

ERRATA - please replace Sections C.5.1 and C.5.2 from the August 12, 2016 technical application and environmental impact assessment report, with this updated version (from October, 2017).

C.5 Water Management

The Grassy Mountain Coal Project has developed a water management strategy that facilitates both the management and use of water from the Project. There will be interaction with both surface water and groundwater resources during the construction, operation and reclamation of the Project. The Project has been designed to manage the surface water and groundwater efficiently and to minimize the impact on the environment.

The following three documents were prepared by SRK Consulting and form the basis for the water management program for the Project:

- [Appendix 10A](#) – Grassy Mountain Project – Geochemical Characterization;
- [Appendix 10B](#) – Grassy Mountain Project – Water and Load Balance Model; and
- [Appendix 10C](#) – Grassy Mountain Project – Water Quality Management.

In addition to these reports, surface hydrology ([CR #4](#)) and surface water quality ([CR #5](#)) provide details of the water management program.

Water is needed to operate the mine, including the coal wash plant which is the major user of water, wash water and evaporation. It has been estimated that approximately 556,631 m³ of water will be required annually to operate the mine. A portion of this volume will require licencing to allow use of the water. Benga has considered various sources of surface water and groundwater to supply the Project's water needs.

A key component of mine development is the surface water management program. This program is primarily focused on capture, treatment and release of all surface run-off and water pumped out of the pit (which also includes a groundwater component) for the removal of suspended sediment. The Project has also identified a geochemical component that requires additional management beyond the typical sediment removal.

This section of the report will deal with the water supply and use, licencing options and requirements, water treatment and water balance and management.

C.5.1 Water Supply and Source

C.5.1.1 Volume Required

The Coal Handling and Preparation Plant (CHPP) requires approximately 57 litres (0.057 m³) of water to wash each metric tonne of raw coal that is processed. The plant has been designed to produce a nominal 4.5 million clean metric tonnes (CMT) of coal per year. Approximately 478,000 m³ of make-up water is required for the coal wash plant each year.

Additional water is also required for washing vehicles and evaporation. The volume of water required for these activities has been estimated at 28,000 m³ annually. The total annual volume of process water required for the Project operations is 556,631 m³. The CHPP water balance is shown on [Figure C.2.5-1](#). This will not be potable water.

Some potable water is required for use at the office/shop/maintenance facilities. It has been estimated that a total volume of 15,500 m³ of potable water will be required. A water well will be drilled in the vicinity of the office to supply water.

C.5.1.2 Water Source

The two main sources of water that were considered for the Project were from surface water and groundwater sources. Considerable effort to identify a viable groundwater supply for the Project was undertaken. While no surface water allocations are being issued in this basin, groundwater licences can be issued.

After Benga completed the site wide water balance, it was apparent that a considerable volume of surface water would be collected on site, some of which could be treated and released, and some that had to be collected and managed for geochemistry concerns (may contain elevated levels of selenium). The estimated volume of water requiring further management would be enough to supply all the Project water needs. It was determined to be usable in the coal wash plant and operations of the Project.

The entire Project non-potable water requirements (~556,631 m³) will be provided from surface water collected on site. This is all surface water that may require a surface water licence/allocation. Benga has engaged numerous existing water licence holders to identify possible water licence transfer opportunities. If there are times of water supply shortage, as a backup, Benga will look at alternative groundwater sources which may include new wells or investigate the legacy underground mines which are known to store considerable volumes of water.

The potable water required for the Project will be groundwater and will be licenced as groundwater, separate from the surface water requirements.

C.5.2 Water Licencing

Since all of the Project's process water needs will be supplied from the Project's surface water management program, it is likely that surface allocations would need to be acquired from existing licence holders. Benga is primarily considering existing water licences for potential transfer opportunities. There is some volume of new surface water allocation available from the unallocated crown reserve for industrial and commercial purposes, which Benga will also apply for. The Project has a requirement for both consumptive and non-consumptive uses, so a balance between these types of water transfers is required.

C.5.2.1 Consumptive Water Use

Consumptive use of water is defined as water that is used in the process and is eventually lost from the system. The raw coal that is brought to the coal wash plant from the pits has a moisture content of 5%. Once the coal has been processed and washed, it will have a moisture content of approximately 10%. This cleaned coal product will be loaded onto rail cars and shipped to market. The additional 5% moisture that the clean coal contains will be lost to the system and is considered consumptive use. This has been calculated to be approximately 152,338 m³ per year.

C.5.2.2 Non-consumptive Water Use

The non-consumptive use of water is defined as water that is used in the process and is not lost, but will remain in the local hydrology of the area, also referred to as "return flow". As the raw coal is washed, most of the water is recovered *via* the use of mechanical dewatering and is available for re-use in the system. For each raw tonne of coal that is processed, approximately 55% is recovered as clean coal and the remaining 45% is reject material. The reject material contains both coarse and fine reject from the plant and contains approximately a combined 18% moisture content. This material is hauled back to the pit/disposal areas where it is disposed of. The water contained in the reject material remains in the hydrologic system and is considered non-consumptive use.

The total volume of non-consumptive "return flow" water has been calculated at 379,000 m³ per year.

C.5.2.3 Licencing Approach

Benga Mining Limited (Benga) is applying under the Alberta *Water Act* (WA) to divert up to 558,772 m³ annually of new, non-recycled, surface water runoff for industrial use at its Grassy Mountain Coal Project (the Project). This application applies to lands described in the Project's Fence-line water management application for Approval provided in [Appendix 1D](#). Benga is applying for three licences

under the WA to divert surface water runoff to maintain ongoing operations from start-up through to end-of-mine and final reclamation of the site. The three licences include:

- an allocation for industrial purposes for 185,022 m³ (150 ac. ft.) of reserved water available under the Oldman River Basin Water Allocation Order, Alberta Regulation 319/2003 and amended to 109/2010 issued at the Fence-line;
- a transfer of an existing Licence 0039493-00-01, held by Devon Canada on the Crowsnest River, to Benga for 123,350 m³ (100 ac. ft.) to the Fence-line; and
- a temporary transfer of an existing Licence 00045622-00-00, held by the Municipality of Crowsnest Pass on York Creek, to Benga for 250,400 m³ (203 acre feet).

The volume of water estimate for the project is 556,631 m³ and the volume requested through the licences and transfers is 558,772 m³ (453 acre feet), which is a function of converting from acre feet to cubic metres. If a term is required, Benga requests a longer-term licence to align with ultimate receipt of a reclamation certificate which will take more than 25 years.

The annual total volume of the water diversions will be sourced from surface runoff and the point of diversion will be all points where water is diverted from surface water runoff within the boundaries of the Fence-line approval with the consumption being in the Coal Processing Plant (CPP), through water drawn from the nearby Raw Water Pond (RWP) located at SW-024-008-04-W5M. The requested diversion licences are within the restricted South Saskatchewan River Basin (SSRB) as per the Bow, Oldman and South Saskatchewan River Basin Water Allocation Order (2007). As a result of this and in the spirit of water conservation in the region, Benga has included numerous water saving measures to minimize water requirements for the project that are not the norm for projects of this nature. This includes proposed changes in the CPP including mechanical dewatering of the reject materials prior to its placement into the waste dumps or pit. The *Water Act* Licence information is provided in [Appendix 1E](#).

C.5.2.4 Licencing and Water Transfer Options

Benga will require existing licence holders to transfer portions or all of their existing licences to secure the required volumes of water rights. Initially over 30 surface water licences in the Crowsnest River watershed were considered. This lengthy list was pared down to several main options that are listed in [Table C.5.2-1](#).

The process to transfer water from one user to another requires consideration of the following items:

- is the licence in good standing;

- what was the historical water use;
- what was the potential of water use based on the approved plan; and
- how much of the licence may be transferable.

With the issuance of a new licence or any transfer, two key items to be evaluated include:

- are there adverse effects to the environment; and
- are there adverse effects to other users.

Benga is assessing and considering all of these items in pursuit of obtaining water rights for the Project. It is likely that numerous transactions from multiple licensees will be required. Benga is also aware that the transfers may need to be moved from one drainage basin to another and the purposes of the water use may also need to be changed, all of which may add complexity to the process.

Table C.5.2-1 Potential Options for Transfer of Water Licences							
Licence No. & Point of Diversion	Licensee	Gross Diversion (m ³ annually)	Gross Diversion (acre-feet)	Consumptive Use (acre-feet)	Rate of Diversion (ft ³ /sec)	Rate of Diversion (m ³ /sec)	Comments
00039493-00-00 (Crowsnest River - Devon) NE-02-008-05-W5M	Devon Canada Corporation	123,350	100	100 (losses)	?	?	Benga and Devon has worked out an arrangement to have this licence transferred to Benga. The request for this transfer is provided in the <i>Water Act</i> Licence for this application for a total of 123,350 m ³ (100 acre-feet).
Unallocated Crown Reserve (industrial)	GoA	184,000	150	150	TBD	TBD	Benga will seek the full volume of this Crown Reserve if necessary (184,000 m ³ (150 acre-feet)) (consumptive)
00045980-00-00 (Gold Creek) NE-31-007-03-W5M (Cancelled by AEP March 4, 2016)	Margetak	250,400	203	not described	0.28	0.008	Benga has requested a temporary transfer of 250,400 m ³ (203 acre-feet) from Gold Creek, all of which would be for consumptive use by Riversdale. This licence has been cancelled and this decision is currently being appealed.
Unallocated Crown Reserve (commercial)	GoA	6,167,500	5,000	5,000	TBD	TBD	Benga will seek the remaining volume of through the Commercial Crown Reserve

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00045625-00-00 (Drum Creek) NE-18-007-03-W5M <i>(Cancelled by AEP March 4, 2016)</i>	MD of Crowsnest Pass	254,100	206	206	0.65		There have been discussions with the Municipality about the transfer of the licenced diversion of 254,100 m ³ (206 acre-feet) (consumptive) from Drum Creek, but no actions have been taken.
00045622-00-00 (York Creek) NW-34-007-04-W5M	MD of Crowsnest Pass	308,280	250	27			There have been discussions with the Municipality about the transfer of the licenced diversion.
00045849-00-00 (coulee to Crowsnest River) NE-29-007-03-W5M <i>(Cancelled by AEP March 4, 2016)</i>	MD of Crowsnest Pass	339,200	275	112	0.9	0.025, 0.007	There have been discussions with the Municipality about the transfer of the licenced diversion of 339,200 m ³ (275 acre-feet) (approx. 40% consumptive) from Drum Creek, but no actions have been taken.
Piikani Nation Water Rights, Oldman River Basin	AEP	43,172,500	35,000				Piikani have up to 10,300 acre-feet of off-Reserve surface water rights as well, with potential for allocation/transfer.

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00032258-00-00 (Allison Creek) SE-27-008-05-W5M	AEP	5,083,170	4121	1	5.61	0.159	The hatchery may have some excess surface water allocation as most of the current water requirements are being supplied by groundwater allocations. Benga has requested a potential transfer of water from AEP.