5- YEAR LONG-TERM MONITORING OR OPERATIONAL ACTIVITY WORK PLAN

Changes to this Work Plan are only accepted via an Approved Addendum.

General Information		
Monitoring Category: *(From OSM long-term plan; choose from drop-down menu)*	Biotic Response Monitoring	
Strategic Monitoring Objective: *(From OSM long-term plan; choose from drop-down menu)*	Objective: Integration and Synthesis	
Work Plan Unique Identifier:	*R-5-1718*	
Monitoring Activity Title:	Integration & Evaluation – Ecosystem Health	
Geographic Location (*choose from drop-down menu, if Project Location is in more than one area choose from second drop-down***)**	Location Not Applicable	
Monitoring Site(s) Coordinates *(latitude and longitude)*	N/A	
Monitoring Organization and Responsible Manager:	Alberta Environment and Parks	Dan Farr
Date Monitoring initiated:	**2016**	
Specific Monitoring Objective: *(State the monitoring objective addressed through this monitoring)*	This work involves establishing and updating the current state of knowledge on the impacts of oil sands development on biodiversity and wildlife health. Overall objectives focus on: **1. Synthesis:** Synthesize findings from the entire suite of JOSM Biodiversity and Wildlife Health projects. **2. Recommendations for adaptive monitoring:** Ongoing assessment and review of scientific, regulatory and socio-economic drivers to inform the design of both biodiversity monitoring components, how effectively the programs address identified needs, and recommendations for design and implementation going forward.	
Deliverables (Annual): *What Data Reports will be produced and when?*	Annual Summary Report Annual Publication	

Monitoring Plan Summary: *Please summarize the monitoring including relevant information such as background, objectives, monitoring area, methods/monitoring design, assumptions, outcomes, and references. These should align with the information provided in Appendix 1: Annual Monitoring Schedule.*

In 2012, the Governments of Canada and Alberta launched the Joint Canada | Alberta Implementation Plan for Oil Sands Monitoring (JOSM; Governments of Canada and Alberta 2012). Along with Air and Water, Biodiversity was identified as a priority for monitoring impacts of oil sands activity. A broad-based biodiversity monitoring program was supported under two JOSM components aligning with major stressors: 1) Wildlife Contaminants and Toxicology and 2) Biodiversity and Land Disturbance. Projects included surveillance monitoring of species and habitats, targeted effects assessment to understand relationships between species and stressors, and methodological assessments to evaluate and improve the protocols and technologies for monitoring.

The resulting program enabled new monitoring initiatives, but also recognized existing capacity and sought to leverage and augment monitoring efforts that were aligned with objectives outlined in the JOSM Implementation Plan. Projects were designed to address stated monitoring and research questions, including: response of species in the oil sands region to ecological and anthropogenic stressors, especially the cumulative effects of habitat disturbance (e.g., Schieck et al. 2013, Solymos et al. 2015a, Mahon et al. 2016, Holloway et al. in review); and toxic effects on species from contaminants released by oil sands operations (e.g., Smits and Fernie 2013).

Methods for monitoring biodiversity and wildlife health include: field samples and lab analyses to measure concentrations of contaminants and assess their physiological effects; field surveys (ground and aerial) to characterize populations and selected measures of individual fitness; and the use of remotely sensed data to characterize the spatial pattern and composition of vegetation and industrial footprint.

Sampling designs range from the province-wide systematic grid implemented by the ABMI (Burton et al. 2014), to stratified sampling of relatively rare species and habitats (Mahon et al. 2016), to targeted sampling of locations selected on the basis of their proximity to oil sands operations (e.g., Smits and Fernie 2013). Focal species included landbirds, waterfowl, ungulates (including woodland caribou), furbearers, amphibians, invertebrates, vascular plants, non-vascular plants, and lichens. Sampled environments include a wide range of both upland and lowland habitat types, including lakes and wetlands, throughout the oil sands region.

Individual monitoring organizations use the data they collect under OSM to evaluate and report on the status of biodiversity and wildlife health in the oil sands region, and assess the impacts of oil sands activity. The broader program objectives have been parsed among multiple individual projects, resulting in complementary but differing results. While publication of findings is ongoing within individual OSM projects, there is a need to compile, synthesize and disseminate findings from the entire suite of projects.

This project will synthesize the data and findings of OSM Biodiversity and Wildlife Health monitoring to date, benchmarking the current state of knowledge on the impacts of oil sands development on biodiversity and wildlife health. We will also assess the extent to which these monitoring activities support legislation and policy to manage and mitigate negative environmental impacts, and inform decisions on future monitoring priorities.

Synthesis will focus on the following activities:

1. Integration of results
2. Ongoing reporting and publication
3. Adaptive monitoring and program design

The substantial investments of financial and other resources since the start of JOSM in 2012 have resulted in a large and diverse set of biodiversity and wildlife health data. While some of these data are available on federal and provincial oil sands monitoring portals (http://www.jointoilsandsmonitoring.ca/, http://osip.alberta.ca), much of the data are held by the organizations that collected it (e.g., Solymos et al. 2015). **Integration of results** will involve a yearly inventory of available findings and data to enable summaries, presentations, and analyses.

Monitoring results will be compiled annually into an **ongoing reporting series** that brings together findings from the entire suite of biotic response projects. This compilation will inform the identification of more detailed summary analyses to be investigated each year. Summary analyses may focus on specific taxa, stressors, or other areas of investigation that warrant further work.

The design of the monitoring system is informed by a number of regulatory, scientific, and socio-economic drivers. The dynamic nature of these drivers underlies the necessity of an **adaptive approach to monitoring**. Synthesis will include ongoing review and consideration of these drivers, the perceived needs arising from them, how the resulting programs can be designed in response, and how effectively needs are addressed. This work will include a combination of literature review, interviews, and workshops. In so doing, we will produce a series of recommendations to inform optimization of adaptive monitoring programs for oil sands monitoring and for other monitoring programs.

References:

Burton, A.C., Huggard, D., Bayne, E., Schieck, J., Sólymos, P., Muhly, T., Farr, D. and Boutin, S., 2014. A framework for adaptive monitoring of the cumulative effects of human footprint on biodiversity. Environmental monitoring and assessment, 186(6), pp.3605-3617.

Governments of Canada and Alberta. 2012. Joint Canada/Alberta implementation plan for oil sands monitoring. Canada. Environment Canada.

Holloway, G.L, C.L. Mahon, and E.M. Bayne, in review. Additive and interactive effects on boreal landbirds: A cumulative effects analysis in a multi-stressor landscape. Landscape Ecology.

Mahon, C. L., Holloway, G., Sólymos, P., Cumming, S. G., Bayne, E. M., Schmiegelow, F. K., & Song, S. J. (2016). Community structure and niche characteristics of upland and lowland western boreal birds at multiple spatial scales. Forest Ecology and Management, 361, 99-116.

Mahon, C.L., G. Holloway, T.M. Carpenter, and J. Keim. 2016. Assessing impacts of Steam Assisted Gravity Drainage (SAGD) disturbance on lowland boreal birds at regional- and lease-area scales. Draft manuscript submitted as report to JOSM.

Schieck, J., T. Muhly, D. Huggard, P. Solymos, D. Pan, S. Heckbert and E. Bayne. 2013. Predicting the cumulative effects of human development on biodiversity in northeastern Alberta. Prepared under contract for Petroleum Technology Alliance Canada (Alberta Upstream Petroleum Research Fund), Calgary, AB.

Smits, J.E.G., and K.J. Fernie. 2013. Avian wildlife as sentinels of ecosystem health. Comparative Immunology, Microbiology, and Infectious Diseases 36, 333-342.

Sólymos, P., C.L. Mahon, P.,Fontaine and E.M.Bayne (2015). Predictive Models for Estimating the Cumulative Effects of Human Development on Migratory Landbirds in the Oil Sands Areas of Alberta, Joint Oil Sands Monitoring: Cause-Effects Assessment of Oil Sands Activity on Migratory Landbirds, Edmonton, AB. pp. 38. http://www.borealbirds.ca/files/Technical_Reports/JOSM_report_Solymos_et_al_2015_final_2.pdf

Sólymos, P., Morrison, S. F., Kariyeva, J., Schieck, J., Haughland, D. L., Azeria, E. T., ... & Narwani, T. 2015b. Data and information management for the monitoring of biodiversity in Alberta. Wildlife Society Bulletin, 39(3), 472-479.

Appendix 1 – Annual Monitoring Schedule

(Please provide detailed information on the specifics of your monitoring schedule including – **locations, schedule, methods**, **SOPs, QA/QC data release**, **references**)

Sampling Locations/Sites	**Sampling Schedule** (*timing/frequency)*	**Compounds to be Analyzed**	**SOPs to be Consulted** (*hyperlinks accepted*)	**QA/QC Complete & Date Data to be Released**
NA	NA	NA	NA	NA

Appendix 2 – Detailed Multi-Year Financial Breakdown: if changes are to be made then an Addendum must be Complete and Approved.

(Complete the following detailed financial breakdown; add or delete categories as required)

Budget requirements	Year 1 (2017- 2018)		Year 2 (201X- 201Y)		Year 3 (201X- 201Y)		Year 4 (201X- 201Y)		Year 5 (201X- 201Y)	
	OSM Funding	External Funding	OSM Funding	External Funding	OSM Funding	External Funding	OSM Funding	External Funding	OSM Funding	External Funding
1) Salaries and benefits										
a) Appendix 3 - Totals	200,000		200,000		200,000		200,000		200,000	
2) Operations and Maintenance										
a) Vehicles and Transportation										
b) Helicopter										
c) Lab analysis										
d) Data management										
e) Field work										
3) Consumable Materials and supplies										
a) (*Describe Consumable Supply*)										
4) Travel										
a) Conferences and meetings (*identify conference/meeting*)										
b) Field work - travel										

c) Project-related travel										
5) External Contracts										
a) (*Describe External Contractor*)										
Grand Total	200,000		200,000		200,000		200,000		200,000	

Appendix 3 – Staffing Plan

(Complete the following detailed staffing plan; add or delete categories as required)

ENVIRONMENT AND CLIMATE CHANGE CANADA PORTION

	Year 1 – Budget Allocation		Year 2 – Budget Allocation		Year 3 – Budget Allocation		Year 4 – Budget Allocation		Year 5 – Budget Allocation	
Responsible Role	OSM Funding	External Funding	OSM Funding	External Funding	OSM Funding	External Funding	OSM Funding	External Funding	OSM Funding	External Funding
Science Expertise PhD student – RAP Casual hire ECCC – EG03 Contractor	 30,430 24,164 22,000		76,594		76,594		76,594		76,594	
Technical/Field Staff										
Administrative and Program Coordination										
Grand Total (*inserted into Appendix 2*)	$76,594	$	$76,594	$	$76,594	$	$76,594	$	$76,594	$

ALBERTA ENVIRONMENT AND PARKS PORTION

	Year 1 – Budget Allocation		Year 2 – Budget Allocation		Year 3 – Budget Allocation		Year 4 – Budget Allocation		Year 5 – Budget Allocation	
Responsible Role	OSM Funding	External Funding	OSM Funding	External Funding	OSM Funding	External Funding	OSM Funding	External Funding	OSM Funding	External Funding
Science Expertise Post-doc / AEP wage hire Post-doc / AEP wage hire	 61,703 61,703		123,406		123,406		123,406		123,406	
Technical/Field Staff										
Administrative and Program Coordination										
Grand Total (*inserted into Appendix 2*)	$123,406	$	$123,406	$	$123,406	$	$123,406	$	$123,406	$

Appendix 4 - Approvals

Project Submitted by:		
Name:		
Organization:	Signature:	Date:

Project Approved by:		
Dr. Monique Dubé AEP)		**Dr. Kevin Cash (ECCC)**
Signature 		Signature 
Date		Date