# MEG Energy Corp. - Water Security 2019

## W0. Introduction

### W0.1

**(W0.1) Give a general description of and introduction to your organization.**

MEG is a thermal oil company focused on sustainable in situ oil development and production in the southern Athabasca region of Alberta, Canada. MEG is actively developing enhanced oil recovery projects that utilize steam-assisted gravity drainage (SAGD) extraction methods to improve the economic recovery of oil as well as lower carbon emissions. MEG transports and sells Access Western Blend (AWB or blend) to refiners throughout North America and internationally. MEG owns a 100% working interest in over 900 square miles of oil sands leases. In the GLJ Petroleum Consultants Ltd. Report (GLJ Report), effective December 31, 2018 with a preparation date of January 11, 2019, GLJ Petroleum Consultants Ltd. (GLJ) estimated that the leases it had evaluated contained 2.8 billion barrels of proved plus probable bitumen reserves. For information regarding MEG's estimated reserves contained in the GLJ Report, please refer to the Corporation's most recently filed Annual Information Form (AIF), which is available on the Corporation's website at www.megenergy.com and is also available on the SEDAR website at www.sedar.com.

Alberta energy companies follow some of the most stringent environmental regulations in the world. At MEG, our focus is not just to meet regulatory requirements – we look for opportunities to go beyond compliance and use our proven technology and our processes to protect air, water and land. MEG employees are proud to work in Alberta's oil sands and are committed to developing projects in an environmentally responsible manner. We invest extensive time and effort into planning where and how projects are developed. This proactive approach, combined with our implementation of leading-edge technology and environmental programs, mitigate impacts and help to create positive outcomes for current and future generations.

MEG currently operates the Christina Lake Regional Project (CLRP) which is located in northeastern Alberta approximately 20 km northeast of Conklin. Bitumen production for the year ended December 31, 2018 averaged 87,731 bbls/d. MEG places significant focus on optimizing steam generation to improve environmental outcomes. An important metric for this purpose is Steam-Oil Ratio (SOR), the quantity of steam used to produce a barrel of oil. SOR is a key measure of efficiency for SAGD projects, with a lower SOR indicating that steam is more efficiently utilized. By decreasing the amount of steam used, MEG is able to reduce its per barrel water and fuel requirements which results in lower greenhouse gas (GHG) emissions intensity and more economic projects. When about one-third of the resource from a well-pattern has been recovered using SAGD and the reservoir has been heated and pressurized, MEG's patented proprietary enhanced modified steam and gas push (eMSAGP) technology can be introduced. eMSAGP involves the injection of a non-condensable gas, like natural gas, into the reservoir to replace a significant portion of the steam. Over the past five years MEG has employed eMSAGP technology to develop our Phase 1 and 2 assets. The application of eMSAGP and cogeneration have enabled MEG to lower greenhouse gas intensity below the in-situ industry average calculated based on reported data to Environment Canada, the Alberta Energy Regulator (AER) and the Alberta Electric System Operator (AESO).

In 2018, MEG's business sustainability was enhanced through further improvements in the organization's cost structure, as well as through measurable improvements in its environmental performance. MEG continued to achieve record low per barrel net operating costs and optimize water requirements with a substantial reduction in non-saline water demand by executing a reconfiguration to utilize produced water for backwash instead of non-saline water. A reduction in greenhouse gas ("GHG") intensity on a year-over-year basis was further realized through steam to oil ratio (SOR) efficiencies achieved with the continued application of eMSAGP and expansion of the enhanced Modified Vapor Extraction (eMVAPEX) pilot. In 2018, MEG had an average SOR of 2.19 which is approximately 20% lower than the SAGD industry volume weighted average SOR of 2.8 and significantly better than the SAGD project average of 3.9 (Peters & Co. – 2018 Year in Review).

### W0.2

**(W0.2) State the start and end date of the year for which you are reporting data.**

| | Start date | End date |
|---|---|---|
| Reporting year | January 1 2018 | December 31 2018 |

### W0.3

**(W0.3) Select the countries/regions for which you will be supplying data.**

Canada

### W0.4

**(W0.4) Select the currency used for all financial information disclosed throughout your response.**

CAD

### W0.5

**(W0.5) Select the option that best describes the reporting boundary for companies, entities, or groups for which water impacts on your business are being reported.**

Companies, entities or groups over which operational control is exercised

## W0.6

**(W0.6) Within this boundary, are there any geographies, facilities, water aspects, or other exclusions from your disclosure?**

No

# W1. Current state

## W1.1

**(W1.1) Rate the importance (current and future) of water quality and water quantity to the success of your business.**

| | Direct use importance rating | Indirect use importance rating | Please explain |
|---|---|---|---|
| Sufficient amounts of good quality freshwater available for use | Important | Important | The availability of water could impact MEG's operating results. Under the Alberta Water (Ministerial) Regulation, saline (brackish) groundwater is water that has total dissolved solids (TDS) > 4000 mg/L. Non-saline (freshwater) has TDS < 4000 mg/L. MEG uses water for: 1. The primary use is steam production in our operations which consists of produced and make-up water. Produced water is composed of injected steam and water from the reservoir. Approximately 90% of the water used for steam generation is recycled produced water while the remainder is make-up. Make-up water sources include saline and non-saline deep groundwater unsuitable for human or agricultural use, from the hydrocarbon-bearing formations. MEG does not use any water from streams, rivers or lakes in its thermal operations. 2. MEG operations are located at a remote site and thus MEG withdrawals non-saline groundwater for its domestic water supply providing drinking and hygiene services. 3. Surface non-saline water is used for industrial purposes such as constructing ice roads, dust suppression and drilling associated with exploration and development drilling programs. MEG's operations require a small proportion of non-saline make-up water. MEG currently operates in an area with non-saline aquifers with adequate supply available, therefore the importance rating is "important". The future dependency is anticipated to decrease as technology development (eMSAGP, eMVAPEX) and optimization projects reduce water use intensities. In terms of indirect use, sufficient amounts of water available for use is considered important to MEG's supply chain. Potential water quality or quantity issues could impact refining capacity of refineries purchasing MEG products. MEG currently operates in the Athabasca River Basin (Mackenzie River Basin sub-basin). The WRI Aqueduct tool classifies overall water risk in this area as Low to Medium Risk (1-2). MEG does not currently operate in water stressed areas. |
| Sufficient amounts of recycled, brackish and/or produced water available for use | Please select | Please select | The availability of water could impact MEG's operating results. Under the Alberta Water (Ministerial) Regulation, saline (brackish) groundwater is water that has total dissolved solids (TDS) > 4000 mg/L. Non-saline (freshwater) has TDS < 4000 mg/L. MEG uses water for: 1. The primary use is steam production in our operations which consists of produced and make-up water. Produced water is composed of injected steam and water from the reservoir. Approximately 90% of the water used for steam generation is recycled produced water while the remainder is make-up. Make-up water sources include saline and non-saline deep groundwater unsuitable for human or agricultural use, from the hydrocarbon-bearing formations. MEG does not use any water from streams, rivers or lakes in its thermal operations. 2. MEG operations are located at a remote site and thus MEG withdrawals non-saline groundwater for its domestic water supply providing drinking and hygiene services. 3. Surface non-saline water is used for industrial purposes such as constructing ice roads, dust suppression and drilling associated with exploration and development drilling programs. Produced water makes up a large proportion of water for steam generation and there are limited alternatives for supply, therefore the importance rating is 'vital'. The future dependency is anticipated to decrease as technology development (eMSAGP, eMVAPEX) and optimization projects reduce water use intensities. In terms of indirect use, sufficient amounts of water available for use is considered important to MEG's supply chain. Potential water quality or quantity issues could impact refining capacity of refineries purchasing MEG products. MEG currently operates in the Athabasca River Basin (Mackenzie River Basin sub-basin). The WRI Aqueduct tool classifies overall water risk in this area as Low to Medium Risk (1-2). MEG does not currently operate in water stressed areas. |

## W1.2

### (W1.2) Across all your operations, what proportion of the following water aspects are regularly measured and monitored?

| | % of sites/facilities/operations | Please explain |
|---|---|---|
| Water withdrawals – total volumes | 100% | Water usage by in situ oil projects is regulated by the AER and AEP. Monitoring and measuring requirements are outlined in various EPEA approvals, AER Directives, and Water Act Licenses including requirements for groundwater, wastewater and surface water. These requirements outline monitoring, measuring and reporting requirements including withdrawal and disposal limits, quality requirements, technical standards and frequencies for monitoring and measuring. MEG's Water Act licenses include requirements for water production rate, volume, level and quality monitoring. Groundwater withdrawals, produced water and non-saline water for the water treatment plant are all measured continuously and monitored daily. All surface water diversion is measured by the pump rate and truck capacity. Groundwater monitoring programs are in place to monitor groundwater usage and quality. Regular water quality monitoring is also conducted at the CLRP facility for parameters ( hardness, pH, etc). |
| Water withdrawals – volumes from water stressed areas | Not relevant | MEG's currently operates in the Mackenzie River Basin. The WRI Aqueduct tool classifies the overall water risk in this area as Low to Medium Risk (1-2). Therefore MEG does not currently operate in water stressed areas MEG's water withdrawals are in accordance with the Water Act, the Water Conservation and Allocation Policy for Oilfield Injection (2006) and Alberta's Water for Life strategy. The Water Conservation and Allocation Policy for Oilfield Injection includes a Watershort Areas Assessment (2006) and MEG's operations are within an area that is identified as "Not Regionally Water-short". MEG does not anticipate issues in the future based on water availability and water use efficiency increases. |
| Water withdrawals – volumes by source | 100% | Water usage by source at in situ oil projects is regulated by the AER and AEP. Monitoring and measuring requirements are outlined in various EPEA approvals, AER Directives, and Water Act Licenses including requirements for groundwater, wastewater and surface water. These requirements outline monitoring, measuring and reporting requirements including withdrawal and disposal limits, quality requirements, technical standards and frequencies for monitoring and measuring. MEG's Water Act licenses include requirements for water production rate, volume, level and quality monitoring. Groundwater withdrawals, produced water and non-saline water for the water treatment plant are all measured continuously and monitored daily. All surface water diversion is measured by the pump rate and truck capacity. Groundwater monitoring programs are in place to monitor groundwater usage and quality. Regular water quality monitoring is also conducted at the CLRP facility for parameters (hardness, pH, etc). |
| Entrained water associated with your metals & mining sector activities - total volumes [only metals and mining sectors] | <Not Applicable> | <Not Applicable> |
| Produced water associated with your oil & gas sector activities - total volumes [only oil and gas sector] | <Not Applicable> | <Not Applicable> |
| Water withdrawals quality | 76-99 | Water withdrawal quality is regulated by the AER and AEP. Monitoring and measuring requirements are outlined in various EPEA approvals, AER Directives, and Water Act Licenses including requirements for groundwater, wastewater and surface water. These requirements outline monitoring, measuring and reporting requirements including withdrawal and disposal limits, quality requirements, technical standards and frequencies for monitoring and measuring. MEG's Water Act licenses include requirements for water production rate, volume, level and quality monitoring. Groundwater monitoring programs are in place to monitor groundwater usage and quality. Regular water quality monitoring is also conducted at the CLRP facility for parameters ( hardness, pH, etc). Water for the WTP is analyzed for parameters identified in the Water Act Licensee |
| Water discharges – total volumes | 100% | Water discharge regulated by the AER and AEP. Monitoring and measuring requirements are outlined in various EPEA approvals, AER Directives, and Water Act Licenses including requirements for groundwater, wastewater and surface water. Disposal water from the facility is collected in a series of collection tanks, all of which have continuous outlet measurement. Readings from these devices are monitored. Wastewater is then directed to a series of disposal wells which are instrumented with a flow meter, pressure gauge and temperature gauge and disposal rates are monitored continuously. Wastewater influent (includes all grey water and sewage) is collected into holding tanks and then hauled to the Wastewater Treatment Plant (WWTP) for processing. This wastewater is treated and released to an effluent field. Effluent is metered leaving the WWTP. Any industrial runoff is tested to meet release requirements. Volumes are estimated based on surface area and pump rates. |
| Water discharges – volumes by destination | 100% | Water discharge regulated by the AER and AEP. Monitoring and measuring requirements are outlined in various EPEA approvals, AER Directives, and Water Act Licenses including requirements for groundwater, wastewater and surface water. Disposal water from the facility is collected in a series of collection tanks, all of which have continuous outlet measurement. Readings from these devices are monitored. Wastewater is then directed to a series of disposal wells which are instrumented with a flow meter, pressure gauge and temperature gauge and disposal rates are monitored continuously. Wastewater influent (includes all grey water and sewage) is collected into holding tanks and then hauled to the Wastewater Treatment Plant (WWTP) for processing. This wastewater is treated and released to an effluent field. Effluent is metered leaving the WWTP. Any industrial runoff is tested to meet release requirements. Volumes are estimated based on surface area and pump rates. |
| Water discharges – volumes by treatment method | 100% | Domestic wastewater is regulated under an AEP EPEA Approval. Domestic wastewater is treated with coarse screening, primary clarification/sedimentation and sludge removal, aeration and microfiltration. After treatment, wastewater is released to an effluent field. The volume of total treated effluent released is metered leaving the WWTP. Both effluent and influent is recorded daily. Water treatment is also part of the oil processing facility. Regular water quality monitoring is also conducted at the CLRP facility for parameters such as hardness, pH, turbidity and others to ensure water meets criteria for steam generation. |
| Water discharge quality – by standard effluent parameters | 100% | Domestic wastewater is regulated under an AEP EPEA Approval. Domestic wastewater is treated with coarse screening, primary clarification/sedimentation and sludge removal, aeration and microfiltration. After treatment, wastewater is released to an effluent field. The volume of total treated effluent released is metered leaving the WWTP. Both effluent and influent is recorded daily. Water treatment is also part of the oil processing facility. Regular water quality monitoring is also conducted at the CLRP facility for parameters such as hardness, pH, turbidity and others to ensure water meets criteria for steam generation. |
| Water discharge quality – temperature | 100% | MEG continually monitors the temperature of water disposed into disposal wells as per AER Directive 051: Injection and Disposal Wells and reports the results to the AER annually as per Directive 054: Performance Presentations, Auditing and Surveillance of In Situ Oil Sands Schemes. In addition to temperature, MEG monitors pH to ensure values are within regulated limits as well as periodic measurements of major ions for disposal fluid compatibility assessments and water treatment plant operations purposes. Any industrial runoff (rain water that lands on the plant developed area and snowmelt) is released at ambient temperature. |
| Water consumption – total volume | 100% | Water consumption by in situ oil projects is regulated by the AER and AEP. Monitoring and measuring requirements are outlined in various EPEA approvals, AER Directives, and Water Act Licenses including requirements for groundwater, wastewater and surface water. These requirements outline monitoring, measuring and reporting requirements including withdrawal and disposal limits, quality requirements, technical standards and frequencies for monitoring and measuring. MEG's Water Act licenses include requirements for water production rate, volume, level and quality monitoring. Withdrawals and discharges are all measured continuously and monitored daily. All surface water diversion is measured by the pump rate and truck capacity. Groundwater monitoring programs are in place to monitor groundwater usage and quality. Regular water quality monitoring is also conducted at the CLRP facility for parameters ( hardness, pH, etc). |
| Water recycled/reused | 100% | MEG complies with the AER Directive 081: Water Disposal Limits and Reporting Requirements for Thermal In Situ Oil Sands Schemes which outlines water management requirements for the thermal in situ oil sands (SAGD) operations. It sets water disposal limits, which required operators to recycle produced water efficiently and ensure that make-up water is effectively used. |
| The provision of fully-functioning, safely managed WASH services to all workers | 100% | Source water for domestic use is pulled from a high quality groundwater source under an AER issued Water Act Licence. This water is treated by an onsite potable water plant to meet Canadian drinking Water Quality guidelines. Sanitation facilities are available in all permanent buildings as well as provided as portable was car units at active project construction areas around the facility. Potable water is piped to the Control, Administration and Maintenance building on site and is trucked to camps for use. Water Act Licences require volume tracking daily when water is being diverted. Water is tested daily within the distribution systems leaving the water treatment plant as well as daily in the distribution system within the camp. Bacteriological samples are also collected weekly and sent to the Provincial Lab for analysis. The volume withdraw is reported monthly to AEP as per the Water Use Reporting requirements. |

## W1.2b

**(W1.2b) What are the total volumes of water withdrawn, discharged, and consumed across all your operations, and how do these volumes compare to the previous reporting year?**

| | Volume (megaliters/year) | Comparison with previous reporting year | Please explain |
|---|---|---|---|
| Total withdrawals | 12761 | About the same | Although the total water withdrawal volume remained about the same, the volume of non-saline make-up water for steam generation decreased significantly from 2017 to 2018. This is a result of optimization projects completed over 2016 and 2017. A portion of make-up water consumed within the facility was used to cool produced water. Optimization work allowed MEG to stop servicing this 'quench' water flow with groundwater, significantly reducing non-saline and make-up water intensities. MEG also implemented changes to the saline water system. We replaced non-saline water with saline water as the primary make-up water source for steam generation. SOR is a key measure of efficiency for SAGD projects, with a lower SOR indicating that steam is more efficiently utilized. By decreasing the amount of steam used, MEG is able to reduce our per barrel water usage. The application of MEG proprietary technology eMSAGP has enabled MEG to reduce its company-wide SOR to 2.19 for 2018. MEG continued the deployment of eMSAGP technology at the Christina Lake Phase 2B wells in 2018 and advanced the eMVAPEX pilot. eMVAPEX is a continuation of eMSAGP, which involves the injection of a solvent into the reservoir with the aim to further reduce the company's SOR beyond the decreases associated with the eMSAGP process. Future volumes of total water withdrawal (produced, saline and non-saline) are anticipated to increase as steam capacity and production increases, however, reservoir technology development along with optimization projects have reduced water use intensities and further reductions are anticipated. Future volumes of saline water withdrawals are unlikely to vary as the facility is currently optimized to minimal rates. Future volumes of non-saline water withdrawals could decrease slightly. Projects to reduce non-saline water demand are being evaluated. Future volumes of produced water are likely to increase along with an increase in steam capacity and production. |
| Total discharges | 12878 | About the same | There were no major changes in the year that significantly impact total disposal. The volume of water discharge may increase slightly in the future as steam capacity and produced water returns increase. In part, this increase will be managed with the future implementation of a blowdown disposal evaporator which will improve water recycle capabilities and reduce blowdown disposal. |
| Total consumption | -116 | About the same | There were no major changes that significantly impact total consumption. Future volumes of water consumption are anticipated to increase with new drum boiler steam generation sources. |

## W1.2h

**(W1.2h) Provide total water withdrawal data by source.**

| | Relevance | Volume (megaliters/year) | Comparison with previous reporting year | Please explain |
|---|---|---|---|---|
| Fresh surface water, including rainwater, water from wetlands, rivers, and lakes | Relevant | 134 | About the same | The water source is relevant because MEG diverts surface water for industrial purposes such as constructing ice roads, dust suppression and drilling associated with exploration and development drilling programs. All water withdrawals are licensed under the Water Act which outlines requirements including source locations and maximum annual volumes. There were no major changes to activities to significantly impact the withdrawal of this source. MEG utilizes no surface water from streams, rivers or lakes for process purposes. Future annual use will align with capital spend and drilling activity during the year. |
| Brackish surface water/Seawater | Not relevant | <Not Applicable> | <Not Applicable> | This category is not relevant to MEG and MEG does not anticipate any future withdrawals from brackish surface water/seawater sources. |
| Groundwater – renewable | Relevant | 1000 | Lower | Make-up water (saline and non-saline) used for steam generation is non-drinkable water located hundreds of meters below surface from the hydrocarbon-bearing formations. Although the total water withdrawal volume remained about the same, the volume of non-saline make-up water for steam generation decreased significantly from 2017 to 2018 as a result of optimization projects. Future volumes of total water withdrawal are anticipated to increase as steam capacity and production increases. Reservoir technology along with optimization projects have reduced water use intensities and further reductions are anticipated. The facility is currently optimized for minimal saline rates and withdrawals are unlikely to vary. Projects to reduce future non-saline water demand are being evaluated. Future volumes of produced water are likely to increase along with an increase in steam capacity and production. |
| Groundwater – non-renewable | Not relevant | <Not Applicable> | <Not Applicable> | This category is not relevant to MEG and MEG does not anticipate any future withdrawals from groundwater non-renewable sources. |
| Produced/Entrained water | Relevant | 11627 | About the same | Produced water is composed mainly of injected steam and water from the reservoir that is produced back along with the bitumen. Produced water is de-oiled and recycled. Approximately 90% of water utilized is recycled on an ongoing basis for steam generation. Future volumes of produced water are anticipated to increase as steam chambers mature, eMSAGP/eMVAPEX are deployed at additional wells and new SAGD wells are brought into production. |
| Third party sources | Not relevant | <Not Applicable> | <Not Applicable> | This category is not relevant to MEG and MEG does not anticipate any future withdrawals from third party sources. |

## W1.2j

**(W1.2j) What proportion of your total water use do you recycle or reuse?**

| | % recycled and reused | Comparison with previous reporting year | Please explain |
|---|---|---|---|
| Row 1 | 76-99% | About the same | MEG complies with the AER Directive 081: Water Disposal Limits and Reporting Requirements for Thermal In Situ Oil Sands Schemes which outlines water management requirements for the thermal in situ oil sands (SAGD) operations. It sets water disposal limits, which required operators to recycle produced water efficiently and ensure that make-up water is effectively used. |

# W2. Business impacts

## W2.1

**(W2.1) Has your organization experienced any detrimental water-related impacts?**

No

## W2.2

**(W2.2) In the reporting year, was your organization subject to any fines, enforcement orders, and/or other penalties for water-related regulatory violations?**

No

# W3. Procedures

## W3.3

**(W3.3) Does your organization undertake a water-related risk assessment?**

Yes, water-related risks are assessed

## W3.3a

**(W3.3a) Select the options that best describe your procedures for identifying and assessing water-related risks.**

**Direct operations**

**Coverage**
Full

**Risk assessment procedure**
Water risks are assessed as part of other company-wide risk assessment system

**Frequency of assessment**
Six-monthly or more frequently

**How far into the future are risks considered?**
>6 years

**Type of tools and methods used**
Enterprise Risk Management

**Tools and methods used**
Other, please specify (Environmental Impact Assessment)

**Comment**
MEG's Enterprise Risk Management process identifies risks that could potentially be most significant to the organization and its ability to achieve its strategic objectives. Risks identified in MEG's assessments are evaluated based on impact severity and likelihood of occurrence within the current business and political environment. Risks are quantified and prioritized, and risk mitigation strategies are updated by management and reviewed by MEG's Board of Directors and the HS&E and Reserves Committee of the Board. MEG continuously monitors both facility water performance as well as any changes to regulatory requirements and regularly updates management and the Board of Directors and Committee.

**Supply chain**

**Coverage**
Partial

**Risk assessment procedure**
Water risks are assessed as part of other company-wide risk assessment system

**Frequency of assessment**
Six-monthly or more frequently

**How far into the future are risks considered?**
>6 years

**Type of tools and methods used**
Enterprise Risk Management

**Tools and methods used**
Other, please specify (Internal company methods)

**Comment**
Suppliers must meet HS&E requirements in order to be granted work. This includes requirements that stem from assessing where there is a potential for spills that could impact water bodies or ensuring regulatory requirements by contractors are met. For example Diversion Water Licences under the Water Act allow MEG to divert a specified volume of water for the purpose of industrial activity (e.g. constructing ice roads, dust suppression and drilling associated with oil sands exploration programs). MEG engages suppliers to provide water movement (hauling) services and requires the suppler to follow internal water diversion guidelines which provide direction for meeting water licence requirements including procedures for withdrawing water and record keeping.

**Other stages of the value chain**

**Coverage**
Partial

**Risk assessment procedure**
Water risks are assessed as part of other company-wide risk assessment system

**Frequency of assessment**
Annually

**How far into the future are risks considered?**
1 to 3 years

**Type of tools and methods used**
Enterprise Risk Management

**Tools and methods used**
Other, please specify (Internal company methods)

**Comment**

## W4. Risks and opportunities

### W4.1

**(W4.1) Have you identified any inherent water-related risks with the potential to have a substantive financial or strategic impact on your business?**
Yes, only within our direct operations

## W4.1b

**(W4.1b) What is the total number of facilities exposed to water risks with the potential to have a substantive financial or strategic impact on your business, and what proportion of your company-wide facilities does this represent?**

| | Total number of facilities exposed to water risk | % company-wide facilities this represents | Comment |
|---|---|---|---|
| Row 1 | 1 | 100 | MEG currently operates one asset, the Christina Lake Regional Project (CLRP). |

## W4.1c

**(W4.1c) By river basin, what is the number and proportion of facilities exposed to water risks that could have a substantive impact on your business, and what is the potential business impact associated with those facilities?**

**Country/Region**
Canada

**River basin**
Mackenzie River

**Number of facilities exposed to water risk**
1

**% company-wide facilities this represents**
100%

**Production value for the metals & mining activities associated with these facilities**
<Not Applicable>

**% company's annual electricity generation that could be affected by these facilities**
<Not Applicable>

**% company's global oil & gas production volume that could be affected by these facilities**
100%

**% company's total global revenue that could be affected**
100%

**Comment**
MEG currently operates one asset, the Christina Lake Regional Project (CLRP).

## W4.2

**(W4.2) Provide details of identified risks in your direct operations with the potential to have a substantive financial or strategic impact on your business, and your response to those risks.**

**Country/Region**
Canada

**River basin**
Mackenzie River

**Type of risk**
Physical

**Primary risk driver**
Increased water scarcity

**Primary potential impact**
Reduction or disruption in production capacity

**Company-specific description**
The availability of water supplies is a principle factor, amongst others, which could affect MEG's operating results. Steam is generated from recycled produced water and make-up water. The risk is around the capacity of underground reservoirs that provide the make-up water. MEG CLRP facility requires water to produce steam which is injected to warm and soften bitumen so it can be pumped to the surface. MEG uses freshwater (non-saline) and brackish (saline) water as make-up water for steam generation. These water sources are obtained from subsurface water supplies which include the Upper Clearwater water sands and McMurray Formation. The availability of water could pose a risk to current and future production.

**Timeframe**
More than 6 years

**Magnitude of potential impact**
Medium-high

**Likelihood**
Exceptionally unlikely

**Are you able to provide a potential financial impact figure?**
Yes, a single figure estimate

**Potential financial impact figure (currency)**
200000000

**Potential financial impact figure - minimum (currency)**
<Not Applicable>

**Potential financial impact figure - maximum (currency)**
<Not Applicable>

**Explanation of financial impact**
Estimated cost of business interruptions associated with chronic events based risk, unmitigated by insurance coverage.

**Primary response to risk**
Increase investment in new technology

**Description of response**
MEG's current operations are located proximal to abundant subsurface water supplies. Through regulatory and operational planning, MEG ensures that sufficient water source wells are available to meet process requirements. MEG's operations recycle produced water which significantly reduces make up water requirements from these sources. SOR is a key measure of efficiency for SAGD projects, with a lower SOR indicating that steam is more efficiently utilized. By decreasing the amount of steam used, MEG is able to reduce our per barrel water usage. The application of MEG proprietary technology eMSAGP has enabled MEG to reduce its company-wide SOR to 2.19 for 2018. MEG continued the deployment of eMSAGP technology at the Christina Lake Phase 2B wells in 2018 and advanced the eMVAPEX pilot. eMVAPEX is a continuation of eMSAGP, which involves the injection of a solvent into the reservoir with the aim to further reduce the company's SOR beyond the decreases associated with the eMSAGP process. Technology development (eMSAGP, eMVAPEX) along with optimization projects have reduced water use intensities with further reductions anticipated in the future.

**Cost of response**
154603

**Explanation of cost of response**
Total of the net capital investment towards eMSAGP and eMVAPEX growth in 2018.

---

**Country/Region**
Canada

**River basin**
Mackenzie River

**Type of risk**
Physical

**Primary risk driver**
Severe weather events

**Primary potential impact**
Reduction or disruption in production capacity

**Company-specific description**
Event driven or longer-term shifts in climate patterns can result in physical risks. Principal factors which could affect MEG's operating results at the CLRP facility could include severe weather patterns or catastrophic events such as fires, lightning, earthquakes, extreme cold weather, storms or explosions and seasonal weather patterns and the corresponding effects of the spring thaw on accessibility to MEG's properties. There is a possibility that severe and seasonal weather patterns will change in the area where MEG operates causing damage to water associated infrastructure. The availability of water supplies is a principle factor, amongst others, which could affect MEG's operating results.

**Timeframe**
More than 6 years

**Magnitude of potential impact**
Medium-low

**Likelihood**
Exceptionally unlikely

**Are you able to provide a potential financial impact figure?**
Yes, a single figure estimate

**Potential financial impact figure (currency)**
200000000

**Potential financial impact figure - minimum (currency)**
<Not Applicable>

**Potential financial impact figure - maximum (currency)**
<Not Applicable>

**Explanation of financial impact**
Estimated costs of business interruptions and damage to facility associated with acute events based risk, unmitigated by insurance coverage.

**Primary response to risk**
Infrastructure maintenance

**Description of response**
Impacts of severe and seasonal weather patterns are identified in the ERM process and mitigated through engineering design and operational procedures. The design of our facilities ensures that storm water run-off facilities have sufficient capacity to manage potential increases in flows and storm events. MEG has extensive environmental monitoring programs for water and wetlands that will identify trends and support appropriate adaptation of operating practices and facilities. MEG's facilities are located in a geographical area that is not prone to significant weather events such as hurricanes or flooding. In 2018 MEG engaged a third-party review of physical climate changes and potential effects these changes could have on CLRP operations. Results will be used to ensure ongoing preparation and proper facility design for the range of climate conditions that may be expected.

**Cost of response**

50000

**Explanation of cost of response**

Cost of review of physical climate changes and potential effects these changes could have on CLRP operations. Results will be used to ensure ongoing preparation and proper facility design for the range of climate conditions that may be expected.

## W4.3

**(W4.3) Have you identified any water-related opportunities with the potential to have a substantive financial or strategic impact on your business?**

Yes, we have identified opportunities, and some/all are being realized

## W4.3a

**(W4.3a) Provide details of opportunities currently being realized that could have a substantive financial or strategic impact on your business.**

**Type of opportunity**
Efficiency

**Primary water-related opportunity**
Improved water efficiency in operations

**Company-specific description & strategy to realize opportunity**
MEG places significant focus on optimizing steam generation to improve environmental outcomes. An important metric for this purpose is Steam-Oil Ratio (SOR), the quantity of steam used to produce a barrel of oil. SOR is a key measure of efficiency for SAGD projects, with a lower SOR indicating that steam is more efficiently utilized. By decreasing the amount of steam used, MEG is able to reduce our per barrel water requirements and GHG intensity. When about one-third of the resource from a well-pattern has been recovered using SAGD and the reservoir has been heated and pressurized, MEG's patented proprietary eMSAGP (enhanced modified steam and gas push) technology can be introduced. eMSAGP involves the injection of a non-condensable gas, like natural gas, into the reservoir to replace a significant portion of the steam. eMSAGP has enabled MEG to reduce its company-wide SOR to 2.19 for 2018. MEG continued the deployment of eMSAGP technology at the Christina Lake Phase 2B wells in 2018 and advanced the eMVAPEX pilot. eMVAPEX is a continuation of eMSAGP, which involves the injection of a solvent into the reservoir with the aim to further reduce the company's SOR beyond the decreases associated with the eMSAGP process. Between 2013 and 2018, MEG's eMSAGP process and optimization of recycling technology enabled MEG to reduce its total water withdrawal intensity by 68%.

**Estimated timeframe for realization**
Current - up to 1 year

**Magnitude of potential financial impact**
Low

**Are you able to provide a potential financial impact figure?**
Yes, a single figure estimate

**Potential financial impact figure (currency)**
2381970

**Potential financial impact figure – minimum (currency)**
<Not Applicable>

**Potential financial impact figure – maximum (currency)**
<Not Applicable>

**Explanation of financial impact**
eMSAGP and eMVAPEX result in efficiency gains in both per barrel water usage and GHG intensities. In 2018, CLRP was able to generate a surplus of emission performance credits partially through efficiency gains realized from the expansion of eMSAGP and eMVAPEX from respective baseline performance. The potential financial impact is calculated as the value of the emission performance credits realized in 2018.

---

**Type of opportunity**
Products and services

**Primary water-related opportunity**
New R&D opportunities

**Company-specific description & strategy to realize opportunity**
MEG places significant focus on optimizing steam generation to improve environmental outcomes by investing in reservoir enhancement technologies. One of these projects is eMVAPEX. In 2018 MEG continued testing its proprietary eMVAPEX technology. A modification of its eMSAGP technology, eMVAPEX has the potential to further decrease MEG's steam-oil ratio (SOR) beyond what eMSAGP can achieve, and further reduce GHG emissions intensities. SOR is a key measure of efficiency for SAGD projects, with a lower SOR indicating that the steam if more efficiently utilized. By decreasing the amount of steam used, MEG is able to reduce our per barrel water requirements and GHG intensity. MEG has been granted funding from Alberta Innovates, Natural Resources Canada, Emissions Reductions Alberta, and Sustainable Development Technology Canada for continued eMVAPEX work.

**Estimated timeframe for realization**
Current - up to 1 year

**Magnitude of potential financial impact**
Medium

**Are you able to provide a potential financial impact figure?**
No, we do not have this figure

**Potential financial impact figure (currency)**
<Not Applicable>

**Potential financial impact figure – minimum (currency)**
<Not Applicable>

**Potential financial impact figure – maximum (currency)**
<Not Applicable>

**Explanation of financial impact**
MEG has been granted funding from Alberta Innovates, Natural Resources Canada, Emissions Reductions Alberta, and Sustainable Development Technology Canada for continued eMVAPEX work.

---

## W5. Facility-level water accounting

## W5.1

**(W5.1) For each facility referenced in W4.1c, provide coordinates, total water accounting data and comparisons with the previous reporting year.**

**Facility reference number**
Facility 1

**Facility name (optional)**
Christina Lake Regional Project

**Country/Region**
Canada

**River basin**
Mackenzie River

**Latitude**
55.666

**Longitude**
-110.714

**Primary power generation source for your electricity generation at this facility**
<Not Applicable>

**Oil & gas sector business division**
<Not Applicable>

**Total water withdrawals at this facility (megaliters/year)**
12761

**Comparison of withdrawals with previous reporting year**
About the same

**Total water discharges at this facility (megaliters/year)**
12878

**Comparison of discharges with previous reporting year**
About the same

**Total water consumption at this facility (megaliters/year)**
-116

**Comparison of consumption with previous reporting year**
About the same

**Please explain**
Although the total water withdrawal volume remained about the same, the volume of non-saline make-up water for steam generation decreased significantly from 2017 to 2018result of optimization projects completed over 2016 and 2017. SOR is a key measure of efficiency for SAGD projects, with a lower SOR indicating that steam is more efficiently utilized. By decreasing the amount of steam used, MEG is able to reduce our per barrel water usage, including the amount of make-up water required. Reservoir technology development such as eMSAGP and eMVAPEX are part of MEG's strategy to reduce SOR and therefore water intensity. Future volumes of total water withdrawal are anticipated to increase as steam capacity and production increases. Reservoir technology development along with optimization projects have reduced water use intensities and further reductions are anticipated. Future volumes of saline water withdrawals are unlikely to vary as the facility is currently optimized to minimal rates. Projects to reduce future non-saline water demand are being evaluated. Future volumes of produced water are likely to increase along with an increase in steam capacity and production. Future volumes of water discharge may increase slightly due to more wells being brought online. There were no major changes that significantly impact total consumption.

## W6. Governance

### W6.1

**(W6.1) Does your organization have a water policy?**
No, but we plan to develop one within the next 2 years

### W6.2

**(W6.2) Is there board level oversight of water-related issues within your organization?**
Yes

### W6.3

**(W6.3) Provide the highest management-level position(s) or committee(s) with responsibility for water-related issues (do not include the names of individuals).**

**Name of the position(s) and/or committee(s)**
Other, please specify (Health, Safety, Environment & Reserves Committee of the Board)

**Responsibility**
Both assessing and managing water-related risks and opportunities

**Frequency of reporting to the board on water-related issues**
Quarterly

**Please explain**
Direction and oversight of climate related matters has been designated to the HS&E and Reserves Committee of the Board. Reports on MEG's environmental performance, including topics such as water use, disposal, recycle and intensities among others, are provided to the committee on a quarterly basis by the Vice President of Subsurface Operations, Environment & Regulatory, Reservoir and Geosciences. The Committee reviews and approves corporate strategies to mitigate environmental risks including water issues. Examples of actions taken include review and approval of strategic investments in cogeneration and MEG's proprietary eMSAGP and eMVAPEX technologies.

**Name of the position(s) and/or committee(s)**
Safety, Health, Environment and Quality committee

**Responsibility**
Both assessing and managing water-related risks and opportunities

**Frequency of reporting to the board on water-related issues**
More frequently than quarterly

**Please explain**
The Corporate Environment, Health and Safety (EH&S) Committee is responsible for providing guidance and oversight with respect to EH&S programs and consists of senior-most representatives from multidisciplinary business areas. Its primary function is to assist MEG in carrying out its responsibilities by reviewing, reporting and making recommendations on MEG's policies, management systems and programs with respect to environment, health and safety and exercising due diligence in ensuring such policies, systems and programs are implemented and functioning properly. The committee reviews water withdrawal, consumption, discharge, intensities, recycling and any compliance issues should they arise. The Committee also addresses regulatory changes, risks and opportunities with respect to water. A monthly report capturing regulatory changes, risks and opportunities is provided to the committee. The EH&S committee reports to the HSE & Reserves Board Committee quarterly.

## W7. Business strategy

### W7.1

**(W7.1) Are water-related issues integrated into any aspects of your long-term strategic business plan, and if so how?**

| | Are water-related issues integrated? | Long-term time horizon (years) | Please explain |
|---|---|---|---|
| Long-term business objectives | Yes, water-related issues are integrated | 21-30 | Issues such as water quality, quantity, regulatory frameworks, status of ecosystems and habitats as well as stakeholder concerns are initially captured through the environmental impact assessment (EIA) process and then regularly through MEG's ERM. Components of the EIA include hydrogeology, hydrology, surface water quality, and aquatic ecology and evaluate current conditions as well as identify components of projects that could affect groundwater quantity and quality, hydrologic conditions, surface water quality and aquatic resources. As a result of the EIA CLRP incorporates design features, management practices and mitigation plans to minimize the potential for adverse impacts. MEG also implements various monitoring programs to ensure adequate management of potential issues. Long-term water issues are aligned with the facility lifetime which is about 10 to 30 years. MEG's ERM process identifies risks that could potentially be most significant to the organization and its ability to achieve its objectives. Risks identified in MEG's assessments are evaluated based on impact severity and likelihood of occurrence within the current business and political environment. Risks are quantified and prioritized, and risk mitigation strategies are updated by management and reviewed by MEG's Board. MEG continuously monitors both facility water performance and changes to regulatory requirements and regularly updates management and the Board. |
| Strategy for achieving long-term objectives | Yes, water-related issues are integrated | 5-10 | MEG's strategic focus on technology drives efficiency gains throughout the organization including operating costs and environmental performance improvements including water performance as demonstrated by continued decrease in SOR. SOR is a key measure of efficiency for SAGD projects, with a lower SOR indicating that steam is more efficiently utilized. By decreasing the amount of steam used, MEG is able to reduce our per barrel water usage. The application of MEG proprietary technology eMSAGP has enabled MEG to reduce its company-wide SOR to 2.19 for 2018. MEG continued the deployment of eMSAGP technology at the Christina Lake Phase 2B wells in 2018 and advanced the eMVAPEX pilot. MEG's Enterprise Risk Management process identifies risks that could potentially be most significant to the organization and its ability to achieve its objectives. Risks identified in MEG's assessments are evaluated based on impact severity and likelihood of occurrence within the current business and political environment. Risks are quantified and prioritized, and risk mitigation strategies are updated by management and reviewed by MEG's Board. MEG continuously monitors both facility water performance and changes to regulatory requirements and regularly updates management and the Board. Technology development along with optimization projects have reduced water use intensities and further reductions are anticipated. |
| Financial planning | Yes, water-related issues are integrated | 5-10 | MEG strategic focus on technology drives efficiency gains throughout the organization including operating costs and environmental performance improvements including water issues such as water use. This is demonstrated by continued decrease in SOR. SOR is a key measure of efficiency for SAGD projects, with a lower SOR indicating that steam is more efficiently utilized. By decreasing the amount of steam used, MEG is able to reduce our per barrel water usage. The application of MEG proprietary technology eMSAGP has enabled MEG to reduce its company-wide SOR to 2.19 for 2018. MEG continued the deployment of eMSAGP technology at the Christina Lake Phase 2B wells in 2018 and advanced the eMVAPEX pilot. Technology development along with optimization projects have reduced water use intensities and further reductions are anticipated. Capital continues to be allocated to projects including eMSAGP and eMVAPEX which integrate water-related issue considerations. |

## W8. Targets

### W8.1

### (W8.1) Describe your approach to setting and monitoring water-related targets and/or goals.

| | Levels for targets and/or goals | Monitoring at corporate level | Approach to setting and monitoring targets and/or goals |
|---|---|---|---|
| Row 1 | Company-wide targets and goals Site/facility specific targets and/or goals | Targets are monitored at the corporate level | MEG complies with regulatory requirements including the AER Directive 081 Water Disposal Limits and Reporting Requirements for Thermal In Situ Oil Sands Schemes which outlines water management requirements for the thermal in situ oil sands (SAGD) operations. It sets water disposal limits, which require operators to recycle produced water efficiently and ensure that make-up water is effectively used. Efficient water treatment, recycle, and disposal at thermal operations optimizes overall water use and energy efficiency. The directive establishes a maximum water disposal limit which is a MEG annual target. This target ensures efficient recycling of produced water. A portion of annual incentives are linked to Health, Safety, and Environment performance indicators. To support the corporate commitment to environmental performance MEG expanded the corporate performance scorecard to create a new “Health, Safety & Environment” category. Two new environmental measures were added to the category: Net GHG Intensity (to measure emissions) and Reportable Spill Intensity Volume. Both of these are integrated with water-related issues. Spills are one of the most common environmental incidents that can be encountered at site and spills are reportable if they are released into a watercourse, groundwater or surface water in quantity. Thus a target to reduce reportable spills at site is also a water-related target preventing water contamination. Energy efficiency and GHG reduction efforts decreases overall input costs and inputs including water use. In 2018 both corporate performance targets were achieved. |

## W8.1a

**(W8.1a) Provide details of your water targets that are monitored at the corporate level, and the progress made.**

**Target reference number**
Target 1

**Category of target**
Water consumption

**Level**
Site/facility

**Primary motivation**
Reduced environmental impact

**Description of target**
MEG complies with the AER Directive 081 Water Disposal Limits and Reporting Requirements for Thermal In Situ Oil Sands Schemes which outlines water management requirements for the thermal in situ oil sands (SAGD) operations. It sets water disposal limits, which required operators to recycle produced water efficiently and ensure that make-up water is effectively used. Efficient water treatment, recycle, and disposal at thermal operations optimizes overall water use and energy efficiency. The directive establishes a maximum water disposal limit which is a MEG annual target. This target ensures efficient recycling of produced water and reducing the need for make-up water consumption. This helps achieve water security by reducing the amount of water needed for steam purposes.

**Quantitative metric**
Other, please specify (Water disposal limit (%))

**Baseline year**
2018

**Start year**
2018

**Target year**
2018

**% achieved**
100

**Please explain**
Targets under AER Directive 081 Water Disposal Limits and Reporting Requirements for Thermal In Situ Oil Sands Schemes are annual. MEG met both the maximum disposal limit and the recycle requirements in 2018.

---

**Target reference number**
Target 2

**Category of target**
Water recycling/reuse

**Level**
Site/facility

**Primary motivation**
Recommended sector best practice

**Description of target**
MEG complies with the AER Directive 081 Water Disposal Limits and Reporting Requirements for Thermal In Situ Oil Sands Schemes which outlines water management requirements for the thermal in situ oil sands (SAGD) operations. It sets water disposal limits, which required operators to recycle produced water efficiently and ensure that make-up water is effectively used. Efficient water treatment, recycle, and disposal at thermal operations optimizes overall water use and energy efficiency. This target ensures efficient recycling of produced water and reducing the need for make-up water consumption. This helps achieve water security by reducing the amount of water needed for steam purposes.

**Quantitative metric**
Other, please specify (% water recycled)

**Baseline year**
2018

**Start year**
2018

**Target year**
2018

**% achieved**
100

**Please explain**
Targets under AER Directive 081 Water Disposal Limits and Reporting Requirements for Thermal In Situ Oil Sands Schemes are annual. MEG met both the maximum disposal limit and the recycle requirements in 2018.

---

## W11. Sign off

## W-FI

**(W-FI) Use this field to provide any additional information or context that you feel is relevant to your organization's response. Please note that this field is optional and is not scored.**

## W11.1

**(W11.1) Provide details for the person that has signed off (approved) your CDP water response.**

| | Job title | Corresponding job category |
|---|---|---|
| Row 1 | Chief Executive Officer (CEO) | Chief Executive Officer (CEO) |

## Submit your response

**In which language are you submitting your response?**

English

**Please confirm how your response should be handled by CDP**

| | Public or Non-Public Submission | I am submitting to |
|---|---|---|
| I am submitting my response | Public | Investors |

**Please confirm below**

I have read and accept the applicable Terms