## Work Plan Application

| Project Information | |
|---|---|
| **Project Title:** | Core Biodiversity Monitoring – Benthic Invertebrates |
| **Lead Applicant, Organization, or Community:** | Environment and Climate Change Canada |
| **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** | W-LTM-S-4-2425 |
| **Project Region(s):** | Oil Sands Region |
| **Project Start Year:** First year funding under the OSM program was received for this project (if applicable) | 2023 |
| **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 | $2,677,070.00 |
| **Requested OSM Program Funding:** For the 2024/25 fiscal year | $2,362,077.00 |
| **Project Type:** | Long Term Monitoring |
| **Project Theme:** | Surface Water |
| **Anticipated Total Duration of Projects (Core and Focused Study (3 years))** | Year 5 |
| **Current Year (choose one):** | Focused Study<br>-Select One- |
| | Core Monitoring<br>Year 2 of 3 |

## Contact Information

| | |
|---|---|
| **Lead Applicant/ Principal Investigator:**<br><br>Every work plan application requires one lead applicant. This lead is accountable for the entire work plan and all deliverables. | Nancy E Glozier |
| **Job Title:** | Section Manger, Arctic Athabasca Watershed |
| **Organization:** | ECCC |
| **Address:** | 11 Innovation Blvd. Saskatoon SK, S7N3H5 |
| **Phone:** | 306-260-3298 |
| **Email:** | Nancy.glozier@ec.gc.ca |

## 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**.

The Benthos Monitoring component of the OSM Monitoring Program applies an adaptive monitoring design that addresses the key questions posed by OSM. Benthic macroinvertebrates (BMI) are key components of riverine food webs. BMI are relatively sedentary, sensitive to pressures/stressors, and critical components of fish habitat, thus, making them ideal indicators of aquatic ecosystem health. By sampling BMI along with water and sediment chemistry, habitat measurements, and other environmental variables this core monitoring program can then relate Pressures/Stressors of the existing conceptual model to determine: 1) whether changes in BMI communities are occurring; 2) if there are linkages with oil sands development and; 3) the extent of cumulative effects along the river course.

Key activities in 2024-25 will focus on:

• Continue working with the SWTAC on 2023-24 funding conditions, including a consensus plan on an updated surface water quality conceptual model, limits of change and reporting to include frequency, power and specificity;

• Continue to lead and implement the adaptive monitoring design for the proposed intensive monitoring in areas of greatest change in the Athabasca River and its major tributaries;

• Continue establishment of baseline for the In Situ areas in the Christina River and Cold Lake Oil Sands Area, including working with the CBM work plan to co-develop the existing desgin;

• As directed by the OC, the project team will work with the the SW-TAC as they lead the scoping, review and development of a benthic monitoring program in the Peace River area for potential implementation in 2025-26. No BMI field work will be conducted in Peace River area in 2024-25;

Rationale for budget changes in 2024-25 are:

• Core long-term monitoring - 11% overall increase required due to increases in laboratory analytical contracts, helicopter, and fuel charges, as well as staff wages;

## 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.

This work plan serves the mandate of the OSM program by addressing the key OSM Program questions (above) with a focus on the use of benthic macroinvertebrate indicators to detect change in aquatic ecosystem health; if changes in aquatic ecosystem health can be attributed to by oil sands development activities; and the contribution in the context of cumulative effects in the mainstem Athabasca River and its tributaries. The geographic scope of this program covers all three oil sands deposits (Cold Lake, Athabasca, and the Peace River Deposits. Any watersheds impacted by either in-situ or open-pit (or both) bitumen extraction activities are similarly in scope for this program. The Benthos Monitoring Program, which is an adaptive monitoring program, uses benthic macroinvertebrate indicators to detect change from Reference areas relative to oil sands development. This program aligns with the “Source-Pathway-Receptor” or “Pressure-Stressor-Pathway-Response” Surface Water Conceptual Model that currently exists. The specific design of this OSM Benthos Monitoring program assesses if changes in benthic macroinvertebrate indicators (Response) relative to the Pressure/Stressor components (landscape disturbance, air emissions, spills, production, seepage; sediments, nutrients, inorganic and organic substances) and the associated Pathways or routes of exposure (overland flow, atmospheric deposition, fluvial transport) exist. For both the Athabasca River mainstem and the Tributaries, Surveillance Monitoring has detected change in ecologically relevant indicators of BMI assemblages. In the mainstem, Reference areas were different from downstream areas of Municipal Sewage Effluent (MSE), Oil Sands Development, and Recovery areas. In addition, benthic macroinvertebrate assemblages in Oil Sands Development areas differed from MSE and Recovery areas. Indicators of BMI assemblages at Oil Sands Development and MSE sampling areas were comprised of more pollution tolerant taxa (e.g., worms and midges) than Reference and Recovery sampling areas. These indicators of BMI change were associated with increased concentrations of contaminants (metals and polycyclic aromatic compounds) and nutrients, which are identified as Stressors and Pressures on the Surface Water Conceptual Model. Similarly, in the tributaries (e.g., Steepbank River) sites from upstream Reference areas within the same tributary had different invertebrate assemblages from areas downstream of Oil Sands Development (i.e., Test areas). In general, Test areas further away from the Reference area had greater differences in aquatic invertebrate assemblages, while several adjacent Test areas had similar assemblages. Test area assemblages tended to have higher abundances of pollution tolerant taxa. As identified in the scoping document, further work is needed to determine if changes in ecological effects observed in the mainstem and tributaries can be attributed directly to oil sands development and is a primary objective of the Benthos Monitoring work plan.

Change in Response BMI indicators, such as community assemblages and other BMI indicators, have been detected in areas downstream of oil sands developments and confirmed in multiple years in both the Athabasca River mainstem and its tributaries. Subsequently, the core Benthos program initiated in 2023-24 increased sampling in areas of greatest detected change with a subsequent reduction in other core sampling sites. This increased sampling in areas of greatest detected change will continue in 2024-25 to further establish baseline in these areas as well as the investigation of effects attributed to oil sands development activities.

For example, in the mainstem Athabasca River, sampling will be more intensive in the reach with the greatest change detected (i.e., the MSE and Oil Sands Development areas [M3-M7C]). This will include an emphasis on examining the nutrient/contaminant interactions and areas of outfalls as appropriate. In addition, to address continued detection of change in the Oil Sands Development area and annual

variability, reduced sampling in Reference and Recovery areas of the Athabasca River will be completed, for example M0, M2A, and M9. Although the total number of sampled sites in the Athabasca River is similar to previous years, six core sites in will be suspended, while 5 new or previously sampled sites in the intensive area (M3-M7C) will continue to be sampled to further investigate the nutrient/contaminant interaction seen in this region of the mainstem Athabasca River.
In tributaries, sampling will be more intensive (e.g., 20 of 22 sites) in the Ells River in the area of greatest change detected (i.e., Test area 2 & 3), with potentially additional sites added along this gradient. To address continued annual variability and changes in the Oil Sands Development area, a minimal annual sampling of core sites in the MacKay, Ells, and Firebag rivers (e.g., 3-6 sites per river) will be conducted. Thus, for the tributaries, a total of 40 sites (reduced by 15- 20) will be sampled (approximately 24 annual surveillance sites and 16-20+ intensive sites in the Ells River).
For both mainstem and tributaries, aquatic health assessment approaches in the areas of intensive sampling will be designed to determine Pressure/Stressor/Pathway of drivers that were identified previously as having ecological effects on BMI assemblages.
For the Christina River and potentially the Cold Lake SAGD areas, the program will continue with establishment of baseline conditions.
As directed by the OC, no BMI sampling in the Peace River Oil Sands Deposit will resume in 2024-25.

## 2.0 Objectives of the Work Plan

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

The objective of this work plan is to collect the data necessary to answer the key OSM questions as they relate to the Benthos Monitoring component of the OSM Surface Water Quality Monitoring Program. With respect to monitoring, these objectives are:

• Lead and implement the adaptive monitoring design for the proposed intensive monitoring in areas of greatest change on the Athabasca River and its major tributaries. Continue establishment of baseline for the SAGD areas in the Christina rivers watersheds and explore opportunities within the Cold Lake Oil Sands Area. More specifically:
o In the Mainstem Athabasca River, collect benthic macroinvertebrate samples at three existing long-term core surveillance sites (M0, M2A, and M9), three surveillance/intensive sites (M3, M3B, and M4) and up to five intensive sites situated through the M3-M7C reach where greatest change in BMI has been observed. See attached monitoring file OSM Program Field Monitoring Schedule_Benthos.xlx for the list of sites planned in 2024.
o In the Athabasca River tributaries, collect benthic macroinvertebrate samples at the 24 existing long-term core surveillance sites to track temporal changes in reference and test areas, sample 15-20 sites in the Ells River with a focus on the Test 2 and 3 areas where greatest change has been observed.
o In the SAGD areas (Christina River mainstem and tributaries, and Hangingstone River) sample up to 40 sites to establish baseline conditions in Reference and downstream areas. See attached monitoring file OSM Program Field Monitoring Schedule_Benthos.xlx for the list of sites planned in 2024.
o As directed by the OC, no BMI sampling in the Peace River Oil Sands Deposit will be conducted in 2024-25.
• Report on results of the 2023-24 sampling program
• Finalize the review of approaches to establishing critical effect sizes, temporal and spatial variability, as well as key indicators of change in BMI assemblages applicable to OSM areas to establish a consensus approach. From this review, lead the scientific evaluation for the establishment of
• benthic indicators, critical effect sizes and limits of change for the Mainstem and Tributary Benthos Monitoring programs;
• Completion of benthic macroinvertebrate and water chemistry data acquisitions and quality assurance/ quality control for upload to the Oil Sands Data Portal.
• Contribute expertise to the OSM team in the advancement of an adaptive monitoring framework.
• Provide support, technical and scientific expertise as needed to the CBM work plan.

- Provide support, technical and scientific expertise as needed to the SOER

## 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 | ☐ 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 | ☐ Wetland |
| ☐ Terrestrial | ☐ Cross-Cutting | | |

## 3.3.1 Surface Water Theme

Please select from the dropdown menus below the sub-theme(s) your monitoring work plan relates to and address the Key Questions:

**3.3.1 Surface Water Theme:**

3.3.1.1 Sub Themes

Biological

**3.3.1.2 Surface Water Key Questions:**

Explain how your surface water monitoring program addresses the key questions below.

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

Yes, for both the mainstem Athabasca River and its Tributaries, Baseline has been established in Reference areas.
The biomonitoring in the SAGD areas of Christina River and Cold Lake oil sands regions are continuing to establish baseline.
As directed by the OC, no BMI sampling in the Peace River Oil Sands Deposit will be conducted in 2024-25.

A key deliverable of the 2023-24 work plan was a review of potential indicators of benthic macroinvertebrate health in relation to Benthos Monitoring of the OSM Surface Water Monitoring Program to enhance baseline, assess confirmation, evaluate limits of change, and develop critical effect sizes for Reference areas and accumulated state for potentially impacted areas. Multiple BMI indicators have been calculated with examination of changes, annual variability, and critical effect sizes. Presentations of these findings at SWTAC meetings and at two workshops were made 2023. We will continue to build consensus on the BMI indicators and limits of change in 2024-25 as directed by the OC.

Are changes occurring in water quality, biological health (e.g., benthos, fish) and/or water quantity/flows relative to baseline? 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?)

Yes, using BMI Response indicators the Benthos Program has detected and confirmed changes in aquatic ecosystem health in multiple years in the mainstem Athabasca River and its tributaries by surveillance monitoring.

In the mainstem Athabasca River and its tributaries, the adaptive monitoring study design of the OSM Benthos core monitoring program is to assess if changes in benthic macroinvertebrate indicators (Response in the Surface Water Conceptual Model) can be detected. Moreover, the study design can determine the association between the change in Response and the potential Pressures/Stressors (landscape disturbance, air emissions, spills, production, seepage; sediments, nutrients, inorganic and organic substances). In addition, this study design is also capable of making associations between Responses and Pressure/ Stressors through Pathways or routes of exposure (overland flow, atmospheric deposition, fluvial transport) hypothesized by the Surface Water Conceptual Model. For example, multiple sampling sites (i.e., Reference sites) exist inside and outside of natural exposure to bitumen, but upstream of areas of oil sands development for the mainstem Athabasca River and its tributaries. In addition, multiple sampling sites are located in, and exposed to, areas of active oil sands development. However, for the mainstem only, areas of municipal sewage effluent and sewage effluent from Oil Sands Development are sampled. Lastly, mainstem sites exist downstream of oil sands development, i.e., Recovery sites, to further assess cumulative effects, while the sites furthest downstream in the tributaries are potential sites to assess cumulative effects. Thus, the established mainstem and tributary Benthos adaptive monitoring study design is capable of detecting change associated with oil sands development and cumulative effects..

Results to date, which have been reported annually to the Surface Water TAC through presentations, have detected and confirmed changes in benthic macroinvertebrate indicators at oil sands development and

municipal sewage sites compared to Reference and Recovery sites (Culp et al. 2018; Culp et al. 2020) in the mainstem Athabasca River. Oil sands Development and Municipal Sewage Effluent sites had a higher abundance of pollution tolerant taxa than Reference or Recovery sites. Moreover, these indicators of benthic macroinvertebrate communities differ between Oil Sands Development and Municipal Sewage Effluent sites. Lastly, signs of cumulative effects have been shown with changes and confirmation of change in benthic macroinvertebrate indicators as you progress from upstream Reference areas, through areas of Municipal Sewage and Oil Sands Development in the mainstem Athabasca River. Changes in benthic macroinvertebrate indicators are associated with higher concentrations of total polycyclic aromatic compounds (PACs) and nutrients in the areas associated with oil sands development (M3B-M7C) and municipal sewage effluent (M3). In addition, Recovery sites, tend to have increased sediment metal concentrations, suggesting detection of cumulative effects at sites furthest downstream.

In three major tributaries of the Lower Athabasca River, the Steepbank, Ells and MacKay rivers, sites from upstream Reference areas within the same tributary had different invertebrate assemblages from downstream, potentially impacted Oil Sands Development (i.e., Test) areas. In general, Test areas further away from the Reference area had greater differences in aquatic invertebrate assemblages, suggesting evidence of cumulative effects, while several adjacent Test areas had similar assemblages in the Steepbank River. For example, Test group 1 was similar to Test group 2 in the Steepbank River, while in the Ells RIver, Test groups 2 and 3 were similar. Test area (i.e., Oil Sands Development areas) assemblages tended to have higher abundances of pollution tolerant taxa. Oil sands development areas or Test Sites tended to have higher concentrations of dissolved metals, sediment PACs, and some major ions (e.g., Chloride) compared to Reference areas, which also suggests an association with cumulative effects.

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

NO

Are changes in water quality and/or water quantity and/or biological health informing Indigenous key questions and concerns?

We are monitoring benthic macroinvertebrates, which are an ideal indicator of the ecological health of the riverine ecosystems. In addition, benthic macroinvertebrates are critical food items for fish. We expect that local communities will have questions regarding the activities and results of the Benthos Monitoring Program especially in regards to the ecological health of these important systems. Therefore, engagement with communities has already begun with several benthos related information sharing sessions and sampling events occurring in fall of 2022 and 2023, including in the upper Christina River and Cold Lake area. The project team will continue to coordinate engagement with the CBM Program to initiate and/or continue discussions with Indigenous communities regarding their questions or concerns around all aspects of the Benthos Monitoring program.

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

Yes. The benthic macroinvertebrate data through 2022 has been uploaded to the Oil Sands Data Portal and is available to the public at http://donnees.ec.gc.ca/data/substances/monitor/benthic-invertebrates-oil-sands-region/. Similarly, the supporting water quality data through March 2022 is also available at the same link. We will continue to add data to the Oil Sands Data Portal annually. In addition, upon request unverified/unvalidated data is provided to partners and public.

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

Yes. Information on Standard Operating Procedures and Best Management Practices are available at the following link http://environmentalmonitoring.alberta.ca/resources/standards-and-protocols/
As well, the national CABIN field and laboratory manual are publically available at https://www.canada.ca/en/environment-climate-change/services/canadian-aquatic-biomonitoring-network/resources.html.
In addition to those links above, the following Standard Operating Procedure is available internally and

upon request.
1) Luiker, E., D. Halliwell, R.B. Brua, D. Hryn and J.M. Culp. 2018. Benthic macroinvertebrate biomonitoring program: Mainstem Athabasca River. Environment and Climate Change Canada, Water Science & Technology, Watershed Hydrology and Ecosystem Research Division, Saskatoon, SK, Canada. 17pp.

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

The core long-term Benthos adaptive monitoring program is integrated with the surface water quality and fish health core monitoring programs. On the mainstem of the Athabasca River, all sites are integrated with the Water Quality, Enhanced and/or Fish programs. In the major tributaries of the Athabasca River 18 sites are integrated with the water quality and/or the fish program (5 in the Steepbank, 5 in the MacKay, 3 in the Ells, 4 in the Firebag and one in the Muskeg). This integration is used to inform and synthesize results of each monitoring program. This program also integrates with the atmospheric program as deposition of contaminants potentially impacts benthic macroinvertebrate health as the mainstem Athabasca River and tributaries are receiving bodies of these contaminants through deposition and overland runoff. Results of this program integration among the different core monitoring programs has been recently published (Culp et al. 2021). In addition, once the initiation of BMI sampling in the Peace River watershed is resumed, several locations will be integrated with the Water Quality and Fish programs.

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?

In the mainstem Athabasca River and its tributaries, the adaptive monitoring study design of the Benthos Core Monitoring program is to assess if changes in benthic macroinvertebrate indicators (Response component of the Surface Water Conceptual Model) can be detected and confirmed using surveillance monitoring. The specific study design implemented by the OSM Benthos Monitoring program can determine the association between the change in the Response indicator and the potential Pressure/Stressor components (landscape disturbance, air emissions, spills, production, seepage; sediments, nutrients, inorganic and organic substances). In addition, the study design allows for making associations between Response indicators and Pressures/Stressors through the associated Pathways or routes of exposure (overland flow, atmospheric deposition, fluvial transport). Also, see Section 3.4.1.2.3 above.

How will this work advance understanding transition towards adaptive monitoring?

The implemented study design of the Benthos Monitoring program directly provides information toward a transition to the conceptual model of an Adaptive Monitoring approach, such as EEM, for OSM. For example, existing and newly acquired data has been able to establish Baseline conditions and is currently used for Surveillance monitoring. This monitoring has detected change in benthic macroinvertebrate Response indicators and confirmed changes in subsequent years in the mainstem Athabasca River and its tributaries. In addition, this data has calculated Critical Effect Sizes of Response indicators of benthic macroinvertebrates to which current and future change can be monitored. Benthos Monitoring in 2024-25 will continue to link Pressures/Stressors and the associated Pathways on Responses of indicators of benthic macroinvertebrates in the proposed intensive monitoring in areas of greatest change on the Athabasca River and its major tributaries

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 - As needed and in the SOER work plan, work with ECCC and AEPA team members to provide data, advice and interpretation for 2024 SOER updates for LAR, EGA and tributary WQ Q1-Q4

## 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.

Changes associated with oil sands development in benthic macroinvertebrate Response indicators (See State of Environment report for some examples) derived from the Benthos Monitoring Program can be used to inform management decisions regarding oil sands development activities. When indicators differ from Reference areas, are confirmed, and exceed some critical effect size suggesting that environmental health is decreasing, changes to management styles can be made. In addition, changes in benthic macroinvertebrate indicators can be used to evaluate cumulative effects of current and future developments. Moreover, these benthic macroinvertebrate Response indicators could be used to assess effects of future developments and mine expansions, as well as for future discharges of treated OSPW into the Athabasca River. Once baseline is established in additional areas (Peace River, Christina River, Cold Lake), similar assessments will be possible.

## 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

In the Benthos Monitoring Program, Response indicators of benthic macroinvertebrates are evaluated to detect changes in the ecological health of aquatic ecosystems. Thus, monitoring of benthic macroinvertebrates are directly related to water quality and health of aquatic organisms inhabiting aquatic ecosystems of concern to Indigenous communities.
As needed and requested, the activities in this workplan will link Indigenous Community-Based Monitoring (ICBM) projects. As identified in the CBM work plans, Benthos monitoring team members will participate in activities as appropriate and as availability allows. This engagement will aim to develop and increase capacity in Indigenous communities throughout the OSM area. Working directly with communities and community representatives to ensure Indigenous Knowledge is collected, interpreted, validated and used in a way that meets each community's protocols would also be an outcome of engagement with Indigenous communities.
Engagement with communities regarding benthic invertebrate monitoring has already begun with several benthos related information sharing sessions and sampling events that occurred in fall of 2023, including in the upper Christina River, Peace River and Cold Lake areas The project team will continue to coordinate engagement with the CBM Program to initiate and/or continue discussions with Indigenous communities regarding their questions or concerns around all aspects of the Benthos Monitoring program.

Does this project include an Integrated Community Based Monitoring Component?

| Yes |
|---|

**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?

NA

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.

NA

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.

NA

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

NA

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

NA

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

NA

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?

NA

## 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.

This work plan generates benthic invertebrate monitoring data necessary to assess environmental condition relative to baseline or Reference areas. In the mainstem Athabasca River, the rigorous, EEM-style, gradient study design implemented to collect Baseline data and to compare with Reference Areas was able to detect and confirm spatially, changes in benthic macroinvertebrate Response indicators at population and community levels along the spectrum of response.

The study design for the tributary biomonitoring followed a similar study design and included replicate sites within Reference and Test areas with an extensive gradient within tributaries rather than a simple upstream downstream approach. As with the mainstem, the tributaries were able to detect and confirm changes in benthic macroinvertebrate Response indicators at population and community levels along the spectrum of response.

In the State of Environment report, benthic macroinvertebrate Response indicators were used to report results of aquatic health bioassessments among Reference and areas of Oil Sands Development. Brief examples of changes in benthic macroinvertebrate Response indicators reported in the State of Environment report include:

In the mainstem Athabasca River, Response indicators of aquatic invertebrate assemblages at Oil Sands Development, Municipal Sewage Effluent, and Recovery areas were all different from assemblage indicators from Reference areas.

• As well, benthic macroinvertebrate assemblage indicators at Oil Sands Development areas differed from all other potentially impacted areas (Municipal Sewage Effluent and Recovery areas)

• Assemblage indicators at Oil Sands Development and Municipal Sewage Effluent areas were comprised of more pollution tolerant taxa than Reference or Recovery areas

In two major tributaries of the Lower Athabasca River, the Steepbank and Ells rivers, sites from upstream Reference areas within the same tributary had different benthic macroinvertebrate assemblage Response indicators from downstream, Oil Sands Development (i.e., Test) areas.

• In general, Test areas further away from the Reference area had greater differences in aquatic invertebrate assemblage Response indicators, while several adjacent Test areas had similar assemblages; in the Steepbank River, Test area 1 was similar to Test area 2, while in the Ells River, Test areas 2 and 3 were similar.

• Test area benthic macroinvertebrate assemblage Response indicators tended to have higher abundances of pollution tolerant taxa.

Further examples are in the draft State of Environment report. However, it is extremely clear that the study designs implemented in the mainstem Athabasca River and its tributaries (including sampling sites, sampling frequency, and Response indicators) provide sufficient statistical power to detect and confirm changes in key benthic macroinvertebrate Response indicators as evidenced by significant differences among Reference and Oil Sands Development areas.

As a confirmed change has been documented, the next phase, and a key priority for the 2024-25 work plan, includes the continuation of the adaptive monitoring design for the proposed intensive monitoring in areas of greatest change on the Athabasca River and its major tributaries. In addition, we will continue to build consensus on establishing critical effect sizes, as well as key indicators of change in BMI assemblages applicable to OSM areas.

In summary, the mainstem Athatabsca River and Tributary programs have:  established Baseline for

Reference and accumulated state in exposure areas (e.g., Oil Sands Development areas); demonstrated statistically significant differences (i.e., detection of biological changes in health) among Reference and exposure areas; confirmed these effects; and established the geographical extent of these changes (i.e., study designs included sites within the entire basin(s) from upstream of all oil sands activities in the Athabasca River or upper headwaters in the tributaries to at or near the mouth).
The In-situ Biomonitoring in the Christina River and Cold Lake oil sands monitoring areas are continuing to establish baseline and evaluate study design options.

## 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 work plan collects the data necessary to inform evaluation and reporting activities focused on answering the key OSM questions. The robust mainstem Athabasca and Tributaries benthic macroinvertebrate long-term core monitoring programs were designed for regional, sub-regional and cumulative effects assessments. Sampling sites are located inside and outside of the bitumen deposit. Sites outside and inside the deposit and upstream of oil sands developments and other human activity are considered Reference sites. In addition, sites located in the Oil Sands Development region were located upstream and downstream of major tributary inputs to capture any change associated with those activities. This design also can capture cumulative effects, including potential effects of local outfalls, as sampling locations are situated along the Athabasca River exposed to natural factors as well as oil sands development and municipal discharge.
The similarly robust tributary benthic macroinvertebrate monitoring plan was designed to assess the status of invertebrate communities regionally (several major tributaries in each of the Athabasca, Christina, Peace, and Cold Lake oil sands deposit areas) and sub-regionally (watershed scale). Multiple sites are located in Reference areas outside and inside oil sands geology as well as within areas of Oil Sands Development. The program is designed to assess benthic macroinvertebrate community changes along a stressor gradient and inform on cumulative effects from natural and human sources.
Thus, the program design spans multiple spatial scales, from small watersheds like the Steepbank River watershed, up to collecting the information on the gradient of the Athabasca River from upstream of all oil sands development activities through to the downstream river reaches just prior to entering the Peace-Athabasca Delta

## 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.

The data resulting from the robust Benthos Monitoring programs for the mainstem Athabasca and Tributaries is disseminated through the publicly accessible Oil Sands Data Portal. The Oil Sands Data Portal stores all of our benthic macroinvertebrate and water chemistry data associated with all sampling sites. Data through 2022 is available on the portal. Some data takes up to 12 months post data-collection to receive the data back from the laboratories. It then needs to be QA/QC'ed and transformed into an acceptable format for the portal. Therefore, data collected in the previous year is being loaded onto the data portal typically in the 3rd Quarter of the subsequent year. In addition, upon request unverified/ unvalidated data is provided to partners and public.

## 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 Benthos Monitoring program work plan includes benthic macroinvertebrate and water chemistry sampling. This program was initially designed with co-location of study sites among monitoring programs (e.g., water quality, fish health) for study efficiency, maximum power, integration, and subsequent synthesis of interpretation (Culp et al. 2018, 2021), which continues in this work plan. In addition, we have highlighted in the Field Monitoring Schedule the Benthos Monitoring sites that are integrated with other OSM programs. On the mainstem of the Athabasca River, all sites are integrated with the Water Quality, Enhanced and/or Fish Health programs. In the major tributaries of the Athabasca River, 18 sites are integrated with the Water Quality and/or the Fish Health program (5 in the Steepbank River, 5 in the MacKay River, 3 in the Ells River, 4 in the Firebag River and one in the Muskeg River). Our teams have identified specific roles of personnel in section 15.0 in this work plan.

Lastly, the Benthos Monitoring program is in communication with the Community Based Monitoring Program to enhance the ability to answer key OSM questions and to reduce the potential for duplication of programs. This Community Based Monitoring Program work plan may include community meetings, engagement, training, and potential initial sample collection.

## 10.0 Work Plan Approach/Methods

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

1. Data Collection
1.1. Preparation for field work (ordering supplies, procuring helicopter support, etc.)
1.2. Collection of samples, field measurements, and observations recorded
1.3. Shipping and submission to designated laboratory

2. Laboratory analyses
2.1. Acknowledgement of sample arrival from labs
2.2. Analysis of sample for requested parameters
2.3. Laboratory specific quality assurance and quality control
2.4. Delivery of results as both electronic data file and laboratory report (PDF)

3. Data Management
3.1. Field and lab data received and uploaded to database
3.2. Review of results including matching with sample metadata and verification and validation of data
3.3. Preparation of data release files in machine readable format (e.g., CSV format)
3.4. Review and approval for data release
3.5. Public data release

4. State of Environment Reporting
4.1. Data organization, data analysis
4.2. Review of benthic macroinvertebrate Response indicators
4.3. Evaluation of Baseline for, Reference comparison to, exposure areas
4.4. Evaluation of change, confirmation, limits of change, magnitude of change, and critical effect size
4.5. Prepare State of Environment report

5.0 Prepare additional deliverable items, presentations, peer-reviewed articles

Describe how changes in environmental Condition will be assessed

Response indicators of benthic macroinvertebrates are used to assess aquatic ecosystem health in the mainstem Athabasca River and its tributaries. Change will be evaluated first for statistical differences relative to Reference areas or Baseline. If statistical change is observed and confirmed, then further investigation will be implemented to examine natural variability and critical effect size of benthic macroinvertebrate indicators.
Please note, that Baseline is still being developed and evaluated for Christina River, Peace River, and Cold Lake regions. In addition, Response indicators of benthic macroinvertebrates for Baseline/Reference areas are continually being evaluated to develop more detailed effect sizes to aid in making more informed adaptive monitoring and management decisions.

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

Benthic macroinvertebrate Response indicators of ecosystem health are used to assess change relative to Reference areas. These Reference areas include sites outside natural bitumen exposure, inside natural bitumen exposure, sites exposed to Oil Sands Development, and, if applicable, sites of municipal and oil sands development sewage effluent. All of these monitoring sites can provide Baseline information against which benthic macroinvertebrate indicators of change (spatial or temporal change) can be assessed to evaluate aquatic health of the mainstem Athabasca River and its tributaries.

(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

Tributary Monitoring
1) The Benthos Monitoring program for the Tributary sites of the Lower Athabasca River and Birch Mountains, Christina River, and Cold Lake Oil Sands Regions will focus on kick sampling and expanded CABIN protocol in erosional habitats (these methods can be found at Standards and Quality Program and Resources for Conducting Aquatic Biomonitoring). Laboratory methods will be provided by contracted labs and reviewed by AEPA and ECCC staff to ensure they are appropriate for the parameters measured.
In the SAGD areas (Christina river mainstem and tributaries, and Hangingstone River) up to 40 sites to establish baseline conditions in Reference and downstream areas will be sampled. See site Schedule_Benthos.xlx for the list of sites planned in 2024.
2) Benthos sampling In the Athabasca River tributaries in 2024-25 will be more intensive (e.g., 20 of 22 sites) in the Ells River in the area of greatest change detected (i.e., Test area 2 & 3), with potentially additional sites added along this gradient. To address continued annual variability and changes in the Oil Sands Development area, a minimal annual sampling of core sites in the MacKay, Steepbank, and Firebag rivers (e.g., 3-6 sites per river) will be conducted. Thus, for the tributaries, a total of 40 sites (reduced by 15- 20) will be sampled (approximately 24 annual surveillance sites and 16-20+ intensive sites in the Steepbank River).
3) Benthos samples collected in autumn will be sorted, identified and enumerated along with QA/QC analysis according to Environment Canada (2012, 2014) by a contractor. Water quality and SPMD samples collected in autumn of the previous year will be analysed, verified and validated. Water samples collected in the autumn will be submitted to contracted labs for analysis. SPMD samples collected in autumn will be submitted to the contractor for analysis. Chl-a samples collected in autumn will be analysed and QA/QC completed.
4) Data analysis of all data collected in the autumn of the previous year will be undertaken and placed into context of the previous sampling years for the State of Environment report and other annual reporting. Analysis of data for additional benthic macroinvertebrate Response indicators will be performed.
5) Data analysis will continue for deliverable items, presentations, reports, and peer-reviewed articles.
Mainstem Monitoring
1) The Benthos Monitoring program for the mainstem Athabasca River focus on kick sampling in cobble habitats. Detailed methods can be found in Luiker et al. 2018 (See section 3.4.1.2.6 above for the reference).
2) Benthos sampling of the mainstem Athabasca River in 2024-25 will be more intensive in the reach with the greatest change detected (i.e., the MSE and Oil Sands Development areas [M3-M7C]). This will include an emphasis on examining the nutrient/contaminant interactions and areas of outfalls as appropriate. In addition, to address continued detection of change in the Oil Sands Development area and annual variability, a minimal annual sampling in Reference and Recovery areas of the Athabasca River will be completed, for example M0, M2A, and M9. Although the total number of sampled sites in the Athabasca River may be similar to previous years, six core sites in 2024-25 will be suspended, while 5 sampled sites from 2023 in the intensive area (M3-M7C) will be sampled to further investigate the nutrient/contaminant interaction seen in this region of the mainstem Athabasca River. See attached monitoring file OSM Program Field Monitoring Schedule_Benthos.xlx for the list of sites planned in 2024.
3) Benthos samples collected in autumn will be sorted, identified and enumerated along with QA/QC analysis according to Environment Canada (2012, 2014) by a contractor. Water quality and SPMD samples collected in autumn of the previous year will be analysed, verified and validated. Water samples collected in the autumn will be submitted to contracted labs for analysis. SPMD samples collected in autumn will be submitted to the contractor for analysis. Chl-a samples collected in autumn will be analysed and QA/QC completed.
4) Analysis of all data collected in the autumn of the previous year will be undertaken and placed into context of the previous sampling years for the State of Environment report and other annual reporting. Analysis of data for additional benthic macroinvertebrate Response indicators will be performed.

5. Data analysis will continue for deliverable items, presentations, reports, and peer-reviewed articles.

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

All key Response indicators used in the Benthos Monitoring program were identified in the initial 2011 Integrated Monitoring Plan for the Oil Sands: Expanded Geographic Extent for Water Quality and Quantity, Aquatic Biodiversity and Effects, and Acid Sensitive Lake Component. Key Response indicators that continue to be used and evaluated in the Benthos Monitoring Program include the benthic macroinvertebrate assemblage, EEM benthic macroinvertebrate endpoints (total abundance, Simpson's Diversity, Simpson's Evenness, Taxa Richness and Bray-Curtis), and additional endpoints, such as Trichoptera (caddisfly) Abundance. Several of these were included in the State of Environment report produced by the principal investigators of this work plan. The metabolome (collection of all small molecules), as identified as an indicator in the 2011 Integrated Monitoring Plan for the Oil Sands, is another key benthic macroinvertebrate Response indicator and has been incorporated into the Benthos Monitoring Program. This Response indicator has shown to be quite sensitive to environmental stressors, such as naphthenic acids (Pomfret et al. 2021), oil sands development and wastewater (Brua et al. 2022; Brua, in preparation), and has been identified as a good indicator for biomonitoring (Pomfret et al. 2020). Moreover, changes in the metabolome can be indicative of changes in biological fitness, such as survival, growth and reproductive capacity, which have implications for ecological effects on benthic macroinvertebrate populations and communities. Evaluation of additional Response indicators, e.g., stream metabolism, decomposition, algal community composition, identified in the 2011 Integrated Monitoring Plan for the Oil Sands continues for potential incorporation into the Benthos Monitoring program.

## 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.

Over the past several years, standard operating procedures have been developed to sample benthic macroinvertebrates and supporting variables, such as water quality data. These documents are available (see section 3.4.1.2 #4) and can be used by other monitoring groups to ensure consistency in sampling regimes and data used to assess change in benthic macroinvertebrate Response indicators in the Oil Sands Areas of Alberta. The Benthos Monitoring team has published multiple manuscripts (Culp et al. 2018, 2021; Pomfret et al. 2020; Klemt et al. 2021; Brua et al. 2022; Lau et al. in prep, Luiker et al. in prep, Ritcey et al in prep). In addition, the Benthos Monitoring team has made several presentations of the monitoring data. This includes annual presentations to update the Surface Water TAC on results, international conferences, and to the COSIA Mine Water Management Workshop.

## 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

Contracts with helicopter providers will be established according to ECCC procurement processes.
A number of contracts will be established with external analytical laboratories according to AEPA and ECCC procurement processes. This process is ongoing currently and it is anticipated to be complete by the end of this fiscal year.

University of Calgary (contact Dr. Fred Wrona). A MSc graduate student has been recruited and formally begantheir programme in January 2023. The objective of the research will be to conduct data analyses of both historical and contemporary monitoring data in the Christina River watershed of the southern portion of the Alberta Oilsands Region. The student will be collaboratively supported by Nancy Glozier (Environment and Climate Change Canada (ECCC), Justin Hanisch (AEPA) and Fred Wrona/David Barrett (University of Calgary) with the scope and outcomes of the project being agreed upon by all parties to ensure alignment with OSM Key Questions and required outcomes.
"Building upon the design and knowledge of the existing OSM tributary monitoring, evaluation and reporting program, the project will contribute new data and knowledge to defining baseline and identifying deviations from historical conditions in the watershed, and will improve the understanding the responses of biological/ecological processes in riverine ecosystems to regional oil sands developments."
Initial scoping work will involve compilation and analyses of historical data utilizing a variety of pre-existing regional data sources, including for example, the TROLS, RAMP and AEOSERP initiatives. The historical data will help inform the establishment of baseline conditions in the watershed and compared with contemporary data obtained from more recent sampling efforts in 2022/23. The student will play an active role in both sampling campaigns. The student project will examine how benthic basal food community composition and productivity (benthic invertebrate, periphyton) may have changed since historical sampling in the mid-1990s in the tributaries to the Christina River in relation to alterations in the physical/chemical environment, particularly in parameters associated with oil sands development.
Additional work to support the student, including laboratory assistance, sample processing and data QA/QC, will be undertaken by UCalgary.

*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:

Aug 12, 2024

13.5 Estimated Data Collection End Date:

Oct 31, 2024

13.6 Estimated Timeline For Upload Start Date:

Jun 2, 2025

13.7 Estimated Timeline For Upload End Date:

Dec 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 |
|---|---|---|---|
| Mainsatem and Tributary Biomonitoring | ECCC Data Portal | Various including CSV | Open by Default |
| AEPA Water Quality | AEPA Data Portal | Various includng CSV | 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 |
|---|---|---|
| Key Engagement/Participation Meeting | Q4 | ECCC & AEPA - As Condition of 2023 24 Work plan Project team to continue to work with the SW TAC for the development of a SWQ conceptual model, approach to defining limits of change and a standardized reporting approach Q1-Q4 |
| Key Engagement/Participation Meeting | Q4 | ECCC & AEPA – As needed and determined in the CBM work plans be available for engagement and training opportunities with community Q1-Q4 |
| OSM Program Annual Progress Report (required) | Q4 | ECCC & AEPA Quarterly and annual reporting as required Q1-Q4 |
| Condition of Environment Report | Q4 | ECCC & AEPA- As needed and in the SOER work plan, work with ECCC and AEP team members to provide data, advice and interpretation for 2024 SOER updates for BMI Q1-Q4 |
| Technical Report | Q4 | ECCC & AEPA- provide a data technical summary report to the SW TAC |
| Key Engagement/Participation Meeting | Q1 | ECCC & AEPA - Quarterly presentation BMI program updates, recent data analysis as needed and requested by TAC |
| Key Engagement/Participation Meeting | Q1 | ECCC & AEPA - Participaton in workshops and meetings with the newly formed ICE Working group |

## 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.

Mainstem Benthos Monitoring (ECCC; in-kind & VNR)
Primary Scientific Staff:
Robert Brua (Research Scientist): Co-PI and study Lead for all Mainstem biomonitoring studies – Design of mainstem Benthos study; field work; statistical analysis and interpretation of data; providing presentations and preparation of reports and publications;
Physical Scientist (Casual)– Data preparation, statistical analysis, and interpretation of results; writing of State of Environment report and manuscript preparation
Primary Technical Staff:
Daryl Halliwell (Field Technician): Field logistics and delivery of field work and lab analyses, data preparation, and preparation of reports and publications;
Samantha Matheson (Field/Lab Technician): Field work assistance during August and September; organizing and summarizing of biological data;
ECCC Field Technician (Field Technician): Field work assistance during August and September
Laboratory Technician (Casual) – Preparation and analysis of field samples requiring specialized chemical analyses; organizing, analyzing, and interpretation of specialized chemical data; assistance in preparation of presentations, reports, and publications

Tributary Benthos Monitoring - including FMM, Christina, and Cold Lake areas (ECCC; in-kind & VNR)

Primary Scientific Staff:

Nancy Glozier (Arctic-Athabasca Section Manager) – Co-PI for work plan and study Lead for all tributary biomonitoring studies;
Allison Ritcey (Aquatic Ecologist) – FMM, Christina and Cold lake areas co-lead;
Lucie Levesque (Senior Aquatic Scientist) – Lead ECCC link to CBM work plan and SPMD data assessments
Julie Roy (Aquatic Scientist) – guidance for SPMD data processing;
Emily McIvor (Aquatic Scientist) – support to the biomonitoring programs for training and fieldwork as required;
Minzhen Su (Data Scientist) – Water Quality Database management and distribution
Kean Steeves, Data Analyst – Data preparation, analysis, and interpretation, writing of State of Environment report, manuscripts

Primary Technical Staff:

Jim Syrgiannis, Erica Keet, Jennifer Maines, Leah Dirk (Aquatic Technicians) – primary field technicians to support biomonitoring sampling
Vijay Tumber (Senior Aquatic Data Technician) – WQ data tracking and QA Mainstem Benthos

Monitoring & Tributary Benthos Monitoring – including FMM, Christina and Cold Lake areas (AEPA)

Primary Scientific Staff:

Kristin Hynes – Invertebrate Monitoring Biologist: AEPA lead for Mainstem biomonitoring

Justin Hanisch – Invertebrate Monitoring Biologist: AEPA lead Christina River, and Cold Lake areas

Primary Technical Staff:
Surface Water Quality Technologist – multiple members to assist during field work of field sampling crew

## 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 |
|---|---|---|
| Invertebrate Monitoring Biologist | AEPA co-lead of program. Leads a field monitoring crew and conducts analyses and reporting. | 100 |
| Invertebrate Monitoring Biologist | AEPA co-lead of program. Leads a field monitoring crew and conducts analyses and reporting. | 75 |
| Field Technician | Support Field Work and Field Logistics | 17.5 |

**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 |
|---|---|---|
| Glozier, Nancy | In-kind, PI, Section Manager and Ecosystem Scientist | 35 |
| Ritcey, Allison | VNR, Co-lead FMM, Christina River, Cold Lake | 100 |
| Levesque, Lucie | In-kind, Lead for CBM work plan and SPMD analysis | 55 |
| McIvor, Emily | In-kind, CABIN training, and field work support as needed | 20 |
| Su, Minzhen | In-kind, WQ database management | 10 |
| Roy, Julie | In-kind, SPMD analysis and field support | 30 |
| Srygiannis, JIm | In-kind, Lead Field Technician | 5 |
| Tumber, VIjay | In-kind, W data tracking and QC | 5 |
| Keet, Erica | VNR, Primary field Technician | 50 |
| Maines, Jennifer | VNR, Primary field Technician | 50 |
| Dirk, Leah | VNR, Primary SPMD Technician | 30 |
| Steeves, Kean | VNR, Primary Data Scientist, field support | 50 |
| Coughlin, John | VNR - Field technican support | 0 |
| Term/ Casual Field Technician (TBD) | VNR, support for field work and CBM work plan | 45 |
| Brua, Bob | In-kind Co-PI, Research Scientist and Mainstem Study Lead | 35 |
| Halliwell, Daryl | In-Kind, Lead Field Technician | 30 |
| ECCC Field Technican | In-Kind Field Techncian | 5 |
| Samantha Matheson | In-Kind, Field/Lab Technician | 25 |
| Casual Physical Scientist | VNR, Mainstem data preparation analysis and reporting | 50 |
| NLET Lab Technician | VNR WQ Laboratory Analysis | 100 |
| NLET Lab Technician | VNR WQ Laboratory Analysis | 50 |
| Casual Lab Technican (TBD) | VNR, Mainstem Lab Analysis | 50 |

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) | 192.5 | $231,000.00 |
| **Operations and Maintenance** | | |
| **Consumable materials and supplies** | | $21,651.06 |
| **Conferences and meetings travel** | | $4,341.00 |
| **Project-related travel** | | $37,347.94 |
| **Engagement** | | $4,500.00 |
| **Reporting** | | $0.00 |
| **Overhead** | | $0.00 |
| Total All Grants (Calculated from Table 16.4 below) | | $0.00 |
| Total All Contracts (Calculated from Table 16.5 below) | | $385,995.00 |
| Sub-Total (Calculated) | | $684,835.00 |
| **Capital*** | | $0.00 |
| AEPA TOTAL (Calculated) | | $684,835.00 |

* 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<br>(Please manually provide the number in the space below) | | $729,856.00 |
| **Operations and Maintenance** | | |
| Consumable materials and supplies | | $695,351.00 |
| Conferences and meetings travel | | $6,000.00 |
| Project-related travel | | $128,597.00 |
| Engagement | | $12,500.00 |
| Reporting | | $5,000.00 |
| Overhead | | $99,938.00 |
| ECCC TOTAL<br>(Calculated) | | $1,677,242.00 |

* 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 | |
|---|---|
| GRANT RECIPIENT - ONLY: Organization | |
| Category | Total Funding Requested from OSM |
| Salaries and Benefits FTE | |
| **Operations and Maintenance** | |
| Consumable materials and supplies | |
| Conferences and meetings travel | |
| Project-related travel | |
| Engagement | |
| Reporting | |
| Overhead | |
| GRANT TOTAL (Calculated) | $0.00 |

**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 | 24RSD827 - Benthic invertebrate sample processing |
| CONTRACT RECIPIENT - ONLY: Organization | Cordillera Consulting Inc. |
| Category | Total Funding Requested from OSM |
| Salaries and Benefits | |
| **Operations and Maintenance** | |
| Consumable materials and supplies | $53,500.00 |
| Conferences and meetings travel | |
| Project-related travel | |
| Engagement | |
| Reporting | |
| Overhead | |
| CONTRACT TOTAL (Calculated) | $53,500.00 |
| CONTRACT RECIPIENT - ONLY: Name | TBD - New contract for PACs in Surface Water Quality |
| CONTRACT RECIPIENT - ONLY: Organization | TBD |
| Category | Total Funding Requested from OSM |
| Salaries and Benefits | |
| **Operations and Maintenance** | |
| Consumable materials and supplies | $151,915.00 |
| Conferences and meetings travel | |
| Project-related travel | |
| Engagement | |
| Reporting | |
| Overhead | |
| CONTRACT TOTAL (Calculated) | $151,915.00 |
| CONTRACT RECIPIENT - ONLY: Name | TBD - New contract for PACs in Sediment Quality |

| CONTRACT RECIPIENT - ONLY: Organization | TBD |
|---|---|
| Category | Total Funding Requested from OSM |
| Salaries and Benefits | |
| **Operations and Maintenance** | |
| Consumable materials and supplies | $80,500.00 |
| Conferences and meetings travel | |
| Project-related travel | |
| Engagement | |
| Reporting | |
| Overhead | |
| CONTRACT TOTAL (Calculated) | $80,500.00 |
| CONTRACT RECIPIENT - ONLY: Name | TBD - New contract for PACs in Semi-permeable membrane devices (SPMDs) |
| CONTRACT RECIPIENT - ONLY: Organization | TBD |
| Category | Total Funding Requested from OSM |
| Salaries and Benefits | |
| **Operations and Maintenance** | |
| Consumable materials and supplies | $100,080.00 |
| Conferences and meetings travel | |
| Project-related travel | |
| Engagement | |
| Reporting | |
| Overhead | |
| CONTRACT TOTAL (Calculated) | $100,080.00 |

**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<br>Sums totals for salaries and benefits from AEPA and ECCC ONLY | $960,856.00 |
| **Operations and Maintenance** | |
| Consumable materials and supplies<br>Sums totals for AEPA and ECCC ONLY | $717,002.06 |
| Conferences and meetings travel<br>Sums totals for AEPA and ECCC ONLY | $10,341.00 |
| Project-related travel<br>Sums totals for AEPA and ECCC ONLY | $165,944.94 |
| Engagement<br>Sums totals for AEPA and ECCC ONLY | $17,000.00 |
| Reporting<br>Sums totals for AEPA and ECCC ONLY | $5,000.00 |
| Overhead<br>Sums totals for AEPA and ECCC ONLY | $99,938.00 |
| Total All Grants (from table 16.2.1 above)<br>**Sums totals for AEPA Tables ONLY** | $0.00 |
| Total All Contracts (from table 16.2.1 above)<br>**Sums totals for AEPA Tables ONLY** | $385,995.00 |
| SUB-TOTAL<br>(Calculated) | $2,362,077.00 |
| Capital*<br>**Sums total for AEPA** | $0.00 |
| GRAND PROJECT TOTAL | $2,362,077.00 |

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.

ECCC and AEPA leads will perform quarterly reviews of budgets and deliverables. Deviations from the proposed work plan will be reported to the OSM program office, and management actions may be taken to facilitate meeting of budget and deliverable expectations.

Foreseeable risks to the program include delays in hiring and contracts.

Previous years budgets have been on track and spent within acceptable guidelines

## 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) |
|---|---|---|
| Science Expertise Tributaries | ECCC | $207,763.00 |
| Technial Expertise Tributaries | ECCC | $10,884.00 |
| Science Expertise Mainstem | ECCC | $43,287.00 |
| Technical Expertise Mainstem | ECCC | $53,059.00 |
| | TOTAL | $314,993.00 |

## 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**

Nancy E,. Glozier

**Title/Organization**

ECCC

**Signature**

Glozier, Nancy Digitally signed by Glozier, Nancy
Date: 2023.11.03 14:28:19 -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