

**Value Chain Solutions-
Heartland Complex
(Bitumen Upgrader
and Specialty Refinery)
Expansion Project**

Initial Project Description

November 2020

**Submitted to:
Impact Assessment Agency of Canada**

**Submitted by:
Value Chain Solutions, Inc.**



Acronyms

AAAQO	Alberta Ambient Air Quality Objective
ACO.....	Aboriginal Consultation Office
ADC™	Accelerated DeContamination™
AER	Alberta’s Energy Regulator
AIH	Alberta’s Industrial Heartland
bpd	barrels per day
CO	carbon monoxide
CO ₂	carbon dioxide
CO ₂ e	carbon dioxide equivalent
COCT™	Clean Oil Cracking™
COLF.....	Clean Oil La-Fit, VCS-H crude oils brand name
DCO	decontaminated oil
Dilbit	diluted bitumen
DRU	diluent recovery unit
EIA	environmental impact assessment
EPEA	<i>Environmental Protection and Enhancement Act</i>
FAP	Fort Air Partnership
GHG.....	greenhouse gas
H ₂ S	hydrogen sulphide
H ₂	hydrogen
IAA.....	<i>Impact Assessment Act</i>
IAAC.....	Impact Assessment Agency of Canada
LPG	liquefied petroleum gas
NH ₃	ammonia
NO _x	oxides of nitrogen
OSCA	<i>Oil Sands Conservation Act</i>
PM.....	particulate matter
PM _{2.5}	fine particulate matter less than 2.5 µm in diameter
ppm	parts per million
ROW.....	Right-of-Way
SO ₂	sulphur dioxide
VCI	Value Creation Inc.
VCG.....	Value Creation Group
VCS	Value Chain Solutions Inc.
VCS-H	Value Chain Solutions–Heartland Complex
WRHP™	Wide Range Hydroprocessing

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General Information

Background Information

Value Chain Solutions Inc. (VCS) has the focused mission to achieve a fundamental shift in the Oil Sands Industry by converting bitumen to clean oil with best-in-class environmental performance in an economically competitive way. VCS, a wholly owned subsidiary of Value Creation Inc., is the operating company of a partially built bitumen upgrader and specialty refinery, named Value Chain Solutions-Heartland Project, short for VCS-H Project 1 in this document. Value Creation Inc. holds the regulatory approvals of VCS-H Project 1.

An Environmental Impact Assessment (EIA) was completed for the approved VCS-H Project 1 in 2004.¹ Diluted bitumen (DilBit) upgrading/specialty refining with a capacity up to 29,890 m³/day (188,000 barrels/day) was approved by the Alberta Energy Regulator (AER) under:

- *Oil Sands Conservation Act* (OSCA) Approval No. 10330B;
- *Environmental Protection and Enhancement Act* (EPEA) Approvals No. 203303-01-00, 203303-01-01; and
- *Water Act* (WA) Approval No. 1001178 and *Water Act* (WA) License No. 00224750-01-00 to withdraw water from the North Saskatchewan River.

A Tank Farm (petroleum storage facility) with a storage capacity of 256,600 m³ (1.6 million barrels)², serving VCS-H Project 1, was approved in 2017 under:

- EPEA Approval No. 387876-00-00.

1. Project Overview

VCS is proposing to construct and operate the Value Chain Solutions-Heartland Complex Expansion Project (the Expansion or the Project). The proposed Project is the expansion of the approved VCS-H Project 1, that will increase the input capacity by a factor of four, for a total combined capacity of up to 119,240 m³/day or 750,000 barrels/day. The combined approved VCS-H Project 1 and proposed Expansion is referred to as the VCS-H Complex. The Project life for the VCS-H Complex as a whole is anticipated to be over 50 years.

The proposed Expansion will also increase the petroleum storage capacity by 1,067,000 m³ (6.7 million barrels) to a total capacity of 1,323,600 m³ (8.3 million barrels) for the entire VCS-H Complex. The proposed Expansion will be implemented in 3 stages, following the approved VCS-H Project 1, named Project 2, 3 and 4 constituting the Expansion.

VCS plans to prepare and submit an integrated EIA and application for the Expansion to amend OSCA Approval No. 10330B and EPEA Approval No.'s 203303-01-01 to the AER.

The Project will be located on private land immediately adjacent to the approved VCS-H Project 1. This land is situated northeast of Edmonton, in the designated Astotin Heavy Industrial Area of Strathcona County within Alberta's Industrial Heartland (AIH) (Figure 1). The proposed Expansion is centered at the south half of Section 11,

¹ No federal comprehensive study of environmental assessment was triggered under the *Canadian Environmental Assessment Act* (1992) in 2004-2005 during the VCS-H Project 1 EIA review stage.

² The Tank farm serving VCS-H Project 1 has a proposed petroleum storage capacity of 256,600 m³, under the threshold of designating physical activities for petroleum storage capacity of 500,000 m³ or more (SOR-2012-147, Schedule 14 as of 2016).

Township 056, Range 21, West of the 4th Meridian, approximately 18 km northeast of the City of Fort Saskatchewan and 8 km west of the Town of Bruderheim.

Similar to the approved VCS-H Project 1, the proposed Expansion will use proprietary technology to upgrade and refine diluted bitumen to value-added products such as premium-medium synthetic crude oil, naphtha, diluent, ultra-low sulphur diesel, and additional blend products: cleaned heavy crude oil and low sulphur marine fuel. VCS-H Complex will reduce net greenhouse gas (GHG) emissions, add value within Alberta and Canada, free up the pipeline bottleneck, broaden the market, and achieve robust economics against volatilities in oil price and light/heavy price differentials.

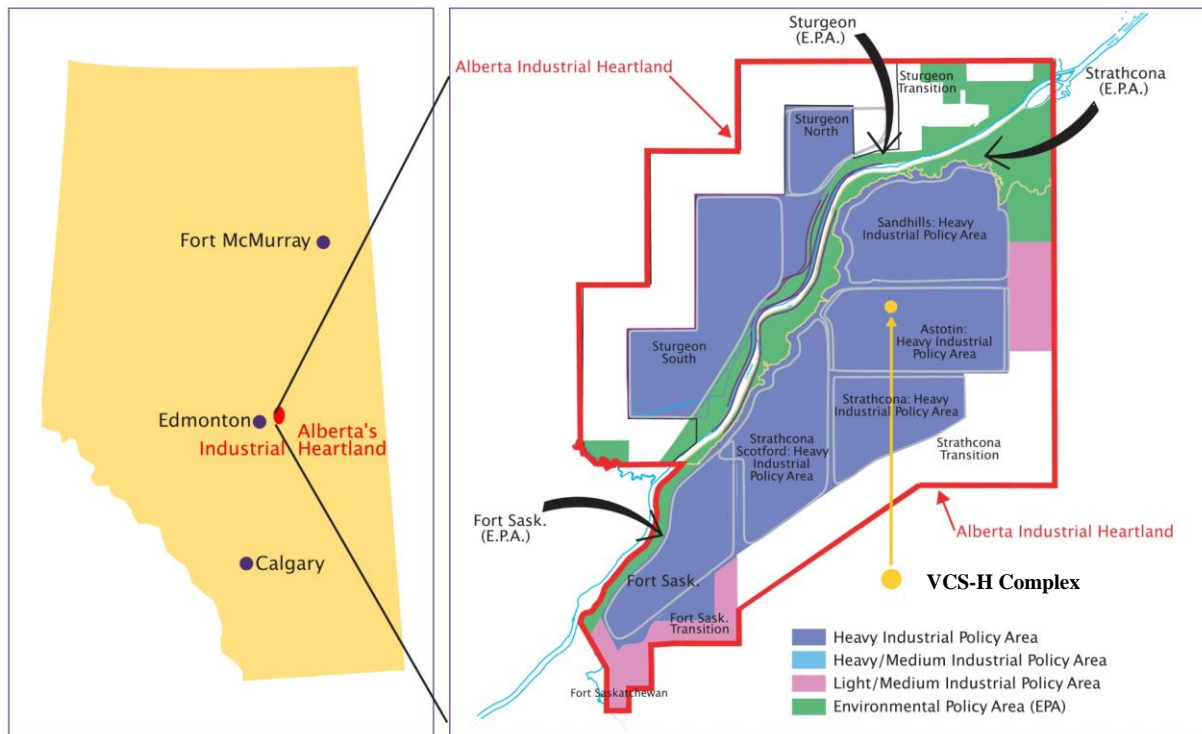


Figure 1 Location of VCS-H Complex in Alberta's Industrial Heartland

2. Contact Information

The Project proponent is Value Chain Solutions Inc. (VCS), a wholly owned subsidiary of Value Creation Inc. (VCI).

Value Chain Solutions Inc.
1100, 635-8th Avenue SW Calgary, Alberta T2P 3M3
Telephone: 403.539.4500 (Calgary) or 1-855-908-8800 Fax: 403.539.4501
Website: www.vcsb2co.com

Contacts for the purpose of the description of the proposed Expansion:
Cindy Yin, Coordinator – VCS-H Regulatory Applications
Iva Georgieva, Government, Regulatory & Stakeholder Relations

Project email: VCS.Heartland@vctek.com

3. Engagements Undertaken

Early engagement on the proposed Expansion has included communication with the local municipal authorities (City of Fort Saskatchewan, Town of Bruderheim and Strathcona County), the AER and the Impact Assessment Agency of Canada (IAAC). In addition to the current Initial Project Description and subsequent Detailed Project Description to be submitted to the IAAC, VCS plans to prepare and submit an integrated EIA and application for the Expansion to the AER. VCS is working with independent environmental consultancy agencies to summarize environmental baseline information and to prepare the applications.

Fisheries and Oceans Canada has been contacted and a Request for Review form will be submitted in due course. VCS will contact Transport Canada with any relevant changes proposed for the Expansion to update VCS-H permits/approvals as required. Additional provincial agencies such as Alberta Transportation will also be contacted regarding the Expansion for traffic impact assessment for the EIA and subsequent railway works approvals.

The municipal authority (Strathcona County) is updated regularly on the status of the approved VCS-H Project 1 and future site plans, including the proposed Expansion.

No key issues or concerns on the proposed Expansion have been raised to date. General inquiries on Project timeline and water usage requirements were received during early engagement activities.

4. Indigenous Group and Public Engagements

Indigenous Group Engagements

VCS is committed to timely, continuous, open and meaningful consultation with potentially affected First Nation(s) and/or Metis Settlement(s) in support of the Expansion. The consultation process is transparent and continuous throughout the life of the Project both pre- and post-approval, including site preparation, construction, commissioning, operation, decommissioning and reclamation phases, in a manner designed to understand opportunities and meaningfully address issues, including potential effects on traditional lands. The consultation process is intended to establish a positive foundation for building respectful and effective relationships that can help shape and guide the longer-term commercial development of the proposed Expansion.

In July 2019, VCS submitted a pre-consultation assessment request to the Aboriginal Consultation Office (ACO) of the Government of Alberta for the Expansion to amend the existing *Environment Protection and Enhancement Act* approvals. After reviewing the Project information, ACO determined that no Indigenous consultation is required. VCS will submit a separate pre-consultation assessment request under the *Water Act* for the proposed Expansion when additional information is available.

In September 2019, VCS alongside leading Alberta First Nations, jointly [announced](#) an Alliance Agreement for meaningful participation and investment interests in the VCS-H Project. This alliance hopes to extend beyond the initial First Nation communities.

Engagement activities with Indigenous communities in the region were initiated for the Project through the distribution of letters and Public Disclosure Documents. VCS invited Indigenous communities to meet and receive more information on the Expansion and to hear and share interests and/or concerns. Please see Appendix II for the list of the Indigenous communities that are being consulted and may be affected by the carrying out of the Project.

During early engagement with Indigenous communities, there have been no issues or concerns raised. Below is a summary of commitments made by VCS based on discussions with Indigenous communities held to date:

- VCS is dedicated to protecting North Saskatchewan River throughout the life of the Project;
- Once approved, Indigenous communities will be included in the notification list in case of major incidents/emergency during construction and operation of the Project; and
- Indigenous communities are open to combine technical review and traditional land use studies, as appropriate, for cost savings and time effective reviews.

VCS will continue to prepare application information and public notices for distribution to Indigenous communities in culturally sensitive, non-technical, plain-language formats. VCS will ensure that information on the proposed Expansion is directly provided to engaged Indigenous groups — First Nation(s) and/or Metis Settlement(s), at key regulatory milestones through a variety of methods, including:

- hand-delivery;
- mail and/or courier;
- web-based material; and
- email.

In addition to the above, VCS will continue engagement with Indigenous groups via in person meetings and/or tele- and video-conferences, or other methods, as needed. The consultation will synchronize with the planning stage and possible Impact Assessment stage during the Impact Assessment Process led by the IAAC. VCS will actively participate in the Engagement Process involving Indigenous communities as regulated by the *Impact Assessment Act* led by the IAAC.

Overall, VCS has been met with broad general acceptance of the proposed Expansion. Most Indigenous communities have expressed interest in contract/service and/or investment opportunities. Future engagement will include regular Project updates to Indigenous communities on key upcoming activities, such as VCS-H Project 1 sanction, service bidding opportunities, employment/apprentice training programs and the Expansion progress.

Public Engagements

VCS remains committed to working with neighbors and community organizations to provide appropriate information about the proposed Project and related potential impacts, benefits and opportunities.

VCS held an Open House on March 26th, 2019 in Fort Saskatchewan for early engagement and consultation on the Expansion plan and options. VCS also held an information booth and presented at the Life in the Heartland event at Lamont Community Hall on April 25th, 2019 for Project update and general public information. There was a strong interest and support from the stakeholders for the future growth of the VCS-H Complex.

As part of its early public engagement for the Expansion, VCS distributed notification packages including a Public Disclosure Document and a Public Involvement Area map to the identified nearby residents and businesses. Stakeholders have been directed to access the VCS website for updates and contact information for both general and specific queries and/or concerns.

VCS is in discussion with a small business owner with a residence near the Project site to address the owners' early concerns and mitigation measures for potential Project-specific impacts. The key issues that were raised by this business owner are listed below and these issues and potential mitigation means on Project-specific impacts are expected to be addressed in the detailed environmental impact assessment report:

- potential noise during construction and operation;
- chemicals emitted from proposed upgrader and refinery;
- increase in local traffic;
- light; and
- groundwater impacts to their business-owned residence.

Consultation and engagement with stakeholders will continue throughout the regulatory approval process and the life of the Project.

5. Regional Environmental Study

Alberta’s Industrial Heartland (AIH) is an active heavy industrial area with multiple projects which have been approved following an EIA and regulatory review process. The environmental studies carried out for adjacent projects are summarized in Table 1.

Table 1 Summary of Environmental Studies Completed for Projects in the Vicinity of the Proposed Project

Proponent and Project Name	Environmental Study Performed	Project Status ¹
Shell Canada Scotford Upgrader	Environmental Impact Assessments of Upgrader (1998), Upgrader Expansion (2005), Upgrader 2 (2007), Quest CSS (2010)	In operation
VCS-Heartland Processing Plant (previous Heartland Upgrader Project)	EIA (2004), EPEA Amendment (2016), and Tank Farm environmental assessment (2016)	Pending sanction
North West Upgrader and Bitumen Refinery	EIA (2006), EPEA renewal (2017)	In operation
Synenco Northern Lights Upgrader	EIA (2006), Application withdrawn (2008)	Cancelled
PetroCanada Fort Hills Sturgeon Upgrader	EIA (2006), EPEA approval (2007)	Suspended
StatoilHydro Canada Upgrader	EIA (2007), Project withdrawn (2008)	Cancelled
Total E&P Canada Upgrader	EIA (2007), EPEA approval (2009), application withdrawn (2010)	Cancelled
Alberta Sulphur Terminals (Hazco) Sulphur Forming and Shipping Facilities	EIA (2008) EPEA approval (2009)	Not available
Sasol Canada Canada GTL Project	EIA (2012) EPEA approval (2014)	Cancelled
Agrium Inc. Redwater Fertilizer Manufacturing Plant	Environmental Assessment (2008 EPEA renewal)	In operation
Heartland Sulphur Ltd. Heartland Sulphur Terminal	Environmental Assessment (2016 EPEA approval)	In operation

¹Obtained from company websites and public information online

Although there are no regional assessments as defined in Sections 92 and 93 of the *Impact Assessment Act* in the Expansion Project region, applicable provincial or municipal management plans that will be considered in the EIA include:

- Alberta Environment and Sustainable Resource Development Cumulative Effects Management System building on:
 - Water Management Framework for the Industrial Heartland and Capital Region
 - Capital Region Air Quality Management Framework
 - Elemental Sulphur Management Framework for the Industrial Heartland
 - Water Management Framework for the Industrial Heartland and Capital Region: Effluent Characterization Program
- Capital Region Land Use Plan
- Northeast Capital Industry Association:
 - Regional Noise Management Plan
 - Regional Groundwater Monitoring
- Strathcona County Management Plans:
 - Land Use Bylaw 6-2015
 - Heartland Industrial Area Structure Plan Bylaw 24-2018
 - Municipal Development Plan Bylaw 20-2017
- Fort Air Partnership Air Monitoring Plan

6. Strategic Assessment

The strategic assessment of climate change, published in July 2020, is a strategic assessment conducted under subsection 95(2) of the *Impact Assessment Act*, and it applies to all designated projects under the *Impact Assessment Act*.

Government of Alberta Strategic Analysis

As a result of the 2013 recommendation by the Alberta Standing Committee on Alberta's Economic Future, the Government of Alberta implemented the Bitumen Royalty-in-Kind program to sustain and enhance the diversification of Alberta's petroleum product portfolio (Government of Alberta 2013). In 2018, the Energy Diversification Advisory Committee recommended the Government of Alberta to promote upgrading and refining of bitumen for energy diversification (Government of Alberta 2018a). The approved VCS-H Project 1 was elected for support by the Alberta Partial Upgrading Program in early 2019, consistent with the Alberta interest for Economic Diversification and Restoring the Alberta advantage. The new Alberta Government discontinued the Partial Upgrading Program grants and loan guarantees within its budget framework constraints in late 2019.

Project Information

7. Purposes/Needs and Potential Benefits

Oil Sands bitumen is a highly viscous extra-heavy-oil that is loaded with high carbon-content micro-solids and inorganic contaminants. For pipeline transportation, half barrel of diluent is needed for one barrel of bitumen to lower its viscosity for transportation. Therefore, it is expensive to transport bitumen for Alberta's Oil Sands producers because of added diluent cost as well as limited available transportation options. In addition to logistic limitation, bitumen can only be processed in energy-intensive deep-conversion (vacuum residue-conversion) refineries that have high capital and operating costs which represent a fraction of crude oil refineries. All of above result in high bitumen

price discounts detrimental to bitumen producers and potential higher environmental impacts associated with these deep-conversion refineries.

The purpose of the proposed Expansion is to increase the capacity to upgrade and refine Alberta Oil Sands diluted bitumen into clean crudes and high-quality fuel products in an economically and environmentally sustainable way. The VCS-H Complex (approved and proposed) will upgrade/refine up to 119,240 m³ or 750,000 barrels per day of diluted bitumen feedstock to produce COLF³ Premium (a premium medium crude), COLF Heavy (a cleaned heavy crude), diesel, diluent and marine fuels in Alberta.

The available North American conventional refining capacity for medium crudes is widening as a result of significant growth in the production of light oil combined with the steady decline of Alaskan North Slope crude oil. The proposed Expansion will produce COLF Premium to meet the widening demand for medium crude oil, COLF Heavy for existing heavy crude refineries/future customized refinery, diluent to return to the local bitumen producers, ultra-low sulphur diesel and low sulphur marine fuel conforming IMO standard 2020.

The VCS-H Complex is part of VCS's Value Chain Solutions strategy and development, in which VCS has been granted rights to use VCI's proprietary technologies. The VCS-H Complex, including the proposed Project, will bring the following benefits:

- reducing net greenhouse gas (GHG) emissions by de-carbonizing bitumen upfront (*i.e.*, removing asphaltenes early in the upgrading-refining process);
- adding value within Alberta and Canada;
- freeing up the pipeline bottleneck;
- broadening the market to accept bitumen-derived clean crude oils; and
- achieving robust economics against volatilities in oil price and light / heavy oil price differential over the Project life.

Environmental Benefits

The application of VCI's unique upgrading/refining technologies reduce the life cycle GHG emissions by approximately 25-30% as compared to conventional upgrading/refining technology from DilBit processing to gasoline/fuel retailing (DilBit-to-Fuel or DilBit-to-Tank), which is enabled by:

- The de-carbonization (and de-contamination via VCI's ADCTM technology) of bitumen upfront, at the Project site, with the removal of asphaltenes. This is compared with the conventional approach of transporting DilBit over long distances, being processed in deep-conversion refineries through multiple processing units, and having the asphaltenes in DilBit rejected in the form of petroleum coke.
- The elimination of the need for diluent due to the application of VCI proprietary technologies, resulting in reduced emissions associated with the transportation of the diluent in DilBit and pure diluent stream to bitumen producers.
- The intrinsic energy efficiency in VCI's proprietary processes. The VCS-H Complex has a relatively simple process configuration as compared to conventional upgrading/refining, which results in lower energy use per unit of feedstock. In particular, unlike a conventional refinery, the VCS-H Complex does not produce coke with coking process or burn coke as in a Catalytic Cracking Unit.

³ COLF, standing for Clean Oil La-Fit, is VCS-H crude oils' brand name.

- The unique properties of the medium crude (COLF Premium) which makes it possible to process using a simple and energy efficient refinery.

In terms of local emissions from the Project itself, the high environmental performance is achieved by the following factors:

- VCS will apply best available technologies economically achievable (BATEA) in designing and operating the process units, in particular, the process heaters, sulphur recovery unit, and wastewater treatment and disposal.
- VCS will minimize water consumption by maximizing recycling of the water used in the utilities and upgrading process.

Additional environmental benefits of VCI's unique upgrading/refining technologies come from the production of higher quality fuel products:

- The high-quality diesel will reduce NOx/particulate matter emission with increased engine performance.
- The low sulphur marine fuel conforms to the [IMO2020](#) clean fuel standard and will reduce SO₂ emissions.

Socioeconomic Benefits

The socioeconomic benefits of the proposed Expansion include:

- increasing the value of the Oil Sands production within the province by going up the value chain, rather than only selling the raw resources;
- increasing Federal, Provincial and Municipal government revenues through taxes;
- providing business and employment opportunities related to facilities engineering, fabrication, construction, operation and maintenance;
- providing employment opportunities with peak construction person power of 2000+, which could be maintained for over a decade, leading to tens of thousands person years of Project execution-related employment in the region; and
- providing long-term operating employment opportunities in hundreds for each stage of the VCS-H Complex, for decades.

Benefits to Indigenous Groups

The anticipated benefits associated with the proposed Expansion to Indigenous groups are as follows:

- VCS is developing genuine, long-term, win-win alliance/partnerships with interested Indigenous communities for direct investment that would lead to sustainable wealth and wellness for their communities, limiting vulnerability as a consequence of the volatility of industrial fluctuations.
- VCS offers the solutions to transform the Oil Sands Industry to Clean Oil Industry, re-vitalizing the industry and Alberta's economy with sustainable and responsible development.

Indirect Benefits

The following are indirect benefits which are anticipated as a result of the construction and operation of the proposed Expansion:

- value added to Alberta through deploying the most cost-effective bitumen upgrading and specialty refining technology available;

- optimal pipeline utilization through diluent removal and localized return to producers, removal of asphaltene volume and use of alternative transportation means such as rail for cleaned heavy crude and specialty refined products to various markets;
- market broadening as most global refineries are built for medium crudes rather than the extra-heavy bitumen blend, which will best-fit growing Asian markets and will reduce Alberta products' reliance on single market enabling achievement of world price;
- robust economics against volatilities in oil price and light / heavy price differential with upgraded products; and
- return of investment to Alberta and Canada.

Long-term Vision

Value Creation Group (VCG), including Value Creation Inc. and Value Chain Solutions, Inc., plans to develop its vast oil sands resources and, through synergistic integration with its breakthrough proprietary technology, build a dynamic, successful energy organization with robust, sustainable growth across the full oil sands value chain.

It is VCG's strategic plan to expand the VCS-H Complex to serve local bitumen producers and have a greater impact to the Oil Sands industry (this application). This merchant complex could be duplicated at other major logistic hubs as well.

VCG is on track to apply for a major commercial Project in the Athabasca region, for regionally integrated resource development and merchant bitumen upgrading.

VCG is working with alliance partners (including Indigenous interests, as well as corporations) for a Coastal Clean Oil Refinery, with expected dominant competitiveness, enabled by unique tailored crude from VCG Clean Oil Complexes and our innovative/synergistic design capability.

8. Provisions

Provision 38 (a) of SOR/2019-285 *Physical Activities Regulations* reads “The expansion of an existing oil refinery, including a heavy oil upgrader, if the expansion would result in an increase in input capacity of 50% or more and a total input capacity of 10 000 m³/day or more;” is interpreted to mean that the proposed Expansion from the approved capacity of 29,890 m³/day or 188,000 barrels/day to up to 119,240 m³/day or 750,000 barrels/day, an increase in input capacity of 300%, is a designated activity under the *Impact Assessment Act*.

Provision 38 (e) of SOR/2019-285 *Physical Activities Regulations* reads “The expansion of petroleum storage facility, if the expansion would result in an increase in storage capacity of 50% or more and a total storage capacity of 500,000 m³ or more;” is interpreted to mean that the proposed Expansion tank farm storage facility from the approved capacity of 256,600 m³ to add storage capacity of approximately 1,067,000 m³, an increase in storage capacity of 416%, is also a designated activity under the *Impact Assessment Act*.

Provision 54 (b) of SOR/2019-285 *Physical Activities Regulations* reads “The construction, operation, decommissioning and abandonment of (b) a new railway yard with a total area of 50 ha or more;” is interpreted to mean that the proposed Expansion rail yard is *not* a designated activity under the *Impact Assessment Act* as the total area (railway and affiliated structures) is approximately 32 ha.

9. Activities, Infrastructure, Structures and Physical Works

Approved Facilities (VCS-H Project 1)

Construction of the approved VCS-H Project 1 was halted in 2008 despite being quite advanced. Site development that was completed includes:

- site preparation;
- installation of underground fire water loop piping and hydrants;
- oily water sewers;
- storm water sewers;
- storm water pond;
- several field constructed tanks;
- API oil-water separator; and
- buildings including the control room/warehouse and administration buildings.

As shown in Figure 2 in the purple boundary, the approved VCS-H Project 1 site is under a preservation program and is manned 24/7. Construction for pilings, foundations for equipment and pipe-racks are well advanced for the entire site. Equipment is preserved on site and stored either in warehouses or kept outdoors with appropriate corrosion-prevention measures. The site is connected to the high voltage power supply, natural gas and river water supply from the North Saskatchewan River. VCS will contract from a third party for water supply for VCS-H Project 1 usage through an existing license under Alberta's *Water Act* for the diversion of water from the North Saskatchewan River.

VCS-H Project 1 includes the approved tank farm (in orange boundary as in Figure 2), which has a separate provincial regulatory approval (EPEA Approval No. 387876-00-00). The tank farm will cover approximately 45 ha to house all storage tank requirements for feeds and products for VCS-H Project 1 as well as rail and truck loading facilities required to move products and byproducts to the market.

Proposed Project Activities

The proposed Expansion will be located adjacent to the approved VCS-H Project 1, in green boundary as in Figure 2, within the VCI owned land. Construction and operation of the Expansion will be implemented in multiple stages (i.e. 3 stages, Project 2 through Project 4).

Table 2 Project Activities and Locations

Value Creation Inc. Owned Lands	Area (ha)	Project Activities	
		Approved Project 1	The Proposed Expansion
SW 10-056-21 W4M (+Portion NW 03)	93	Main facility for VCS-H Project 1 and Tank Farm	-
SE 10-056 21 W4M	65	Main facility for VCS-H Project 1	-
SW 11-056 21 W4M	64	-	Main facility for the Expansion*
NW 11-056 21 W4M	58	-	Main facility for the Expansion*
SE 11-056 21 W4M	57	-	Main facility for the Expansion* Realigned Astotin Creek*
NE 03-056 21 W4M	59	Railway loop for the VCS-H Project 1 and storm water pond inside railway loop	Tank farm for the Expansion* Railway loop for the Expansion
NW 02-056 21 W4M	62	Rail spur to connect with CP Railway	Tank farm for the Expansion*
NE 02-056 21 W4M	62	-	Storm water pond and flare stacks for the Expansion* Realigned Astotin Creek*
NW 01-056 21 W4M	19	-	Soil storage pile for the Expansion*
Sum Area (ha)	539	179	260

Asterisks(*) denote the Designated Activities as described in Section 9.

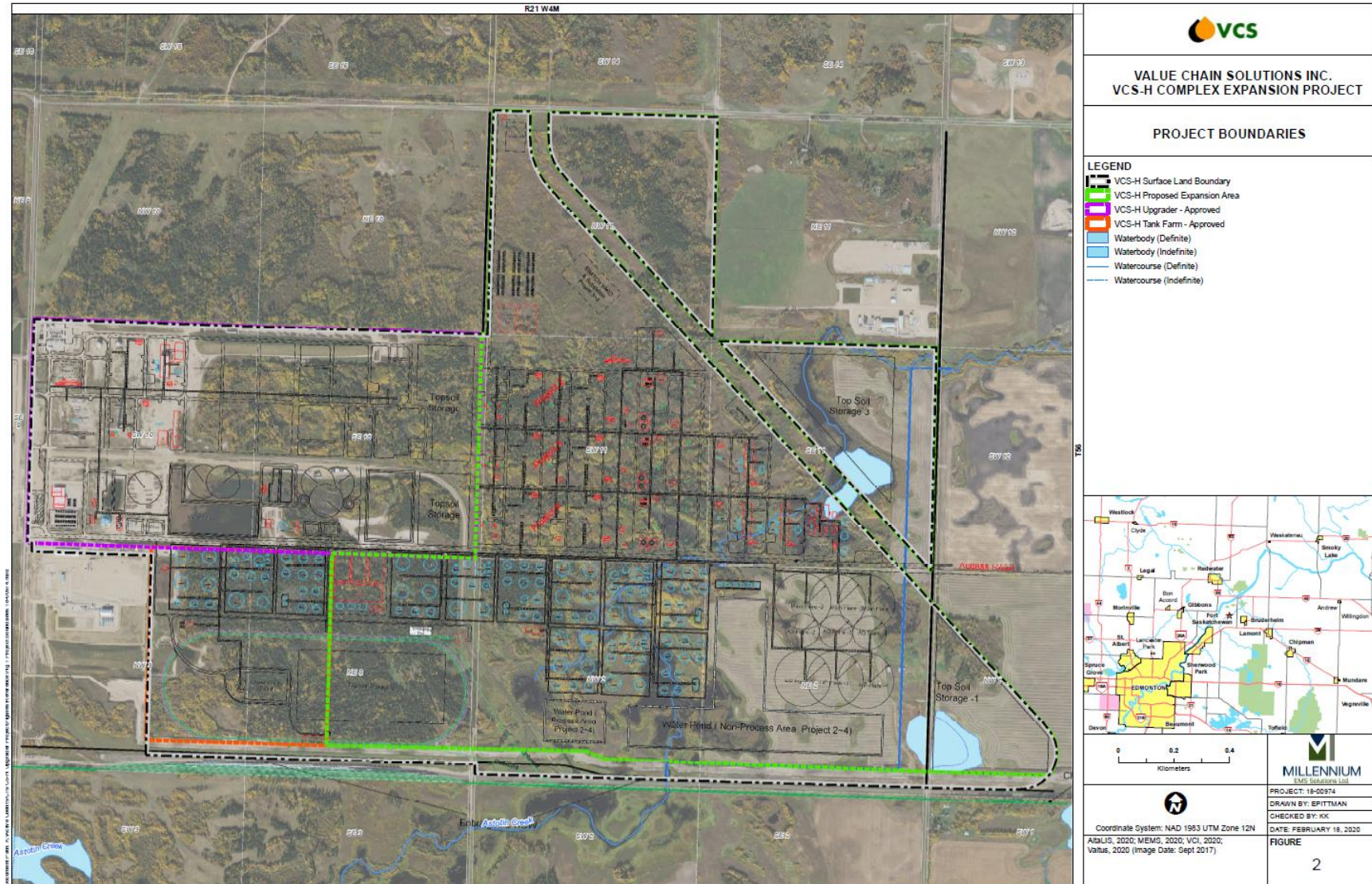


Figure 2 Site Map Showing the VCS-H Complex Boundaries and Components

Planned construction activities for the Expansion will include:

- site clearing and grubbing followed by site grading, timber salvage and mulching;
- VCS' installation of a new pipeline connecting the Expansion site to a third party North Saskatchewan River water intake facility to be approved under a new *Water Act* license;
- construction of additional water treatment, distribution and disposal facilities;
- installation of a storm water system including a pond, pumps and piping connections;
- construction of administration and new control room buildings and supporting infrastructure with laydown areas and a parking lot;
- additional connection to the electrical grid and a new substation;
- construction of a tank farm for diluted bitumen and storage of products;
- additional railway loops, connections and loading facilities;
- re-alignment of Astotin Creek;⁴
- upgrading and construction of access roads connecting to municipal road(s); and
- drilling and completion of water disposal wells.

Operations

Operation of the proposed Expansion and the approved VCS-H Project 1 will be similar as the common objective will be to produce clean crude oils and fuels. The main difference between the approved and proposed Projects will be in the transportation of the upgraded/refined products to the market. VCS-H Project 1 will make use of pipeline, truck and rail transportation due to the smaller volumes of product while the Expansion will maximize the use of pipeline and rail transportation due to the higher product volumes.

Activities associated with the Expansion Project include:

- commissioning and start-up of bitumen upgrading and refining process units;
- water treatment and use including wastewater/storm water treatment and disposal through deep-well injection;
- water recycling to reduce water disposal;
- planned and unplanned maintenance;
- diluted bitumen receiving; and
- products and byproducts loading and shipping.

Supporting process units for the Expansion include:

- Amine Treating Unit for sour gas (such as H₂S and CO₂ from the cracking units) absorption in the amine absorption towers: dissolved acid gases will be stripped and sent to the Sulphur Recovery Unit, amine solution is recycled for reuse through a regeneration tower.
- Sour Water Stripper for acid gases separation from sour water: H₂S and NH₃ are stripped off and sent to the Sulphur Recovery Unit, and the stripped water will be recycled for use in the Hydroprocessing units as wash water or in the desalter.
- Mercaptan Treatment Unit for mercaptans and other reactive sulphur compounds extraction and conversion.
- Asphaltene Handling Facilities that deal with the byproduct asphaltene dewatering and loading.

⁴ The current proposed realignment follows the south and east boundary of the Project site on VCI-owned lands west of Range road 211. A conceptual plan for a proper realignment route will be submitted with environmental surveys, construction and monitoring program will be reviewed with AER and Fisheries and Oceans Canada accordingly.

- Sulphur Recovery Unit that will convert the H₂S in sour gases through different stages (thermal stage and catalyst reaction stages) into elemental sulphur, degas the liquid sulphur, and store it prior to shipping.
- Hydrogen Manufacturing Unit that produces hydrogen (H₂) for hydroprocessing units from natural gas using the Steam Methane Reforming technology.

Utilities and off-sites supporting the Expansion include:

- expansion of Amelia substation or a new substation for Project electricity usage;
- river water treatment and wastewater treatment units;
- potable water and sanitary system, storm water ponds;
- cooling tower system;
- fuel gas and natural gas systems;
- nitrogen and air systems;
- steam and condensate systems;
- flare system;
- new petroleum storage tanks and dikes, pumps and piping, vapour recovery units and controlling units; and
- expansion of VCS-H Project 1 rail yard through adding more railway loops, connections, and supporting units including loading facility and unloading pits.

The regional infrastructure supporting the Expansion include:

- tie-in to existing natural gas pipelines;
- DilBit feed supply lateral pipeline(s);
- recovered diluent return lateral pipeline; and
- product sales lateral pipelines.

Activities incidental to the Designated Project Activities with possible third party contracting for construction and operation include:

- installation of high power supply through the expansion of Amelia substation or building a new substation;
- installation of local water pipeline and pumps from water intake facility to Project site;
- transportation and storage of byproduct Asphaltene at depleted mine site(s); and
- construction and operation of Sulphur forming facilities.

Decommissioning and Reclamation

At the end of the Expansion Project life, any affected soils will be treated onsite or moved to approved disposal facilities. Belowground pipelines will be purged, capped and abandoned in place per regulatory standards. A conceptual conservation and reclamation plan will be provided as part of the environmental impact assessment.

10. Production Capacity and Process Descriptions

Project Capacity

At full build-out, the VCS-H Complex is expected to process a maximum⁵ of ~ 120,000 m³ per day or 750,000 barrels per day of DilBit to produce diluent, COLF Premium, COLF Heavy, diesel, marine fuels and smaller quantities of petrochemical products after blending. Proposed capacity for DilBit and main products for the Expansion as well as VCS-H Project 1 approved capacity and VCS-H Complex total combined capacity are shown in Table 3.

Table 3 Proposed Capacity⁵ of the Expansion, VCS-H Project 1 Approved Capacity and VCS-H Complex Total Combined Capacity

Project	Feed-stock	Feedstock Flow Rate		Main Products Before Blending	Product Flow Rate	
		Tonnes/stream day	m ³ /stream day		Tonnes/stream day	m ³ /stream day
The Expansion (Projects 2-4)	Diluted bitumen	77,458	82,803	Diluent Product	15,013	19,385
				Bypass DCO	21,714	22,263
				Straight-run Gas Oil	6,985	7,866
				Naphtha	3,663	5,081
				Diesel	10,571	12,672
				LPG	425	777
				Tail oil	4,910	5,417
				Asphaltene (dry basis)	12,942	
				Sulphur Recovered	768	
Approved (Project 1)	Diluted bitumen	25,734	27,601	Diluent Product	8,495	10,710
				Bypass DCO	1,383	1,351
				Naphtha	3,895	5,242
				Diesel	5,416	6,535
				LPG	301	546
				Tail oil	95	106
				Asphaltene (dry basis)	5,825	
				Sulphur Recovered	377	
VCS-H Complex Total	Diluted bitumen	103,192	110,404			

The water requirement for the Expansion is estimated to be 1,212 tonnes per hour. The Expansion will require a new *Water Act* application for the required water volume at an existing 3rd party water intake facility for its freshwater withdrawal from the North Saskatchewan River.

Description of the Production Processes

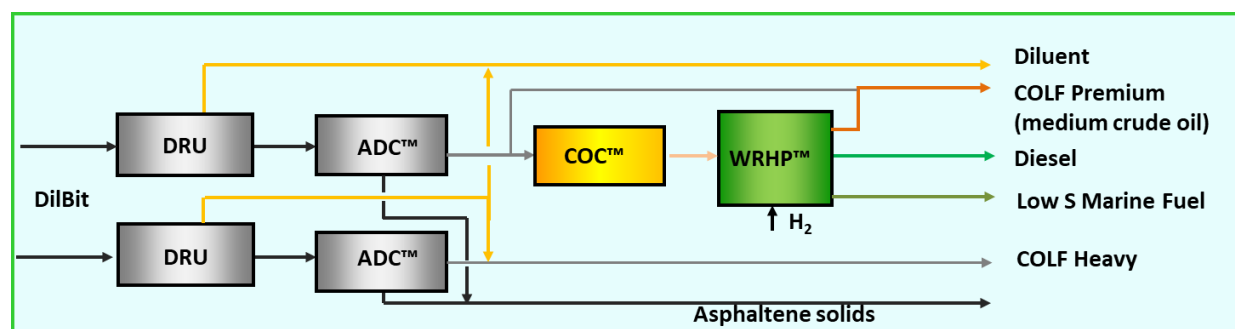
The main processing units of the Expansion include:

- the Diluent Recovery Unit (DRU), which separates the diluent from the bitumen in the diluted bitumen feedstock;

⁵ A maximum capacity is the capacity the VCS-H Complex could reach after further debottlenecking and optimization on operating conditions, it is expected the maximum total intake capacity of VCS-H Complex (Project 1 and the Expansion) will be ~120,000 m³/stream day or 750,000 barrels/stream day. Proposed capacity is the capacity as shown in the material balance in regulatory applications based on design conditions.

- the Accelerated De-Contamination unit (ADC™), which separates asphaltene from the bitumen feed to produce De-Contaminated Oil (DCO);
- the Clean Oil Cracking unit (COC™), which thermally cracks half of the DCO into gas oil, distillate and naphtha with unconverted vacuum residue to be removed in the other ADC™ unit; and
- the Wide Range Hydroprocessing units (WRHP™), which accepts the vacuum gas oil, distillates and naphtha for hydrotreating and hydrocracking to produce diesel and refined products for blending into COLF Premium and low sulphur marine fuels.

The other half of the DCO is blended with the recovered diluent to produce COLF Heavy as shown in Figure 3, which presents a Process Schematic of the Expansion.



DRU- Diluent Recovery Unit; ADC™-Accelerated De-Contamination; COC™- Clean Oil Cracking; WRHP™-Wide Range Hydroprocessing

Figure 3 The Expansion Process Schematic

The ADC™ is a proprietary technology that separates asphaltenes from bitumen emulsion with high efficiency and high oil yield. The plan for offsite handling of the asphaltene byproduct is to use the asphaltene as fill material for mine pit reclamation at depleted coal mines. Potential mine pit location(s) selection is under business discussions and regulatory planning. Alternative commercial non-combustion uses of asphaltene are being explored with emerging technologies including the production of activated carbon, carbon fibers, road construction material and others.

The COC™ is a proprietary thermal cracking process based on conventional technology, with design optimization enabled by the DCO product generated by ADC™.

The Wide Range Hydroprocessing (WRHP™) unit processes the liquid products from the COC™ unit with hydrogen and catalysts into premium medium synthetic crude and refined products such as diesel.

11. Project Schedule

The staged expansion of the VCS-H Complex will follow conventional project management procedures that include scoping, design, engineering, procurement and construction after which facilities are turned over to operations to maintain and operate for several decades prior to decommissioning and abandonment. Subject to regulatory approvals, market conditions and future investment decisions, design, construction and commissioning of each sub-Project stage of the Expansion will commence three to four years after the previous stage with the earliest Expansion operations in 2029 and then continuing for over 50 years. At its current location, there is no anticipation for further expansion beyond the proposed Expansion.

The Expansion is expected to operate successfully in the public interest for a long period of time to transition from raw petroleum products to support world energy needs and as long as Alberta maintains Oil Sands bitumen harvesting.

With the Expansion located in Alberta's Industrial Heartland, the site is expected to be reclaimed for industrial use after decommissioning.

12. Alternative Considerations

Project Technology

The current commercial method of upgrading bitumen involves high capital costs, is energy intensive, and does not address the increasing demand of medium crude. It is the founder and CEO of Value Creation Group, Dr. Columba Yeung's vision, and VCS's mandate to implement VCI's proprietary upgrading/specialty refinery technologies to the Oil Sands industry to provide a fundamental transformation of the full value chain of Oil Sands development.

The key VCI technology, ADC™ technology, has successfully undergone bench scale and pilot scale tests, scale-up studies, commercial design and fabrication, hazard and operability studies ("HAZOP"), and safety integrity level ("SIL") evaluations. Each of these major steps have been witnessed, reviewed and/or validated by third-party consultants, independent engineers, and/or cold eye reviewers. VCS-H Project 1 was elected for support by the Alberta Partial Upgrading Program in early 2019, as the top-choice recommended by third-party reviewers among dozens of available competing upgrading technologies. VCS-H Project 1 will be the first VCS Project to commercialize the VCI technologies for bitumen upgrading and specialty refining. The Expansion will incorporate applicable optimizations from detailed engineering and execution of the VCS-H Project 1.

Technical Alternative to the Byproduct (Asphaltene) Use

The base plan is to store the asphaltenes in depleted coal mines – a form of solid carbon sequestration. VCS is in discussion with the Alberta Energy Regulator and working with mine and pit operators. The objective is to minimize footprint by using existing brownfield areas and this storage arrangement will provide transitional employment for miners.

Emerging technologies to make use of asphaltene include the making of paving and roofing asphalt using asphaltene with other recycled materials including recycled plastics, production of activated carbon, carbon fiber from asphaltene.

Alternatives to Electrical Substation

The 240 kV AltaLink Amelia substation located immediately north of the VCS-H Complex is fully operational. VCS-H Project 1 will receive power through tie-in to the Amelia substation. For the Expansion, it is expected that either an expansion will be required at the current Amelia substation (additional transformer and feeder breakers), or a new substation could be built for the power needs for Expansion subject to further assessments.

Alternatives to Water Supply

The majority of water supply for the proposed Expansion is expected to be water withdrawn from the North Saskatchewan River via a 3rd party river water intake facility. While alternatives to the river water supply could be from:

- groundwater wells with water from the Beverly Channel;
- storm water from the storm water pond onsite or from nearby facilities;

- discharged cooling water from cooling tower or other used process water.

Alternatives to Astotin Creek Realignment Route

The proposed Astotin Creek realignment route and other options were considered preliminarily based on Alberta Environment regulation guidelines and Codes of Practice (AENV 2000) with goals to:

- minimize wildlife habitat fragmentation and impacts on critical wildlife habitats;
- minimize length of realignment;
- use existing crossing across VCI land boundary wherever possible and minimize number of crossings with road, pipelines, and rail ROWs; and
- maximize integration with existing disturbance and ROWs.

The current proposed realignment follows the south and east boundary of the Project site on VCI-owned lands west of Range Road 211. A conceptual plan for a proper realignment route will be submitted with environmental surveys, construction and monitoring program and will be reviewed with AER and Fisheries and Oceans Canada, accordingly.

A summary of the alternatives considered for the proposed Expansion is provided below in Table 4.

Table 4 Summary of Alternative Considerations

	Potential Alternative Considered
Means of carrying out the Project (technically and economically feasible, including best available technologies)	<ul style="list-style-type: none"> • Upgrading/refining technology <ul style="list-style-type: none"> • VCI’s proprietary technology is more efficient as compared to conventional technology and will be used in VCS-H Project • Byproduct-asphaltene use: <ul style="list-style-type: none"> • Long-term storage at depleted mine pits • Convert asphaltene using commercially ready technologies to paving and roofing asphalt, activated carbon and more in the future • Electrical substation for the Expansion electricity needs: <ul style="list-style-type: none"> • The expansion of the existing Amelia substation • Construction of a new substation • Water supply • Astotin creek realignment route
Alternative to the Project (technically and economically feasible and directly related to the Project)	<ul style="list-style-type: none"> • A newly built or revamped coastal refinery to refine customized crude streams from the VCS-H Complex • An upgrader/specialty refinery closer to the bitumen producers in the Athabasca region • An upgrader/specialty refinery at another logistic hub, i.e. Hardisty

Project Location

13. Project Location Description

The proposed Expansion will be located adjacent to the approved VCS-H Project 1 facilities (built and planned), strategically located in the pivotal Oil Sands transportation hub in Alberta's Industrial Heartland (AIH), in the Astotin Heavy Industrial Area of Strathcona County, northeast of Edmonton. The area of the VCS-H Complex is approximately 5.4 square kilometers (540 hectares) and includes the approved VCS-H Project 1 and the proposed Expansion facilities. The legal land description for the center of the proposed Expansion is the southern half of Section 11, Township 056, Range 21, West of the 4th Meridian, approximately 18 km northeast of the City of Fort Saskatchewan and 8 km west of the Town of Bruderheim, as presented in Figure 4.

The Expansion site is located on private land zoned for heavy industrial activities. The land is also within the treaty land boundaries of Treaty 6 First Nations and Métis Nation of Alberta Region 4. The closest First Nation communities include the Enoch Cree Nation located approximately 60 km southwest and the Alexander First Nation approximately 60 km west of the Project site (Figure 4). AIH has been an active industrial area for the past 20 years. There are no current or known traditional uses of the Project site to date and VCS is not aware of any anticipated impacts on hunting, fishing, or gathering uses by Indigenous people at the Expansion site.

Federal lands in the proximity of the Project include the Elk Island National Park (approximately 25 km southeast of the Project in Figure 4), the Canadian Forces Base Edmonton (Edmonton Garrison, approximately 35 km southwest of the Project) and the Redwater Helicopter training site (approximately 15 km northeast of the Project).

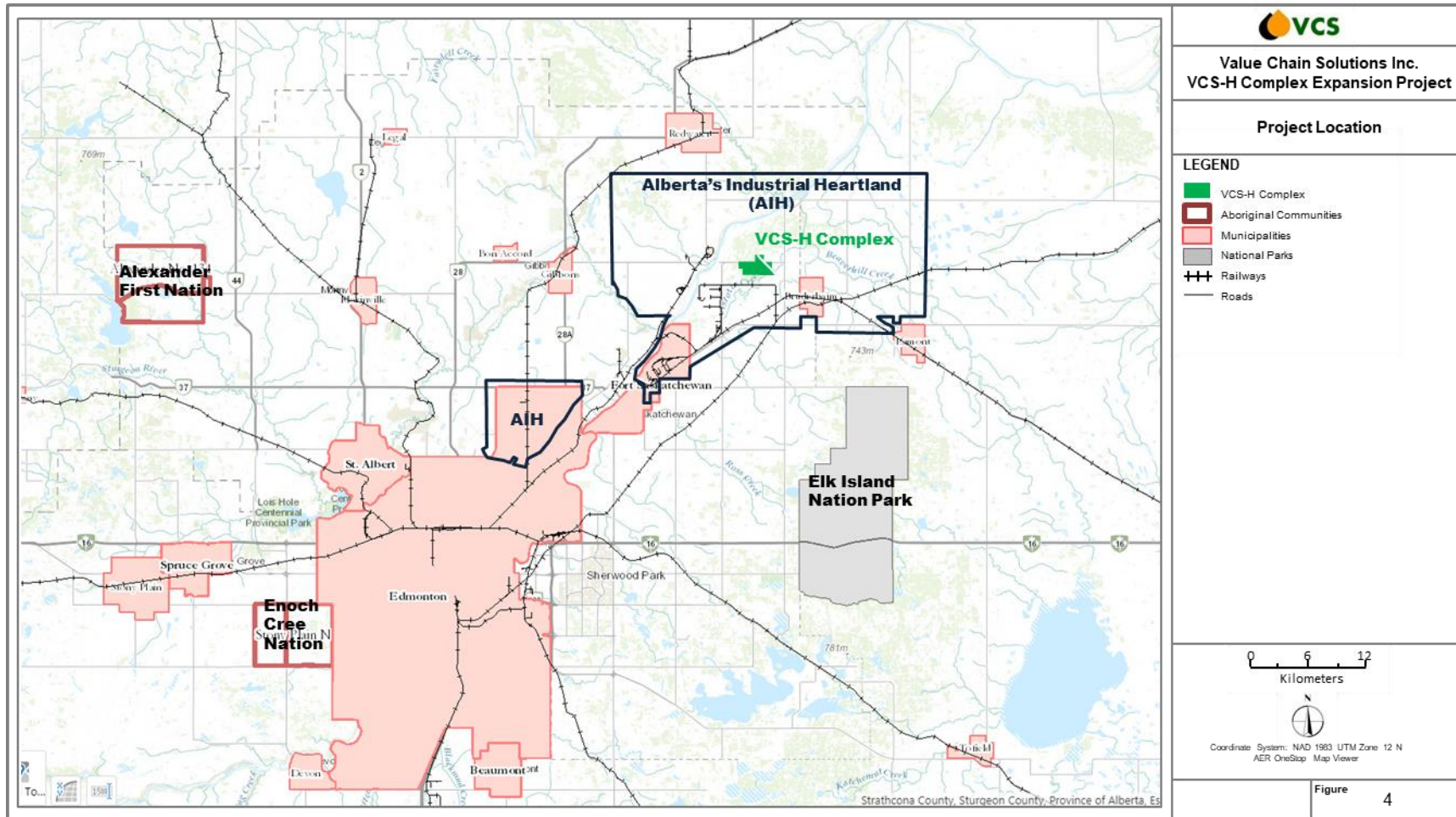


Figure 4 Project Location

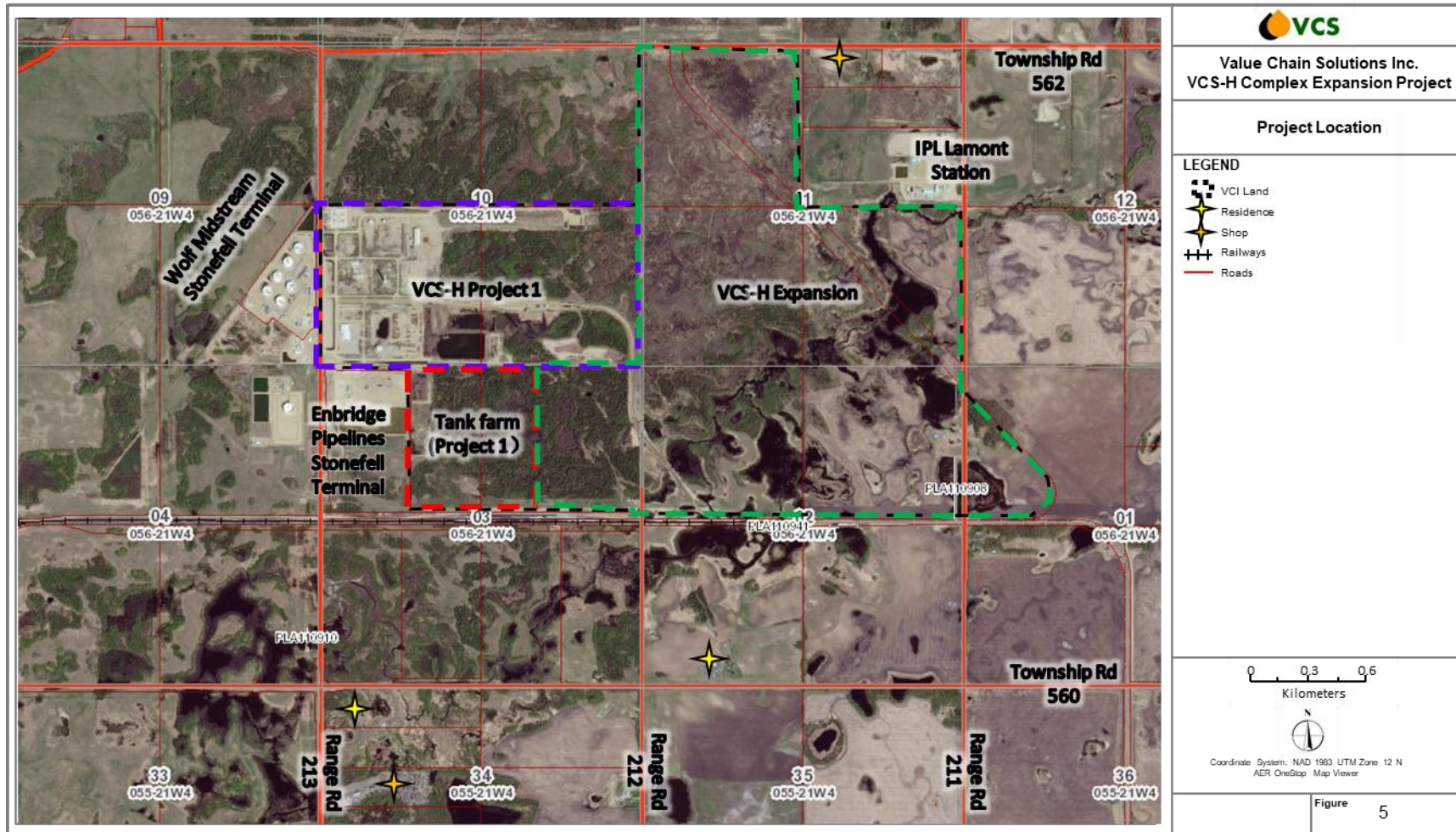


Figure 5 Site Map Showing the VCS-H Complex Location

Figure 5 is a site map of the VCS-H Complex with the approved VCS-H Project 1 (in purple boundary), approved tank farm supporting VCS-H Project 1 (in orange boundary), and the proposed Expansion (in green boundary). The main facilities for the proposed Expansion include bitumen processing units with supporting units, utilities and offsites, storm water ponds, flare stacks, administration building/parking lots and topsoil storage piles.

The VCS-H Complex is situated at a major bitumen blend pipeline hub in Alberta and is in close proximity to existing infrastructure that provides:

- access to a range of diluted bitumen feedstocks from the Athabasca and Cold Lake Oil Sands region with lateral pipelines to access the Peace River region;
- access to refinery markets through major sales trunk pipelines;
- feedstocks to petrochemical plants, and
- connections to CP Railway including interchanges with CN Railway.

The updated 2018 Strathcona County Area Structure Plan (Strathcona County, 2018) for AIH reinforces that the area is primarily to be developed as heavy industrial with transitional border areas.

In addition to the public notification and Open House/industrial community meetings, VCS is committed to more tailored public engagement based on public safety, potential concerns and the emergency planning zone for the Expansion. This tailored engagement group includes the nearby residents, landowners and industry land users in the area inside and adjacent to the estimated emergency planning zone. In addition to the nearby industry land users outlined in Figure 5, there are three residence located about 1 km from the nearest VCS-H Complex boundary to the south (two residence at approximately 750m and 1.1 km, one business shop at approximately 1.5 km) and one business residence (approximately 300 m) to the northeast.

14. Physical and Biological Environment

VCS and affiliated environmental consultants have conducted environmental baseline work that will be incorporated into an environmental impact assessment for the Project. All potential environmental and social impacts will be identified, and appropriate mitigation and monitoring will be proposed to minimize or eliminate potential Project effects.

The previous designation of the Astotin Natural Area located north of the Expansion Project area was repealed on December 19 2007. As of 2007, BA Energy Inc. (BA, amalgamated into Value Creation Inc.) with Canadian Pacific Railway Company had reached agreements with the Province of Alberta, represented by Alberta Tourism, Parks, Recreation and Culture and Alberta Sustainable Resource Development. The agreements were about exchanging lands with equal or greater environmental benefit and market value to be added to the Provincial Parks and Protected Areas network. Lands that were exchanged as part of the agreement include lands near Miquelon Lake Provincial Park, the Lois Hole Centennial Park, the Mistik Lake Game Bird Sanctuary and Beaverhill Lake Heritage Rangeland Natural Area. Subsequently, the Astotin Natural Area designation on the west half of Section 11, Range 056, Township 21, West of the 4th Meridian was repealed.

For the proposed Expansion Project area, approximately 60 ha of land is cleared (approximately 17%, contract farmed), and the remaining area is undisturbed land (300 ha, approximately 83%).

Subject to further discussion with the Strathcona Country, two range roads can be used to access the Project site: Range Road 213 along the west end (primarily for VCS-H Project 1 access) and Range Road 211 along the east, which

will be used to access the Expansion Project site. Township Road 562 runs along the north boundary of the VCS-H Complex, which will also provide access for the Expansion (Figure 5).

The Expansion Project site is surrounded by major industrial facilities, linear disturbances and agricultural lands with environmental considerations as described in the following sections.

Air Quality

The climate in AIH features cold and dry winters with average monthly temperatures reaching a low of -12°C in January and mild summers that seldom exceed 30°C in summer. Mean annual precipitation in AIH ranges from 400 to 500 millimeters (mm). Daily precipitation maximums generally occur in June and July and are in the range of 80 to 92 mm. The average annual wind speed reported at the Fort Saskatchewan air quality monitoring station is 9.1 km/h. The windiest month is April with average wind speeds of 11 km/h with prevailing winds from the west and southwest directions in the summer, and from the northwest direction in winter.

AIH is an area designated by the Province of Alberta for heavy industrial growth. Ambient air quality in the Heartland is monitored and reported by Fort Air Partnership with 10 continuous monitoring stations that measure certain air contaminants on a 24-hour basis, and a network of 47 passive monitors that measure concentrations of sulphur dioxide and hydrogen sulphide on a monthly average basis. The continuous monitoring stations are located in Fort Saskatchewan, Gibbons, Lamont County, Redwater, Elk Island National Park, Scotford Temporary, Ross Creek, Range Road 220 and a portable station currently located in Chipman. Ambient air quality in the Heartland can vary with location depending on the proximity to industrial sites, traffic corridors and urban centers in the region. Exceedances of the Alberta Ambient Air Quality Objectives (AAAQO) have been existent for substances such as SO_2 , H_2S , benzene (not since 2015) and $\text{PM}_{2.5}$. Not all of the exceedances are attributable to industrial activity (as many $\text{PM}_{2.5}$ exceedances are caused by forest fires, and some H_2S exceedances are caused by natural processes in bogs and slews). Air quality is in the low health risk level, as measured by the Air Quality Health Index most of the time (refer to Fort Air Partnership website for details).

Noise

There are significant existing and proposed regulated industrial noise sources nearby. The Expansion is located within AIH, which consists of dozens of large-scale industrial facilities that are regulated by the AER as well as the Alberta Utilities Commission. Operational facilities within approximately 4 km include:

- Wolf Midstream Stonefell Terminal [Immediately west of Range Road 213]
- Enbridge Pipelines Stonefell Terminal [Immediately east of Range Road 213]
- Inter Pipeline Lamont Pump Station [1,500 m east]
- ATCO Pipelines Salt Caverns Facility [2,800 m south]
- Shell Scotford Facility [2,200 m southwest]
- Nutrien Redwater Fertilizer Operations (RFO) [3,000 m northwest]

There are also several other facilities beyond 4 km. All existing industrial facilities within the study area will be included in the noise assessment for the EIA, using the regional noise model that has been generated by the Northeast Capital Industrial Association (NCIA).

Nearby significant roads include Secondary Highway 830 (approximately 3.2 km east of the VCS-H Complex), and Highway 15 (approximately 4.8 km south of the VCS-H Complex). There is also a heavily used railway that runs approximately 800 m south of the VCS-H Complex.

Soils and Terrain

The Redwater Plain District is an undulating plain with slope gradients generally ranging between one and three percent (Agriculture Canada 1986). The proximity of the Redwater Plain to the North Saskatchewan River explains the presence of sandy, glaciofluvial deposits that dominate the area. A portion of these deposits have been wind-worked into dune topography and subsequently stabilized by vegetation. This dune topography consists of low-relief parabolic or U-shaped dunes with slope gradients ranging from two to nine percent. The stabilized dunes are interspersed with well-drained Chernozemic soils and poorly-drained Organic and Gleysolic soils. Dune soils are typically Eutric Brunisols and, combined with the moderately to strongly rolling topography, are rapidly-drained to well-drained (Timoney and Robinson 1998).

Aquatic Resources

The Expansion is situated in the Astotin Creek watershed. Astotin Creek originates at Astotin Lake located in Elk Island National Park and drains into the offsite Beaverhill Creek which, in turn, drains into the offsite North Saskatchewan River. Known fish species in the Project area and in the Astotin Creek watershed are almost exclusively small-bodied fish species with the exception of white sucker, which is the only large-bodied fish species recovered in the Astotin Creek watershed from more than 180 fish inventories conducted in the watershed between 1997 and 2018 (Alberta Environment and Parks 2019). The section of offsite Beaverhill Creek from the confluence of Astotin Creek to its confluence with the offsite North Saskatchewan River contains both small-bodied and large-bodied fish species, with the large-bodied fish species being exclusively from the sucker family. No sport fish species have been recovered in either Astotin Creek or the lower section of the offsite Beaverhill Creek, and none of the fish species known to reside in either Astotin Creek or the lower section of offsite Beaverhill Creek are listed in any of the schedules of the *Species at Risk Act* (Government of Canada 2019) or as candidate species by COSEWIC (Committee on the Status of Endangered Wildlife in Canada 2019).

Surface Water

The Expansion will overlap Astotin Creek and several open water, fen, marsh, and swamp wetlands (Alberta Environment and Parks 2018). The Project area is located within the Dry Mixedwood Natural Subregion. Lakes within this subregion are among the least sensitive to acid deposition compared to other lakes in Alberta (AENV 1999). The undisturbed area is currently natural, undeveloped land. Disturbed areas include some acquired acreage homes and some lands are presently being contract farmed. Previous field inspection and examination of surveyed topographic data conducted for the original application (BA Energy 2004) indicates that the land generally slopes in a southeasterly direction towards Astotin Creek.

Previous environmental assessments (Total E&P Canada 2007 and recent baseline field survey by VCS) indicate the following regarding the surface water quality of Astotin Creek:

- it is slightly alkaline, very hard, and with high levels of alkalinity, total dissolved solids, and conductivity;
- it has an ionic composition that is dominated by magnesium and calcium cations and the bicarbonate anion;
- it is eutrophic; and
- it has concentrations of total and dissolved metals that, with few exceptions, are within provincial water quality guidelines for the protection of aquatic life (Government of Alberta 2018b).

Groundwater

The regional geology in the Fort Saskatchewan area has been influenced by pre-glacial, glacial and postglacial events. The geological sequence consists of a succession of unconsolidated Neogene and Quaternary-aged deposits unconformably overlying Cretaceous-aged deposits.

The Beverly Channel is a major pre-glacial valley incised within the upper bedrock and consisting of buried sand and gravel deposits (Andriashek 1988). The channel is roughly coincident with the present-day North Saskatchewan River Valley and the buried sand and gravel deposits form an important regional aquifer. The upper bedrock consists of the Belly River Formation. The Belly River Formation includes sandstone units that form local or regional aquifer/aquitard systems such as the Oldman Aquifer, the Continental Foremost Aquifer and the Milan Aquifer (Stein 1976).

The North Saskatchewan River is a major regional groundwater discharge feature for bedrock aquifers and the Beverly Channel. Water wells in the Fort Saskatchewan area are completed in the surficial sand deposits, the sand and gravel deposits of the Beverly Channel, and the upper bedrock. The majority of the wells are for domestic or domestic and agricultural use. There are no known active groundwater wells in close proximity to the Expansion Project site.

Vegetation

The Project site is located within the Dry Mixedwood Natural Subregion, which is characterized by aspen forests, cultivated lands, and fens typically occurring in low-lying areas (Natural Regions Committee 2006). The aspen-dominated forests are comprised of species-rich understories of low bush cranberry (*Viburnum edule*), beaked hazelnut (*Corylus cornuta*), prickly rose (*Rosa acicularis*), wild sarsaparilla (*Aralia nudicaulis*), cream colored vetchling (*Lathyrus ochroleucus*), purple peavine (*Lathyrus nevadensis*), and bluejoint (*Calamagrostis canadensis*). Pure or mixed stands of balsam poplar (*Populus balsamifera*), aspen (*Populus tremuloides*) and white spruce (*Picea glauca*) occur on moist, rich sites with understories containing prickly rose (*Rosa acicularis*), red-osier dogwood (*Cornus sericea*), and a variety of herbaceous species. Treed and shrubby fens are common in wet, poorly drained sites and the vegetation species largely depend on the nutrient status and water levels in each site (Natural Regions Committee 2006).

Following a review of the Schedule 1 species of the *Species at Risk Act* and the candidate species assessed by COSEWIC, no federally-listed vegetation species at risk are known or expected to occur within the Project area.

Wildlife

The Project is located in a portion of Strathcona County that falls within AIH, an area that is predominantly characterized by agricultural and industrial land uses. Wildlife habitat within a fragmented landscape is largely a function of forest clearings and the amount of edge habitat relative to interior habitat. Closed deciduous and mixedwood forests in the Project area are the core interior habitats used by numerous wildlife species, including ungulates, birds and small mammals. Agricultural and anthropogenic lands generally have little value for wildlife, whereas wetland, grassland, and forest/shrub habitat types will have the highest value for wildlife.

Large concentrations of northern breeding ducks, geese and swans stage on Alberta lakes during spring and fall migration, with a large proportion of these birds using habitats within Strathcona County. The Project area overlaps Astotin Creek and several open water, fen, marsh and swamp wetlands according to the Alberta Merged Wetland Inventory, which will provide aquatic habitat for water-dependent birds (ducks, geese and shorebirds), semi-aquatic mammals (beaver, muskrat and mink) and amphibians (frogs and toads) during the breeding season.

Several species that are considered to be of “Special Concern” or are Schedule 1 species as defined under the *Species at Risk Act* are known to occur in the Fort Saskatchewan Area, including: northern leopard frog (*Lithobates pipiens*), western tiger salamander (*Ambystoma mavortium*), bank swallow (*Riparia riparia*), evening grosbeak (*Coccothraustes vespertinus*), horned grebe (*Podiceps auratus*), olive-sided flycatcher (*Contopus cooperi*), rusty blackbird (*Euphagus carolinus*), short-eared owl (*Asio flammeus*), Sprague’s pipit (*Anthus spragueii*), western grebe (*Aechmophorus occidentalis*), and yellow rail (*Coturnicops noveboracensis*).

15. Health, Social and Economic Regional Information

A human health risk assessment and socioeconomic impact analysis is underway and will cover detailed analyses in due course. Following is an overview of the background information on health and socioeconomics in the region.

According to the Community Social Profile published in 2018 by Strathcona County, there are 27,345 residents living in the rural area of Strathcona County in 2016 with 70,700 residents in the urban Sherwood Park. This places Strathcona County as the fourth largest municipality in Alberta after Calgary, Edmonton and Red Deer. Four percent (4%) of the Strathcona County population was identified as Aboriginal as of 2011.

The median age of the population in Strathcona County was 37.8 in 2006, 39.1 in 2011 and 40.1 in 2016, indicating a larger portion of the population is aging from 2006 to 2016. The life expectancy in the Edmonton Zone where Strathcona County lies within is 81.8-82.0 years from 2011 to 2017, as compared to that of 81.8-82.1 years in Canada.

The economics of the region was affected largely by the energy industry downturn due to the economic effect of a decline in oil prices. The workforce population reached the lowest point in July 2016 and slowly recovered but is not back to the level that was observed in 2013. As of 2016, the unemployment rate in Strathcona County is 6.5%, as compared to 9% in Alberta.

As health data are typically reported on a regional basis (or “by zone”) across Alberta, it is important that the data concerning the current health status in the area (i.e., baseline health data) be interpreted with a certain degree of caution. Baseline health data are publicly available on a relatively broad scale, wherein information is presented for the primary urban centres or for large geographic areas. Limited specific baseline health data are currently available for most of the communities in the vicinity of the Project (e.g., Redwater, Gibbons, Bruderheim, etc.). Although some of the information that will be presented in detail in the EIA may not be specifically relevant to the residents of the study area, it can still be useful for identifying critical receptors as well as in interpreting the health risk assessment in the context of population baseline, project and cumulative risks.

In the past, it’s been reported that the residents of the Capital Health Region (wherein the Project will be located) are generally in good health and rank highly on many standard measures of population health. For instance, mortality rates for heart disease in the Capital Health Region have been lower than the provincial average and mortality rates for stroke and cancer are generally similar to the provincial average.

In their 2013 community profile for Strathcona County, Alberta Health indicated the following:

- In 2010, the disease with the highest prevalence rate (per 100 population) in Strathcona County was hypertension. The rate associated with this disease was similar to the provincial average (13.7 vs. 14.2 in Alberta).
- The age-standardized rate for people with three or more chronic diseases (per 100 population) was similar in Strathcona County compared to the province (2.1 vs. 2.2 in Alberta).

- The mortality rate (per 100,000 population) due to all causes was similar in the County compared to the province (497.6 vs. 519.2 in Alberta), and the most frequent cause of death reported between 2001 and 2010 was diseases of the circulatory system.

In 2012, Strathcona County undertook a telephone survey to assess residents' perceptions about health and lifestyle issues. Survey respondents were asked to rate their personal health. The key findings of the health aspects of the survey were that:

- two-thirds (67%) of Strathcona County residents rated their personal health as very good/excellent; and
- higher proportions of rural residents (71%) rated their personal health as very good/excellent as compared to Sherwood Park residents (66%).

Although conducted more than a decade ago, but still relevant with respect to baseline health, Alberta Health's Fort Saskatchewan and Area Community Exposure and Health Effects Assessment Program examined health records to compare residents of Fort Saskatchewan with residents of a reference location (Lethbridge, Alberta) for selected morbidity and mortality measures, with a particular focus on respiratory disease. The study concluded that Fort Saskatchewan had higher rates of doctor visits for respiratory diseases (including the common cold), but not for illness or death from asthma, bronchitis, chronic obstructive pulmonary disease (COPD) or other chronic respiratory diseases.

The baseline health assessment of the application will present a comparative analysis of various health indicators for the region using Alberta's Interactive Health Data Application.

Benefits of the VCS-H Complex to the local and broader socio-economy and economy can be found in Section 7. A detailed human health risk assessment and a socioeconomic impact assessment will be addressed in the EIA.

Federal, Provincial, Territorial, Indigenous and Municipal Involvement

16. Federal Financial Support

VCS has not received Federal financial support to date, while VCS is open to funding programs supporting the GHG benefits this Project will bring.

17. Federal Land Use

No federal land will be used for the development of the Expansion.

18. Jurisdictions with Powers, Duties or Functions

The Federal jurisdictions potentially having powers, duties or functions in relation to the assessment of the proposed Expansion's environmental effects are listed in Table 5.

Table 5 Federal Jurisdictions and Legislative Acts

Federal Jurisdiction	Legislative Acts	Related Permits
Impact Assessment Agency of Canada	<ul style="list-style-type: none"> • <i>Impact Assessment Act</i>, 2019 • <i>Migratory Birds Convention Act</i>, 1994 (MBCA) • <i>Species at Risk Act</i>, 2002 (SARA) • <i>Fisheries Act</i>, 2019 	Notice of Determination and Decision statement for Impact Assessment (if required)
Environment and Climate Change Canada	<ul style="list-style-type: none"> • <i>Migratory Birds Convention Act</i>, 1994 (MBCA) • <i>Species at Risk Act</i>, 2002 (SARA) • <i>Fisheries Act</i>, 2019 	<i>Species at Risk Act</i> Permit
Fisheries and Oceans Canada	<ul style="list-style-type: none"> • <i>Species at Risk Act</i>, 2002 (SARA) • <i>Fisheries Act</i>, 2019 	<i>Fisheries Act</i> Authorization <i>Species at Risk Act</i> Permit
Transport Canada	<ul style="list-style-type: none"> • <i>Railway Safety Act</i>, 2019 	Railway operating certificate

Subject to review by IAAC, and governed by the newly passed *Impact Assessment Act*, this document serves as the Initial Project Description for the proposed Expansion.

An EIA together with OSCA and EPEA applications are in preparation for the AER to review under Alberta provincial legislations.

Other provincial authorities will review and dispense permits as required prior to construction and/or operation of the Expansion under the *Water Act* and the *Railway (Alberta) Act*.

A municipal development permit will also be required before construction activities commence under Land Use Bylaw 6-2015 of the Municipality of Strathcona County.

Potential Effects of the Project

19. Changes to the Environment within the Fisheries Act, Species at Risk Act and Migratory Birds Convention Act

Fish and Fish Habitat within the *Fisheries Act*

The Expansion Project may cause changes to fish and fish habitat, as defined in subsection 2(1) of the *Fisheries Act*, specifically in Astotin Creek. A summary of the potential changes to fish and fish habitat are as follows.

Potential Effects from Changes to Surface Cover: The proposed Project footprint will be comprised of a number of facilities and infrastructure developments, which may potentially affect runoff to Astotin Creek. The assessment will consider a worst-case condition, whereby the Project footprint is considered completely enclosed for the life of the Project and none of the runoff from the Project footprint returns to Astotin Creek.

Potential Effects from Changes in Drainage Patterns and Changes in Channel Morphology: While there will be no transfer of water from one watershed to another as a result of the Project, the proposed Project footprint will cross Astotin Creek, which will be realigned from its current channel in NW 02, SE 11, Township 056, Range 11

W4M. The fish resources that have been recovered in the portion of Astotin Creek that would be re-aligned consist of mostly small-bodied species, one large-bodied species, and no game fish species. This portion of Astotin Creek is classified as *Stream-Recurring*, i.e., a river/stream with a stream bed that is often dry during certain times of the year due to climatic conditions and/or a limited area of drainage⁶. The proposed Astotin Creek realignment work will be in accordance with all applicable provincial requirements and the Federal Department of Fisheries requirements as stated in the *Fisheries Act*. Potential effects from changes in channel morphology downstream of the Project area, including changes in frequency of channel overtopping and flooding, are not anticipated. Similarly, because effects of any changes in surface runoff associated with Project development are expected to be negligible, sediment concentrations in Astotin Creek are not expected to increase.

Potential Effects from Surface Disturbance and Construction Activities: Surface disturbance and fill handling during construction (clearing and stripping of vegetation and topsoil to facilitate Project construction), operation, and decommissioning and dismantling of Project infrastructure may result in sediment deposition to the aquatic environment, which may affect surface water quality and sediment quality.

Potential Effects through Discharge of Project-Affected Waters and Accidental Spills: Discharge of Project-affected water into surface waters is not proposed for the Project. It is expected that process-produced water from the Project will be recycled to the extent possible. Accidental spills of fuels, hydrocarbons, chemicals, and waste products used for the Project could negatively affect water quality and sediment quality. The storage and handling of deleterious substances (*e.g.*, fuels, chemicals, contaminating materials, *etc.*) or hazardous materials would be dictated by applicable environmental legislation, regulations, standards, or codes.

Potential Effects from Changes in Groundwater Quality and Quantity: Project activities present a potential risk of contaminating groundwater, which in turn has the potential to result in adverse effects on surface water quality and sediment quality. There are two potential pathways of concern with respect to groundwater contamination that will be investigated and assessed: overland flow and accidental release of deleterious substances. The Project is located within the areal extent of the buried Beverly Channel aquifer. The buried channel is separated from surface activities by a thick layer of clay and clay till deposits (Andriashek 1988) and is not expected to be impacted by the Project.

Potential Effects through Instream Works: Watercourse crossings may be required as part of the proposed Project, and these will be designed and constructed in compliance with the *Alberta Code of Practice for Pipelines and Telecommunication Lines Crossing a Waterbody* (AESRD 2013a) and the *Alberta Code of Practice for Watercourse Crossings* (AESRD 2013b). Results from formal watercourse crossing assessments that will be conducted will guide the selection of appropriately sized crossing structures such that flows are not impeded during times of high flow and channel erosion does not occur.

Potential Effects due to Increased Fishing Pressure: Astotin Creek does not contain sport fish species. There is recreational fishing associated with larger waterbodies such as lower Beaverhill Creek and the North Saskatchewan River and the construction labour force for the Project may create incremental fishing pressure on local sport fish resources.

Potential Regional Effects: The potential effects of the Project described above may extend regionally, to lower Beaverhill Creek and to the North Saskatchewan River. The Regional Study Area for aquatic resources will include lower Beaverhill Creek and an extended part of the North Saskatchewan River below the confluence of Beaverhill Creek so as to assess any potential regional effects.

⁶ As defined in <https://geodiscover.alberta.ca/geoportal/catalog/search/resource/details.page?uuid=%7B7F9C0F33-6DDB-4479-B2D9-1419D79E2D26%7D>

Potential Effects of Acidifying Emissions: The Project may release acidifying emissions of NO_x and SO_x that can result in the acidification of waterbodies with subsequent effects on fish and fish habitat in those waterbodies. Evaluation of these potential effects will be conducted in the Regional Study Area adopted by the Air Quality component.

Species Listed Under Schedule 1 of the *Species at Risk Act*

A number of wildlife species may occur in the Fort Saskatchewan Area that are listed federally as “Special Concern” (may become a threatened or an endangered species) or are Schedule 1 species as defined under the *Species at Risk Act*. These include northern leopard frog, western tiger salamander, bank swallow, barn swallow, evening grosbeak, horned grebe, olive-sided flycatcher, rusty blackbird, short-eared owl, Sprague’s pipit, western grebe, and yellow rail. Terrestrial and aquatic habitats in the Fort Saskatchewan Area may support one or more of these species of conservation concern and may be affected by Project development.

Potential Effects from Changes to Surface Cover: The proposed Project footprint will be comprised of a number of facilities and infrastructure developments, which may affect federally-listed wildlife species that potentially occur in the area through several mechanisms. These effects include direct (e.g., vegetation clearing, wetland drainage, channel realignment, etc.) and indirect (e.g., noise/sensory disturbance) loss and/or alteration of habitats and potential reductions in local and regional habitat connectivity (i.e., movement corridors) resulting from habitat fragmentation. The assessment will assume a worst-case scenario where the Project footprint will be altered for the life of the Project, particularly as it relates to changes in terrestrial and aquatic habitats.

Potential Effects from Surface Disturbance and Construction Activities: Surface disturbance and fill handling during construction (clearing and stripping of vegetation and topsoil to facilitate Project construction), operation, and decommissioning of Project infrastructure may result in increased mortality risk for any federally-listed bird and amphibian species. Potential concerns are associated with destruction of nests, wetland drainage, and channel realignment.

Potential Effects through Discharge of Project-Affected Waters and Accidental Spills: Discharge of Project-affected water into surface waters is not proposed for the Project. It is expected that process-produced water from the Project will be recycled to the extent possible with the remainder disposed of via an approved deep well disposal facility. Accidental spills of fuels, hydrocarbons, chemicals, and waste products used for the Project could negatively affect water quality and sediment quality and any terrestrial areas adjacent to a spill site which could directly and/or indirectly affect federally-listed wildlife species. The storage and handling of deleterious substances (e.g., fuels, chemicals, contaminating materials, etc.) or hazardous materials would be dictated by applicable environmental legislation, regulations, standards, or codes.

Potential Regional Effects: The potential effects of the Project described above on federally-listed wildlife species may extend regionally to adjacent terrestrial habitats to aquatic habitats associated with Astotin Creek and to the North Saskatchewan River. The Regional Study Area for wildlife will include terrestrial and aquatic habitats within a 50 km² area around the Local Study Area so that any potential regional effects on federally-listed species are addressed.

Potential Effects of Acidifying Emissions and Other Pollutants: The Project may release acidifying emissions of NO_x, SO_x, or other pollutants. The primary mechanisms through which federally-listed wildlife can be affected include effects on habitat quality (e.g., inhalation and deposition on terrestrial vegetation or into water) and availability and

quality of food (e.g., ingestion of benthic invertebrates and/or terrestrial/aquatic vegetation). These potential effects will be assessed in the context of the Regional Study Area defined for the Air Quality component.

There are no aquatic species in Astotin Creek that are listed in any of the schedules of the *Species at Risk Act* or as a candidate species by COSEWIC. Therefore, no changes to aquatic species as defined in subsection 2(1) of the *Species at Risk Act* as a result of the Project are anticipated.

Migratory Birds within the Migratory Birds Convention Act

The Expansion may affect migratory birds as defined by the *Migratory Birds Convention Act*. Potential Project-related effects on migratory birds are expected to be largely related to direct (e.g., vegetation clearing, wetland drainage) and indirect (e.g., noise/sensory disturbance) loss and/or alteration of habitat, and increased mortality risk (e.g. nest destruction, collisions with Project infrastructure, etc.).

Other potential effects on migratory birds resulting from the construction, operation and decommissioning of the Project may include increases in ambient concentrations of criteria air contaminants, or accidental spills of deleterious substances (e.g., wildlife health through inhalation or ingestion) and reductions in habitat security and abundance (habitat loss and species displacement to adjacent habitats).

Mitigation Measures

To address the environmental aspects of the Expansion, VCS is committed to using appropriate adaptive best management practices (BMP) and mitigation measures that will be identified, analyzed and considered in the Project design.

Based on Project characteristics, VCS mitigation measures will be developed to directly address every identified potential impact. A Construction Environmental Management System (CEMP) will be prepared to provide a targeted mitigation plan that focuses on addressing possible effects on various specific environmental resources.

As well, the CEMP will be based on applicable provincial and federal regulations and permit requirements, the environmental conditions at the site and mitigations developed from the environmental impact assessments processes will be implemented in a timely manner.

Furthermore, VCS will seek the services of a qualified environmental professional (QEP) from a reputable environmental consulting company to detail in a CEMP all the potential construction-related environmental aspects. The plan will identify, develop, document and implement applicable mitigation measures and BMPs to avoid or reduce adverse construction impacts on the identified environmental aspects.

20. Changes to the Environment to Federal Lands

The Expansion's environmental impact assessment will be addressed in detail in the EIA including any potential impacts to the nearby Federal lands including:

- an air quality impact assessment, which will include:
 - a description of the potential for reduced air quality resulting from the Project;
 - an estimation of ground-level concentrations of appropriate air quality parameters;
 - a discussion of any expected changes to particulate deposition, nitrogen deposition or acidic deposition patterns; and

- a description of air quality impacts resulting from the Project, and their implications for other environmental resources, including habitat diversity and quantity, soil resources, vegetation resources and water quality.
- a noise impact assessment, which will include identification of components of the Project that have the potential to increase noise levels and a discussion of the implications, including:
 - potentially affected people and wildlife;
 - an estimate of the potential for increased noise resulting from the development; and
 - strategies to monitor and mitigate any increased noise levels.
- a human health risk assessment, which will evaluate the potential human health risks that would be posed by emissions from the Project.

The Expansion will enable an approximately 25-30% reduction of GHG emissions from upgrading and refining diluted bitumen to fuel products as compared to those of baseline without the Project (see Section 23 for details).

21. Impact to the Indigenous People of Canada on Physical and Cultural Heritage, Traditional Land Use and Historical Resources

The closest First Nation or Métis communities are approximately 60 km away. The proposed Expansion is located within AIH, an area dedicated to heavy industrial activities and development. No issues have been raised during the early consultation with the Indigenous communities. Below is a summary of commitments made by VCS based on discussions with Indigenous communities held to date:

- VCS is dedicated to protecting North Saskatchewan River throughout the life of the Project;
- Once approved, Indigenous communities will be included in the notification list in case of major incidents/emergency during construction and operation of the Project; and
- Indigenous communities are open to combine technical review and traditional land use studies, as appropriate, for cost savings and time effective reviews.

An historical, archaeological, and paleontological study including ground reconnaissance was conducted for VCS-H Project 1 which included part of the Expansion Project area in the 2004 EIA. An *Historical Resources Act* Clearance was granted for VCS-H Project 1 following the Historical Resource Impact Assessment. A record review is currently underway for the Expansion through a screening application to Alberta Culture, Multiculturalism and Status of Women.

VCS will gather information, including potential impacts, related to Indigenous physical and cultural heritage, traditional land use, and historical, archaeological, paleontological or architectural significance for the proposed Expansion during the consultation process with Indigenous communities. Collected information will help VCS to avoid or mitigate any potential adverse impacts of the proposed Project activities to Indigenous communities.

22. Impact to the Indigenous People of Canada on Health, Social or Economics

The nearest Indigenous communities are approximately 60 km away from the Expansion site. It is expected there are no adverse health, social or economic impact to the Indigenous People of Canada. Health risk assessment and socioeconomic impact assessment will be discussed within the regional and local study area centered at the Project in the EIA report.

It is expected that the Indigenous People of Canada will benefit from business/employment opportunities from the Project construction and potential partnership for direct economic benefits to uplift Indigenous wellbeing and wellness, all in harmony with sustainable growth of the Oil Sands upgrading industry.

23. GHG Emissions Estimates

The Expansion will generate GHG emissions throughout the construction, operation and decommissioning stages.

Construction and decommissioning GHG emissions will be provided in the detailed Project Description and are expected to represent a small fraction of the GHG emissions of the whole Project life. Sources of GHG emissions during these stages include on site stationary and mobile equipment/truck fuel combustion as well as the GHG emission associated with the imported electrical energy.

GHG emissions associated with operations will primarily be generated through the upgrader/specialty refinery process units that use natural gas and some refinery gas as a fuel source in addition to electricity for energy inputs.

The direct GHG emissions from operation of the Expansion are listed below in Table 6.

Table 6 Direct GHG Emissions for the Expansion Operation

	CO ₂ (kt/year)	CO (kt/year)	NO _x (kt/year)	CO _{2e} (kt/year)
Total	2,978	5	1.4	3,386

$$\text{Net GHG Emissions} = \text{Direct GHG Emissions} + \text{Acquired Energy GHG Emissions} - \text{CO}_2 \text{ Captured and Stored} - \text{Avoided Domestic GHG Emissions} - \text{Offset Credits}$$

Avoided domestic GHG emissions was calculated based on a life cycle analysis comparing the GHG emissions with or without the application of VCI technologies (Matrix Solutions 2018). The avoided domestic GHG emissions is estimated at 0.02 tonne CO_{2e}/barrel of bitumen processed.⁷ And it is estimated that there will be approximately 1,800 kt/year of net GHG emissions for the Expansion using the equation provided above (Government of Canada 2020).

The benchmark for DilBit-to-Tank life cycle analysis has DilBit being transported via pipeline to an extra heavy oil refinery near Edmonton with delayed coking process and refined to fuel products. Diluent that is separated from DilBit is then transported back to bitumen producers in the Athabasca region.

The Expansion case includes DilBit upgrading and refining at VCS-H Complex to produce ultra-low sulphur diesel and COLF upgraded crude oil blends. COLF blends are further refined into gasoline and diesel products at downstream medium or heavy oil refineries near Edmonton, which benefit from the selective removal of carbon-rich asphaltenes. Asphaltene storage/alternative usage may be qualified for offset credits although is not included in the current calculations.

Emission intensity is estimated by the equation provided below (Government of Canada 2020) and the emission intensity is projected to be approximately 0.014 tonne CO_{2e}/barrel of bitumen for the Expansion.

⁷ The avoided domestic GHG emissions could vary in a range depending on assumptions of refineries locations where bitumen or the COLF from VCS-H is refined. Current assumptions used in the model are Eastern Canada refineries to refine crudes received through pipelines.

Emission Intensity = Net GHG Emissions/Unit Produced

24. Waste and Emissions

The air emissions used in the Air Quality assessment includes Base Case emissions (i.e., emissions of existing and approved projects prior to the proposed Expansion application in a 120 km by 120 km study area centered at the Expansion site) plus the emission sources associated with the Expansion. Relative to the Base Case, the Expansion results in a small increase to regional SO₂, NO_x, particulate matter, or CO emissions in the range of 3% to 15%, as presented in Table 7.

Table 7 Expected Air Emissions from Operation of the Expansion

Emission Source	Emission Rate (t/d)			
	SO ₂	NO _x	Particulate Matter	CO
Base Case Including Planned Activities	134.2	104.3	10.2	97.1
The Expansion	12.5	3.1	0.61	15.0
% increase due to the Expansion	9%	3%	6%	15%

Additional types of waste that are expected to be generated from the Expansion include:

- disposal wastewater from water treatment;
- spent catalysts;
- spent adsorbent, ion exchange resins and catalyst supports;
- spent air desiccant; and
- other miscellaneous filters, containers etc.

A summary of the estimated quantities of these wastes that will be generated and anticipated disposal methods is presented in Table 8. The proposed Expansion will have mitigation measures and contingency plans for the waste in the event of leaks, spills, etc. as part of a detailed Waste Management Plan.

Table 8 The Expansion Solid Waste and Wastewater Information

	Quantity [t]	Frequency	Disposal Method
Solid Wastes			
Spent Catalysts for Hydroprocessing	1,800	3 years	Return to supplier for recycle
Spent Catalysts for Hydrogen Manufacturing	90	3 years	Return to supplier for recycle
Spent Zinc Oxide from Hydrogen Manufacturing	143	year	Third-party landfill
Spent Shift Catalyst from Hydrogen Manufacturing	154	3 years	Third-party landfill
Spent Adsorbents for Hydrogen Manufacturing	377	20 years	Third-party landfill
Spent Catalysts for Sulphur Recovery	500	3 years	Return to supplier for recycle
Spent Ceramic Balls (catalyst support)	580	3 years	Third-party landfill
Spent Air Desiccant	100	10 years	Third-party landfill
Spent Ion Exchange Resins for Water Treatment	200	7 years	Third-party landfill
Miscellaneous (filters, containers, domestic garbage, etc.)	To be determined	year	Third-party landfill



Wastewater for Deep Well Disposal			
Desalter reject water from process units	276	hour	Deep Well Disposal
Reject water from water treatment units	50.5	hour	Deep Well Disposal

Liquid and semi-liquid (sludge) waste management includes waste oils, spent liquid chemicals, sanitary sewage, and wastewater (Table 8). Waste oils will be stored in the existing slop oil tank and re-processed in the process units if suitable. Spent liquid chemicals, including contaminated oily wastes that are not suitable for re-processing, will be stored in designated containers, and shipped offsite by licensed third-party contractors for disposal or recycle. Sanitary waste will be hauled off-site by a licensed third-party contractor for further treatment and disposal.

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Appendix I. Information Required in Initial Description of Designated Project

(SOR/2019-283 Schedule 1)

PART A

General Information

- 1** The project's name, type or sector and proposed location.
- 2** The proponent's name and contact information and the name and contact information of their primary representative for the purpose of the description of the project.
- 3** A summary of any engagement undertaken with any jurisdiction or other party, including a summary of the key issues raised and the results of the engagement, and a brief description of any plan for future engagement.
- 4** A list of the Indigenous groups that may be affected by the carrying out of the project, a summary of any engagement undertaken with the Indigenous peoples of Canada, including a summary of key issues raised and the results of the engagement, and a brief description of any plan for future engagement.
- 5** Any study or plan, relevant to the project, that is being or has been conducted in respect of the region where the project is to be carried out, including a regional assessment that is being or has been carried out under section 92 or 93 of the Act or by any jurisdiction, including by or on behalf of an Indigenous governing body, if the study or plan is available to the public.
- 6** Any strategic assessment, relevant to the project, that is being or has been carried out under section 95 of the Act.

PART B

Project Information

- 7** A statement of the purpose of and need for the project, including any potential benefits.
- 8** The provisions in the schedule to the *Physical Activities Regulations* describing the project, in whole or in part.
- 9** A list of all activities, infrastructure, permanent or temporary structures and physical works to be included in and associated with the construction, operation and decommissioning of the project.
- 10** An estimate of the maximum production capacity of the project and a description of the production processes to be used.
- 11** The anticipated schedule for the project's construction, operation, decommissioning and abandonment, including any expansions of the project.
- 12** A list of
 - (a)** potential alternative means of carrying out the project that the proponent is considering and that are technically and economically feasible, including through the use of best available technologies; and
 - (b)** potential alternatives to the project that the proponent is considering and that are technically and economically feasible and directly related to the project.

PART C

Location Information

13 A description of the project's proposed location, including

- (a) its proposed geographic coordinates, including, for linear development projects, the proposed locations of major ancillary facilities that are integral to the project and a description of the spatial boundaries of the proposed study corridor;
- (b) site maps produced at an appropriate scale in order to determine the project's proposed general location and the spatial relationship of the project components;
- (c) the legal description of land to be used for the project, including, if the land has already been acquired, the title, deed or document and any authorization relating to a water lot;
- (d) the project's proximity to any permanent, seasonal or temporary residences and to the nearest affected communities;
- (e) the project's proximity to land used for traditional purposes by Indigenous peoples of Canada, land in a *reserve* as defined in subsection 2(1) of the *Indian Act*, *First Nation land* as defined in subsection 2(1) of the *First Nations Land Management Act*, land that is subject to a comprehensive land claim agreement or a self-government agreement and any other land set aside for the use and benefit of Indigenous peoples of Canada; and
- (f) the project's proximity to any federal lands.

14 A brief description of the physical and biological environment of the project's location, based on information that is available to the public.

15 A brief description of the health, social and economic context in the region where the project is located, based on information that is available to the public or derived from any engagement undertaken.

PART D

Federal, Provincial, Territorial, Indigenous and Municipal Involvement

16 A description of any financial support that federal authorities are, or may be, providing to the project.

17 A list of any federal lands that may be used for the purpose of carrying out the project.

18 A list of any jurisdictions that have powers, duties or functions in relation to an assessment of the project's environmental effects.

PART E

Potential Effects of the Project

19 A list of any changes that, as a result of the carrying out of the project, may be caused to the following components of the environment that are within the legislative authority of Parliament:

- (a) fish and fish habitat, as defined in subsection 2(1) of the *Fisheries Act*;

(b) aquatic species, as defined in subsection 2(1) of the *Species at Risk Act*; and

(c) migratory birds, as defined in subsection 2(1) of the *Migratory Birds Convention Act*, 1994.

20 A list of any changes to the environment that, as a result of the carrying out of the project, may occur on federal lands, in a province other than the province in which the project is proposed to be carried out or outside Canada.

21 With respect to the Indigenous peoples of Canada, a brief description of the impact — that, as a result of the carrying out of the project, may occur in Canada and result from any change to the environment — on physical and cultural heritage, the current use of lands and resources for traditional purposes and any structure, site or thing that is of historical, archaeological, paleontological or architectural significance, based on information that is available to the public or derived from any engagement undertaken with Indigenous peoples of Canada.

22 A brief description of any change that, as a result of the carrying out of the project, may occur in Canada to the health, social or economic conditions of Indigenous peoples of Canada, based on information that is available to the public or derived from any engagement undertaken with Indigenous peoples of Canada.

23 An estimate of any greenhouse gas emissions associated with the project.

24 A list of the types of waste and emissions that are likely to be generated — in the air, in or on water and in or on land — during any phase of the project.

PART F

Summary

25 A plain-language summary of the information that is required under items 1 to 24 in English and in French.

Appendix II: Indigenous Groups Consultation List

The following is a list of the regional First Nations and Métis Locals that are being consulted and may be affected by the carrying out of the Project.

Alexander First Nation
Alexis Nakota Sioux Nation
Athabasca Chipewyan First Nation
Beaver Lake Cree Nation
Blood Tribe
Buffalo Lake Métis Settlement
Chipewyan Prairie Dene First Nation
Descendants of Michel First Nation (Michel First Nation)
Elizabeth Métis Settlement
Enoch Cree Nation #440
Ermineskin Cree Nation
Fishing Lake Métis Settlement
Foothills Ojibway First Nation*
Fort McMurray First Nation #468
Friends of Michel Society (Michel First Nation)*
Gunn Métis Local 55
Kehewin Cree Nation
Kikino Métis Settlement
Louis Bull Tribe
Métis Nation of Alberta – Region 4
Montana First Nation
O'Chiese First Nation
Paul First Nation
Piikani Nation
Saddle Lake Cree Nation
Samson Cree Nation
Siksika Nation
Stoney Nakoda Nation
Tsuut'ina Nation
Whitefish Lake First Nation #128

VCS was not able to reach the two groups with asterisks() with information packages returned