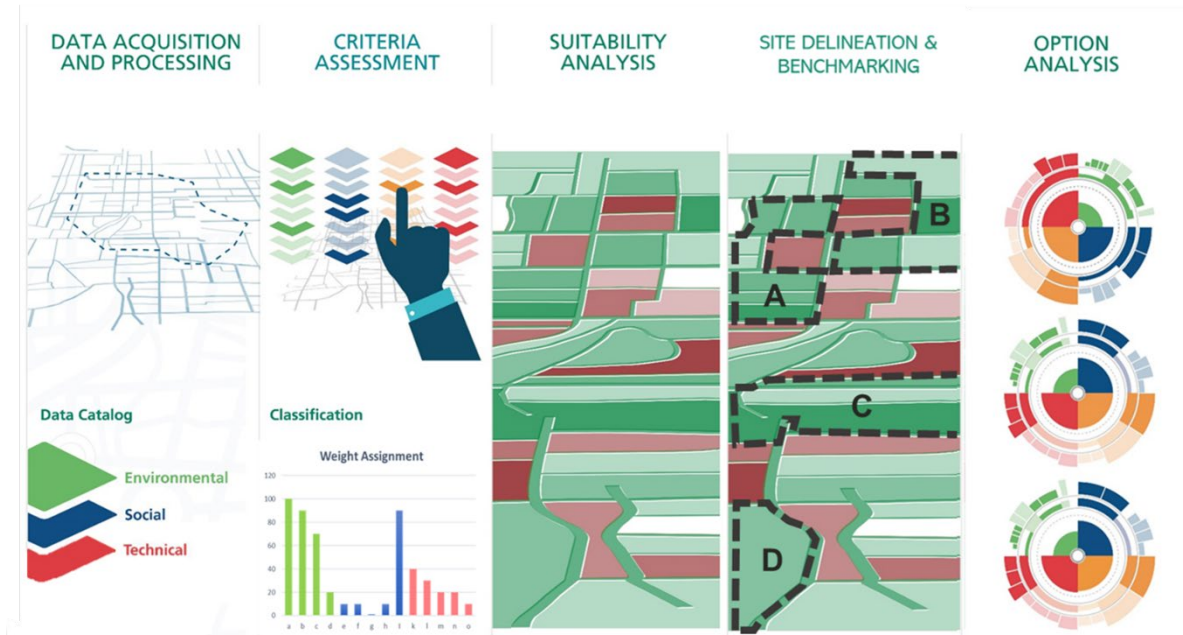


Figure 1: GoldSET® Approach

In GoldSET®, AHP begins by defining indicators first and then proceeds to evaluating the importance of the themes (environmental, social/cultural, and technical) once the indicators and their respective trade-offs are better understood.

Indicator weight is determined by assessing the relative prominence each indicator has to the other indicators within the same theme (e.g., environmental, social/cultural and technical). Weighting is expressed as a percentage (%) where the highest weight equals 100% and the lowest weight equals 10%. It is possible for several (or all) indicators to be assessed as having equal weighting for the purposes of decision making and share the same contribution to the outcome.

At a higher level in the hierarchy, GoldSET® themes are also assigned a weighting expressed as a percentage (%) where highest equals 100% and lowest equals 1%. Theme weights are determined by the relative importance of the environmental, social/cultural, and technical themes. Theme weights can be used to analyze the sensitivity of the criteria within each region. Trade-offs need to be calibrated and/or balanced against one another.



The AHP algorithm in GoldSET® determines the suitability score based on the normalized product of all theme and indicator weights, as shown in Equation 1 and Equation 2 [2]. The resulting suitability map represents the combined interaction of all themes and indicators as a normalized (0 to 100) scale of suitability for a particular development.

Equation 1: suitability is computed as a normalized product of weighted indicators.

$$S = \sum w_i x_i \quad \text{where} \quad \begin{array}{l} S = \text{suitability} \\ w_i = \text{weight of factor } i \\ x_i = \text{criterion score of factor } i \end{array}$$

Equation 2: the suitability formula may include the product of constraints (full exclusion areas).

$$S = \sum w_i x_i * \prod c_j \quad \text{where} \quad \begin{array}{l} c_j = \text{criterion score of constraint } j \\ \prod = \text{product} \end{array}$$

It should be noted that the more numerous indicators are within a theme, the more diluted their individual contribution is to overall suitability. Themes with a higher number of indicators are often given a higher theme weight to increase the contribution to suitability of those indicators. Conversely, themes with fewer indicators may have their weighting diminished to avoid biasing the GoldSET® model in that theme's direction.

The final GoldSET® suitability output is visualized spatially as a “heat map” with highly suitable areas expressed in darker shades of green, neutral as yellow shades, and low suitable areas shown in darker red. Exclusion areas are removed from the map and appear as voids.



3.3 REGIONAL SITING CRITERIA AND WEIGHTING

The “Indicator Workbook Table” presented for comment through the REP is provided as Annex A. Indicator Workbook Table.



REFERENCES

- [1] Saaty, T. "The Analytic Hierarchy Process: Planning, Priority Setting, Resource Allocation". ISBN 0-07-054371-2, McGraw-Hill, 1980
- [2] Marinoni, O. "Implementation of the analytical hierarchy process with VBA in ArcGIS". Computers & Geosciences, Vol. 30, Issue 6, pp. 637-646, 2004.



ANNEX A. INDICATOR WORKBOOK TABLE

SLIDE ID	THEME	NAME	SHORT DESCRIPTION	DESCRIPTION	LAYER PRE-PROCESSING AND COMMENTS/WEIGHTING	DATA SOURCE
1	Environmental	Aquatic Species at Risk Range	Minimize encroachment on aquatic Species at Risk (SAR) distribution range	Includes the aquatic Species at Risk Act (SARA) distribution (range). Bigmouth Buffalo and Mountain Sucker species are included. Development in these areas may be hindered by increased social scrutiny and regulatory concerns.	10 km buffer added. Weighting: 20	Fisheries and Oceans Canada's (DFO)
2	Environmental	Federal Critical Habitat	Avoid areas with sensitive species	Critical habitat and important habitat for species at risk listed on Schedule 1 of the federal Species at Risk Act (SARA) occurs in Saskatchewan. Not all the area within these boundaries is necessarily critical habitat and should be considered in conjunction with the complementary species' recovery document. Both proposed and final areas are included.	Exclusion, no buffer added.	Environment and Climate Change Canada
3	Environmental	Federal Critical Habitat Proximity	Minimize proximity to areas with sensitive species	Critical habitat and important habitat for species at risk listed on Schedule 1 of the federal Species at Risk Act (SARA) occurs in Saskatchewan. These areas should be considered in conjunction with the complementary species' recovery document(s). Both proposed and final areas are included.	0 to 10 km distance decay buffer added. Weighting: 50	Environment and Climate Change Canada



SLIDE ID	THEME	NAME	SHORT DESCRIPTION	DESCRIPTION	LAYER PRE-PROCESSING AND COMMENTS/WEIGHTING	DATA SOURCE
4	Environmental	Managed Lands	Minimize encroachment on managed lands	Managed lands include the representative areas network, agricultural crown land, game preserves, conservation easements, ecological reserves, special management areas, wildlife habitat protection lands, wildlife refuges, land claim selections, crown conservation easements, protected and conserved area network lands, parks/sports fields, federal pastures, and crown land subdivisions.	No buffer added. Weighting: 50	Saskatchewan Ministry of Environment
5	Environmental	Protected Lands	Avoid encroachment on protected lands	Protected lands include national wildlife areas, migratory bird sanctuaries, national parks, provincial parks, recreation sites, regional parks, parks authority lands, parks historic sites, fish & wildlife development fund lands and representative areas.	Exclusion, no buffer added.	Saskatchewan Ministry of Environment (data includes federal lands)
6	Environmental	Protected Lands Proximity	Minimize proximity to protected lands	Protected lands include national wildlife areas, migratory bird sanctuaries, national parks, provincial parks, recreation sites, regional parks, parks authority lands, parks historic sites, fish & wildlife development fund lands and representative areas.	0-5 km low suitability, 5-10 km distance decay buffer. Weighting: 20	Saskatchewan Ministry of Environment



SLIDE ID	THEME	NAME	SHORT DESCRIPTION	DESCRIPTION	LAYER PRE-PROCESSING AND COMMENTS/WEIGHTING	DATA SOURCE
7	Environmental	Rare/Endangered Species	Avoid rare and endangered species	Development in areas with rare and endangered species may be hindered by increased social scrutiny and regulatory concerns. Note, these data have been assigned a lower weight in the siting model because they are largely based on observed occurrence versus habitat. Observations may be sporadic and geographically inconsistent over time; whereas habitat distribution is a more reliable measure of the range over which species may occur. See Terrestrial Wildlife Habitat Inventory (Indicator 8).	No buffer added. Weighting: 10	Saskatchewan Conservation Data Centre (SKCDC)
8	Environmental	TWHI Wildlife Habitat	Minimize encroachment on Terrestrial Wildlife Habitat Inventory (TWHI) areas	Development in areas identified by the Terrestrial Wildlife Habitat Inventory may be hindered by increased social scrutiny and regulatory concerns.	No buffer added. Weighting: 50	Wildlife Branch, Saskatchewan Ministry of Environment



SLIDE ID	THEME	NAME	SHORT DESCRIPTION	DESCRIPTION	LAYER PRE-PROCESSING AND COMMENTS/WEIGHTING	DATA SOURCE
9	Environmental	Waterbodies	Avoid development on permanent waterbodies	Encroachment on permanent waterbodies including an appropriate setback distance must be avoided.	Added selected waterbodies from SaskPower and removed intermittent waterbodies. Added a 50 m buffer to the exclusion.	CanVec, Geogratias, Natural Resources Canada (NRCan) / SaskPower
10	Environmental	Watercourses	Avoid development on permanent watercourses	Encroachment on permanent watercourses including an appropriate setback distance must be avoided.	Exclusion, 50 m buffer added.	CanVec, Geogratias, Natural Resources Canada (NRCan)
11	Environmental	Wetlands	Avoid development on wetlands	Encroachment on wetlands should be avoided. Includes CanVec intermittent waterbodies defined as a body of water coming and going at intervals and saturated soils defined as areas with vegetation requiring a significant amount of water.	Add intermittent waterbodies. No buffer added. Weighting: 80	CanVec, Geogratias, Natural Resources Canada (NRCan)
12	Environmental	Woodland Caribou Habitat	Avoid encroachment in caribou habitat	Draft Caribou Habitat Management Areas (CHMAs) are based on known woodland caribou use and habitat potential mapping, including Tier 1, 2 and 3 areas. Development in these areas may be hindered by increased social scrutiny and regulatory concerns.	Exclusion, no buffer added.	Saskatchewan Ministry of Environment



SLIDE ID	THEME	NAME	SHORT DESCRIPTION	DESCRIPTION	LAYER PRE-PROCESSING AND COMMENTS/WEIGHTING	DATA SOURCE
13	Social and Cultural	Cemeteries	Avoid quarter sections with cemeteries	Encroachment on quarter sections with cemeteries should be avoided due to their social and cultural sensitivity.	Include only quarter sections with cemeteries. https://www.saskgenealogy.com/index.php/saskatchewan-cemeteries/	Saskatchewan Cemeteries Project Information Services
14	Social and Cultural	Department of National Defence (DND) Military Lands	Avoid proximity to military bases and airspace	Department of National Defence (DND) Military Lands conduct activities and store explosives, weapons and other equipment which are not compatible with the location of a SMR. The EPRI "Advanced Nuclear Technology: Site Selection and Evaluation Criteria for New Nuclear Power Generation Facilities (Siting Guide)" (2015) recommends an exclusion setback of 5 miles, or 8 km.	Exclusion, 8 km buffer added.	IHS Markit Canada ULC
15	Social and Cultural	First Nations Reserves	First Nations Land will be considered case by case	The effect of this indicator is neutral (placeholder) to the model results.	No buffer added.	Geogratis, Natural Resources Canada (NRCan)



SLIDE ID	THEME	NAME	SHORT DESCRIPTION	DESCRIPTION	LAYER PRE-PROCESSING AND COMMENTS/WEIGHTING	DATA SOURCE
16	Social and Cultural	Future Urban Development	Minimize encroachment on future development lands	Encroachment on land adjacent to urban municipality boundaries and First Nations communities should be minimized. Areas beyond 5 km of communities is assumed to have a lower risk of high-density development in the next 60 years.	Zero to 5 km is low suitability, from 5 to 10 km distance decay is from low to high from urban municipalities. A 500 m buffer added to areas within First Nations reserves with a population density > 50 people/km ² Weighting: 10	Information Services Corporation (ISC)



SLIDE ID	THEME	NAME	SHORT DESCRIPTION	DESCRIPTION	LAYER PRE-PROCESSING AND COMMENTS/WEIGHTING	DATA SOURCE
17	Social and Cultural	Heritage Sensitivity	Avoid sensitive heritage resources	Heritage sensitive describes the potential of a quarter section to contain intact archaeological and/or paleontology sites. This includes Conditionally Sensitive and Sensitive lands. Detailed cultural, archeological, and paleontological investigations will be conducted at the local siting level.	Non-sensitive land or null = 100 (highest suitability) Conditionally Sensitive = 50 Sensitive = 0 (lowest suitability). Weighting: 10	Heritage Conservation Branch, Saskatchewan Ministry of Parks, Culture and Sport
18	Social and Cultural	International Border	Avoid proximity to international border	Proximity to international borders should be considered as there may be legal and/or treaty considerations. The effect of this indicator is neutral (placeholder) to the model results.	0 - 25 km distance decay buffer added.	International Boundary Commission
19	Social and Cultural	Population Density	Minimize encroachment of moderate population density	Land with higher population density is less suitable. This can be a proxy for socially sensitive areas such as residences, local parks, urban infrastructure, and emergency services.	Indicator processed with a linear, increasing scale of suitability from 200 people/km ² to 0. Weighting: 80	Stats Canada 2016 Census data



SLIDE ID	THEME	NAME	SHORT DESCRIPTION	DESCRIPTION	LAYER PRE-PROCESSING AND COMMENTS/WEIGHTING	DATA SOURCE
20	Social and Cultural	Population Density > 200	Avoid areas of high population density	Land with a population density greater than 200 people per square km is excluded. This can be a proxy for socially sensitive areas such as residences, local parks, urban infrastructure, and emergency services.	Exclusion, join population to dissemination blocks and use area to calculate population density; query > 200.	Stats Canada 2016 Census data
21	Social and Cultural	Proximity to Workforce	Prefer sites within 75 km of settlements >2,000 people	Population centers greater than 2,000 people provide a localized workforce and access to emergency services (e.g., hospitals, fire, police, and EMS). The 2016 Statistics Canada Census data was used for communities above 1,800 people to which a 2% annual compounded growth rate was applied.	Calculate population of populated areas by adding the population of dissemination blocks within them. Distance decay buffer added from 0 to 75 km. Weighting: 100	Stats Canada 2016 Census data
22	Social and Cultural	SaskPower Lands	Prefer sites on land already owned by SaskPower.	It is preferable to site the SMR on lands owned by SaskPower.	No buffer added. Weighting: 50	SaskPower



SLIDE ID	THEME	NAME	SHORT DESCRIPTION	DESCRIPTION	LAYER PRE-PROCESSING AND COMMENTS/WEIGHTING	DATA SOURCE
23	Social and Cultural	Urban Municipal Areas	Avoid encroaching on urban areas	Avoid siting within the legal boundary of urban municipalities and First Nations communities. An additional buffer of 500 m was added to small First Nations settlements where settlement boundaries were uncertain.	No buffer added on urban municipalities. 500 m exclusion buffer added to areas within First Nations reserves with a population density > 50 people/km ²	Information Services Corporation (ISC) Stats Canada 2016 Census data Geogratis, Natural Resources Canada (NRCan)
24	Technical	Aerodrome - Large	Aerodrome airspace with radius of greater than 6 km	The site must not be within airspace with a radius of greater than 6 km. Commercial airports, non-commercial service airports and aerodromes are included. Aerodrome Airspace areas from the Saskatchewan Government web mapping service were used.	Query radius of aerodromes. Remove features with a radius less than 6 km. No additional buffer added. Indicator is an exclusion.	NavCanada



SLIDE ID	THEME	NAME	SHORT DESCRIPTION	DESCRIPTION	LAYER PRE-PROCESSING AND COMMENTS/WEIGHTING	DATA SOURCE
25	Technical	Aerodrome - Small	Aerodrome airspace with radius of less than 6 km	The site should not be within airspace with a radius of less than 6 km. Commercial airports and non-commercial service airports, aerodromes, and heliports are included. Aerodrome Airspace areas from the Saskatchewan Government web mapping service were used.	Query radius of aerodromes. Remove features with a radius greater than 6 km. No additional buffer added. Weighting: 100	NavCanada
26	Technical	Airspace - Advisory	Minimize encroachment on advisory restricted airspace (CYA)	Includes Class F federal airspace advisory (CYA) airspace reserved for civilian pilot training, emergency services, and/or air ambulance operations.	Query CYA, no buffer added. Weighting: 100	Saskatchewan Ministry of Environment
27	Technical	Airspace - Restricted	Avoid encroaching on federally restricted airspace (CYR)	Includes federally restricted Class F airspace (CYR) for military training, correctional services, emergency services and within 3 nautical miles (5.6 km) of airports or any certified airport listed in the Canadian Flight Supplement.	Query CYR. Exclusion, no buffer added.	Saskatchewan Ministry of Environment



SLIDE ID	THEME	NAME	SHORT DESCRIPTION	DESCRIPTION	LAYER PRE-PROCESSING AND COMMENTS/WEIGHTING	DATA SOURCE
28	Technical	Dams	Avoid proximity to dam sites	SMR can be sited within a few kilometers of dams on reservoirs but not in close proximity. Dams were categorized for different setback distances by a subject matter expert knowledgeable of Saskatchewan dams. More detailed hazard evaluations should be done to assess risk. Additional guidance on establishing minimum distances from these sites is provided in the US NRC Regulatory Guide 1.91	Combine "WSA Dams" and "Dams" datasets. Consider major or non-major WSA dams, owner of other dams and imagery to assign 250 m, 500 m or 1 km setback. Weighting: 10	Water Security Agency (WSA)
29	Technical	Drought Potential	Avoid areas with drought potential	Site shall not be situated in an area with high drought frequency. The Climate Moisture Index (CMI) was calculated as the difference between annual precipitation and potential evapotranspiration (PET) – the potential loss of water vapour from a landscape covered by vegetation. Positive CMI values indicate wet or moist conditions. Negative CMI values indicate dry conditions. The CMI is well suited to evaluating moisture conditions in dry regions such as the Prairie Provinces and has been used for other ecological studies. This indicator may be representative of the long-term climate risk due to climate change.	Larger Climate Moisture Index (CMI) values are more suitable. Weighting: 10	Environment and Climate Change Canada Canadian Climate Normals 1981 - 2010



SLIDE ID	THEME	NAME	SHORT DESCRIPTION	DESCRIPTION	LAYER PRE-PROCESSING AND COMMENTS/WEIGHTING	DATA SOURCE
30	Technical	Existing Power Plants	Proximity to existing power plants	This indicator is neutral (a placeholder) to the model results. Assessment needed.	Neutral.	SaskPower
31	Technical	Faults	Avoid areas with active faults	The US NRC Appendix A to Part 100 includes Table 1 which presents the minimum length of faults to be considered as a function of distance from site. Detailed studies are required during local siting to determine actual fault data to be used. The effect of this indicator is neutral (placeholder) to the model results.	Neutral.	Saskatchewan Mining and Petroleum GeoAtlas, Faults 250K
32	Technical	Gas Storage	Avoid areas of gas storage in salt caverns	Storage of hydrocarbons and CO ₂ occur at certain locations in underground reservoirs and salt caverns. These locations are not suitable for locating an SMR.	Confidential data to be screened separately.	SaskEnergy, confidential data
33	Technical	Hazardous Facilities	Avoid siting adjacent to hazardous facilities	Major facilities include manufacturing, chemical, petrochemical, agricultural, refining, and mining. Exclude existing power generation facilities. Exclude industrial solid depot, domestic waste, and liquid waste.	Exclusion, 1 km buffer	IHS Markit Canada ULC Environment and Climate Change Canada, National Pollutant Release Inventory (NPRI)



SLIDE ID	THEME	NAME	SHORT DESCRIPTION	DESCRIPTION	LAYER PRE-PROCESSING AND COMMENTS/WEIGHTING	DATA SOURCE
34	Technical	Hazardous Facilities Proximity	Avoid proximity to hazardous facilities	Major facilities include manufacturing, chemical, petrochemical, agricultural, refining, and mining. Exclude existing power generation facilities. Exclude industrial solid depot, domestic waste, and liquid waste.	8 km distance decay, Weighting: 50	IHS Markit Canada ULC Environment and Climate Change Canada, National Pollutant Release Inventory (NPRI)
35	Technical	High Pressure Pipeline Proximity	Avoid proximity to high pressure pipelines	The site should not be in proximity to high pressure hydrocarbon pipelines.	Distance decay buffer to 1 km added Weighting: 80	IHS Markit Canada ULC Water Security Agency (WSA), Geomatics unit.



SLIDE ID	THEME	NAME	SHORT DESCRIPTION	DESCRIPTION	LAYER PRE-PROCESSING AND COMMENTS/WEIGHTING	DATA SOURCE
36	Technical	Highway Proximity - Primary	Prefer areas within 1 km of primary weight highways	The site has multimodal transportation infrastructure access for heavy equipment during all life cycles of the project. Roads should be designed to withstand heaviest shipment loads from the SMR facility, which will be during construction. Only year-round primary weight highways are considered. These are also favorable as they are less prone to flooding.	Classify highways based on 2021 weight classification map. Only include Primary Weight and Primary Weight by Ministerial Order. Suitability from 0-1 km is high (100), 1-5 km distance decay buffer added. Weighting: 50	Saskatchewan Ministry of Highways



SLIDE ID	THEME	NAME	SHORT DESCRIPTION	DESCRIPTION	LAYER PRE-PROCESSING AND COMMENTS/WEIGHTING	DATA SOURCE
37	Technical	Highway Proximity - Secondary	Prefer areas within 1 km of secondary weight highways	Secondary roads are important for access during operation and during states of emergency. Secondary weight highways, 9-month primary weight highways and 8,000 kg restricted highways would be in better condition than highways not included on the weight classification map.	Only include secondary weight highways, 9-month primary weight highways, and 8,000 kg restricted highways. Suitability from 0-1 km is high (100), 1-5 km distance decay buffer added. Weighting: 30	Saskatchewan Ministry of Highways
38	Technical	Historical Fires	Avoid areas with high potential for severe fires	The site should not be situated in an area with high fire frequency as indicated by previous, historical fire activity	Dissolve historical wildfires. Kernel density on historical wildfire outlines. Weighting: 80	Saskatchewan Public Safety Agency (SPSA) Saskatchewan Ministry of Environment, Wildfire Management Branch



SLIDE ID	THEME	NAME	SHORT DESCRIPTION	DESCRIPTION	LAYER PRE-PROCESSING AND COMMENTS/WEIGHTING	DATA SOURCE
39	Technical	Linear Infrastructure	Avoid siting on existing linear infrastructure	The site should not be situated on top of existing linear infrastructure. Primary and secondary highways, railways, and 72 kV and higher transmission lines are included.	Combine data sources. No buffer added to exclusion.	Saskatchewan Ministry of Highways Geogratis, Natural Resources Canada (NRCan) SaskPower
40	Technical	Mining	Avoid proximity to mines	The site should not be situated on or near active, abandoned, transitional, or operating mines.	5 km distance decay buffer added. Weighting: 10	Natural Resources Canada (NRCan), Lands and Minerals Sector, Saskatchewan Mining and Petroleum GeoAtlas, Saskatchewan Mining WMS



SLIDE ID	THEME	NAME	SHORT DESCRIPTION	DESCRIPTION	LAYER PRE-PROCESSING AND COMMENTS/WEIGHTING	DATA SOURCE
41	Technical	Oil and Gas Wells	Avoid siting on oil and gas wells	Oil and gas developments including processing facilities, wells, and disposal wells are not suitable for locating an SMR.	Use surface location for non-vertical wells. Retain these status fields: Active, Downhole, Planned, Suspended and Re-entered. A 500 m buffer added to exclusion.	IHS Markit Canada ULC Saskatchewan WMS
42	Technical	Oil and Gas Wells Proximity	Avoid proximity to oil and gas wells	The site should not be in close proximity to oil and gas wells.	Distance decay to 1 km buffer added. Weighting: 80	IHS Markit Canada ULC Saskatchewan WMS
43	Technical	Pipelines	Avoid siting on high pressure and water pipelines	The site should not be near high pressure hydrocarbon or water pipelines.	Exclusion. 500 m buffer added.	IHS Markit Canada ULC Water Security Agency (WSA), Geomatics unit.



SLIDE ID	THEME	NAME	SHORT DESCRIPTION	DESCRIPTION	LAYER PRE-PROCESSING AND COMMENTS/WEIGHTING	DATA SOURCE
44	Technical	Railway Proximity - Mainline	Prefer sites closer to railway access	The site should have multimodal transportation infrastructure access for heavy equipment during all life cycles of the project; roads and railways are within 2 km of the site. Interprovincial railways are less preferred than spurs.	Remove discontinued fields and spurs. Suitability from 0-1 km is high (100), 1-5 km distance decay buffer added. Weighting: 20	Geogratis, Natural Resources Canada (NRCan)
45	Technical	Railway Proximity - Spurs	Prefer sites closer to railway access	The site should have multimodal transportation infrastructure access for heavy equipment during all life cycles of the project; roads and railways are within 2 km of the site. Railway spurs (lines with dead ends) are preferred.	Remove discontinued fields and spurs. Suitability from 0-1 km is high (100), 1-5 km distance decay buffer added. Weighting: 50	Geogratis, Natural Resources Canada (NRCan)



SLIDE ID	THEME	NAME	SHORT DESCRIPTION	DESCRIPTION	LAYER PRE-PROCESSING AND COMMENTS/WEIGHTING	DATA SOURCE
46	Technical	Regional Power Demand	Prefer sites closer to regional demand for power	Prefer sites with close proximity to major load centres and/or areas with significant planned generation retirement.	Include Regina, Saskatoon, Estevan, Coronach and Weyburn from Urban Municipal Areas. High suitability within 50 km. Distance decay to 200 km. Weighting: 80	Information Services Corporation (ISC)
47	Technical	Seismic Hazard	Avoid areas of moderate to high seismic hazard	Areas where regional hazard mapping shows peak ground accelerations (PGAs) exceeding 0.30 g at a probability of exceedance of 2% in 50 years shall be excluded. The largest PGA within 10 km of a potential water source in Saskatchewan is about 0.14 g.	Larger peak ground accelerations (PGA) values are less suitable. Weighting: 10	Geogratias, Natural Resources Canada (NRCan)
48	Technical	Severe Precipitation	Avoid areas of high precipitation exceeding design amounts	Probable maximum precipitation (PMP) is used as a proxy for severe precipitation.	Larger probable maximum precipitation (PMP) values are less suitable. Weighting: 20	Environment Canada R. F. Hopkinson 1999



SLIDE ID	THEME	NAME	SHORT DESCRIPTION	DESCRIPTION	LAYER PRE-PROCESSING AND COMMENTS/WEIGHTING	DATA SOURCE
49	Technical	Surficial Geology	The site should be geotechnically stable	Surficial geology should be suitable for building infrastructure on.	Geotechnical team scored surficial geology types and linear landform types for siting suitability. When no subtype is available, classify manually within Local Study Area. Buffer linear landforms by 500 m and use instead where they exist. Weighting: 100	Saskatchewan Mining and Petroleum GeoAtlas, Surficial Geology 250K
50	Technical	Tornado Potential	Avoid areas with high potential for tornadoes	Tornadoes historically occur throughout the southern portion of Saskatchewan but occur in some locations more frequently based on past observations. It is assumed that tornadoes will continue to occur on a more frequent basis in locations where they have been frequent in the past. Further detailed studies will be required to determine specific site risk(s).	Calculate density of tornadoes based on previous, known, historical tornado occurrences. Weighting: 20	Environment and Climate Change Canada Tornado Database (1980-2009)



SLIDE ID	THEME	NAME	SHORT DESCRIPTION	DESCRIPTION	LAYER PRE-PROCESSING AND COMMENTS/WEIGHTING	DATA SOURCE
51	Technical	Transmission Grid 230 kV	Proximity to the 230 kV transmission grid	This indicator is neutral (a placeholder) to the model results. Assessment needed.	Neutral.	SaskPower
52	Technical	Water Sources	Prefer sites within 10 km of highly suitable water sources	The site should be within 10 km of a suitable water source. Water availability factors, water quality factors, and physical water body characteristics have been considered.	Water resources created a suitability index with a 10 km buffer added. Use highest suitability where buffers overlap. Weighting: 100	SaskPower, Golder, CanVec, Geogratia, Natural Resources Canada (NRCan)
53	Technical	Water Sources Proximity	Suitable water sources should be located within 3 km	Although other references have indicated 10 km as an acceptable distance, the SMR regional assessment study has chosen a lower distance to address potential water supply delivery and cost risks (e.g., 3 km or less distance).	Suitability from 0-3 km is high (100), 3-10 km distance decay buffer added. Weighting: 100	SaskPower, Golder, CanVec, Geogratia, Natural Resources Canada (NRCan)



SLIDE ID	THEME	NAME	SHORT DESCRIPTION	DESCRIPTION	LAYER PRE-PROCESSING AND COMMENTS/WEIGHTING	DATA SOURCE
54	Technical	Water Wells	Avoid proximity to water wells	Water wells should be avoided for siting the SMR. These include all water uses except domestic which will be considered on a site-by-site basis. Quality monitoring, recharge waste disposal, and withdrawal well uses are included. Due to uncertainty in the well location based on the spatial data available, the entire quarter section was used as an extent if a well is present.	Remove domestic wells. Only include quality monitoring, recharge waste disposal, unknown and withdrawal well uses. Apply to full quarter section boundary. Weighting: 10	Water Security Agency (WSA)