Work Plan Application

Project Information	
Project Title:	Wetland Ecosystem Monitoring Program
Lead Applicant, Organization, or Community:	Craig Mahoney. Alberta Environment and Protected Areas
Work Plan Identifier Number: If this is an on-going project please fill the identifier number for 24/25 fiscal by adjusting the last four digits: **Example:** D-1-2425 would become D-1-**2425**	WL-PD-10-2425
Project Region(s):	Oil Sands Region
Project Start Year: First year funding under the OSM program was received for this project (if applicable)	2017
Project End Year: Last year funding under the OSM program is requested **Example: 2024**	Ongoing
Total 2024/25 Project Budget: From all sources for the 2024/25 fiscal year	
Requested OSM Program Funding: For the 2024/25 fiscal year	$1,896,088.00
Project Type:	Long Term Monitoring
Project Theme:	Wetlands
Anticipated Total Duration of Projects (Core and Focused Study (3 years))	Year 3
Current Year (choose one):	Focused Study -Select One-
	Core Monitoring Year 3 of 3

Contact Information

Lead Applicant/ Principal Investigator: Every work plan application requires one lead applicant. This lead is accountable for the entire work plan and all deliverables.	Craig Mahoney
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Project Summary

In the space below, please provide a summary of the proposed project that includes a brief overview of the project drivers and objectives, the proposed approach/methodology, project deliverables, and how the project will deliver to the OSM Program objectives. The summary should be written in plain language and **should not exceed 300 words**.

This work plan aims to achieve the Wetlands TAC vision of an Integrated Wetland Monitoring Program (WMP) with an adaptive monitoring, evaluation and reporting system that is inclusive of and responsive to local Indigenous Communities. The Integrated Wetland Work Plan was developed in alignment with the Scope of Work (reviewed by SIKIC) by a team of wetland scientists and the Wetland TAC and addresses OSM Program mandates to determine the following key questions:

1. If changes in wetland ecosystem indicators are occurring in the oil sands region?
2. If these changes are caused by oil sands development activities?
3. What contribution of change is caused by oil sands development in the context of cumulative effects?

The Integrated WMP Work Plan includes:

1. The Surveillance WMP will deliver critical monitoring data required to assess wetland condition within the context of OSM mandates. A wetland TAC- and SIKIC-identified priority under the Surveillance WMP is the continued expansion of the wetland monitoring site network to establish baseline conditions for wetland indicators (completion 2025), any deviations from which (in disturbed wetlands) may be assessed. This works to address the Surveillance Effect Key Question for Wetlands recommended by the Oversight Committee: ‘How have wetland ecosystems changed from baseline?’
2. Bog monitoring efforts to assess the effect of deposition on bog ecosystem structure and function, and specifically the emissions of greenhouse gases (GHGs).
3. Three wetland related Community Based Monitoring standalone work plans submitted through ICBMAC.
4. Support for continuing geospatial initiatives that support data needs for the wetlands program.

These components support partnerships with Alberta EPA, ECCC, ABMI, and other external collaborators through other OSM TACs and are vital to the continued success of the Integrated WMP. A summary of how each component collectively contributes to the Integrated WMP Work Plan within an adaptive monitoring approach is provided (Supplement03).

1.0 Merits of the Work Plan

All work plans under the OSM Program must serve the mandate of the program by determining (1) if changes in indicators are occurring in the oil sands region and (2) if the changes are caused by oil sands development activities and (3) the contribution in the context of cumulative effects. In the space below please provide information on the following:

- Describe the key drivers for the project identifying linkages to Adaptive Monitoring framework particularly as it relates to surveillance, confirmation and limits of change (as per OC approved Key Questions).
- Explain the knowledge gap as it relates to the Adaptive Monitoring that is being addressed along with the context and scope of the problem as well as the Source - Pathway - Receptor Conceptual Models .
- Describe how the project meets the mandate of the OSM Program or areas of limited knowledge is the work being designed to answer with consideration for the TAC specific Scope of Work Document (attached) and the Key Questions (attached)?
- Discuss results of previous monitoring/studies/development and what has been achieved to date. Please identify potential linkages to relevant sections of the State of Environment Report.

Wetlands occupy approximately 64,000 km2 or 45% of the Oil Sands Region (OSR) (Ficken et al. 2019) and provide important water storage and conveyance functions that maintain landscape integrity essential to their own function, as well as adjacent uplands and downstream aquatic systems (IPBES 2019; Volik et al. 2020). However, wetlands can be highly sensitive to oil sands development activities including surface and groundwater withdrawals and diversions at a watershed scale (Kompanizare 2018), as well as land disturbances at a local scale (Volik et al., 2020; Volik et al. submitted). These activities can disrupt hydrological processes and functions and may not be readily observable over the short term or at local scales, but may have a cumulative impact on landscape function over temporal scales greater than the disturbance. There is also evidence that land disturbances have altered wetland plant communities (Ficken et al. 2019) and that wetland vegetation structure has changed with increased proximity to oil sands development activities (Chasmer et al. 2021). Additionally, bogs and poor fens have shown acute sensitivity to increasing contaminant deposition (e.g. nitrogen) associated with oil sands upgrader emissions and other non-point sources including tailings ponds, fleet vehicles, fugitive dust, and overland flow in riverine floodplain wetlands (Wieder et al. 2016; 2019; 2020; 2021). Water quality samples from wetlands have been used to assess nutrients associated with oil sands upgrader stack emissions (Wieder et al. 2021), cations, routines and metals associated with land disturbance and fugitive dust from oil sands mines (Landis et al. 2012, Makar et al. 2018). Long-term surveillance monitoring is needed to understand holistically, the ecological and social impacts of these changes.

A priority of the surveillance wetland monitoring program is to ensure oil sands operators' are deemed 'in compliance' of Environmental Protection and Enhancement Act (EPEA) approval conditions for regional wetland monitoring to determine the effects of oil sand development activities on wetland ecosystems. The surveillance wetland monitoring program follows the EEM framework approach for a 'surveillance' level monitoring program to address the 'effects' of oil sands development 'sources' of disturbance, and addresses the following OSM key question identified for wetlands: 'How have wetland ecosystems changed from baseline (species distributions, communities, populations, health)?'

This project builds on results from the pilot 'Wetland Ecosystem Monitoring Program' (2017-2021) which identified and developed wetland indicators that are sensitive to oil sands development activities across various wetland classes. This project also builds off the work of previous OSM wetland Focus Studies in select geographies/study areas (e.g. Peace-Athabasca Delta wetlands), specific wetland indicator group and methods development projects (e.g. Remote Sensing of Wetland Ecosystems). This is the third year of a Phase 1 regional surveillance wetland monitoring program. The 2024-2025 work plan builds on the successes of the two previous years of work (2022-2024) to assess the potential effects of oil sands development for priority sources of disturbance that are anticipated to cause changes to various wetland ecosystems common in the OSR including bogs, fens, swamps, and shallow open water (SOW).

The pilot 'Wetland Ecosystem Monitoring Program' developed a wetland conceptual model that identified priority oil sands development 'sources' of disturbance shown to cause changes in wetland ecosystem state conditions (Volik et al. 2020; Ficken et al. 2021). These key oil sands sources of disturbance include land disturbances, contaminants (e.g., upgrader stack emissions, fugitive dust associated with land disturbance), and hydrological alterations (i.e. groundwater and surface water withdrawals and diversions). This conceptual model has guided the study design and site selection - 'test' sites, identified as those at the greatest risk of impacts from disturbances associated with oil sands development activities, are targeted, and will be compared to 'baseline' sites with minimal disturbances present to determine if 'effects' are detected. Preliminary power analysis of the vegetation communities from pilot scale datasets indicate that 30 sites per wetland class are required (Ficken et al. pers. Comm.) in order to detect change at a statistical power recommended by the OSM program (Environment Canada 2012). As a result, a total of 120 sites are proposed for monitoring (30, bog, 30 fen, 30 swamp, and 30 SOW) under Phase 1 of the Surveillance wetland monitoring program. From 2022-2024, 85 sites (22 bog, 27 fen, 21 swamp, and 16 SOW) were monitored for a core suite of surveillance wetland monitoring indicators; 70 were new sites and 15 were previously monitored 'sentinel' sites. In 2024-2025, approximately 40 sites will be established and monitored along with a small suite of previously monitored 'sentinel' sites. Within the existing western science criteria that has guided previous years site selections, local communities will be offered the opportunity to contribute to site selection. The 2024-2025 work plan represents the final year of site network development to yield a sufficient sample size (total site count of 120) to establish baseline conditions, allow analysis of natural variability, and examine potential effects of oil sands development in highly disturbed areas. Work will commence on assessing data from the site network to determine indicator specific limits of changes and identify if modifications and/or further site samples are required to ensure statistically robust assessments of change can be determined using each indicator.

A suite of core wetland monitoring indicators have been developed that are: 1) sensitive to key oil sands development disturbances (Chasmer et al. 2020a; 2020b; 2021, Ficken et al. 2019; 2021; Volik et al. 2020; Volik et al. in review; Wieder et al. 2016; 2019; 2020;), 2) quantifiable, 3) rapid, and 4) repeatable, with standardized operating procedures. The wetland conceptual model identifies specific source-effect pathways, which enables testing individual pathways explicitly within a cumulative effects framework. Analysis will be performed to obtain estimates of various oil sands disturbance levels for each of the wetland monitoring sites, which will then be assessed for source-effect relationships within a cumulative effects framework (e.g. mixed effects models). Wetland ecological condition trends will be assessed over time, as well as potential drivers of change, which will help address local Indigenous community concerns regarding effects of oil sands development on wetland ecosystems in the region (e.g. are wetlands drying?, is the water safe to drink?). These datasets will be available for use in annual reports on the status of wetland ecological condition in the oil sands region for State of the Environment Reporting or similar.

References

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2.0 Objectives of the Work Plan

List in point form the objectives of the 2024/25 work plan below

Phase 1 Objectives: Implementation of a core surveillance wetland monitoring program that follows the Adaptive Monitoring Framework approach directed by the OSM Program.
Status: Started 2022, proposed 2024-2025 work plan and beyond.

1. To implement (including Monitoring, Evaluation and Reporting) a core surveillance wetland monitoring program that is scientifically robust and efficient, and follows an adaptive monitoring framework approach adopted by the OSM Program.

1a. Conduct the 2nd year of a 2-year focused to investigate the impact of increased N and S deposition from OS emissions on greenhouse gas (GHG) emissions (CH_4 and N_2O) from bogs and fens. This study will be conducted in the laboratory and is motivated by literature showing that N deposition can lead to increased CH_4 and N_2O emissions while S deposition can lead to decreased CH_4 emissions. Emissions of methane from OS facilities are roughly comparable to regional emissions from bogs and fens. Work has been moved from the Air TAC as directed by SIKIC

2. To develop further a core surveillance wetland monitoring program within an adaptive management framework that meets the Mandate of the OSM Program – i.e. establish baseline conditions and evaluate natural variability, establish monitoring and management 'triggers', identify deviations (if any) from 'baseline' and pre-development (where possible) conditions. (Phase 1 – proposed).

2a. Continue building site network to 120 sites which will be used to establish a baseline of wetland conditions,assess associated natural variability, detect potential changes in wetland conditions from baseline, and potentially attribute cause. (Phase 1 – proposed). The 2024-2025 cycle is year 3 of 3 of the site network expansion, years 1 and 2 (2022-2024) established 85 sites of a proposed 120 sites across priority wetland classes (30 bogs, 30 fens, 30 swamps, and 30 shallow open water).

2b. Preliminary assessment of surveillance wetland monitoring data to establish baseline conditions and assess potential effects of oil sands development is underway. However, more sites are needed for robust evaluation.

Phase 2 Objectives: Assessment of Phase 1 surveillance wetland monitoring program to recommend an adaptive monitoring approach.
Status: Proposed 2025-2026 work plan and beyond.

3. Critical assessment of wetland monitoring data acquired under Phase 1 to critically review and refine (as appropriate) elements of the surveillance wetland monitoring program related to study design (i.e. statistical power analysis), indicator sensitivity, defining indicator triggers, and identify deviations (if any) from baseline.

3a. Identify wetland health indicators and determine which indicators may be more sensitive than others, if some indicators are unsuitable, or if new indicators are required.

3b. Identify if more sites are required to establish a robust baseline for wetland conditions.

3c. Establish triggers of deviation from baseline and identify such deviations (if any).

3.0 Scope

Evaluation of Scope Criteria (Information Box Only- No action required)
Your workplan will be evaluated against the criteria below. A successful workplan would:

- Be in scope of the OSM Program (e.g., regional boundaries, specific to oil sands development, within boundaries of the Oil Sands Environmental Monitoring Program Regulation)
- consider the TAC-specific Scope of Work document and the key questions
- integrate western science with Indigenous Community-Based Monitoring)
- address the Adaptive Monitoring particularly as it relates to surveillance, confirmation and limits of change as per approved Key Questions.
- have an experimental design that addresses the Pressure/Stressor, Pathway/Exposure, Response continuum
- produce data/knowledge aligned with OSM Program requirements and is working with Service Alberta
- uses Standard Operating Procedures/ Best Management Practices/ Standard Methods including for Indigenous Community-Based Monitoring

3.1 Theme

Please select the theme(s) your monitoring work plan relates to:

- [ ] Air
- [ ] Groundwater
- [ ] Surface Water
- [x] Wetlands
- [ ] Terrestrial Biology
- [ ] Data Management Analytics & Prediction
- [ ] Cross Cutting

3.2 Core Monitoring, Focused Study or Community Based Monitoring

Please select from the dropdown menu below if the monitoring in the work plan is “core monitoring” and/or a “focused study”. Core monitoring are long term monitoring programs that have been in operation for at least 3 years, have been previously designated by the OSM program as core, and will continue to operate into the future. Focused studies are short term projects 1-2 years that address a specific emerging issue.

Long Term Monitoring

Themes

Please select the theme from the options below. Select all that apply.

- [ ] Air
- [ ] Groundwater
- [ ] Surface Water
- [x] Wetland
- [ ] Terrestrial
- [ ] Cross-Cutting

3.3.3 Wetland Themes

3.3.3.1 Sub Themes

Cross-Cutting

3.3.3.2. Wetlands - Key Questions:

Explain how your wetlands monitoring program addresses the key questions below.

Has baseline been established? Have thresholds or limits of change been identified?

Baseline has not been fully established. 2024-2025 is anticipated to be the final year of site network building that is required to meet the expected number of sites (n=120) required to assess baseline with statistical confidence. Future site network build-out may be required based on adaptive assessment of baseline - select wetland indicators may require additional samples to meet the statistical confidence requirements of the OSM program. Existing wetland monitoring data has been used to determine land disturbance indicators (Ficken et al. 2019), which are incorporated in the surveillance wetland monitoring program. Continued site build-out for 2024-2025 to establish baseline is a priority identified by the wetland TAC and SIKIC, and works to address the Surveillance Effect Key Question for Wetlands recommended by the Oversight Committee: ‘How have wetland ecosystems changed from baseline?’.

Thresholds or limits of change have not yet been identified – baseline is required to identify suitable limits of change as a function of indicator. Limits of change will consider science and/or indigenous knowledge. For specific scientific indicators, limits may only be determined once baseline conditions and associated natural variability has been established, whereas other indicators (e.g. water quality) have well established safety guidelines (e.g. CCME). Indigenous indicator limits will be developed in collaboration with local communities and ICBMAC.

Are changes occurring in wetlands due to contaminants and hydrological processes? If yes, is there evidence that the observed change is attributable to oil sands development? (Describe source-pathway-receptor and/or conceptual models) and what is the contribution in the context of cumulative effects?

Open pit mine operation has a significant effect on surface and groundwater flow, including lowering water table and water diversion through canals, reservoirs and dikes. Ground water removal can disrupt hydrologic connectivity between the basal and shallow groundwater, alter local and regional recharge/discharge and create a drawdown zone around a mine. Such drawdown can result in desiccation of the adjacent wetlands and uplands, which has been predicted by Environmental Impact Assessments and independent hydrology models (Kompanizare et al. 2018). For example, the Voyageur South Mine EIA predicted impacts to more than 700 ha of wetlands proximal to the mine. Water diversion not only affects hydrological connectivity between landscapes, surface waterbodies and underlying aquifers, but also alters the water budget of the area through changes in evaporation (e.g., wetland evaporation rates vs. reservoir evaporation rates), water storage (e.g., wetland water storage capacity vs. canal water storage capacity) and run off. Modelling results showed that thinner surficial geology layers in the mining areas (located mostly in downstream parts of the watershed) lead to lower hydrological connectivities making them more vulnerable to mining impacts (Kompanizare et al. 2018). Hydrologic alterations associated with OS development including surface water diversions, groundwater and surface water withdrawals and indirect alterations associated with land disturbance are predicted to cause local to watershed scale impacts to adjacent wetlands (Volik et al. submitted).

Previous work has detected contaminants attributed to oil sands resource extraction activities in wetlands. N-deposition (Ndep), S-deposition (Sdep), and base cation (BCdep) gradients are well explained between oil sands mining operation sources and receptor sites within 10-15 km, and are detectable out to a distance of 20-50 km; ≥ 50 km from sources Ndep approaches regional background values (Edgerton et al. 2020). Bogs and poor fens are predicted to be the most sensitive wetland ecosystems to increased Ndep, due to naturally low nutrient levels. Increased Net Primary Productivity, increased shrubs and forbs biomass, and decreased Sphagnum biomass are predicted at sites with > 3 $kg\ ha^{-1}\ yr^{-1}$ (Wieder et al. 2019). There is a high (90% confidence) likelihood that N-deposition from oil sands operations will negatively effect bogs and poor fens in the region, causing a loss of Sphagnum species due to shading from increased shrub and vascular plant growth. Quantitative charasterisation of vegetation changes in N enriched bogs is planned to be addressed through the monitoring of bog tissues under the core program, however, the infrequency of sampling may not be sufficient to adequately detect effects (Wieder et al. 2021)- this will be assessed via analysis of program data in 2025. Other wetland classes (rich fens, swamps and open water wetlands) are presumed less sensitive to N-deposition (mesotrophic; not N-limited). Increased Ndep may cause increased NPP of all wetland ecosystems near N-emissions sources.

There is also evidence that changes in wetland vegetation communities in the oil sands region are related to various land disturbance activities. Land disturbance activities can impact wetland vegetation communities by introducing non-native species (Boutin and Carpenter, 2017), and by reducing seed germination (Crowe et al., 2002), both of which can result in reduced abundance of native species and reduced overall floristic quality of wetlands (Ficken et al. 2019). Land disturbance associated with oil sands development can influence wetland hydrologic function and vegetation through numerous physical, chemical, and biological mechanisms (Volick et al. submitted; Ficken et al. 2019). For example, physical disturbances to the landscape (e.g. seismic lines,well pads, or buried pipelines) that affect water availability (Lee and Boutin, 2006; Strack et al., 2018; Lovitt et al., 2018) can affect plant diversity and composition.

References

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Are there unanticipated results in the data? If yes, is there need for investigation of cause studies?

At present, no unanticipated results have been observed in the wetland surveillance monitoring data, however, baseline needs to be established for appropriate comparisons to be made across sites. Some disturbed sites near OS developments have been found to be outside of normal ranges for certain indicators (e.g., select water quality measurements exceed CCME guidelines), but confirmation is required for other indicators through comparison with baseline data (under development). Once baseline has been established, trends related to contaminant deposition (through nutrient enrichment), hydrological alteration, and land disturbances can be further examined.

The 2nd year of a 2-year focused lab study will be continued to investigate the impacts of increased deposition of N and S from OS emissions on greenhouse gas emissions from bogs and fens. This focused study stems from the unanticipated result of changes to bog and fen ecological indicators caused by increased N and S deposition noted under the long-term intensive bog monitoring program that was led by Villanova University in previous years.

Are changes in wetlands informing Indigenous key questions and concerns?

The surveillance wetland monitoring program includes indicators and protocols of interest to local communities that may be used to address key questions and concerns of local communities (e.g. Are wetlands drying? Is the water safe to drink?).

Engagement and participation of local indigenous communities in the surveillance wetland monitoring program and wetland CBM projects is underway in 2023-2024 through a jointly hosted workshop by the wetland TAC and ICBMAC (panned for February 2024). It is envisioned that these engagement activities will help build shared understanding of these key questions and concerns for improved and more integrated monitoring between the long-term wetlands program and CBM efforts.

Are data produced following OSM Program requirements and provided into the OSM Program data management system?

Yes, all data produced by the core wetland monitoring program will follow OSM Program requirements, and be provided to the OSM Program data management system.

Do methodologies use relevant Standard Operating Procedures/ Best Management Practices/ Standard Methods?

All methodologies apply existing Standard Operating Procedures (SOPs) and Methods. While SOPs have undergone refinement during 2023-2024 following in-field testing during 2022-2023 and with SIKIC support, refinement will continue in 2024-2025 in collaboration with the wetland TAC, ICBMAC, and local communities to develop Traditional Knowledge indicators and finalise western science indicators.

How does the monitoring identify integration amongst projects, themes or with communities?

The Surveillance wetland monitoring program is integrated amongst other environmental monitoring programs through integrated conceptual models, and consistent data collection protocols where possible (e.g. surface water quality parameters and SOP’s and lab contracts). The Surveillance wetland monitoring program is also integrated with communities through supporting the submission of multiple standalone CBM work plans (submitted through ICBMAC) that continue to monitor wetland indicators of importance to local communities. Three wetland CBM projects are anticipated from Conklin Metis, Fort McKay Metis and Mikisew Cree First Nation communities. The regional surveillance monitoring program has provided support to these projects over the past several years by providing training on western science indicators and protocols, equipment loans, logistical support for sample submission to laboratories. Continued support and integration through the Athabasca University’s Facilitation Centre is anticipated including further support on indicator development, evaluation, and reporting. Engagement through a jointly hosted wetland TAC and ICBMAC workshop with stakeholder communities is planned for February 2024 to integrate the existing wetland related CBM projects and initiate integration efforts within the wetlands surveillance monitoring program.

Further, integration with the Geospatial work plan (submitted through the Data Analytics and Integration

TAC) is facilitated through supporting multiple wetland related projects that are critical to the integrated wetland monitoring program:

1) Remote Sensing of Vegetation Monitoring (LAI, VH, Biomass and Trend Analysis).
This work includes measurements and products related to Leaf Area Index, Vegetation Height, and Biomass of vegetation. These attributes are all collected in the vegetation field component in the core wetland monitoring program. This work has already been completed and is in the final reporting stages.

2) Geospatial Surface Water Level Mapping in Lakes and Wetlands
Geospatial surface water mapping is a continuing program from 2022 and is in the scoping and analysis stage. This work has two objectives:
Objective 1: Seasonal and multi-year surface water area change monitoring using combined optical and SAR (Synthetic Aperture Radar) data.
Objective 2: Seasonal and multi-year water level change monitoring in lakes and wetlands using Interferometric SAR (InSAR) data.

This project accurately maps temporal wetland water extent and level in lakes and wetlands. It compliments wetland program meteorological station data and supports annual/seasonal change analysis and explains variability in the wetlands being monitored.

3) Human Footprint Inventory (HFI) data are required to assess the extent of various land disturbances in the oil sands region, which is a key stressor for wetland ecosystems under the conceptual model. Updates and enhancements to the HFI are also supported under the Terrestrial Biodiversity Monitoring (TBM) Program work plan.

These integrated components support partnerships with external collaborators through other OSM TACs and are vital to the continued success of the wetland monitoring program. Efforts have been made to mitigate duplication of work across theme areas and ensure that all data will be shared. A summary of how each of these components collectively contribute to the Integrated wetland monitoring program Work Plan within an adaptive monitoring approach is provided in Supplement 03.

With consideration for adaptive monitoring, where does the proposed monitoring fit on the conceptual model for the theme area relative to the conceptual model for the OSM Program?

The surveillance wetland monitoring program is designed to address oil sands pressures (land disturbance, contamination, and hydrologic alteration) identified in the OSM programmatic conceptual model. Anticipated ‘high disturbance’ sites (n=40) have been established along gradients of the above oil sands pressures. Reference sites will be established in areas where little to no anthropogenic disturbance exists or is anticipated. Reference sites (n=80) will be analysed to determine baseline conditions (and pre-development conditions where appropriate) and develop limits of change against which observations at disturbed sites may be compared. In the event that observations at a disturbed site exceed baseline variability, investigation of cause will be triggered, and adaptations made to facilitate more intensive monitoring at a localized site scale.

All wetland monitoring program indicators, oil sands pressures (atmospheric deposition, land disturbance, or hydrologic alteration in local watershed), wetland stressors (wetland hydrology/ meteorology, surface water quality or sediment quality) or wetland ecosystem responses (vegetation, invertebrates) noted in the wetland conceptual model. This wetland monitoring program will test and validate the relationships of the wetland conceptual model.

How will this work advance understanding transition towards adaptive monitoring?

Once baseline conditions are established and associated natural variability (by wetland class) has been assessed (phase 1), data may be assessed to facilitate a critical review and refinement (as appropriate) of elements of the long-term surveillance monitoring program related, but not limited to study design (i.e., number of sites to achieve appropriate statistical power for change detection) and indicator sensitivity (phase 2). Moreover, established baseline conditions will allow the identification of more robust triggers and limits of change, the definition of which are vital for transitioning/adapting from regional surveillance monitoring to localized intensive monitoring to investigation of cause.

Is the work plan contributing to Programmatic State of Environment Reporting? If yes, please identify potential linkages to relevant sections of the State of Environment Report.

Yes, this work plan will provide data, evaluation and reporting products as directed to support Programmatic State of Environment Reporting (or similar as directed by the program) of the wetlands chapter.

4.0 Mitigation

Evaluation of Mitigation Criteria (Information Box Only- No action required)
Your workplan will be evaluated against the criteria below. A successful workplan would potentially inform:

- efficacy of an existing regulation or policy
- an EPEA approval condition
- a regional framework (i.e., LARP)
- an emerging issue

Explain how your monitoring program informs management, policy and regulatory compliance. As relevant consider adaptive monitoring and the approved Key Questions in your response.

The key driver for the long-term wetland monitoring program is to ensure oil sands operators are deemed 'in compliance' of Environmental Protection and Enhancement Act (EPEA) approval conditions for regional wetland monitoring to determine the effects of oil sand development activities on wetland ecosystems in the oil sands region. Results from the monitoring program are used to inform regulatory decisions on oil sands development activities as well as government policies.

A Wetland Monitoring Program is required under Oil Sands operators' EPEA approval conditions which includes the following:

1. a plan to monitor natural wetlands for natural variability;

2. a plan to determine and monitor the potential effect of oil sands development activities (various activities and pressures are listed including for mines the effects of dewatering and mine development, and for in situ projects the effects of roads, well pads, or other infrastructure, surface water and groundwater withdrawals and any other disturbances) on wetland communities; and

3. corrective measures, where appropriate, to protect affected wetland communities.

Wetland monitoring data collected under this program supports assessment of whether oil sands development regulatory decisions and other land use decisions are leading to environmental outcomes that are consistent with the goals and objectives of the provincial Wetland Policy and desired land use planning outcomes under the Lower Athabasca Regional Plan (LARP).

The vegetative changes linked to deposition recently observed at Jack Pine and wetland bog sites are emerging issues that require on-going monitoring to track changes

The wetland monitoring program aims to address emerging and ongoing concerns of local indigenous communities regarding oil sands development activities on wetland ecosystems raised in Environmental Impact Assessments (EIA). Future work will compare wetland indicator data with EIA predictive models on source-pathway-effects to wetland ecosystems (e.g. atmospheric deposition, and regional hydrology).

5.0 Indigenous Issues

Evaluation of Indigenous Issues Criteria (Information Box Only- No action required)
Your workplan will be evaluated against the criteria below. A successful workplan would potentially:

- Investigate Indigenous communities key questions and concerns
- Includes culturally relevant receptor(s) and indicator(s)
- Include or be driven by Indigenous communities (participatory or collaborative)
- Develop capacity in Indigenous communities
- Include a Council Resolution or Letter of Support from one or more Indigenous communities
- Describe how ethics protocols and best practices regarding involvement of Indigenous peoples will be adhered to
- Provide information on how Indigenous Knowledge will be collected, interpreted, validated, and used in a way that meets community Indigenous Knowledge protocols

Explain how your monitoring activities are inclusive and respond to Indigenous key questions and concerns and inform the ability to understand impacts on concerns and inform Section 35 Rights

Local communities have raised concerns regarding effects of oil sands development activities on wetland ecosystems through oil sands regulatory hearings, land use planning engagement activities, and OSM engagement activities, which has been incorporated in the Wetland Monitoring Program as follows:

1. Development of a wetland conceptual model that incorporates local indigenous community concerns and observations regarding oil sands development activities on valued wetland ecosystem indicators. Inputs of contaminants are thought to be affecting the health and potency of culturally important foods and medicines. Land disturbances are causing changes to plant communities and wildlife habitat, and increases in human activity affecting wildlife distribution and abundance. Changes to wetland hydrology in the region are causing wetlands to dry up and change land navigation pathways of community access. These observations and concerns regarding wetlands are being incorporated into the development of culturally important wetland indicators under the core wetland monitoring program.

2. Wetland Site selection – Sites monitored by local communities have been selected because they are valued by their local community and/or there are concerns of change to those wetlands. Local indigenous communities (Fort McKay Metis, Mikisew Cree First Nation, & Conklin Metis) have elected to submit full standalone work plans to build on previous work that was supported under the wetland monitoring program. CBM wetland sites can be used to fill knowledge gaps in the surveillance wetland monitoring program. In addition, planned engagement through a jointly hosted wetland TAC and ICBMAC workshop (February 2024) will offer opportunity to for communities to identify sites of high value for potential inclusion (where appropriate) within the surveillance wetland monitoring program site network.

3. Indicators and associated protocols – The wetland monitoring program continues to work with communities to develop core wetland health indicators and protocols that are highly valued by the community and can be collected by the community. Such work will contribute to further refinement of the wetlands SOPs.

4. Empowering communities to monitor wetlands – The wetland monitoring program provides training and resources where required to enable communities to monitor their own wetlands. This is a demonstrable success of the wetlands monitoring program, as communities have elected to continue to monitor and build (through independent work plan submission) on previous years of work that was supported under the wetlands monitoring program in previous years.

5. Evaluation and Reporting – The wetland monitoring program continues to work with communities to evaluate emerging community concerns and how to address those concerns in the wetland monitoring program through the merger of western science and community-valued indicators. The wetland monitoring program also communicates monitoring program information that is valued by communities through stakeholder presentations.

The Program is inclusive whereby traditional and local knowledge informs monitoring program design through program objectives, site and indicator selection, providing appropriate capacity and support (such as training, where required), and collaboration on shared information, gatherings and reporting.

Work is underway, and will continue in 2023-2024, to develop an integrated CBM component for wetlands. Information sharing on the regional surveillance monitoring program and independent wetland CBM projects are planned, with next steps to co-develop an integrated wetland monitoring approach for local Indigenous communities. This may include meetings to engage directly with communities and minimize barriers for co-developing an integrated plan.

Does this project include an Integrated Community Based Monitoring Component?

No

If YES, please complete the ICBM Abbreviated Work Plan Forms and submit using the link below

ICBM WORK PLAN SUBMISSION LINK

5.1 Alignment with Interim Ethical Guidelines for ICBM in the OSM Program

Are there any community specific protocols that will be followed?

No community specific protocols are followed under the wetlands monitoring program. The program developed SOPs that communities were involved in the development of and have adopted for their own wetland CBM programs. Under their standalone work plans communities will follow the regional surveillance wetland SOP's where possible, in addition, individual communities will follow informal community protocols for respectful data collection. Traditional knowledge SOPs are anticipated to be developed through 2024-2025, however, it is still expected that communities remain free to select which elements of the SOPs to adopt.

Does the work plan involve methods for Indigenous participants to share information or knowledge (e.g. interview, focus group, survey/structured interview), or any other Indigenous participation? If yes, describe how risks and harms will be assessed, and the consent process that will be used.

No, the surveillance wetland monitoring program does not involve methods for indigenous participants to share information or knowledge. The wetlands monitoring program supports community participation through the submission of standalone work plans, led by communities. Details on the sharing of information or knowledge related to communities is documented under individual stand alone work plans submitted by communities.

Do the activities include any other collecting/sharing, interpreting, or applying Indigenous knowledge? Please describe how these activities will be conducted in alignment with the Interim Ethical Guidelines, and any community-based protocols and/or guidelines that may also apply.

Application of indigenous knowledge has been and will continue to be pursued to understand wetland indicators of high importance to communities and identify community concerns.

The wetlands monitoring program work plan will not directly collect/share or interpret indigenous knowledge in 2024-2025, because CBM wetland work will be conducted under standalone work plans submitted by individual communities. Details on collecting/sharing, interpreting, or applying indigenous knowledge and how they align with interim Ethical Guidelines and any community based protocols are documented in these standalone work plans, submitted by Fort McKay Métis, Conklin Métis, and Mikisew Cree First Nation.

Indicate how Indigenous communities / Indigenous knowledge holders will be involved to ensure appropriate analysis, interpretation and application of data and knowledge.

The wetland monitoring program data will be shared with communities for their interpretation. No acquisition or sharing of traditional knowledge will occur under the wetland monitoring program.

How are Indigenous communities involved in identifying or confirming the appropriateness of approach, methods, and/or indicators?

Communities have provided input to the wetlands conceptual model which identified wetland indicators, and wetland sites of value to communities. The wetland program has offered training to communities such that they continue wetland monitoring work through the submission of standalone work plans where the approach, methods, and indicators are informed directly by the communities. In addition, engagement workshops hosted by the wetland TAC and ICBMAC (planned February 2024) will offer opportunity for further community involvement in the development of methods, indicators, and community-valued site selections.

How does this work plan directly benefit Indigenous communities? How does it support building capacity in Indigenous communities?

The wetland monitoring program work plan does not feature an integrated CBM component. However, the wetland monitoring program continues to offer support to communities through training (as required), and reporting program information to build capacity. Wetland related CBM monitoring will be conducted by three local communities, submitted under standalone work plans.

How is the information from this work plan going to be reported back to Indigenous communities in a way that is accessible, transparent and easy to understand?

Information from the wetland monitoring program work plan will be reported to communities as done previously. This includes a stakeholder presentation summarising program activities and the sharing of an annual report as required.

6.0 Measuring Change

Evaluation of Measuring Change Criteria (Information Box Only- No action required)

Your workplan will be evaluated against the criteria below. A successful workplan would potentially:

- assess changes in environmental conditions compared to baseline (e.g., validation of EIA predictions)
- report uncertainty in estimates and monitoring is of sufficient power to detect change due to oil sands development on reasonable temporal or spatial scales
- include indicators along the spectrum of response (e.g., individual, population, community)
- focus on areas of highest risk (where change is detected, where change is greater than expected, where development is expected to expand collection of baseline).
- measure change along a stressor gradient or a stressor/reference comparison

Explain how your monitoring identifies environmental changes and how can be assessed against a baseline condition. As relevant, consider adaptive monitoring, the TAC specific Scope of Work document and the Key Questions in your response.

Wetland ecosystem changes will be assessed against baseline conditions through selecting wetland sites along a cumulative effects stressor gradient, ranging from high risk stressor areas to areas with little to minimal oil sands stressors (reference areas). Wetlands in high disturbance areas will be compared to wetlands in reference areas. The study design is also constrained by natural wetland landscape units (covariables include surficial geology, topography, fire history) in the oil sands region to minimize factors affecting natural variability (where possible). The continued build-out of the wetland monitoring site network to establish baseline conditions for wetland indicators is a wetland TAC- and SIKIC-identified priority. This works to address the Surveillance Effect Key Question for Wetlands recommended by the Oversight Committee: 'How have wetland ecosystems changed from baseline?'

Preliminary analysis of various wetland plant community parameters (e.g., species richness) and oil sands stressor gradients indicates that at least 30 wetland sites of each wetland class (i.e. 30 bogs, 30 fens, 30 swamps and 30 shallow open water wetlands; SOWs) are needed to detect effects. At present 85 monitoring sites have been established (32 bogs, 31 fens, 31 swamps, and 26 SOWs) during 2022-2024, where an additional 40 sites are planned to be established throughout 2024-2025 (year three of the site network expansion process). A minimum of 120 sites (bogs, fens, swamps and SOW) will be established and monitored (40 per year) by 2025, at which time additional power analysis will be used to further review and adapt the wetland monitoring site network as needed (phase 2).

7.0 Accounting for Scale

Evaluation of Accounting for Scale Criteria (Information Box Only- No action required)

Your workplan will be evaluated against the criteria below. A successful workplan would potentially be:

- appropriate to the key question and indicator of interest
- relevant to sub-regional and regional questions
- relevant to organism, population and/or community levels of biological organization
- where modelled results are validated with monitored data
- where monitoring informs on environmental processes that occur at a regional scale. e.g. Characterizing individual sources to gain a regional estimate of acid deposition and understand signal from individual contributing sources.

Explain how your monitoring tracks regional and sub-regional state of the environment, including cumulative effects. As relevant, consider adaptive monitoring, the TAC specific Scope of Work document and the Key Questions in your response.

This is the third year of implementation of a core wetland monitoring program (phase 1) beyond the pilot scale work completed to date. Adding surveillance monitoring sites in 2024-2025 is a priority identified by the wetland TAC and SIKIC in order to establish baseline conditions, which will be used to assess the effects of oil sands development on wetlands in the Athabasca Oil Sands Region. The program is scaling up from the existing network of 85 wetlands to a minimum of 120 wetlands across four wetland classes (bogs, fens, swamps and open water).

The surveillance wetland monitoring network is focused on monitoring wetland indicators that are sensitive to oil sands stressors and that can be scaled-up to watershed and regional scales through remote sensing and modelling approaches. Wetland monitoring sites are located along oil sands stressor gradients to examine and compare predicted effects of high disturbance areas compared to reference areas. Through scaling-up approaches the wetland monitoring program aims to answer; ‘What is the spatial extent and magnitude of wetland changes in the Oil Sands Region?’ and; ‘Are these changes due to oil sands development activities or cumulative effects from other human development activities?’

The Wetland Monitoring Program plans to scale-up wetland field measurements through well understood remote sensing approaches. (Phase 2 - 2025 and beyond)

8.0 Transparency

Evaluation of Transparency Criteria (Information Box Only- No action required)
Your workplan will be evaluated against the criteria below. A successful workplan would potentially include:

- a plan for dissemination of monitoring data, including appropriate timing, format, and aligns with OSM program data management plan
- demonstrated transparency in past performance
- identified an annual progress report as a deliverable
- reporting of monitoring results occurs at timing and format that is appropriate for recipient audience.

Explain how your monitoring generates data and reporting that is accessible, credible and useful. As relevant, consider adaptive monitoring, the TAC specific Scope of Work document and the Key Questions in your response.

Monitoring utilizes standard operating procedures. The surveillance wetland monitoring program staff have worked with and continue to work with Service Alberta staff to release core wetland monitoring program data through an online data portal system. Targets have been set to have all newly acquired core wetland monitoring data to be QA/QC'd and available online within 3 months of data collection where possible. Reporting and deliverables of Wetland Monitoring data have been identified that include scientific manuscripts as well as scientific reports, and annual State of the Environment reports.

9.0 Efficiency

Evaluation of Efficiency Criteria (Information Box Only- No action required)
Your workplan will be evaluated against the criteria below. A successful workplan would include:

- appropriately addressed a risk-informed allocation of resources
- identified the role and justification for each staff member on the proposed work plan
- identified in-kind and leveraged resources (e.g., resources and approaches are appropriately shared with other OSM projects where possible)
- established partnerships (value-added) and demonstrated examples of coordinated efficiencies (e.g., field, analytical)
- identified co-location of monitoring effort
- demonstrated monitoring activities and information collected are not duplicative
- considered sampling/measurement/methods compatibility to other data sources (e.g., AER)

Explain how your monitoring is integrated with other OSM projects and incorporates community-based participation and/or engagement in proposed monitoring activities. As relevant, consider adaptive monitoring, the TAC specific Scope of Work document and the Key Questions in your response.

The Wetland Monitoring Program is efficient by maximizing the likelihood of detecting effects by:

1. A study design that maximizes the likelihood of detecting effects through selecting sites along key oil sands stressor gradients including targeting high disturbance risk areas and reference areas.

2. Selecting wetland indicators that are sensitive to oil sands stressors and can be used to scale-up site-level observations to regional-scale observations through either remote sensing or modelling approaches.

3. Developing wetland indicator protocols that are robust and repeatable and consistent with other OSM monitoring programs and projects to the extent appropriate and practical (e.g. protocols and labs are consistent for atmospheric deposition, surface water quality).

4. In-kind and leveraged resources and partnerships where possible (e.g. shared service providers, lab contracts, helicopter contracts).

5. Co-location of monitoring sites, monitoring indicators, protocols and analytic laboratories avoids duplications.

10.0 Work Plan Approach/Methods

List the Key Project Phases and Provide Bullets for Each Major Task under Each Project Phase

Phase 1, Objective 1 - To implement (including Monitoring, Evaluation and Reporting) a core surveillance wetland monitoring program that is scientifically robust and efficient, and follows an adaptive monitoring framework approach adopted by the OSM Program.
Status – Proposed 2023-2024 work plan and beyond.

The design of the surveillance wetlands monitoring program will be evaluated and potentially modified as appropriate based on the investigation of an external consultant (as per the following OC funding condition: 'SIKIC directs the Wetlands TAC to identify external expert(s) to support the TAC in exploring the monitoring design's fit for the work required by the OSM program. The consultant is expected to meet with SIKIC and TAC to discuss the scope. SIKIC will need to approve the scope and outcome of the work for the 2024/25 work plan.' This work is currently in progress and will be incorporated into the 2024-2025 work plan as appropriate, given outcomes of this work will likely not be available until partway through the 2024-2025 cycle. Outcomes of this work will be fully incorporated in to future work plans.

Implementation of the surveillance wetland monitoring program will be achieved with support from the ABMI and the University of Villanova. Staffing resources and support from the ABMI are paramount in the implementation and delivery of the surveillance wetland monitoring program, without ABMI support the surveillance wetland monitoring program will only be partially delivered due to limited EPA resources. Additional information on the ABMI’s role in implementing and delivering the surveillance wetlands monitoring program is provided in supplement 04. A focused study will monitor the effects of OS emissions of N and S in bogs and attempt to address their influence of changes to greenhouse gases (GHGs). This effort will be undertaken by the University of Villanova, lead by Dr. Kel Weider. Additional information on the University of Villanova's contributions and historic involvement in the surveillance wetland monitoring program is provided in supplement 05.

The surveillance wetland monitoring program will be achieved by following tasks and deliverables:

1. Development of Wetland Field Monitoring Work Plan and schedule – EPA staff leads work plan development with support from ABMI staff.

2. Implementation of Wetland Field Monitoring Work Plan and schedule – EPA staff leads implementation with support from ABMI staff.
2a. EPA staff leads (ABMI supporting) site selection, set-up, take-down, and data retrieval.
2b. EPA staff leads (ABMI supporting) water quality data collection.
2c. ABMI staff lead (EPA supporting) vegetation surveys, associated field data collection and management, and QAQC.

3. Sample processing and laboratory analysis
3a. ABMI leads taxonomic lab analysis of vegetation samples.

4. GHG bog monitoring at select bog site(s) - U. Villanova leads implementation.
4a. Monitoring includes collection of peat cores and the analysis of N,S and N_2O and CH_4 concentrations.

5. All preliminary data received by EPA staff – QA/ QC, data validation prior to submission to OSM Program Office for upload to the OSM data portal.

Phase 1, Objective 2 - To further develop a surveillance wetland monitoring program within an adaptive management framework and that meets the mandate of the OSM Program.
Status – Proposed 2023-2024 work plan and beyond.

To develop further a core surveillance wetland monitoring program within an adaptive management framework that meets the Mandate of the OSM Program – i.e. establish baseline conditions and evaluate natural variability.

1. Expand the existing wetland monitoring site network to 120 sites (30 bogs, 30 fens, 30 swamps, and 30 shallow open water) in order to establish a baseline of wetland condition. Ten (10) suspected high disturbance sites of each wetland class will be monitored in addition to 20 reference sites of each wetland class.
1a. Disturbed sites were identified using a wetland stressor map developed at a HUC10 watershed-scale during the pilot phase of the wetland program. This so-called wetland disturbance index (WDI) was calculated based on hydrologic alteration (summed industrial water allocations attributed to oil sands operations), land disturbance (density of oil sands human footprint features) and oil sands priority contaminants (GEM-MACH atmospheric deposition loading estimates for N, S, & PACs). Additional detail on development of the WDI is provided in supplement 06.

2. The regional oil sands WDI map was used to develop a desktop-based site selection criteria (see supplement 06 for additional detail) as follows:
2a. 'Baseline' watersheds (HUC10) had the lowest WDI scores. Additionally, only 'baseline' watersheds within 100km of the Fort McMurray airport were selected to minimize travel time and cost to the wetland monitoring program. These 'baseline' watersheds are generally located in the vicinity of the highest risk 'test' watersheds.
2b. 'Baseline' sites were randomly selected from wetland inventories within the 'baseline' watersheds. Twenty sites for each wetland class in the OSR (bog, fen, swamp, and shallow open water) for a total of 80 'baseline' sites. Selected sites are subject to change based on in-field evaluation of suitability.
2c. A 'Disturbed' study area was identified within watersheds (HUC10) with the highest WDI scores that were within a 10 km buffer of oil sands lease boundaries, targeting wetlands at greatest risk of disturbance from oil sands development.
2d. 'Disturbed' sites were randomly selected within the 'disturbed' study area. Ten sites were selected for each wetland class in the OSR for a total of 40 'test' sites. Selected sites are subject to change based on in-field evaluation of suitability.

3. Baseline conditions will be established through evaluation of wetland indicator data collected at all 80 baseline monitoring sites, this will facilitate the identification of natural variability in baseline conditions and provides the foundation for identifying deviations from baseline.

Phase 2, Objective 1 – Critical assessment of wetland monitoring data acquired under Phase 1 to critically review and refine (as appropriate) elements of the surveillance wetland monitoring program related to study design (i.e. statistical power analysis), indicator sensitivity, defining indicator triggers, and identify deviations (if any) from baseline.
Status: Proposed 2025 work plan and beyond.

Adaptive monitoring work will occur throughout Phase 2 of the surveillance wetland monitoring program's implementation including:

1. Establish monitoring and management 'triggers' for wetland indicators, and identify deviations (if any) from 'baseline' conditions.

2. Evaluate and review the study design, optimize site selection, and conduct statistical power analysis to ensure baseline conditions are adequately representative and a reliable means of identifying statistically significant deviations from baseline for all wetland indicators.

3. Further co-develop an integrated wetland monitoring program that is valued by local Indigenous communities to ensure the program is robust, efficient, and addressing emerging concerns of communities.

4. Evaluate the sensitivity of wetland indicators to oil sands disturbances in relation to baseline conditions, adding and/or removing indicators as appropriate. Any identified prospective indicators must be quantifiable, rapid and repeatable, valued by local communities, and broadly representative of wetland ecological health and condition.

5. Further integration of wetland monitoring program with remote sensing to scale-up results to regional scales to assess the extent and magnitude of wetland ecosystem changes that are attributable to oil sands development.

6. Further integration of the wetland monitoring program with the Air Deposition, Groundwater, Surface Water Quantity and Quality, and Terrestrial Biological Monitoring Programs through alignment as appropriate on key stressor gradients, study design and site selection criteria, and common ecosystem indicators and protocols.

Describe how changes in environmental Condition will be assessed

Wetland ecosystem changes will be assessed against baseline conditions and pre-development conditions (where appropriate). Site network build-out to 120 sites (30 of each wetland class) is ongoing (expected completion 2025) and will facilitate the establishment of baseline conditions of wetland health. Change will be measured through selecting wetland sites along a cumulative effects stressor gradient (wetlands disturbance index; see supplement 06) in high risk stressor areas (disturbance areas) and compared against baseline/predevelopment conditions established through the analysis of appropriate reference sites established in areas with minimal oil sands stressors (reference areas). The study design is also constrained by natural wetland landscape units (covariables include surficial geology, topography, fire history) in the oil sands region to minimize factors affecting natural variability.

Wetland conditions will be assessed at each site: including hydrology (water level), water quality, sediment quality (shallow open water wetlands only), plant community composition and structure, and benthic invertebrate community composition (only at shallow open water wetlands).

Remote sensing data and associated field data (spatial location/extent, vegetation structure, wetland class) will be used to assess changes in wetland state (i.e., area and extent) over time across the region through the creation of contemporary wetland change products. Surveillance wetland monitoring sites will be used to validate wetland geospatial products.

Are there Benchmarks Being Used to Assess Changes in Environmental Condition? If So, Please Describe, If Not, State "NONE"

Yes, water, sediment, and biotic tissues collected as part of this work plan are compared to existing protective environmental guidelines (e.g., CCME guidelines for the protection of aquatic life) in order to provide toxicological context and to assess changes in environmental conditions. Where protective environmental guidelines do not exist, wetland ecosystem conditions in higher impact areas (i.e., close to oil sands development) will be compared to baseline and pre-development (where appropriate) conditions to develop thresholds of change.

Historical geospatial data products (e.g. Alberta Merged Wetland Inventory, Human Footprint Inventory, etc.) are benchmarks against which contemporary data (field acquired data and/or wetland inventories) will be assessed against to identify change.

(e.g., objectives, tiers, triggers, limits, reference conditions, thresholds, etc.)

Provide a Brief Description of the Western Science or Community-Based Monitoring Indigenous Community-Based Monitoring Methods by Project Phase

Phase 1 continues (year 3 of the surveillance wetland monitoring program) to implement the measurement of a suite of core wetland indicators selected for their sensitivity to oil sands disturbances that are quantifiable, efficient, and repeatable. The indicators and protocols have been selected to address local

Indigenous community concerns and observations of wetland changes (e.g., drying wetlands, water contamination, etc.), and engagement with communities will continue to further define traditional knowledge indicators and protocols (where appropriate) and refine existing protocols.

Following updates and revision based on field implementation during 2022, previous feedback/co-development from the wetland TAC and SIKIC, and continued feedback from the wetland TAC the draft SOP's will be submitted to the OSM Program Office for final review during 2024. A summary of Wetland Indicators and standard operating procedures are noted by project phase and objectives as follows:

Phase 1 Objectives 1 & 2 (outlined above) are met by the methods described below.

Delivered by EPA:
1. Establish new sites based on desktop site selection criteria (including set up of hydrometeorological instrumentation, vegetation survey transects, and GNSS location measurements of vegetation plot) during May.

2. Hydrology monitoring protocol for water table depth using pressure transducers in stilling wells throughout the growing season (May – October).

3. Surface water quality (SWQ) protocols for shallow open water wetlands collects grab samples largely following the Alberta Environment and Parks SWQ Monitoring Program protocol (AENV 2006) for the suite of OSM SWQ parameters of concern listed in the OSM Phase I Monitoring Plan (2011). Results will be compared to existing single substance guidelines (e.g., Protection of Aquatic Health Guidelines).

4. Shallow groundwater quality sampling protocols for bogs, fens and swamps obtains water from two piezometers in each wetland. Water quality parameters will be sampled for a prioritized list of parameter groups (i.e. water isotopes, nutrients, routines, cations, anions, total metals) based on the sample volumes obtained. Results will be compared to existing single substance guidelines (e.g., Protection of Aquatic Health Guidelines).

5. Sediment quality grab samples will be collected from shallow open water wetlands to assess oil sands sediment parameters of concern listed in the OSM Phase I Monitoring Plan (2011).

6. Benthic invertebrates will be sampled at shallow open water wetlands following CABIN Wetlands Protocol (ECCC 2019); http://publications.gc.ca/site/eng/9.875937/publication.html

Delivered by ABMI:
1. Bogs will be sampled for plant tissue chemistry (total nitrogen) for 1-3 indicator plant species that are sensitive to nitrogen deposition associated with oil sands development. Indicator species and sampling protocols follow Wieder et al. 2016; Wieder et al. 2019. Plant tissues will be sampled once in July/August at separate locations to the sites defined under the U. Villanova work.

2. Wetland vegetation protocols have been developed that target assessment of vegetation composition, structure (percent cover and height), and aboveground biomass. The vegetation structure assessment includes characterizing dominant species, vegetation strata (i.e. trees, shrubs, forbs, ground cover) and selected indicator species including those that are sensitive to land disturbances (Ficken et al. 2019). Additionally, obligate wetland species sensitive to hydrological alterations and species sensitive to nitrogen deposition identified by Wieder et al. 2019; 2020 are identified.

3. Vegetation assessment targets transitional zones of wetlands (fen, swamp, shallow open water) that are sensitive, and the area of wetlands where change is most easily detected, to land disturbances and hydrological alterations (Chasmer et al. 2021). Vegetation assessment of bogs are conducted at the wetland center (identified as most susceptible to change; Wieder et al. 2019; 2020). Spatial and structural

data generated from the vegetation surveys are useful for validating remote sensing data that enables scaling-up and assessment of wetland vegetation change across the landscape (Chasmer et al 2020b).

Delivered by U. Villanova:
1. Select bog(s) (not duplicated in the long-term monitoring program site network) will be peat core sampled for N, S, N2O, and CH4 concentrations.

List the Key Indicators Measured, If Not Applicable, State N/A

The key indicators monitored in the surveillance wetland monitoring program and associated rationale are as follows:

1. Wetland area (changes in wetland area, fragmentation, loss of connectivity, etc.)
1a. Tracking wetland area status and trends is a critical indicator of wetland health and condition.
1b. Direct wetland loss, fragmentation and loss of connectivity through land disturbances.
1c. Wetland loss and disturbance results in impairment of wetland ecosystem services to local communities (Gardner and Finlayson 2018, Chasmer et al. 2020).

2. Meteorology (precipitation, temperature, relative humidity)
2a. Important to attribute the influence of weather on wetland hydrological conditions (observed through measurements of precipitation, temperature, relative humidity) versus the effects of oil sands development.

3. Hydrology (water table depth, soil moisture levels)
3a. Water table position, soil moisture levels, and open water area are proxies for assessing change in wetland function.
3b. Hydrological conditions are sensitive to local land disturbances, and hydrological alterations associated with industrial water use.

4. Surface water quality (full suite of oil sands SWQ parameters of concern for shallow open water wetlands; reduced suite of parameters in peatlands)
4a. Surface water quality parameters (trace metals, chlorophyll A, routines, nutrients, Mercury, PACs) are proxies of the condition of aquatic habitat and can be assessed against established guidelines (e.g. CCME Water Quality Guidelines).
4b. SWQ is used as a measure of the condition of an aquatic habitat relative to the needs of organisms (e.g. habitat for plants and animals) or people (e.g. drinking water and recreation).
4c. Specific conductance and pH is a proxy of contaminant deposition.

5. Sediment quality (shallow open water wetlands only)
5a. Sediment parameters (trace metals, nutrients, phenols, Mercury, PACs) are proxies of the condition of aquatic habitat.
5b. Where available, contaminant concentrations are compared against established guidelines (e.g. CCME PAL Guidelines) to identify contaminants in sediments associated with oil sands development, such as sediment enriched in vanadium and nickel near mines (Klemt et al. 2020).

6. Vegetation (community composition and structure; culturally important plants; high land disturbance indicator species; obligate wetland species)
6a. Aboveground biomass across vegetation functional groups (cryptogams, herbs, graminoids, shrubs and trees) changes due to contaminant enrichment (Wieder et al. 2020), and long-term water table drawdown (Kompanizare et al. 2018).
6b. Vegetation structure has been observed with proximity to land disturbance (Chasmer et al. 2021).
6c. Changes in plant species composition are associated with land disturbances (Ficken et al. 2019) water drawdown (Murphy et al. 2009), and increasing nitrogen deposition (Wieder et al. 2019; 2020).
6d. High disturbance indicator species identified by Ficken et al. (2019) can be used to identify wetlands

that have undergone land disturbance.
6e. Plant tissue analysis for 3 indicator species, exclusively in bogs, will assess impacts of contaminant enrichment (Wieder et al. 2021).

7. Benthic invertebrates (shallow open water wetlands only; community composition)
7a. Benthic invertebrate composition (sensitive to water quality changes) are used to assess the environmental condition of freshwaters (Parsons et al. 2010).
7b. Results from the wetland monitoring pilot study show benthic invertebrate communities are sensitive to land disturbance and associated changes in surface water quality.

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Wieder, R. K., M. A. Vile, K. D. Scott, C. M. Albright, J. C. Quinn and D. H. Vitt (2021). "Bog plant/lichen tissue nitrogen and sulfur concentrations as indicators of emissions from oil sands development in Alberta, Canada." Environmental monitoring and assessment 193(4): 1-18.

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Wieder, R. K., D. H. Vitt, M. A. Vile, J. A. Graham, J. A. Hartsock, J. M. Popma, H. Fillingim, M. House, J. C. Quinn and K. D. Scott (2020). "Experimental nitrogen addition alters structure and function of a boreal poor fen: Implications for critical loads." Science of the Total Environment 733: 138619

11.0 Knowledge Translation

In the space below, please provide the following:

- Describe the plan for knowledge transfer and distribution of learnings from the project. This could include workshops, publications, best practice documentation, marketing plan, etc.
- Demonstrate that the knowledge transfer plan is appropriate for the intended end-users.

Knowledge translation will involve training for local Indigenous community partners on protocols for monitoring core wetland indicators, where requested. This will enable communities to conduct their own wetland monitoring consistent with the core program.

An annual State of Environment Report (or similar) will be produced each year for various end-users including local Indigenous communities, and other stakeholders, The State of Environment report will be plain-language and summarize key findings on wetland ecosystem indicators in relation to oil sands development activities.

Ongoing conversations and engagement over the course of the year involving members of the ICBMAC, IKCMCS, and Indigenous members of the wetland TAC, will continue to work towards co-development of a multiple evidence based approach to monitoring wetlands including engagement on defining baseline and pre-development conditions under an adaptive monitoring framework. This may involve participation in CBM workshops, working meetings, desktop research, and field visits to communities by project leads. Conversations will seek to leverage lessons and guidance from completed and ongoing activities by the ICBMAC and IKCMCS related to ICBM best practices, ethical guidelines and conceptual models.

12.0 External Partners

List by project or project phase each component that will be delivered by an external party (including analytical laboratories) and name the party. Describe and name the associate work plan/grant/contract for these services. * state none if not required

Continued development of the surveillance Wetland Ecosystem Monitoring Program is led by Dr. Craig Mahoney and EPA's wetland science team with input from all project partners. This includes site network optimization along key oil sands source gradients, core wetland indicator development, and defining baseline conditions and monitoring tiers and triggers to support State of the Environment Reporting.

For the implementation phase (phase 1) of the surveillance wetland monitoring program, the field component of monitoring at 120 wetland sites will be jointly delivered by EPA wetland staff and the Alberta Biodiversity Monitoring Institute (ABMI). Existing partner; new contract required.

Surface water quality and sediment samples will be analyzed under contracts with various commercial analytical laboratories. Existing contracts for both water quality and sediment quality are used by all theme areas for consistency within and among monitoring programs. These contracts expire March 31st 2024 and are in the renewal process (Lead by Chenxing (Angela) Sun); all new contracts are anticipated to be executed in time for 2024-2025 sample analyses. Previously, water and sediment samples were submitted to the following vendors: the Biogeochemical Analytical Services Laboratory (22RSD850; 22RSD949), SGS AXS (22RSD853; 22RSD950), Bureau Veritas (22RSD851), ALS Canada (22RSD948) and InnoTech (22RSD852; 22RSD919).

Wetland benthic invertebrate samples will be analysed under existing contract 23RSD837 (Biologica Environmental) following the CABIN Laboratory Methods, Processing, Taxonomy and Quality Control of Benthic Macroinvertebrate Samples (http://ec.gc.ca/rcba-cabin/). Analysis of carbon, nitrogen and sulphur in plant tissues (bogs only) will be analysed by Bureau Veritas under new contract 24RSD861. DNA barcoding of plant voucher samples will be analysed under a new sole source contract to InnoTech (pending DM approval).

A greenhouse gas (GHG) bog monitoring focused study will be delivered by the University of Villanova.

Existing partner; continuation of approved 2-year grant required for focused study (24GRRSD28 ; year 1 of 2 approved and executed under Air TAC (grant manager: Greg Wentworth). Year 2 of 2 planned for execution under the Wetland TAC (grant manager: Craig Mahoney).

*To ensure complete work plan proposal submission, all grants and contracts listed in this section should also be captured in Grants & Contracts.

13.0 Data Sharing and Data Management

For 2024-25 the following approach will be taken by the OSM Program related to data sharing.

For all work plans of a **western science** nature funded under the OSM Program, data sharing is a condition of funding and must align with the principle of **"Open by Default"**. In this case, all data is to be shared with the OSM Program as directed by the OSM Program Data Management work plan.

For all work plans involving **Indigenous Knowledge** as defined below and funded under the OSM Program, data sharing is a condition of funding and the Indigenous Knowledge components of the work plan must align with the principle of **"Protected by Default".** In this case, all data as defined as Indigenous Knowledge, are to be retained by the Indigenous community to which the Indigenous Knowledge is held.

Indigenous Knowledge is defined as:

"The knowledge held by First Nations, Inuit and Métis peoples, the Aboriginal peoples of Canada. Traditional knowledge is specific to place, usually transmitted orally, and rooted in the experience of multiple generations. It is determined by an Aboriginal community's land, environment, region, culture and language. Traditional knowledge is usually described by Aboriginal peoples as holistic, involving body, mind, feelings and spirit. Knowledge may be expressed in symbols, arts, ceremonial and everyday practices, narratives and, especially, in relationships. The word tradition is not necessarily synonymous with old. Traditional knowledge is held collectively by all members of a community, although some members may have particular responsibility for its transmission. It includes preserved knowledge created by, and received from, past generations and innovations and new knowledge transmitted to subsequent generations. In international or scholarly discourse, the terms traditional knowledge and Indigenous knowledge are sometimes used interchangeably."

This definition was taken from the Canadian Government's Tri-council Policy Statement for Ethical Research involving Humans (Chapter 9, pg. 113) and is an interim definition specific to the Oil Sands Monitoring Program.

13.1 Has there, or will there be, a Data Sharing agreement established through this Project? *

Yes

13.2 Type of Quantitative Data Variables**:**

Both

13.3 Frequency of Collection:

Other

13.4 Estimated Data Collection Start Date:

May 1, 2020

13.5 Estimated Data Collection End Date:

Oct 31, 2024

13.6 Estimated Timeline For Upload Start Date:

Dec 1, 2024

13.7 Estimated Timeline For Upload End Date:

Mar 31, 2025

13.8 Will the data include traditional knowledge as defined by and provided by an Indigenous representative, Community or Organization?

No

Table 13.9 Please describe below the Location of Data and Data Type:

Add a Data Source by clicking on the add row on the bottom right side of table

Name of Dataset	Location of Dataset (E.g.:Path, Website, Database, etc.)	Data File Formats (E.g.: csv, txt, API, accdb, xlsx, etc.)	Security Classification
Wetland Hydrometric Data	OSM Data Portal	xlsx	Open by Default
Wetland Surface Water Quality	OSM Data Portal	xlsx	Open by Default
Wetland Groundwater Quality	OSM Data Portal	xlsx	Open by Default
Wetland Sediment Quality	OSM Data Portal	xlsx	Open by Default
Wetland Benthic Invertebrate Data	OSM Data Portal	xlsx	Open by Default
Wetland Vegetation Composition Data	OSM Data Portal	xlsx	Open by Default
Wetland Vegetation Structure Data	OSM Data Portal	xlsx	Open by Default

14.0 2024/25 Deliverables

Add an additional deliverable by clicking on the add row on the bottom right side of table

Type of Deliverable	Delivery Date	Description
Other (Describe in Description Section)	Q4	OSM Wetland core indicators data (water quality, sediment quality, benthic invertebrate composition, vegetation composition & structure, water level and temperature) added to OSM Data Portal
Other (Describe in Description Section)	Q4	Bog monitoring data (tissue analysis, water quality) posted to Oil Sands Data Portal
Technical Report	Q4	Annual report to Wetland TAC and stakeholder groups
Technical Report	Q4	Technical Report: Vegetation Surveillance Method Comparison 2023 Data
Technical Report	Q4	ABMI Wetland Surveillance Monitoring Annual Report
Stakeholder or Community Presentation	Q4	Annual presentation of wetland surveillance monitoring program to wetland TAC and stakeholder groups.
Condition of Environment Report	Q4	Annual evaluation and reporting of program datasets for Condition of Environment Reporting (or similar report)

15.0 Project Team & Partners

In the space below please provide information on the following:

- Describe key members of the project team, including roles, responsibilities and expertise relevant to the proposed project.
- Describe the competency of this team to complete the project.
- Identify any personnel or expertise gaps for successful completion of the project relative to the OSM Program mandate and discuss how these gaps will be addressed.
- Describe the project management approach and the management structure.

Alberta Environment and Protected Areas team members include:

Dr. Craig Mahoney (EPA), Principle Investigator, Wetland Scientist, Ph.D.
Wetland Monitoring Program and Geospatial Lead.
- lead OSM Wetland Monitoring Program
- manage and oversee wetland monitoring program implementation with EPA staff and external partners
- participate in Indigenous Community and stakeholder engagement
- supervise (as required) and lead field work and data collection
- geospatial analysis of OSM wetland monitoring data
- remote sensing and wetland change detection
- contribute to Wetland Monitoring Program evaluation and reporting, including supervise analyses and write scientific manuscripts, technical reports and knowledge translation products.

Stephanie Connor (EPA), Wetland Scientist, M.Sc.
Habitat and Biotics Lead.
- hydrology, surface water quality, sediment, and benthic invertebrate technical lead
- supervise (as required) and lead field work and data collection
- field data validation, review and analysis
- database management
- literature review and manuscript preparation
- contribute to Wetland Monitoring Program evaluation and reporting, including supervise analyses and write scientific manuscripts, technical reports and knowledge translation products.

Joshua Montgomery (EPA), Wetland Scientist, M.Sc.
Hydrometeorological and Vegetation Lead.
- meteorology, vegetation and remote sensing technical lead
- supervise (as required) and lead field work and data collection
- GIS and remote sensing analysis
- field data validation, review and analysis
- literature review and manuscript preparation
- contribute to Wetland Monitoring Program evaluation and reporting, including supervise analyses and write scientific manuscripts, technical reports and knowledge translation products.

Dr. Danielle Cobbaert (EPA), Senior Wetland Scientist, Ph.D.
- wetland program support & guidance
- manuscript preparation
- lead vegetation protocol comparison with ABMI

16.0 Project Human Resources & Financing

Section 16.1 Human Resource Estimates

Building off of the competencies listed in the previous section, please complete the table below. Add additional rows as necessary. This table must include **ALL staff involved** in the project, their role and the % of that staff's time allocated to this work plan. The AEPA calculated amount is based on an estimate of $120,000/year for FTEs. This number cannot be changed. The OSM program recognizes that this is an estimate.

Table 16.1.1 AEPA

Add an additional AEPA Staff member by clicking on the add row below the table. The total FTE (Full Time Equivalent) is Auto Summed (in Table 16.2.1) and converted to a dollar amount.

Name (Last, First)	Role	%Time Allocated to Project
Wetland Scientist	Program and Geospatial Lead	100
Wetland Scientist	Habitat and Biotics Lead	100
Wetland Scientist	Hydrometeorological and Vegetation Lead	100
Wetland Scientist	Program support, evaluation and reporting	15

Table 16.1.2 ECCC

Add an additional ECCC Staff member by clicking on the add row below the table. The total FTE (Full Time Equivalent) is Auto Summed (in Table 16.2.2) and converted to a dollar amount.

Name (Last, First)	Role	%Time Allocated to Project

The tables below are the financial tables for Alberta Environment & Protected Areas (AEPA) and Environment & Climate Change Canada. All work plans under the OSM Program require either a government lead or a government coordinator.

Section 16.2 Financing

The OSM Program recognizes that many of these submissions are a result of joint effort and monitoring initiatives. A detailed “PROJECT FINANCE BREAKDOWN” must be provided using the Project Finance Breakdown Template provided, accessible here. Please note that completion of this Project Finance Breakdown Template is mandatory and must be submitted along with each workplan.

PROJECT FINANCE BREAKDOWN TEMPLATE

Table 16.2.1 Funding Requested BY ALBERTA ENVIRONMENT & PROTECTED AREAS

Organization - Alberta Environment & Protected Areas ONLY	Total % time allocated to project for AEPA staff	Total Funding Requested from OSM
Salaries and Benefits (Calculated from Table 16.1.1 above)	315	$378,000.00
Operations and Maintenance		
Consumable materials and supplies		$21,300.00

Conferences and meetings travel	$0.00
Project-related travel	$311,925.00
Engagement	$5,000.00
Reporting	$10,000.00
Overhead	$0.00
Total All Grants (Calculated from Table 16.4 below)	$1,018,673.00
Total All Contracts (Calculated from Table 16.5 below)	$126,540.00
Sub-Total (Calculated)	$1,871,438.00
Capital*	$24,650.00
AEPA TOTAL (Calculated)	$1,896,088.00

* The Government of Alberta Financial Policies (*Policy # A600*) requires that all **capital asset** purchases comply with governmental and departmental legislation, policies, procedures, directives and guidelines. **Capital assets** (*Financial Policy # A100*, Government of Alberta, January 2014) are tangible assets that: have economic life greater than one year; are acquired, constructed, or developed for use on a continuing basis; are not held for sale in ordinary course of operations; are recorded and tracked centrally; have a cost greater than $5,000.
Some **examples of capital asset equipment include:** laboratory equipment, appliances, boats, motors, field equipment, ATV's/snowmobiles, stationary equipment (pier/sign/weather), fire/safety equipment, pumps/tanks, heavy equipment, irrigation systems, furniture, trailers, vehicles, etc. (*Financial Policy # A100*, Government of Alberta, January 2014).

Table 16.2.2 Funding Requested BY ENVIRONMENT & CLIMATE CHANGE CANADA

Organization - Environment & Climate Change Canada ONLY	Total % time allocated to project for ECCC staff	Total Funding Requested from OSM
Salaries and Benefits FTE (Please manually provide the number in the space below)	0	$0.00
Operations and Maintenance		
Consumable materials and supplies		
Conferences and meetings travel		
Project-related travel		
Engagement		
Reporting		
Overhead		
ECCC TOTAL (Calculated)		$0.00

* ECCC cannot request capital under the OSM program. Any capital requirements to support long-term monitoring under the OSM program should be procured by Alberta and captured in that budget table.

Table 16.3

Complete ONE table per Grant recipient.

Add a Recipient by clicking on add table below the table. The total of all Grants is Auto Summed in Table 16.2.1

GRANT RECIPIENT - ONLY: Name	Delivery of core monitoring data & summer field surveys - Alberta Biodiversity Monitoring Institute
GRANT RECIPIENT - ONLY: Organization	Alberta Biodiversity Monitoring Institute
Category	Total Funding Requested from OSM
Salaries and Benefits FTE	$550,505.00
Operations and Maintenance	
Consumable materials and supplies	$21,000.00
Conferences and meetings travel	
Project-related travel	$250,950.00
Engagement	
Reporting	
Overhead	$82,245.00
GRANT TOTAL (Calculated)	$904,700.00
GRANT RECIPIENT - ONLY: Name	GHG influence on bog emissions - Kel Wieder
GRANT RECIPIENT - ONLY: Organization	University of Villanova
Category	Total Funding Requested from OSM
Salaries and Benefits FTE	$75,329.00
Operations and Maintenance	
Consumable materials and supplies	$16,344.00
Conferences and meetings travel	$10,215.00
Project-related travel	
Engagement	
Reporting	
Overhead	$12,085.00
GRANT TOTAL (Calculated)	$113,973.00

Table 16.4

Complete ONE table per Contract recipient.

Add a Recipient by clicking on add row below the table.. This section is only to be completed should the applicant intend to contract components or stages of the project out to external organizations. The total of all Contracts is Auto Summed in Table 16.2.1

CONTRACT RECIPIENT - ONLY: Name	Analysis of trace metals in water
CONTRACT RECIPIENT - ONLY: Organization	TBD via new Open Competition
Category	Total Funding Requested from OSM
Salaries and Benefits	
Operations and Maintenance	
Consumable materials and supplies	$15,540.00
Conferences and meetings travel	
Project-related travel	
Engagement	
Reporting	
Overhead	
CONTRACT TOTAL (Calculated)	$15,540.00
CONTRACT RECIPIENT - ONLY: Name	Analysis of total and methylmercury in water
CONTRACT RECIPIENT - ONLY: Organization	TBD via new Open Competition
Category	Total Funding Requested from OSM
Salaries and Benefits	
Operations and Maintenance	
Consumable materials and supplies	$7,252.00
Conferences and meetings travel	
Project-related travel	
Engagement	
Reporting	
Overhead	
CONTRACT TOTAL (Calculated)	$7,252.00
CONTRACT RECIPIENT - ONLY: Name	Analysis of routines, major ions and nutrients in water

CONTRACT RECIPIENT - ONLY: Organization	TBD via new Open Competition
Category	Total Funding Requested from OSM
Salaries and Benefits	
Operations and Maintenance	
Consumable materials and supplies	$10,065.00
Conferences and meetings travel	
Project-related travel	
Engagement	
Reporting	
Overhead	
CONTRACT TOTAL (Calculated)	$10,065.00
CONTRACT RECIPIENT - ONLY: Name	Analysis of polycyclic aromatic compounds in water
CONTRACT RECIPIENT - ONLY: Organization	TBD via new Open Competition
Category	Total Funding Requested from OSM
Salaries and Benefits	
Operations and Maintenance	
Consumable materials and supplies	$7,490.00
Conferences and meetings travel	
Project-related travel	
Engagement	
Reporting	
Overhead	
CONTRACT TOTAL (Calculated)	$7,490.00
CONTRACT RECIPIENT - ONLY: Name	Analysis of isotopes (2H and 18O) in water
CONTRACT RECIPIENT - ONLY: Organization	TBD via new Open Competition
Category	Total Funding Requested from OSM
Salaries and Benefits	
Operations and Maintenance	

Consumable materials and supplies	$3,630.00
Conferences and meetings travel	
Project-related travel	
Engagement	
Reporting	
Overhead	
CONTRACT TOTAL (Calculated)	$3,630.00
CONTRACT RECIPIENT - ONLY: Name	Analysis of trace metals in sediment
CONTRACT RECIPIENT - ONLY: Organization	TBD via new Open Competition
Category	Total Funding Requested from OSM
Salaries and Benefits	
Operations and Maintenance	
Consumable materials and supplies	$1,670.00
Conferences and meetings travel	
Project-related travel	
Engagement	
Reporting	
Overhead	
CONTRACT TOTAL (Calculated)	$1,670.00
CONTRACT RECIPIENT - ONLY: Name	Analysis of total and methylmercury in sediment
CONTRACT RECIPIENT - ONLY: Organization	TBD via new Open Competition
Category	Total Funding Requested from OSM
Salaries and Benefits	
Operations and Maintenance	
Consumable materials and supplies	$3,710.00
Conferences and meetings travel	
Project-related travel	
Engagement	
Reporting	

Overhead	
CONTRACT TOTAL (Calculated)	$3,710.00
CONTRACT RECIPIENT - ONLY: Name	Analysis of N, C and PSA in sediment
CONTRACT RECIPIENT - ONLY: Organization	TBD via new Open Competition
Category	Total Funding Requested from OSM
Salaries and Benefits	
Operations and Maintenance	
Consumable materials and supplies	$1,273.00
Conferences and meetings travel	
Project-related travel	
Engagement	
Reporting	
Overhead	
CONTRACT TOTAL (Calculated)	$1,273.00
CONTRACT RECIPIENT - ONLY: Name	Analysis of polycylic aromatic compounds in sediment
CONTRACT RECIPIENT - ONLY: Organization	TBD via new Open Competition
Category	Total Funding Requested from OSM
Salaries and Benefits	
Operations and Maintenance	
Consumable materials and supplies	$8,190.00
Conferences and meetings travel	
Project-related travel	
Engagement	
Reporting	
Overhead	
CONTRACT TOTAL (Calculated)	$8,190.00
CONTRACT RECIPIENT - ONLY: Name	23RSD837; Laboratory Analysis of Wetland Benthic Samples
CONTRACT RECIPIENT - ONLY: Organization	Biologica Environmental

Category	Total Funding Requested from OSM
Salaries and Benefits	
Operations and Maintenance	
Consumable materials and supplies	$22,320.00
Conferences and meetings travel	
Project-related travel	
Engagement	
Reporting	
Overhead	
CONTRACT TOTAL (Calculated)	$22,320.00
CONTRACT RECIPIENT - ONLY: Name	24RSD861; Analysis of C, N and S in Plant Tissues
CONTRACT RECIPIENT - ONLY: Organization	Vendors being evaluated

Category	Total Funding Requested from OSM
Salaries and Benefits	
Operations and Maintenance	
Consumable materials and supplies	$15,000.00
Conferences and meetings travel	
Project-related travel	
Engagement	
Reporting	
Overhead	
CONTRACT TOTAL (Calculated)	$15,000.00
CONTRACT RECIPIENT - ONLY: Name	DNA Identification of Wetland Plants
CONTRACT RECIPIENT - ONLY: Organization	InnoTech

Category	Total Funding Requested from OSM
Salaries and Benefits	
Operations and Maintenance	
Consumable materials and supplies	$30,400.00

Conferences and meetings travel	
Project-related travel	
Engagement	
Reporting	
Overhead	
CONTRACT TOTAL (Calculated)	$30,400.00

Table 16.5 GRAND TOTAL Project Funding Requested from OSM Program

The table below is auto calculated, please do not try to manually manipulate these contents.

Category	Total Funding Requested from OSM
Salaries and Benefits Sums totals for salaries and benefits from AEPA and ECCC ONLY	$378,000.00
Operations and Maintenance	
Consumable materials and supplies Sums totals for AEPA and ECCC ONLY	$21,300.00
Conferences and meetings travel Sums totals for AEPA and ECCC ONLY	$0.00
Project-related travel Sums totals for AEPA and ECCC ONLY	$311,925.00
Engagement Sums totals for AEPA and ECCC ONLY	$5,000.00
Reporting Sums totals for AEPA and ECCC ONLY	$10,000.00
Overhead Sums totals for AEPA and ECCC ONLY	$0.00
Total All Grants (from table 16.2.1 above) **Sums totals for AEPA Tables ONLY**	$1,018,673.00
Total All Contracts (from table 16.2.1 above) **Sums totals for AEPA Tables ONLY**	$126,540.00
SUB-TOTAL (Calculated)	$1,871,438.00
Capital* **Sums total for AEPA**	$24,650.00
GRAND PROJECT TOTAL	$1,896,088.00

Some **examples of capital asset equipment include:** laboratory equipment, appliances, boats, motors, field equipment, ATV's/snowmobiles, stationary equipment (pier/sign/weather), fire/safety equipment, pumps/tanks, heavy equipment, irrigation systems, furniture, trailers, vehicles, etc. (*Financial Policy # A100*, Government of Alberta, January 2014).

17.0 FINANCIAL MANAGEMENT

The OSM Program reserves the right to reallocate project funding during the current fiscal year on the basis of project performance and financial overspend or underspend.

☑ Please check this box to acknowledge you have read and understand

In the space below please describe the following:

- Discuss how potential cost overruns and cost underruns will be managed.
- If this is a continuing project from last year, identify if this project was overspent or underspent in the previous year and explain why.
- Describe what risks and/or barriers may affect this project.

Throughout the duration of the wetland monitoring project cost overruns and cost underruns will be managed by ensuring there is quarterly reporting from external partners and contractors, with any variance in budget highlighted and justified. In addition, we will hold quarterly project team meetings, where any potential barriers to the proposed work plan will be brought forward, solutions proposed, and potential impact on project budget and timelines communicated.

To mitigate the risks associated with the reliance on hiring new wetland staff given provincial constraints, this work plan has included outsourcing some of the wetland monitoring work to academic partners and NGO partners. Because a significant portion of the work for this project will be completed under contract/grant, there is a risk that if contracts and grants are not quickly initiated and approved in Q1 of 2024-2025 fiscal year that multiple phases/tasks/deliverables may be delayed or not completed in entirety within the 2024-2025 fiscal year.

Potential risks and barriers to the successful implementation of the wetland work plan include: Timely approval of the work plan to the tasks can be initiated on schedule, hiring available resources to undertake work as required, and the ability to get contracts and grants in place in a timely fashion; support with wetland data architecture and services from Service Alberta, and the collaboration and support from all theme areas in supplying spatial data and; the availability and suitability of high quality geospatial data to assess both stressors and natural covariates.

18.0 Alternate Sources of Project Financing - In-Kind Contributions

Table 18.1 In-Kind Contributions

Add an In Kind Contribution by clicking on the table and then clicking on the add row on the bottom right side of table.

Description	Source	Equivalent Amount ($CAD)
Lab Space and Equipment	Alberta Biodiversity Monitoring	$92,000.00
In Kind Technical Expertise	Alberta Biodiversity Monitoring	$35,000.00
	TOTAL	$127,000.00

19.0 Consent & Declaration of Completion

Should your application be successful, The OSM Program reserves the right to publish this work plan application. Please check the box below to acknowledge you have read and understand:

☑ I acknowledge and understand.

Lead Applicant Name

Craig Mahoney

Title/Organization

Wetland Scientist / Alberta Environment and Protected Areas

Signature

Craig.Mahoney Digitally signed by Craig.Mahoney
Date: 2024.04.16 10:55:59 -06'00'

Government Lead / Government Coordinator Name (if different from lead applicant)

Title/Organization

Signature

Please save your form and refer to the instructions page for submission link.

Program Office Use Only

Governance Review & Decision Process

this phase follows submission and triggers the Governance Review

TAC Review (Date):

ICBMAC Review (Date):

SIKIC Review (Date):

OC Review (Date):

Final Recommendations:

Decision Pool:

Notes:

Post Decision: Submission Work Plan Revisions Follow-up Process

This phase will only be implemented if the final recommendation requires revisions and follow-up from governance

ICBMAC Review (Date):

SIKIC Review (Date):

OC Review (Date):

Comments:

Decision Pool:

Notes & Additional Actions for Successful Work Plan Implementation:

Signature