

## **Acknowledgements**

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## **Executive Summary**

JACOS is a 100% owned Canadian subsidiary of Canada Oil Sands Co., Ltd. (CANOS), a Japanese subsidiary of Japan Petroleum Exploration Co., Ltd. (JAPEX). JAPEX is a petroleum exploration and production company and is traded on the Tokyo Stock Exchange (Securities Code Number 1662).

JACOS started in the Athabasca area in 1978 when the company "farmed in" on leases held by Petro-Canada, Canadian Occidental (Nexen Inc.) and Esso (Imperial Oil) to form what is referred to as the PCEJ group. All of these companies are currently active in pursuing oil sands development in the region.

JACOS currently operates a steam-assisted gravity drainage (SAGD) Demonstration Project in the Hangingstone area about 52 kilometres south southwest of Fort McMurray, Alberta in Township 84, Range 11 W4M. The JACOS Hangingstone Demonstration Project (the Demonstration Project) is in its eleventh year of operation of a projected 25 year lifespan. The facility started producing bitumen in July 1999 and production has increased to its current level of 1200 m<sup>3</sup>/d (7500 bpd). The licensed maximum capacity is 1750 m<sup>3</sup>/d (11 000 bpd).

In 2001, JACOS proposed the development of a project in the same Hangingstone project area and commenced Environmental Impact Assessment (EIA) work and conceptual engineering. That proposed project was put on hold prior to filing for approval while the company underwent a substantial change in its ownership structure.

In May of 2008, JACOS issued a new Public Disclosure Document for public review and comment. The details of the JACOS Hangingstone Expansion Project (the Expansion Project), as described in this Application, are similar to what was originally disclosed in 2001 but there are sufficient differences to require completion of a new EIA and Application package. Figure 1-1 provides an overview of the location of the Expansion Project within the region. Figure 1-2 shows the extent of the planned Project Footprint within the overall Expansion Project Area. Figure 1-3 shows a Project Flow Diagram for the Expansion Project.

The Application is being submitted to AENV and the Energy Resources Conservation Board (ERCB) to meet the needs of the various regulations that cover applications for industrial facilities.

This EIA has been prepared following Terms of Reference from Alberta Environment. A comprehensive methodology has been used to assess the effects of the Expansion Project on a number of valued environmental components (VECs), including:

- Air Quality
- Noise
- Hydrogeology
- Hydrology
- Surface Water Quality
- Fish and Fish Habitat

- Terrain and Soils
- Vegetation and Wetlands
- Wildlife
- Biodiversity and Fragmentation
- Land and Resource Use
- Visual Aesthetics
- Historical Resources
- Traditional Ecological Knowledge and Land Use
- Socio-Economics
- Human and Ecological Health

The results of the EIA are summarized in the Summary Report – Environmental Impact Assessment (the EIA Summary), provided as a stand-alone document as the first volume in the Application package. The EIA Summary includes brief discussions of methods and findings of the EIA.

At the request of Aboriginal groups who have been involved in the review of the EIA methods and findings, a brief, qualitative comparison of pre- and post-disturbance conditions in the area is provided as Appendix 14 B (Volume 2, Section 14, Biodiversity and fragmentation). This assessment qualitatively compares conditions in 1949 and 2009 using air photos from each year.

The EIA concludes that there will be direct and indirect effects on the various environmental components in the vicinity of the Expansion Project. However, with application of management measures and procedures (modified from those used for the currently operating Demonstration Project), and implementation of the various mitigation strategies and activities described in the Expansion Project Description and EIA, there are not expected to be any significant effects resulting from the Expansion Project. Some rare and endangered plants and animals have been found on and around the area to be occupied by the Expansion Project, but mitigation measures and final project siting (e.g. final placement of CPF and wellpads) are expected to limit any effects.

The findings of the EIA support the conclusion that JACOS can construct, operate and decommission the Hangingstone Expansion Project in a manner that will not have significant effects on the environment.

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## Abbreviations

7Q10.....	lowest seven-day average flow with a return period of 10 years
95 <sup>th</sup> UCLM .....	95 <sup>th</sup> upper confidence limit of the mean
AAAQG.....	Alberta Ambient Air Quality Guideline
AAAQO.....	Alberta Ambient Air Quality Objective
AADT .....	average annual daily traffic
AAFRD .....	Alberta Agriculture Food and Rural Development
AAQC .....	ambient air quality criteria
ABMI.....	Alberta Biodiversity Monitoring Institute
ACBS.....	Alberta Centre for Boreal Studies
ACCS .....	Alberta Culture and Community Spirit
ACFN.....	Athabasca Chipewyan First Nation
ADAG .....	Alberta Acid Deposition Assessment Group
ADCP .....	Acoustic Doppler Current Profiler
ADD.....	average daily dose
ADV .....	Acoustic Doppler Velocimeter
AENV.....	Alberta Environment
AEP .....	Alberta Environmental Protection
AF .....	absorption factor
AFB .....	absolute fraction bias
AFDM .....	ash-free dry mass
AGCC.....	Alberta Ground Cover Classification
AGP.....	aboveground pipeline
AGRASID .....	Agricultural Region of Alberta Soil Information Database
AGS.....	Alberta Geological Survey
AI-Pac.....	Alberta-Pacific Forest Industries Inc.
ANHIC .....	Alberta Natural Heritage Information Centre
ANPC .....	Alberta Native Plant Council
ANS.....	absolute number of species
AOSERP .....	Alberta Oil Sands Environmental Research Program
AOSP .....	Alberta Oil Sands Project
AQM.....	air quality monitoring
AQMG .....	Air Quality Model Guideline
ARG.....	Aboriginal Review Group
asl.....	above sea level
ASL.....	ambient sound level
ASRD .....	Alberta Sustainable Resource Development
ATPR.....	Alberta Tourism, Parks and Recreation

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ATS	Alberta Township System
ATSDR	Agency for Toxic Substances and Disease Registry
ATV	all-terrain vehicle
AVI	Alberta Vegetation Inventory
AWI	Alberta Wetland Inventory
AXYS	AXYS Environmental Consulting Ltd.
B(a)P	benzo(a)pyrene
BA	Baseline Assessment
BAF	bio-accumulation factor
BATEA	Best Available Technology Economically Achievable
BCF	bioconcentration factor
bgl	below ground level
BH	Boreal Highlands
bpd	barrels per day
BTEX	benzene, toluene, ethylbenzene and xylenes
BW	body weight
C&R	conservation and reclamation
CACs	criteria air contaminants
Cal EPA	California Environmental Protection Agency
CAS	Chemical Abstracts Service
CASA	Clean Air Strategic Alliance
CBD	Convention on Biological Diversity
CCME	Canadian Council of Ministers of the Environment
CDED	Canadian Digital Elevation Data
CEAA	<i>Canadian Environmental Assessment Act</i>
CEC	cation exchange capacity
CEMA	Cumulative Environmental Management Association
CEPA	<i>Canadian Environmental Protection Act</i>
CHRS	Canadian Heritage Rivers System
CM	Central Mixedwood
CMAQ	Community Multi-Scale Air Quality modeling system
CNRL	Canadian Natural Resources Limited
CNS	central nervous system
CNT	consultative notation
CO <sub>2e</sub>	carbon dioxide equivalent
COPC	chemical(s) of potential concern
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CPAWS	Canadian Parks and Wilderness Society

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CPDFN	Chipewyan Prairie Dene First Nation
CPF	central processing facility
CPPI	Canadian Petroleum Products Institute
Cr	chromium
CR	concentration ratio
CS <sub>2</sub>	carbon disulphide
CSF	chemical-specific cancer slope factor
CTDM	complex terrain dispersion model
CV	critical chemical values
CWL	continuous water level
CWQG	Canadian Water Quality Guidelines
CWS	Canada-wide Standard
DA	drainage area
dB	decibel
dBA	A-weighted decibel
dbC	C-weighted decibel
DBH	diameter at breast height
DEM	digital elevation model
Demonstration Project	JACOS Hangingstone Demonstration Project
DFO	Fisheries and Oceans Canada
DO	dissolved oxygen
DOC	dissolved organic carbon
DRS	Disposition Reservation
EC	electrical conductivity
EC	Environment Canada
Eco-SSL	ecological soil screening level
EIA	environmental impact assessment
ELC	Ecological Land Classification
EPC	exposure point concentration
EPEA	<i>Environmental Protection and Enhancement Act</i>
EPP	Environmental Protection Plan
ERA	ecological risk assessment
ERCB	Energy Resources Conservation Board
ESA	environmentally sensitive area
ESA	Environmentally Significant Area
EUB	Energy Utilities Board
Expansion Project	JACOS Hangingstone Expansion Project
FEARO	Federal Environmental Assessment and Review Office

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FGD.....	flue gas desulphurization
FM #468 FN .....	Fort McMurray #468 First Nation
FMA.....	FMA Heritage Inc.
FMA.....	Forest Management Agreement
FMFN .....	Fort McKay First Nation
FMUs.....	forest management units
FONG.....	AWI wetland type: Peatland/Graminoid (Poor and Rich Fens)
FONS .....	AWI wetland type: Peatland/Shrubby (Poor and Rich Fens)
FTNN.....	AWI wetland type: Peatland/Wooded (Treed Poor and Rich Fens)
FToR .....	Final Terms of Reference
FWMIS .....	Fisheries and Wildlife Management Information System
GCM.....	global climate model
GDP.....	gross domestic product
GHG .....	greenhouse gas
GIR.....	government industry relations
GIS .....	geographic information system
GLC.....	ground-level concentration
GPS.....	global positioning system
GWP.....	global warming potential
H <sup>+</sup> /ha/y.....	Hydrogen Ion Equivalent per hectare per year
HD-MAPP.....	High Definition Mapping and Application system
HHERA.....	human health and ecological risk assessment
HHRA.....	human health risk assessment
HHRAP.....	human health risk assessment protocol
HP .....	high pressure
HQ.....	hazard quotient
HRIA.....	Historical Resources Impact Assessment
HSI .....	habitat suitability index
IBA.....	International Association for Bear Research and Management
IDF.....	intensity duration frequency
IF .....	intake factor
ILCR.....	incremental lifetime cancer risk
IPCC.....	Intergovernmental Panel on Climate Change
IR.....	ingestion rate
IRC.....	Industry Relations Corporation
IRIS .....	Integrated Risk Information System
IRP .....	Integrated Resource Plan
ISO.....	International Organization for Standardization

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ISP	Industrial Sample Plot
JACOS	Japan Canada Oil Sands Limited
ka BP	thousand years before present
keq H <sup>+</sup> /ha/y	kiloequivalents hydrogen ion per hectare per year
kg CO <sub>2e</sub> /bbl	kilograms carbon dioxide equivalent per barrel
kg N/ha/y	kilograms nitrogen equivalent per hectare per year
kg/ha/yr	kilograms per hectare per year
K <sub>h</sub>	horizontal hydraulic gradient
KI	Key Indicator
KNOC	Korea National Oil Corporation
K <sub>ow</sub>	octanol-water partition coefficient
kt/y	kilotonnes per year
LACT	lease automatic custody transfer
LADD	lifetime average daily dose
LAI	Leaf Area Index
LAPR	Lower Athabasca Planning Region
LC <sub>50</sub>	median lethal concentration
LCC	Land Capability Class
LCCS	Land Capability Classification System
LCR	lifetime cancer risk
LD <sub>50</sub>	median lethal dose
L <sub>eq</sub>	energy equivalent sound level
LICA	Lakeland Industry and Community Association
LiDAR	Light Detection and Ranging
LOAEL	lowest observed adverse effect level
Lower Athabasca Region	Lower Athabasca Land Use Region
LP	low pressure
LSA	local study area
LSAS	Land Status Automated System
max	maximum
MCFN	Mikisew Cree First Nation
MDP	Municipal Development Plan
MJ/m <sup>2</sup> /day	Megajoules per square metre per day
MOE	Ontario Ministry of the Environment
MONG	AWI wetland type: Non-Peatland/Graminoid (Open Marsh/Wet Meadow)
MP	McElroy-Pooler
MSC	Meteorological Services of Canada
MSES	Management and Solutions in Environmental Science

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MW	megawatt
NAAQO	National Ambient Air Quality Objectives
NAD 83	North American Datum 1983
NAPS	National Air Pollutant Surveillance Network
NIA	noise impact assessment
NMVOCs	non-methane volatile organic compounds
NOAEL	no observed adverse effect level
NO <sub>x</sub>	oxides of nitrogen
NRC	Natural Regions Committee
NRDC	National Resources Defense Council
NTDB	National Topographic Database
NTS	National Topographic System
NWPA	Navigable Waters Protection Act
OLM	Ozone Limiting Method
OSDG	Oil Sands Developers Group
OTSG	once-through steam generator
PA	Project Area
PAH	polycyclic aromatic hydrocarbon
PAI	potential acid input
PDA	Project Development Area
PDC	Planned Development Case
PDF	probability distribution function
PG	Pasquill Gifford
PHC	petroleum hydrocarbons
PIL	Project Inclusion List
PM <sub>2.5</sub>	fine particulate matter
PMP	probable maximum precipitation
PNT	protective notation
ppb	parts per billion
ppbv	parts per billion by volume
PPRTV	provisional peer reviewed toxicity value
PQRA	preliminary quantitative risk assessment
PSBP	plant biodiversity potential
PSL	permissible sound level
Q	flow
Q <sub>2</sub>	1:2-year peak flow
QA/QC	quality assurance and quality control
Q <sub>R</sub>	peak flow associated with given return period

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RAMP	Regional Aquatics Monitoring Program
RD	Rural District
RELAD	Regional Lagrangian Acid Deposition
RfC	reference concentration
RfD	reference dose
RFMA	Registered Fur Management Area
RIVM	The Netherlands National Institute for Public Health and the Environment
RMWB	Regional Municipality of Wood Buffalo
ROI	region of influence
ROW	right-of-way
RSA	regional study area
RSC	reduced sulphur compound
RSDS	Regional Sustainable Development Strategy
RSF	resource selection function
RSPF	resource selection probability function
SAGD	steam-assisted gravity drainage
SARA	<i>Species at Risk Act</i>
SCR	Selective Catalytic Reduction
SCRAM	Support Centre for Regulatory Air Models
SE	standard error
SEIA	socio-economic impact assessment
SEWG	Sustainable Ecosystems Working Group
SF	slope factor
SIL	Survey intensity level
SMC	surface material licence
SME	surface materials exploration
SML	surface material lease
SONS	AWI wetland type: Non-Peatland/Shrubby (Open Deciduous Swamp)
SOP	standard operating procedure
sp	species
Spp	species (plural)
Stantec	Stantec Consulting Ltd.
STNN	AWI wetland type: Non-Peatland/Wooded (Coniferous Swamp)
STP	south tailings pond
t/d	tonnes per day
TDA	timber damage assessment
TDL	Temporary Diversion License
TDS	total dissolved solids

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TEEM .....	Terrestrial Environmental Effects Monitoring
TEK .....	Traditional Ecological Knowledge
TEQ .....	toxic equivalency
THC .....	total hydrocarbon
TK .....	Traditional Knowledge
TLU .....	Traditional Land Use
TLUOS .....	Traditional Land Use and Occupancy Study
TLUS .....	Traditional Land Use Study
ToR .....	Terms of Reference
TPH .....	total petroleum hydrocarbons
TPR .....	timber productivity rating
TRS .....	total reduced sulphur
TRV .....	toxicity reference value
TSP .....	total suspended particulate
TSS .....	total suspended solids
UCL .....	upper confidence limit
UF .....	uncertainty factor
ug/L .....	microgram (10 <sup>-6</sup> g) per litre
ULSE .....	Universal Soil Loss Equation
UNECE .....	United Nations Economic Commission for Europe
UNEP .....	United Nations Environment Program
UP .....	uptake factor
UR .....	unit risk factor
US EPA .....	United States Environmental Protection Agency
UTM .....	Universal Transverse Mercator
VCR .....	Voluntary Challenge and Registry
VEC .....	Valued Environmental Component
VOC .....	volatile organic compounds
VP .....	visual interest point
VRU .....	vapour recovery unit
WBEA .....	Wood Buffalo Environmental Association
WBHDC .....	Wood Buffalo Housing and Development Corporation
WHO .....	World Health Organization
WMO .....	World Meteorological Organization
WMU .....	wildlife management unit
WONN .....	AWI wetland type: Non-Peatland/Shallow Open Water
WSBP .....	wildlife biodiversity potential
WSC .....	Water Survey of Canada

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$\mu\text{g/kg bw/d}$  ..... micrograms per kilogram of body weight per day  
 $\mu\text{g/L}$  ..... microgram per litre  
 $\mu\text{g/m}^3$  ..... microgram per cubic metre  
 $\mu\text{S/cm}$  ..... microsiemens/centimetre