COAL ASSESSMENT REPORT TITLE PAGE AND SUMMARY

TITLE OF REPORT:
Coal Assessment Report for the EB Main coal licences, Mt. Spieker area, British Columbia

TOTAL COST: $3,517,056.24

AUTHOR(S): **C.G. Cathyl-Huhn P.Geo., P. Singh M.A.Sc., and L.R.LeMay, B.Sc.**
SIGNATURE(S):

NOTICE OF WORK PERMIT NUMBER(S)/DATE(S):**CX-9-7**

YEAR OF WORK: 2001, 2007, 2008, 2011, 2013 and 2014

PROPERTY NAME: **EB Main (Mt. Spieker)**

COAL LICENSE(S) AND/OR LEASES ON WHICH PHYSICAL WORK WAS DONE: **381712, 381713, 381714, and 381715; non-physical work only on 381716 and 381717**

MINERAL INVENTORY MINFILE NUMBER(S), IF KNOWN: **93P 015**

MINING DIVISION: **Liard (Peace region)**
NTS / BCGS: **NTS 93P/3 BCGS 093P.003, 004, 013 and 014**
LATITUDE: **55° 06' 00" N**
LONGITUDE: **121° 24' 00" W** (at centre of work)
UTM Zone: **10N** EASTING: **602003** NORTHING: **6107078**

OWNER(S): **Walter Canadian Coal Partnership**

MAILING ADDRESS: **800-688 West Hastings Street, Vancouver, B.C. V6B 1P1**

OPERATOR(S) [who paid for the work]: **Wolverine Coal Partnership**

MAILING ADDRESS: **800-688 West Hastings Street, Vancouver, B.C. V6B 1P1**

REPORT KEYWORDS (lithology, age, stratigraphy, structure, alteration, mineralisation, size and attitude. Do not use abbreviations or codes)
Coal, sandstone, siltstone, mudstone, Early Cretaceous, Hauterivian, Aptian, Albian, Bullhead Group, Gething Formation, Gaylard Member, Bluesky Member, Bullmoose Member, Chamberlain Member, Green Marker, Moosebar Formation, Cowmoose Member, Spieker Member, Gates Formation, Torrens Member, Falher Member, Notikewin Member, Blue Marker, Hulcross Formation, Boulder Creek Formation, Cadotte Member, Walton Creek Member, Paddy Member, Hasler Formation, thrust faults, folds, décollement tectonics, bedding-plane detachment zones, northeast vergence, Bullmoose Thrust, East Bullmoose Thrust, Headwaters Thrust, Overlook Thrust, Spieker Syncline, glauconite
REFERENCES TO PREVIOUS ASSESSMENT WORK AND ASSESSMENT REPORT NUMBERS:
Coal Assessment Reports 552, 553, 555, 556, 558, 901; **Petroleum Assessment Report 863**.

SUMMARY OF TYPES OF WORK IN THIS REPORT		EXTENT OF WORK (in metric units)	ON WHICH TENURES
GEOLOGICAL (scale, area)			
	Ground, mapping	**none**	
	Photo interpretation **1:10,000 1,780 hectares**	**1,780 hectares**	**381712 through 381717**
GEOPHYSICAL (line-kilometres)			
	Ground (Specify types)	**none**	
		none	
	Airborne	**none**	
	(Specify types)	**none**	
	Borehole –		
	Gamma, Resistivity	**9,398.22 metres**	**381712 through 381715**
	Resistivity	**9,398.22 metres**	**381712 through 381715**
	Caliper	**9,398.22 metres**	**381712 through 381715**
	Deviation	**7,791.91 metres**	**381712 through 381715**
	Dip	**1,081.90 metres**	**381712 through 381715**
	Others (specify) **Density (with gamma, resistivity and caliper)** **Neutron (with gamma)**	**9,398,22 metres** **9,392.54 metres**	**381712 through 381715** **381712 through 381715**
	Core **(partial and complete)**	**1,130.03 metres**	**381713, 381714, and 381715**
	Non-core	**8,074.38 metres**	**381712 through 381715**
SAMPLING AND ANALYSES			
Total # of Samples			
	Proximate **(on raw coal)**	**159 samples**	**381713, 381714, and 381715**
	Ultimate **(including coking test reports)**	**45 samples**	**381713, 381714, and 381715**
	Petrographic **(including coking test reports)**	**31 samples**	**381713, 381714, and 381715**
	Vitrinite reflectance **(including coking test reports)**	**31 samples**	**381713, 381714, and 381715**
	Coking **(pilot-scale coke-oven tests)**	**2**	**381714**
	Wash tests	**45 samples**	**381713, 381714, and 381715**
PROSPECTING (scale/area)		**none**	
PREPARATORY/PHYSICAL		**none**	
Line/grid (km)		**none**	
Trench (number, metres)		**none**	
Bulk sample(s) -- **drilled bulk samples only**			

Section 5 (Coal Quality, Coal Resources, and Coal Reserves), portions of Page 73, and Appendices C, D, E remain confidential under the terms of the Coal Act Regulation, and have been removed from the public version.

http://www.bclaws.ca/civix/document/id/complete/statreg/251_2004

1 Table of contents

1.1 List of tables

2 Objectives, situation, and details of work

This report presents a synthesis of the surface and subsurface geology of the EB Main coal licences (comprising provincial mineral tenures 381712 through 381717, inclusive), as performed by Wolverine Coal Partnership on behalf of Walter Canadian Coal Partnership during the years 2001 through 2014. Partial results are given for the year-2014 exploration programme, as it has been only recently completed, and compilation of its results are still underway at time of this writing.

In general terms, the present study is intended to summarise and review historic exploratory work conducted by various parties – as referenced in this report's bibliography – as far back as the year 1959, and to present an updated geological map (**Map 2-3**) based upon modern concepts of regional coalfield geology.

This report is intended to provide an updated geological interpretation of the EB Main coal property, and to further guide Walter Canadian Coal Partnership's ongoing data analysis and coal-resource appraisal.

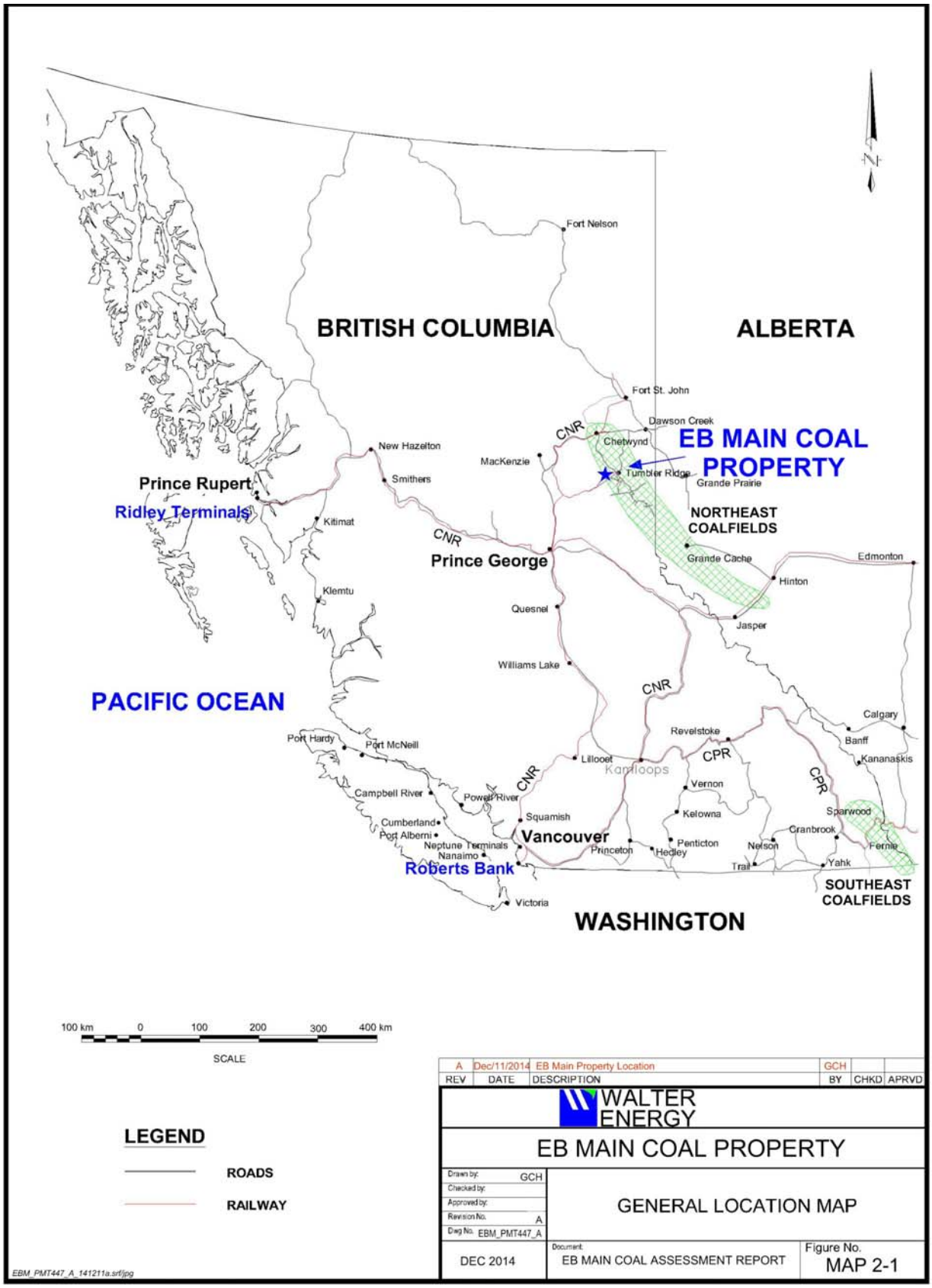
2.1 Location, access, and tenure

General location of the property, within northeastern British Columbia, is depicted as **Map 2-1**, and coal land tenure (**Table 2-1**) is depicted in relation to the local topographic setting of the EB Main coal property as **Map 2-2**.

The EB Main coal property is located approximately 100 kilometres south of the town of Chetwynd, and 30 kilometres west of the town of Tumbler Ridge, within the western half of map-area 93 P/03 of Canada's National Topographic System. Road access to EB Main is via paved provincial highway BC-29, southeastward from Chetwynd or northwestward from Tumbler Ridge, and thence twelve kilometres southwestward along the gravelled Wolverine Forest Service Road, to its junction with the gravelled, non-status Perry Creek Road. EB Main is located a further eight kilometres to the northwest along Perry Creek Road. Several former logging-roads and coal-exploration trails, some of them now repurposed as natural-gas wellsite service roads, branch from Perry Creek Road and thus provide vehicular access to the northwestern portion of the EB Main coal property.

The northeastern portion of the property is an elevated plateau, rimmed by steep cliffs. Access to this area was formerly available via drill trails, but these routes are now frequently blocked by talus, and access is therefore solely by walking, or by helicopters. Landing-sites for helicopters are available along exposed ridge-crests, but walking outward from these alpine areas is rendered more difficult by dense, scrubby forest cover near treeline.

Crushed sandstone and conglomerate from localised colluvial deposits are the only sources of good-quality rock for construction aggregate and road-building. Locally-quarried siltstone and mudstone (mostly from the Moosebar Formation) have been used for construction of natural-gas drilling-rig roads. These fine-grained materials pack down acceptably to make smooth roads, although roads thus constructed become muddy in wet weather and dusty in dry weather.


BRITISH COLUMBIA
ALBERTA
PACIFIC OCEAN
WASHINGTON
EB MAIN COAL PROPERTY
NORTHEAST COALFIELDS
SOUTHEAST COALFIELDS
Fort Nelson
Fort St. John
Dawson Creek
Chetwynd
Tumbler Ridge
Grande Prairie
New Hazelton
MacKenzie
Smithers
Prince Rupert
Ridley Terminals
Kitimat
Prince George
Grande Cache
Edmonton
Hinton
Klemtu
Quesnel
Jasper
Williams Lake
Revelstoke
Calgary
Banff
Kananaskis
Port Hardy
Port McNeill
Lillooet
Kamloops
Campbell River
Powell River
Vernon
Kelowna
Sparwood
Cranbrook
Fernie
Cumberland
Port Alberni
Squamish
Vancouver
Neptune Terminals
Nanaimo
Princeton
Penticton
Hedley
Nelson
Trail
Yahk
Roberts Bank
Victoria
CNR
CPR
100 km 0 100 200 300 400 km
SCALE
LEGEND
ROADS
RAILWAY
A Dec/11/2014 EB Main Property Location GCH
REV DATE DESCRIPTION BY CHKD APRVD
WALTER ENERGY
EB MAIN COAL PROPERTY
Drawn by: GCH
Checked by:
Approved by:
Revision No. A
Dwg No. EBM_PMT447_A
GENERAL LOCATION MAP
DEC 2014
Document: EB MAIN COAL ASSESSMENT REPORT
Figure No. MAP 2-1
EBM_PMT447_A_141211a.srf/jpg

Surface access for drilling and other exploratory works is regulated by the provincial government, subject to the *Coal Act Regulations* and the *Mines Act*. The EB Main property is situated within the Wapiti PSYU (Public Sustained Yield Unit), with timber cutting subject to the terms of a *Free Use Permit* issued by the Ministry of Forests, with area-based stumpage fees.

2.2 Property description

The EB Main coal property consists of six coal licences (as depicted in **Map 2-2**), originally acquired late in October of 2000 by Western Canadian Coal Corporation (WCCC), subsequently passed onward to the reorganised Western Coal Corporation (WCC) and, following WCC's acquisition by Walter Energy, transferred onward to Walter Canadian Coal Partnership (WCCP). All of these coal tenures cover ground previously held by Brameda Resources Limited, and optioned by them to various companies (although these options subsequently lapsed).

Coal licences grant to their holder the exclusive right to explore for coal, subject to consultation with local First Nations, coordination of access with other tenure-holders (such as oil and gas firms, other mineral-tenure holders, and timber companies), and the successful submission of an exploratory work plan. Coal licences do not, in and of themselves, confer the ownership of coal upon their holder (as the coal remains the property of the Crown via the province of British Columbia), but they can under appropriate circumstances be converted into coal leases, upon which a scheme of mining may be established. Holders of coal licences are obliged to make annual reports to the Crown, as concerns exploratory work done on their respective tenures. Prior to 1986, the Crown required that a certain minimal amount of assessable exploratory work be done each year, in order to retain the tenure in good standing. Since 1986 there have been no such requirements for annual work commitments, although such requirements may be re-enacted at some future date.

The term of coal licences is one year, which may normally be extended upon the payment of an area-based annual rental fee as prescribed by the provincial *Coal Act Regulation*. EB Main is now approaching the end of its third five-year span of increased rental fees, at $15/hectare. In October of 2015, however, the fourth five-year span will commence, and rental fees will increase to $20/hectare).

As of the writing of this report, annual rentals for the EB Main coal licences have been paid, but the tenures themselves will not be advanced in good standing until such time as the present report is accepted by the Mineral Titles Branch on behalf of the Crown. **Table 2-1** presents details of the coal tenures at EB Main, whose aggregate area is 1,780 hectares (approximately 4,398 acres) and whose annual rental cost is $26,700.

Table 2-1: Coal tenures at EB Main

Tenure Numbers		Land description		Area	Dates		Annual rental
Current	Historic	Blocks	Units		Issued on	Renew by	at $15/ha
381712	CL 3052	93P/03 Blk.F	1,2,11,12	297 ha	Oct. 30, 2000	Oct.30, 2014	$4455
381713	CL 3051	93P/03 Blk.F	3,4,13,14	297 ha	Oct. 30, 2000	Oct.30, 2014	$4455
381714	CL 3047	93P/03 Blk.F	21,22,31,32	297 ha	Oct. 30, 2000	Oct.30, 2014	$4455
381715	CL 3046	93P/03 Blk.F	23,24,33,34	297 ha	Oct. 30, 2000	Oct.30, 2014	$4455
381716	CL 3042	93P/03 Blk.F	41,42,51,52	296 ha	Oct. 30, 2000	Oct.30, 2014	$4440
381717	CL 3041	93P/03 Blk.F	43,44,53,54	296 ha	Oct. 30, 2000	Oct.30, 2014	$4440
Totals		6 coal licences / 24 units		1780 ha			$26,700

2.3 Infrastructure

Electrical power is potentially available from B.C. Hydro's Bullmoose Mine substation, served by 230-KV transmission line 2L322, although six to eight kilometres of newly-built power line would be required to serve the EB Main property. Mine plans currently under consideration include the option of installing Diesel-powered generators at the proposed EB minesite. The final choice of power source will entail a balance of capital and operating costs, against environmental impacts.

Telecommunications are available via satellite telephone systems. Satellite access is excellent in upland areas, but unreliable in the heavily-wooded hillsides. Cellular telephone coverage is unlikely to be available at EB Main, owing to distance from transmitters, and issues of line-of-sight in mountainous country.

2.4 Base-maps, imagery, and surveys

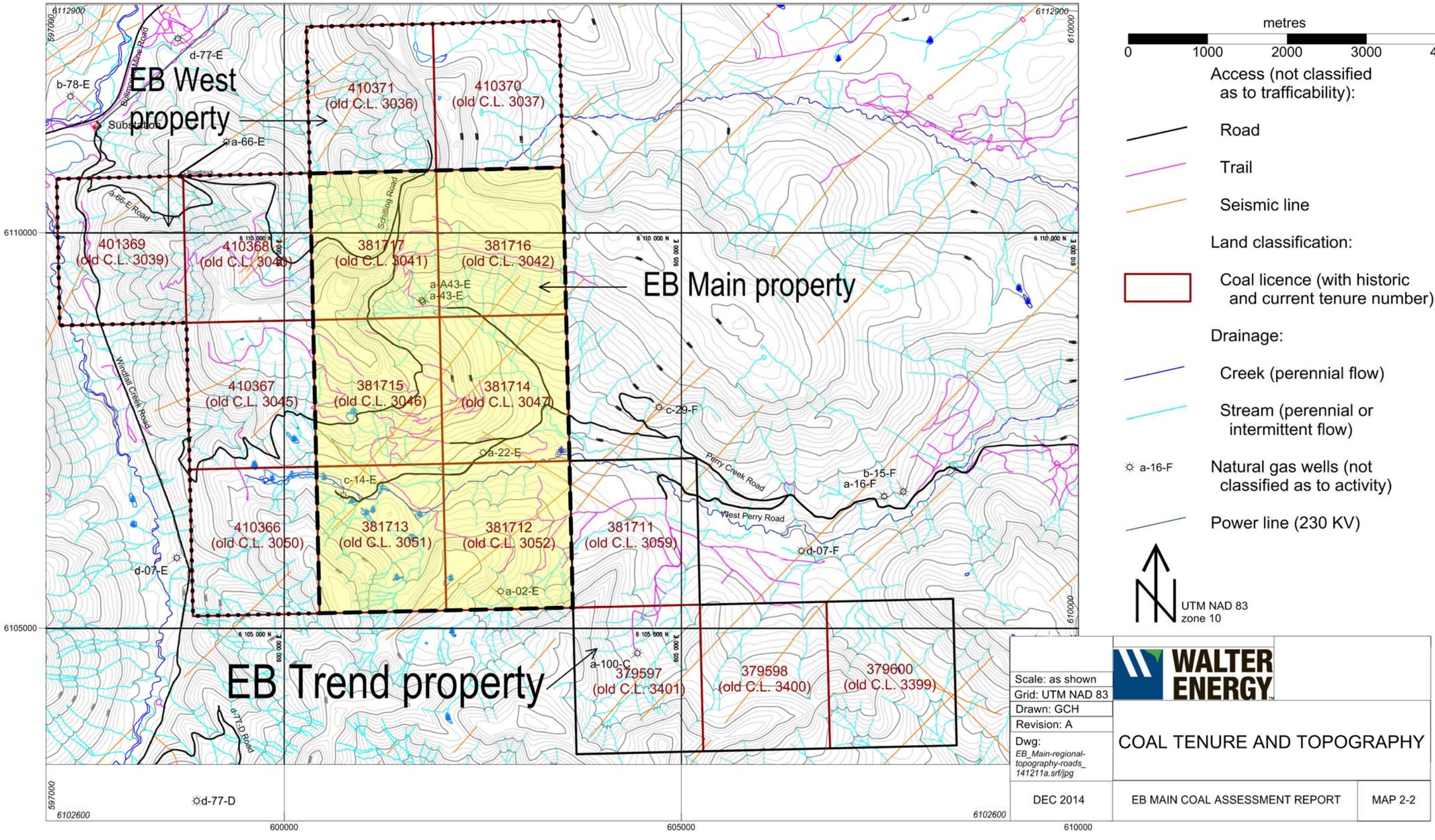
Base-mapping for EB Main is freely available from the provincial government's Base Map Online Store, which affords a facility for downloading shaded-relief topographic maps at 1:20,000 scale. Hardcopy British Columbia Geographic System (BCGS) and digital Terrain Resource Information Management (TRIM) maps 093P.003, .004, .013, and .014 cover the property. Canada's national Army Survey Establishment (ASE) has also for several decades maintained a series of topographic maps at 1:50,000 scale, as part of the National Topographic System (NTS). MTS map-sheet 92P/3 covers the EB Main property. Depending on their vintage, these maps are referred to the North American Datums of 1927 (NAD27) or that of 1983 (NAD83). UTM NAD83 grid references are used exclusively within the current report.

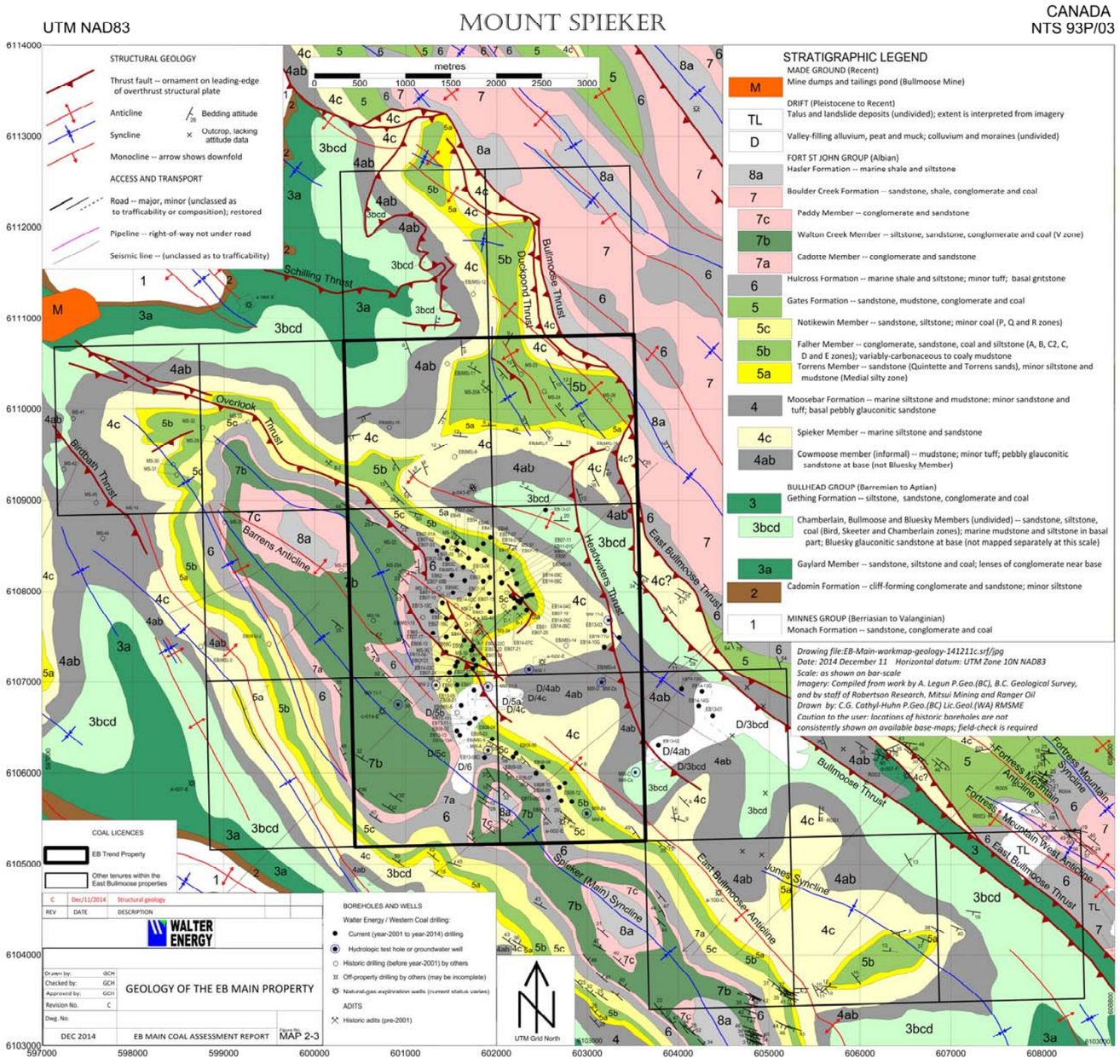
Detailed base-maps of the original Mt. Spieker coal property were produced in the late 1970s: copies of these maps are included in various of the historic Coal Assessment Reports, although they are generally marked-up and their depicted coordinate systems are clearly not UTM NAD83 (and may, instead, be some form of local polyconic system used by Brameda Resources).

Georeferenced satellite photography is freely available via the *Google Earth* web-service, as discussed further below. In general, this imagery is sufficiently detailed for studies of gross geological and geomorphological structure, but mostly of year-2005 to year-2006 vintage (despite its copyright date of 2014), and therefore lacking in details of recent road-construction by the logging, mining and petroleum industries. Various archival aerial photographs are held in WCCP's Canadian technical files; the vintage of these photographs is clearly quite old, as few roads or forestry cutblocks are shown on them. Nevertheless, the aerial photographs are useful for stereo-viewing of landforms. Legal survey control points have been installed in conjunction with petroleum development, but their specific locations within the EB Main coal property are not known.

2.5 Physiography, landscapes, climate, and forest cover

Elevations range from 1395 metres above sea level, in the valley-bottom of Perry Creek (at the property's eastern edge) to 1971 metres above sea level, atop Mount Spieker, (in the northeastern corner of the property). Terrain is generally mountainous, with very steep hillslopes, capped by rolling sub-alpine plateaux which have been dissected by steep northeast-draining gullies, ravines, creeks and glacial cirques.


EB West property
EB Main property
EB Trend property
410371 (old C.L. 3036)
410370 (old C.L. 3037)
401369 (old C.L. 3039)
410368 (old C.L. 3040)
381717 (old C.L. 3041)
381716 (old C.L. 3042)
410367 (old C.L. 3045)
381715 (old C.L. 3046)
381714 (old C.L. 3047)
410366 (old C.L. 3050)
381713 (old C.L. 3051)
381712 (old C.L. 3052)
381711 (old C.L. 3059)
379597 (old C.L. 3401)
379598 (old C.L. 3400)
379600 (old C.L. 3399)
Bullmoose Mine Road
Schilling Road
Windfall Creek Road
Perry Creek Road
West Perry Road
a-66-E Road
d-77-D Road
Substation
d-77-E
b-78-E
a-66-E
a-A43-E
a-43-E
c-29-F
a-22-E
c-14-E
b-15-F
a-16-F
d-07-F
d-07-E
a-02-E
a-100-C
d-77-D
6112900
6102600
597000
600000
605000
610000
6110000
6105000
metres
0
1000
2000
3000
4000
Access (not classified as to trafficability):
Road
Trail
Seismic line
Land classification:
Coal licence (with historic and current tenure number)
Drainage:
Creek (perennial flow)
Stream (perennial or intermittent flow)
a-16-F
Natural gas wells (not classified as to activity)
Power line (230 KV)
UTM NAD 83 zone 10
Scale: as shown
Grid: UTM NAD 83
Drawn: GCH
Revision: A
Dwg: EB_Main-regional-topography-roads_141211a.srf/jpg
WALTER ENERGY
COAL TENURE AND TOPOGRAPHY
DEC 2014
EB MAIN COAL ASSESSMENT REPORT
MAP 2-2


UTM NAD83
MOUNT SPIEKER
CANADA
NTS 93P/03
metres
0 500 1000 1500 2000 2500 3000
STRUCTURAL GEOLOGY
Thrust fault -- ornament on leading-edge of overthrust structural plate
Anticline
Bedding attitude
Syncline
Outcrop, lacking attitude data
Monocline -- arrow shows downfold
ACCESS AND TRANSPORT
Road -- major, minor (unclassed as to trafficability or composition); restored
Pipeline -- right-of-way not under road
Seismic line -- (unclassed as to trafficability)
STRATIGRAPHIC LEGEND
MADE GROUND (Recent)
M Mine dumps and tailings pond (Bullmoose Mine)
DRIFT (Pleistocene to Recent)
TL Talus and landslide deposits (undivided); extent is interpreted from imagery
D Valley-filling alluvium, peat and muck; colluvium and moraines (undivided)
FORT ST JOHN GROUP (Albian)
8a Hasler Formation -- marine shale and siltstone
7 Boulder Creek Formation -- sandstone, shale, conglomerate and coal
7c Paddy Member -- conglomerate and sandstone
7b Walton Creek Member -- siltstone, sandstone, conglomerate and coal (V zone)
7a Cadotte Member -- conglomerate and sandstone
6 Hulcross Formation -- marine shale and siltstone; minor tuff; basal gritstone
5 Gates Formation -- sandstone, mudstone, conglomerate and coal
5c Notikewin Member -- sandstone, siltstone; minor coal (P, Q and R zones)
5b Falher Member -- conglomerate, sandstone, coal and siltstone (A, B, C2, C, D and E zones); variably-carbonaceous to coaly mudstone
5a Torrens Member -- sandstone (Quintette and Torrens sands), minor siltstone and mudstone (Medial silty zone)
4 Moosebar Formation -- marine siltstone and mudstone: minor sandstone and tuff; basal pebbly glauconitic sandstone
4c Spieker Member -- marine siltstone and sandstone
4ab Cowmoose member (informal) -- mudstone; minor tuff; pebbly glauconitic sandstone at base (not Bluesky Member)
BULLHEAD GROUP (Barremian to Aptian)
3 Gething Formation -- siltstone, sandstone, conglomerate and coal
3bcd Chamberlain, Bullmoose and Bluesky Members (undivided) -- sandstone, siltstone, coal (Bird, Skeeter and Chamberlain zones); marine mudstone and siltstone in basal part; Bluesky glauconitic sandstone at base (not mapped separately at this scale)
3a Gaylard Member -- sandstone, siltstone and coal; lenses of conglomerate near base
2 Cadomin Formation -- cliff-forming conglomerate and sandstone; minor siltstone
MINNES GROUP (Berriasian to Valanginian)
1 Monach Formation -- sandstone, conglomerate and coal
Drawing file:EB-Main-workmap-geology-141211c.srf/jpg
Date: 2014 December 11 Horizontal datum: UTM Zone 10N NAD83
Scale: as shown on bar-scale
Imagery: Compiled from work by A. Legun P.Geo.(BC), B.C. Geological Survey, and by staff of Robertson Research, Mitsui Mining and Ranger Oil
Drawn by: C.G. Cathyl-Huhn P.Geo.(BC) Lic.Geol.(WA) RMSME
Caution to the user: locations of historic boreholes are not consistently shown on available base-maps; field-check is required
Schilling Thrust
Buckpond Thrust
Bullmoose Thrust
Overlook Thrust
Birdbath Thrust
Barrens Anticline
Headwaters Thrust
East Bullmoose Thrust
Spieker (Main) Syncline
East Bullmoose Anticline
Fortress Mountain Syncline
Fortress Mountain Anticline
Fortress Mountain West Anticline
COAL LICENCES
EB Trend Property
Other tenures within the East Bullmoose properties
C Dec/11/2014 Structural geology
REV DATE DESCRIPTION
WALTER ENERGY
Drawn by: GCH
Checked by: GCH
Approved by: GCH
Revision No. C
Dwg. No.
GEOLOGY OF THE EB MAIN PROPERTY
DEC 2014 EB MAIN COAL ASSESSMENT REPORT Figure No. MAP 2-3
BOREHOLES AND WELLS
Walter Energy / Western Coal drilling:
Current (year-2001 to year-2014) drilling
Hydrologic test hole or groundwater well
Historic drilling (before year-2001) by others
Off-property drilling by others (may be incomplete)
Natural-gas exploration wells (current status varies)
ADITS
Historic adits (pre-2001)
UTM Grid North
6114000
6113000
6112000
6111000
6110000
6109000
6108000
6107000
6106000
6105000
6104000
6103000
597000 598000 599000 600000 601000 602000 603000 604000 605000 606000 607000 608000

On east- and north-facing slopes, winter snow-cover lingers into late summer, and small patches of firn persist year-round in the headwalls of the cirques.

Soil cover is patchy, consisting mainly, till, alluvium and peat at lower elevations, and talus and colluvium at higher elevations. Much of the upland plateau surface is covered by frost-shattered bedrock with interspersed patches of organic muck in poorly-drained areas.

EB Main has a continental alpine climate, characterised by long, moderately cold, snowy winters and short, rainy summers. Snow and frost may occur in any month of the year. Winds are generally gusty and ongoing, with rare calm periods. Convective thunderstorms frequently occur during summer months, bringing intense rain-showers and occasional hail.

Coniferous forest covers the lower slopes of the property, declining in size and vigour with increasing altitude and wind-exposure. Subalpine slopes are occupied by patchy, stunted, densely-tangled coniferous krummholz, and the upland areas are covered by grasses, mosses and lichens. The EB Main coal property is situated within two biogeoclimatic zones (Aldritt-McDowell, 1998; Macdonald and Hewitt, 2007).

- ESSF: the Engelmann Spruce-Subalpine Fir zone, above 1200 metres' , and beneath 1700 to 1800 metres' elevation, depending upon topographic aspect; characterised by a moderately dense coniferous forest; and
- BAFA: the Boreal Altai Fescue Alpine zone, above 1700 to 1800 metres' elevation, characterised by alpine tundra with willows, grasses, sedges and lichens and patches of krummholz subalpine fir and lodgepole pine, often comprising excellent habitat for caribou.

2.6 Historic work

Historic work at EB Main consists of exploratory geological mapping, conducted on behalf of Triad Oil in 1959 (Jones, 1960), and subsequent drilling (**Section 2.6.2**, **Table 2-2**) supported by further geological mapping, undertaken by Mitsui Mining (Shima and Nishio, 1975; Shima and Kinoshita, 1976; Yayoshi and Wada, 1977), and Robertson Research (Jordan and Dawson, 1978) during the 1970s, and by Peace River Coal Incorporated (Jefferys, 2007) in 2006.

In addition to the exploratory mapping by industrial workers, regional structural and stratigraphic mapping were undertaken by workers from the British Columbia Geological Survey Branch, published as open-file reports by Kilby and Wrightson (1987b) and Legun (2009b).

Widely-spaced drilling was also undertaken by oil and gas companies, seeking to explore and develop natural gas deeply-buried carbonate reservoirs within thrust-faulted and folded Triassic rocks. A moderately-dense grid of seismic-reflection survey lines was established in support of natural gas exploration.

2.6.1 Comments on historic geological mapping

Jones' work for Triad Oil consisted of widely-separated traverses along ridgelines, aimed at elucidating the regional pattern of folds and major thrust-faults. Mapping conducted by Mitsui Mining's and Robertson Research's field parties was done to exacting detail, although it is presented on a topographic base-map which requires substantial warping to fit current maps. Peace River Coal's mapping was intermediate in scope between the detailed work done on behalf of Mitsui Mining and Robertson Research and the regional studies done on behalf of

Triad Oil.

2.6.2 Historic drilling

Considerable historic (pre-2001) drilling has been done at EB Main, all of which has been cored. In all, 31 historic boreholes have been drilled, at overall depth of 5,758.72 metres. The deepest borehole at EB Main was also the first one to be drilled: historic borehole EB(MS)-1, completed at a depth of 508.41 metres in September of 1975. **Table 2-2** presents details of historic drilling at EB Main, based upon information available within the British Columbia Geological Survey's *COALFILE* database. Cross-references are given to coal-assessment reports as cited in **Section 8** of the present report.

2.6.3 Cross-references to earlier studies

Historic work by others is duly referenced within the present text, and all such references consolidated with full bibliographic detail in **Section 8** of this report.

2.7 Current work

Current work at EB Main, for the purposes of this report, comprises geological compilation (conducted in 2013, within Coal Licences 381712 through 381717 inclusive) and the drilling of 108 exploratory boreholes, totalling at least 11,428.78 metres' drilled depth (conducted between 2001 and 2014, within Coal Licences 381712 through 381715.

2.7.1 Geological compilation and photogeological interpretation

Regional structural and stratigraphic compilation mapping, a portion of which was previously presented within Coal Assessment Report No.938 (Cathyl-Huhn and Avery, 2014b), and a subsequent (as-yet uncatalogued) report on the EB Trend property (Cathyl-Huhn and Singh, 2014) was extended to cover the EB Main property. Mapping has been updated to reflect the results of current drilling (especially year-2013 and year-2014 work) within the property, as well as findings of a photogeological study of the EB Main area. **Map 2-3** presents the current understanding of bedrock geology within the EB Main property.

Data sources for the geological compilation included false-coloured satellite imagery from *Google Earth*, greyscale aerial photographs from the British Columbia government, and historic geological mapping as mentioned above in **Section 2.6**. Use was also made of geological structure observations tabulated by Jefferys (2007), whose work overlapped property boundaries to cover portions of the EB Main coal property. As a check on the geological compilation, site visits were made during the summers of 2013 and 2014, to assess the congruence of structural interpretations as compared with the landforms visible from roadside vantage-points. Owing to thick forest cover on the lower hillslopes, and the late persistence of heavy snowpack, no attempt was made to conduct ground-based off-road traversing of geology.

Table 2-2: Details of historic boreholes at EB Main

borehole	UTM (NAD 83)		metres		drilling details		date (year/month/day)		Coal Assessment Report reference
	easting	northing	elevation	depth	method	size	commenced	completed	
EB(MS)-1	601744.67	6108224.08	1767.7	508.41	Core	NQ	unknown	1975-09-10	Shima and Nishio
EB(MS)-4	603177.97	6107025.58	1443.7	115.21	Core	NQ	unknown	1976-09-16	Shima and Kinoshita
EB(MS)-5	601566.37	6106669.58	1534.5	142.06	Core	NQ	unknown	1976-09-09	Shima and Kinoshita
EB(MS)-6	601913	6106312	1531	157.28	Core	NQ	unknown	1976-09-23	Shima and Kinoshita
EB(MS)-7	602591.47	6109680.98	1807.1	276.15	Core	NQ	unknown	1977-09-12	Yayoshi and Wada
EB(MS)-8	601538.27	6109477.98	1722.3	112.17	Core	NQ	1977	1977	Yayoshi and Wada
EB(MS)-9	602113.17	6107988.38	1708.9	255.42	Core	NQ	unknown	1977-08-25	Yayoshi and Wada
EB(MS)-10	600819.87	6109798.88	1675.6	77.42	Core	NQ	unknown	1977-07-26	Yayoshi and Wada
EB(MS)-11	601456.87	6110500.48	1760.7	182.88	Core	NQ	1977	1977	Yayoshi and Wada
EB(MS)-13	601186.17	6107711.08	1686.5	276.45	Core	NQ	unknown	1977-08-11	Yayoshi and Wada
EB(MS)-14	602764.07	6107402.18	1462.1	151.49	Core	NQ	1977	1977	Yayoshi and Wada
EB(MS)-15	603218.47	6109567.38	1821.9	101.15	Core	NQ	1977	1977	Yayoshi and Wada
MS-16	600645.27	6107675.78	1689.9	328.25	Core	HQ	1978-06-17	1978-06-25	Jordan and Dawson
MS-17	601554.87	6107842.38	1747.1	160.63	Core	HQ	1978-06-21	1978-06-24	Jordan and Dawson
MS-18	601365.57	6108036.58	1827.4	245.97	Core	HQ	1978-06-26	1978-07-02	Jordan and Dawson
MS-19	601508.07	6108480.08	1751.9	160.63	Core	HQ	1978-06-27	1978-06-30	Jordan and Dawson
MS-20	*not surveyed*		unknown	285.6	Core	HQ	1978-07-01	1978-07-03	Jordan and Dawson
MS-20A	601873.37	6110208.18	1904.8	320.73	Core	HQ	1978-07-26	1978-08-13	Jordan and Dawson
MS-21	601693.77	6107710.28	1702.3	106.71	Core	HQ	1978-07-03	1978-07-04	Jordan and Dawson

Table 2-2: Details of historic boreholes at EB Main (concluded)

borehole	UTM (NAD 83)		metres		drilling details		date (year/month/day)		Coal Assessment Report reference
	easting	northing	elevation	depth	method	size	commenced	completed	
MS-22	600692.17	6108445.78	1875.8	430.38	Core	HQ	1978-07-05	1978-07-18	Jordan and Dawson
MS-23	602271.77	6110388.58	1941.7	70.1	Core	HQ	1978-07-15	1978-07-17	Jordan and Dawson
MS-24	602523.37	6110196.58	1944.9	56.69	Core	HQ	1978-07-19	1978-07-21	Jordan and Dawson
MS-25	*not surveyed*		unknown	46.33	Core	HQ	1978-07-20	1978-07-26	Jordan and Dawson
MS-25A	600992.37	6108181.48	1857.6	386.18	Core	HQ	1978-07-27	1978-08-07	Jordan and Dawson
MS-26	603241.27	6110099.98	1929.2	49.07	Core	HQ	1978-07-23	1978-07-25	Jordan and Dawson
MS-34	602077.47	6107838.78	1701.6	103.09	Core	HQ	1980	1980	Little
MS-35	601639.97	6107257.98	1560.3	120.49	Core	HQ	1980	1980	Little
MS-36	601565.87	6107222.18	1560.6	160.26	Core	HQ	1980	1980	Little
MS-37	602059.07	6108239.68	1716.1	158.8	Core	HQ	1980	1980	Little
MS-38	601476.07	6107019.18	1558.5	137.92	Core	HQ	1980	1980	Little
MS-40	601803.87	6107652.48	1679.3	74.8	Core	HQ	1980	1980	Little

Note: borehole MS-20 is presumed to be close to borehole MS-20A; similarly, borehole MS-25 is presumed to be close to borehole MS-25A. Positions of boreholes MS-35 and MS-36 are inferred to have been mistakenly swapped during the compilation of Little's report; their positions as given here are 'unswapped', based upon on a nearby current borehole (EB08-13), drilled as a check of this possibility.

Table 2-3: Current (year-2001 through year-2014) drilling at EB Main

borehole	coordinates (UTM NAD 83)		metres		drilling method	borehole diameter	geophysical logs run?	dates (year-month-day)		trajectory	
	easting	northing	elevation	depth				commenced	completed	azimuth	dip
EB45	601787.007	6108460.814	1726.052	100.9	Rotary	13 cm	yes	unknown	2001-08-27	24.3	-81.22
EB46	601931.801	6108593.003	1676.029	52.6	Rotary	13 cm	yes	unknown	2001-08-27	93.9	-89.24
EB47	601853.644	6108528.661	1706.759	40.5	Rotary	13 cm	yes	unknown	2001-08-28	35.9	-86.74
EB48	601560.779	6108536.528	1737.271	125.9	Rotary	12 cm	yes	unknown	2001-09-16	21.1	-83.5
EB49	602140.634	6108373.315	1681.374	31.3	Rotary	13 cm	yes	unknown	2001-08-30	28.1	-88.17
EB50	602222.031	6108084.169	1676.066	65.1	Rotary	12 cm	yes	unknown	2001-09-16	105.6	-88.59
EB51	602330.59	6107798.788	1647.145	43.1	Rotary	13 cm	yes	unknown	2001-08-31	266.3	-88.54
EB52	601930.149	6107776.365	1699.194	98.3	Rotary	12 cm	yes	unknown	2001-09-04	168.3	-89.59
EB53	601854.765	6108109.092	1763.435	147.5	Rotary	12 cm	yes	unknown	2001-09-08	61.5	-89.3
EB54	601693.489	6108361.811	1758.084	130.9	Rotary	12 cm	yes	unknown	2001-09-18	5.3	-88.6
EB55	601446.405	6107697.268	1699.49	153.5	Rotary	12 cm	yes- thru rods	unknown	2001-09-23	54.3	-74.48
EB56	601744.115	6107398.986	1588.128	9	Rotary	unknown	no- not to rock	unknown	unknown	0	-90
EB57	601743.507	6107247.502	1549.764	15	Rotary	unknown	no- not to rock	unknown	unknown	0	-90
EB58C	601442.318	6107335.935	1581.596	132.9	Spot-core	HWG?	yes	unknown	2001-10-27	47.2	-85.85
EB59C	601704.144	6107968.03	1770.849	176.3	Spot-core	HWG	yes	unknown	2001-10-19	90.2	-87.85
EB60	601566.081	6106967.845	1550.877	153.75	Rotary	12 cm	yes	unknown	2001-09-15	85.4	-84.72
EB61	601751.706	6106913.203	1530.69	99.2	Rotary	12 cm	yes	unknown	2001-09-18	359.8	-85
EB62	601507.288	6108172.922	1811.454	227.1	Rotary	12 cm	yes	unknown	2001-09-18	79.5	-87.7
EB63C	601633.636	6108266.779	1778.532	161.09	Spot-core	HWG	yes	unknown	2001-10-25	102.8	-87.58

Table 2-3: Current (year-2001 through year-2014) drilling at EB Main (continued)

borehole	coordinates (UTM NAD 83)		metres		drilling method	borehole diameter	geophysical logs run?	dates (year-month-day)		trajectory	
	easting	northing	elevation	depth				commenced	completed	azimuth	dip
EB64	601646.377	6107457.819	1615.909	105.33	Rotary	12 cm	yes	unknown	2001-09-19	69.7	-84.65
EB65	601300.785	6107538.869	1627.611	197.9	Rotary	12 cm	yes	unknown	2001-09-20	64.9	-83.21
EB07-01A	601458.23	6108557.44	1731	132.3	Rotary	11.43 cm	yes	2007-06-09	2007-06-16	28.4	-77.52
EB07-02	601415.56	6108487.85	1766.85	180.39	Rotary	11.43 cm	yes	2007-06-22	2007-06-24	54.1	-83.66
EB07-03	601342.9	6108448.6	1800.35	209.21	Rotary	12.06 cm	yes	2007-07-02	2007-07-05	62.8	-86.48
EB07-04C	601637.9	6108536.13	1728.16	108.28	Core	HQ	yes- thru rods	2007-07-07	2007-07-20	0	-90
EB07-05	601562.87	6108452.18	1748.17	151.79	Rotary	unknown	no-collapsed	unknown	unknown	0	-90
EB07-06	601457.2	6108353.16	1783.92	191.74	Rotary	unknown	no-collapsed	unknown	unknown	0	-90
EB07-07	601865.99	6108339.85	1735.88	135.06	Rotary	11.43 cm	yes	2007-06-07	2007-06-09	31.1	-79.05
EB07-08	*not surveyed*		unknown	155.45	Rotary	unknown	yes- thru rods	unknown	unknown	0	-90
EB07-08A	*not surveyed*		unknown	175.26	Core	no	yes	2007-06-13	2007-07-03	70.5	-86.85
EB07-08B	601649.85	6108116.09	1778.74	178.16	Spot-core	PWF	yes	2007-07-03	2007-07-10	68.7	-86.58
EB07-09	601521.15	6107988.42	1798.33	212.39	Rotary	11.43 cm	yes	2007-06-17	2007-06-19	81.1	-85.68
EB07-10	601403.9	6107874.82	1759.58	216.75	Rotary	11.43 cm	yes	2007-06-12	2007-06-14	52.9	-70.88
EB07-11	602176.91	6108230.24	1679.56	62.9	Rotary	11.43 cm	yes	unknown	2007-04-22	14.1	-86.9
EB07-11A	*not surveyed*		unknown	57.46	Core	6-inch	yes	unknown	unknown	0	-90
EB07-11B	*not surveyed*		unknown	57.73	Core	6-inch	no	unknown	unknown	0	-90
EB07-11C	*not surveyed*		unknown	61.21	Core	6-inch	no	unknown	unknown	0	-90

Table 2-3: Current (year-2001 through year-2014) drilling at EB Main (continued)

borehole	coordinates (UTM NAD 83)		metres		drilling method	borehole diameter	geophysical logs run?	dates (year-month-day)		trajectory	
	easting	northing	elevation	depth				commenced	completed	azimuth	dip
EB07-11D	*not surveyed*		unknown	87.36	Core	PWF	no	unknown	2007-09-10	0	-90
EB07-12	602114.57	6108192.94	1702.64	131.8	Rotary	11.43 cm	yes	unknown	2007-03-24	32	-82.21
EB07-12A	*not surveyed*		unknown	58.67	Core	6-inch	no	unknown	2007-03-29	0	-90
EB07-12B	*not surveyed*		unknown	59.42	Core	6-inch	no	unknown	2007-04-02	0	-90
EB07-12C	*not surveyed*		unknown	26.41	Core	6-inch	no	unknown	2007-04-11	0	-90
EB07-12D	*not surveyed*		unknown	58.8	Core	unknown	no	unknown	unknown	0	-90
EB07-13	602057.56	6108096.38	1721.24	143.06	Rotary	10.79 cm	yes	2007-06-27	2007-06-28	56.9	-86.14
EB07-14	601917.77	6107978.98	1738.71	141.25	Rotary	10.79 cm	yes	2007-06-25	2007-06-26	69	-86.91
EB07-15	601793	6107839.43	1713.01	119.82	Rotary	10.79 cm	yes	2007-06-24	2007-06-25	86.5	-88.07
EB07-16C	601558.53	6107604.6	1660.55	143.28	Core	HQ	yes	2007-07-22	2007-08-05	0	-90
EB07-17	601445.47	6107494.46	1626.59	171.56	Rotary	11.43 cm	yes	2007-06-28	2007-06-29	64	-78
EB07-18	*not drilled*										
EB07-19	602353.48	6107957.26	1640.97	61	Rotary	11.43 cm	yes	2007-06-09	2007-06-10	124.1	-89.26
EB07-20	602258.07	6107878.69	1683.65	90.01	Rotary	11.43 cm	yes	2007-06-11	2007-06-11	2.5	-89.11
EB07-21	602197.1	6107822.47	1682.14	79.76	Rotary	11.43 cm	yes	2007-06-11	2007-06-12	8.9	-89.24
EB07-22	601727.54	6107355.9	1575.53	65.35	Rotary	11.43 cm	yes	2007-07-14	2007-07-14	59.3	-85.15
EB07-22C	601720.24	6107356.13	1576.41	52.12	Core	HQ	yes	2007-07-28	2007-08-04	102.8	-86.98

Table 2-3: Current (year-2001 through year-2014) drilling at EB Main (continued)

	coordinates (UTM NAD 83)		metres		drilling	borehole	geophysical	dates (year-month-day)		trajectory	
borehole	easting	northing	elevation	depth	method	diameter	logs run?	commenced	completed	azimuth	dip
EB07-23	601547.3	6107178.35	1556.09	104.42	Rotary	11.43 cm	yes	2007-07-10	2007-07-12	0	-90
EB07-24	601480.26	6107108	1557.67	126.92	Rotary	11.43 cm	yes	2007-07-09	2007-07-10	93.1	-82.12
EB07-25	601777.01	6107186.62	1539.32	93.05	Rotary	10.79 cm	yes	2007-06-29	2007-06-30	71.6	-85.12
EB07-26	601738.08	6107153.06	1539.29	92.89	Rotary	11.43 cm	yes	2007-07-01	2007-07-02	82.8	-85.99
EB07-27	601667.18	6107075.09	1541.41	65.99	Rotary	11.43 cm	yes	2007-07-22	2007-07-24	127	-87.29
EB07-28	601855.06	6107262.82	1541.71	59.74	Rotary	10.79 cm	yes	2007-07-26	2007-07-28	102.5	-88.75
EB08-01	601610.85	6106741.71	1536.64	72.75	Rotary	12.06 cm	yes	2008-09-04	2008-09-15	45	-60
EB08-02	601705.72	6106549.99	1510.61	45.72	Rotary	unknown	no- not to rock	2008-09-07	2008-09-10	0	-90
EB08-03	601952.15	6106375.22	1521.36	111.64	Rotary	12.06 cm	yes	2008-08-30	2008-08-31	47.3	-56.19
EB08-04	601766.04	6106604.88	1511.87	38.1	Rotary	unknown	no- not to rock	2008-09-11	2008-09-14	0	-90
EB08-05	602182.09	6106178.89	1590.92	129.8	Rotary	10.16 cm	yes	2008-08-31	2008-09-02	44.2	-54.35
EB08-06	602216.17	6106217.87	1579.41	77.65	Rotary	12.06 cm	yes	2008-08-31	2008-08-31	43.6	-56.32
EB08-07	602436.04	6106000.33	1673.78	181.7	Rotary	10.16 cm	yes	2008-08-26	2008-08-30	44	-51.86
EB08-08	602505.2	6106062.93	1634.65	87.2	Rotary	10.16 cm	yes	2008-09-02	2008-09-03	45.7	-55.41
EB08-09	602691.99	6105842.73	1635.44	111.7	Rotary	10.16 cm	yes	2008-08-27	2008-08-28	27.8	-56.64
EB08-10	602751.66	6105893.8	1626.5	77.93	Rotary	11.43 cm	yes	2008-08-28	2008-08-29	53.2	-57.46
EB08-11	602712.23	6105701.04	1587.46	99.04	Rotary	11.43 cm	yes	2008-09-04	2008-09-04	28.9	-49.57
EB08-12	602828.32	6105690.95	1570.6	64.9	Rotary	11.43 cm	yes	2008-09-03	2008-09-04	29.8	-56.99
EB08-13	601569.31	6107222.77	1556.54	102.43	Rotary	12.7 cm	yes	2008-09-15	2008-09-17	77.2	-81.98
EB11-01C	602055	6108094	1721	133.39	Core	HQ	yes	2011-10-25	2011-11-10	65.6	-89.22

Table 2-3: Current (year-2001 through year-2014) drilling at EB Main (continued)

	coordinates (UTM NAD 83)		metres		drilling	borehole	geophysical	dates (year-month-day)		trajectory	
borehole	easting	northing	elevation	depth	method	diameter	logs run?	commenced	completed	azimuth	dip
MW 11-1	600916.3	6106749.49	1682.39	unknown	Rotary	unknown	no	unknown	unknown	0	-90
MW 11-2	603230.16	6107679.12	1429.25	unknown	Rotary	unknown	no	unknown	unknown	0	-90
MW 11-5	601904.11	6106948.19	1517.78	unknown	Rotary	unknown	no	unknown	unknown	0	-90
WW 1	602356.42	6107144.92	1477.99	unknown	Rotary	unknown	no	unknown	unknown	0	-90
WW 2	601333.55	6106964.89	1561.62	unknown	Rotary	unknown	no	unknown	unknown	0	-90
EB13-03	603188	6107570	1429.6	151.52	Rotary	11.43 cm	yes	2013-08-06	2013-08-09	0	-90
EB13-04	601348.8	6107249	1576.66	176.78	Rotary	11.43 cm	yes	2013-08-13	2013-08-15	0	-90
EB13-05	601447.3	6106915	1557.66	139.34	Rotary	11.43 cm	yes	2013-08-16	2013-08-18	0	-90
EB13-06	601924.8	6108148	1753.22	164.59	Rotary	11.43 cm	yes	2013-08-19	2013-08-20	0	-90
EB13-07	602537.7	6108891	1544.88	176.78	Rotary	11.43 cm	yes	2013-08-20	2013-08-23	0	-90
EB13-08C	601868.4	6106172	1548.23	280.37	Core	9.6 cm	yes	2013-09-03	2013-09-10	45.9	-80
EB13-09C	602572.4	6105735	1655.17	262.76	Core	9.6 cm	yes	2013-10-12	2013-10-16	43.3	-80
EB13-10C	601290.5	6107787	1716.61	223.95	Core	10.16 cm	yes	2013-10-28	2013-10-30	38.2	-70
EB13-11	601698.6	6106544.6	1516.65	132.58	Rotary	11.43 cm	yes	2013-09-23	2013-10-01	0	-90
EB13-12	601761	6106604	1517.47	111.25	Rotary	11.43 cm	yes	2013-10-02	2103-10-07	0	-90
EB13-13	601563.7	6106465	1515.57	70.1	Rotary	11.43 cm	yes	2013-10-08	2013-10-08	0	-90
EB13-13A	601595.55	6106420.2	1507.57	216.4	Rotary	11.43 cm	yes	unknown	2013-10-30	0	-90
MW-A	601907.28	6106248.09	1555.23	145.41	Rotary	9.5 cm	yes	2013-07-28	2013-07-29	0	-90
MW-B	602988.68	6105557.23	1525.2	93.67	Rotary	9.5 cm	yes	2013-07-23	2013-07-24	0	-90
MW-Bs	602991.57	6105557.71	1524.22	23	Rotary	unknown	no	unknown	unknown	0	-90

Table 2-3: Current (year-2001 through year-2014) drilling at EB Main (concluded)

borehole	coordinates (UTM NAD 83)		metres		drilling method	borehole diameter	geophysical logs run?	dates (year-month-day)		trajectory	
	easting	northing	elevation	depth				commenced	completed	azimuth	dip
MW-C	603527.06	6106005.78	1444.03	68.87	Rotary	10.5 cm	yes	2013-07-25	2013-07-26	0	-90
MW-Cs	603529.69	6106006.65	1443.8	18	Rotary	unknown	no	unknown	unknown	0	-90
MW-D	603154.33	6106997.62	1439.16	93.67	Rotary	9.5 cm	yes	2013-07-27	2013-07-28	0	-90
MW-Ds	603152.51	6106996.11	1439.3	12	Rotary	unknown	no	unknown	unknown	0	-90
EB14-01C	601870.346	6108340.45	1736.425	141.73	Core	22.86 cm	yes	2014-07-21	2014-07-29	0	-90
EB14-02C	601793.311	6107838.808	1714.555	120.39	Core	24.13 cm	yes	2014-07-30	2014-08-05	0	-90
EB14-03C	601485.958	6107109.14	1558.87	115.82	Core	24.13 cm	yes	2014-08-06	2014-08-13	0	-90
EB14-04C	602393.578	6107964.485	1624.395	27.12	Core	9.6 cm	yes	2014-08-14	2014-08-15	0	-90
EB14-05C	602323.135	6107942.369	1662.184	61.26	Core	9.525 cm	yes- thru rods	2014-08-15	2014-08-18	0	-90
EB14-06C	602275.948	6107917.019	1682.742	87.17	Core	9.525 cm	yes	2014-08-18	2014-08-20	0	-90
EB14-07C	602230.308	6107894.957	1692.704	97.53	Core	9.525 cm	yes	2014-08-20	2014-08-23	0	-90
EB14-08C	602192.546	6107922.759	1699.27	100	Core	11.43 cm	yes	2014-08-23	2014-08-25	0	-90
EB14-09C	602159.683	6107947.219	1703.268	108.5	Core	11.43 cm	yes	2014-08-25	2014-08-27	0	-90
EB14-10G	603184.427	6107387.914	1430.116	39.62	Rotary	unknown	no	2014-09-17	2014-09-20	0	-90
EB14-11G	603349.289	6107487.692	1413.554	48.76	Rotary	unknown	no	2014-09-15	2014-09-17	0	-90

Note: borehole EB07-18 was apparently not drilled, as no record of its existence nor planned location has been found. Logs noted as 'thru rods' were run with steel drill rods or casing within the borehole, typically on account of caving conditions. Boreholes EB07-05 and EB07-06 collapsed prior to geophysical logging; only their total depth is known (from drillers' reports). No details have been found concerning boreholes MW11-1, MW11-2, MW 11-5, WW-1 and WW-2, other than tabulation of their locations.

2.7.2 Current drilling

Between the years 2001 and 2014, 108 boreholes (as listed in **Table 2-3**), totalling at least 11,428.78 metres' drilling, were drilled at EB Main. Drilling was confined to the southern four licences, the two northern licences having not received any current drilling. Locations of current boreholes are shown as solid circles in **Map 2-3**, whereas historic boreholes are shown as open circles. Most of the current drilling has been by means of air-rotary 'open hole' methods, while a few holes were drilled as partially or completely cored holes.

2.7.2.1 Cross-reference to current borehole data

Available geophysical logs (**Table A-1**) and core descriptions (up to the end of year-2013) are presented in **Appendix A** of this report. Coal beds intersected by current drilling (up to the end of year-2013) are presented in **Tables 4-3**, **4-6** and **4-7** within **Section 4** of this report.

Analytical information from current boreholes (up to the end of year-2013) is presented in **Appendices B**, **C**, **D** and **E.**

2.8 Acknowledgements and professional responsibility

Statements of qualifications and authorship are presented in **Section 10** of this report. Gwyneth Cathyl-Huhn P.Geo. accepts overall professional responsibility for the contents of this report, and to that effect has signed and sealed the original copy of the report.

Preetpal Singh M.A.Sc scanned, ontologised, and data-wrangled the geophysical and geological records presented in **Appendices A** through **E**, and compiled the geophysical-log statistics presented in **Table A-1**.

Laura R. LeMay B.Sc. compiled a subsurface database of coal tops covering the Mt. Spieker area, from which **Tables 4-1** through **4-7** have been extracted and adapted by Gwyneth Cathyl-Huhn.

Blake Snodsmith at Walter Energy’s Alabama office provided a scalable TRIM base-mapping layer for the Sukunka-Quintette coalfield, including the area shown in **Map 2-2**, and also provided a summary of exploration expenditures for year-2013 and year-2014 work at EB Main.

Dr. Peter B. Jones P.Geol., now retired from the Russian Academy of Science, again gave generously of his time in explaining regional structural concepts which underpinned his year-1959 tectonic mapping on behalf of Triad Oil (Jones, 1960).

David Richardson P.Geo. and Sara MacPhail P.Geo. at the B.C. Ministry of Natural Gas Operations provided copies of natural-gas well logs and well-history reports, and of Dr. Jones’ maps.

3 Geology

Regional and local geology of EB Main (and the Sukunka-Quintette coalfield in general) is known mainly from the extensive work of D.F. Stott (1960; 1961; 1963; 1968; 1973; 1974; 1982; 1998), and D.W. Gibson (1992a, 1992b) on behalf of the Geological Survey of Canada (1968; 1973; 1982; 1998). As well, numerous coal-company reports are available as open file documents from the provincial Geological Survey Branch. The most useful of these reports (available as Coal Assessment Report No.556) was written by G.R. Jordan and F.M. Dawson (1978), working for Robertson Research (North American) Limited, on behalf of Ranger Oil (Canada) Limited.

3.1 Regional geology

The EB Main coal property lies within the Sukunka-Quintette coalfield of northeastern British Columbia, part of the Foothills structural province of the Canadian Cordillera. All rocks exposed at the ground surface are of Early Cretaceous age, belonging to the Bullhead (Barremian to Aptian stages) and Fort St. John (Albian stage) groups. Where the entire section has been preserved from erosion, total thickness of the Lower Cretaceous rocks is about 2.5 kilometres. Depth to Precambrian continental basement, including both Mesozoic and Palaeozoic rocks, is more substantial, in the range of 10 to 12 kilometres (McMechan, 1984), although some of this thickness is attributable to thrust-induced structural telescoping of the rock.

Regional geological mapping by M. McMechan (1994), also on behalf of the Geological Survey of Canada, covers the EB Main property and nearby portions of the Sukunka-Quintette coalfield, at a scale of 1:250,000. More detailed regional mapping by P.B. Jones (1960), on behalf of Triad Oil, covers the EB Main property and nearby areas, at a scale of 1:63,630 (one inch to one mile).

The majority of sedimentary rocks within the Sukunka-Quintette coalfield are clastic in nature, ranging in grain-size from claystones and mudstones through pebble-conglomerates. Lesser amounts of biologically- and chemically-derived sedimentary rocks are present, comprising coals, banded and nodular ironstones, glauconite-rich sandstones and gritstones, and impure dolomites.

Volcanic rocks constitute a very small component of the Jurassic and Early Cretaceous strata, comprising very fine- to fine-grained tuffs, interpreted to have originated as wind-borne distal ash-fall deposits from contemporaneous volcanoes situated within the Coast Plutonic Complex, far to the southwest of the property. The volcanic rocks characteristically occur as very thin (at most a few decimetres) yet regionally-extensive bands, which are of practical utility as markers for structural and stratigraphic correlations. No intrusive rocks are known to occur at EB Main, nor within the Sukunka-Quintette coalfield in general.

3.1.1 Regional stratigraphy and exploratory concept

Regionally, coal is known to be present within five paleodelta systems, within the Boulder Creek, Gates, and Gething formations. Of these three formations, only the Gates and Gething formations have attracted any significant exploratory interest within the Sukunka-Quintette coalfield, including at EB Main, and of those latter two formations, the vast majority of drilling at EB Main has been within the Gates Formation, with a lesser amount of drilling

within the Gething Formation. Coal-measures of the Boulder Creek Formation have been drilled at a few locations (as noted in **Table A-2** within **Appendix A**), but this formation has not been regarded as an exploratory target in its own right, although it has attracted some attention within the Highhat Mountain area, several tens of kilometres to the northeast of EB Main.

During much of the Early Cretaceous, the Western Interior of North America was occupied by a shallow seaway, variably-designated by different authors as the Western Interior Sea, the Boreal Sea, or by various analogues of formation names, such as the Clearwater Sea, Hulcross Sea or Moosebar Sea. Into this seaway, the paleodeltas were built.

Coal deposits formed atop the paleodeltas, as a result of plant growth, peat accumulation, and burial of that peat beneath sufficient sediment to protect the peat from subsequent erosion. Peat-forming and peat-burial processes were repeated several times, in concert with autogenic fluvial/deltaic processes such as meandering, avulsion and deltaic lobe-switching, and also in concert with wider-ranging allogenic processes such as eustatic sea-level change. The outcome of these processes was the development of several vertically-stacked coal zones, each comprised of one or more coal beds.

3.1.2 Regional tectonic setting

The EB Main coal property, and its regional surroundings, is characterised by a thin-skinned deformational style comprising folded, laterally-arcuate thrust faults and associated fault-bend folds (Barss and Montandon, 1981).

Age relationships amongst the thrusts are as generally observed within the Cordilleran fold-thrust belts of the Laramide Orogen within North America, with the oldest thrusts occupying stratigraphically-higher positions, generally to the tectonic inboard side (hence, to the southwest) of the stratigraphically-lower and younger thrusts. As a general observation, the thrusts dip to the southwest and strike to the northwest, with vergence (sense of tectonic transport) to the northeast. Thrusts range in scale from mesoscopic features with stratigraphic displacements of a few decimetres to a few metres, to regionally-throughgoing faults and fault zones (such as the Bullmoose Fault and associated splays) with stratigraphic displacements of several hundred metres to more than a thousand metres. Thrusts characteristically overlap in *en echelon* manner, with displacement gradually transferring from one fault to another via trains of folds (Dahlstrom, 1970).

Bedding dips within the Sukunka-Quintette coalfield are generally less than 20 degrees within the broad synclinoria which characterise the coalfield. Steep dips (rarely near-vertical to overturned) are occasionally observed within tightly-folded displacement-transfer zones near the ends of *en echelon* thrusts.

Regionally, the Hasler and Moosebar formations are often zones of *décollement* (tectonic detachment), characterised by near-bedding-parallel thrust faults (Cooper and others, 2004). Near-bedding detachments are occasionally seen within soft muddy siltstones and mudstones of the basal Falher Member of the Gates Formation, as well as within the Cowmoose mudstone within the Moosebar Formation. Gates Formation coals may also host bedding-parallel detachment zones, as expressed by the concentration of shearing within internal partings of impure coal or coaly rock.

Table 3-1: Table of lithostratigraphic units and significant coal beds

Geological Age		Lithostratigraphic Units				Thickness	Map-Units		Coal Beds/Coal Zones	
		Group	Formation	Member	Division				Bed	Zone
Early Cretaceous	Late Albian	Fort St. John	Hasler			>20 m	8a			
			----- *uppermost extent of drilled rocks at EB Main* -----							
			Boulder Creek	Paddy		9 to 30 m	7	7c		
				Walton Creek		95 to 115 m		7b	V coal bed	
	Late Middle Albian			Cadotte		20 to 40 m		7a		
	Middle Albian		Hulcross			105 to 125m	6			
	Late Early Albian		Gates	Notikewin		63 to 105 m	5	5c	P, Q and R coal beds (underlain by 'Blue Marker' bioherm)	
				Falher		75 to 85 m		5b	A, BL, BU, CL, CU, C2L, C2U, DL and DU coal beds; E coaly rock (horizon only)	
				Torrens	Quintette sandstone	25 m		5a		
					Medial siltstone	13 m				
					Torrens sandstone	12 m				
			Moosebar	Spieker		150 to 170 m	4	4c		
				Cowmoose mudstone		75 to 110 m		4b		
				basal 'Green Marker'		nil to 2.4 m		4a		
		Bull-head	Gething	Chamber-lain	(unnamed coal measures)	34 m	3	3d	Upper Bird	Bird zone
									Lower Bird	
									Skeeter coal bed	
									Chamberlain coal bed	
					Chamber-lain sandstone	11 to 17 m				
				Bullmoose	Upper	16 to 21 m		3c		
					Middle	1.5 to 3 m				
					Lower	15 to 17 m				
				Bluesky		0.3 to 3 m		3b		
	Hauterivian to Late Early Albian			Gaylard		145 to 150 m		3a	'Middle and Lower Coals' (Gething A through Gething E)	
	Hauterivian to Barremian		----- *lowermost extent of drilled rocks at EB Main* -----							
			Cadomin			50 m	2			
	Berriasian to Val-anginian	Minnes	Monach			>300 m	1		not yet explored	

Note: this chart revised December 12, 2014. Marker beds and 'Divisions' are local lithologic units without formal stratigraphic rank, although in most cases they extend across property boundaries.

3.2 Local geology

Approximately 1400 metres of Mesozoic (mostly Early Cretaceous) strata are present at EB Main, locally thickened to 1800 to 1900 metres by structural telescoping along thrust-faults. The Mesozoic section is incomplete, owing to deep erosion of its uppermost beds, accomplished during the Late Tertiary and Quaternary.

With the exception of thin bands of tuffaceous volcanic ash, all of the Lower Cretaceous strata within the EB Main area are sedimentary rocks. Intrusive igneous rocks, volcanic flows, and evaporites are unknown within the EB Main area.

3.2.1 Local stratigraphy

Within the EB Main property, rocks belonging to the Bullhead and Fort St. John groups are exposed at the ground surface, with the older rocks of the Minnes Group inferred to be present within the deeper subsurface.

Formations mapped (see **Map 2-3** and **Table 3-1**) as being present at outcrop range downwards from the Hasler Formation (map-unit 8a, the youngest mapped formation) to the Gething Formation (map-unit 3, the oldest mapped formation).

In addition to formations, formal and informal lithostratigraphic units with ranks ranging from member to division to (marker-) bed may be recognised within the closely-drilled southern four coal licences at EB Main. These subordinate units are presented in **Table 3-1**, and discussed in greater detail within **Section 4** of this report.

3.2.2 Local structural geology

The EB Main coal property consists, essentially, of a gently-deformed 'layer-cake' of sedimentary rocks, generally present in normal (‘tops-up’) stratigraphic position, with upward-younging age relationships.

Exceptions to this general situation are presented by at least four laterally-throughgoing, northeast-verging, northwest-striking thrust faults, defining a series of narrow to broad structural ‘plates’ (thrust sheets) separated by complexly-crumpled smash zones adjacent to the thrusts. Each of the structural plates is thus telescoped upon the underlying plate, acting to structurally shorten (in a southwest-northeast direction) and thicken (in a vertical direction) the overall section of sedimentary rocks. Thrust faults are inferred to have developed in the typical downward-younging sequence of successive faulting, with one exception as noted below in **Section 3.2.3**.

Overall intensity of deformation (and hence structural shortening), as signified by increased inclination of bedding, and by shortened wavelength of folds, appears to increase from the southwestern corner of the EB Main property to its northeastern corner.

3.2.3 Discussion of faults

As noted above, at least four throughgoing northeast-verging thrust faults have been mapped at EB Main, with several more low-displacement ‘minor’ thrust faults found within boreholes drilled thus far (**Table 3-2**), and also locally-mappable at ground surface. **Map 2-3** depicts the structures under discussion.

From southwest to northeast, the major thrust faults are:

- Overlook Thrust, interpreted to have partially-shortened the Notikewin Member and Hulcross Formation within the west-central upland part of the EB Main property, and to possibly have splayed southward into several anastomosing imbricate 'slices' within the closely-drilled central part of the property. The southeastward continuity of the Overlook Thrust has not yet been satisfactorily established, although structural studies now underway may lead to its recognition as far along strike as the southeastern corner of Coal Licence 381712.

- Headwaters Thrust, interpreted to have brought the uppermost coal-measures of the Gething Formation to the bedrock surface within the east-trending uppermost valley of Perry Creek. The southeastward continuation of the Headwaters Thrust has not yet been established, and it may ‘tip out’ laterally in an anticline-syncline couple formed by the East Bullmoose Anticline and the Jones Syncline, within the adjoining EB Trend coal property (Cathyl-Huhn and Singh, 2014).

- Bullmoose Thrust, interpreted to have brought the uppermost Gething coal-measures over the Moosebar Formation for much of its length. Displacement of the Bullmoose Thrust appears to increase northwestward along its trace, throwing the Spieker Member of the Moosebar Formation over the Hasler Formation, within the northeastern corner of the EB Main property.

- East Bullmoose Thrust, interpreted to telescope the Moosebar Formation over Boulder Creek Formation, within the northeastern corner of the EB Main property. The East Bullmoose Thrust appears to be an out-of-sequence thrust, being truncated (to the north along strike) by the overlying Bullmoose Thrust.

Of the faults enumerated above, the Bullmoose and East Bullmoose thrusts are the major through-going structural features at regional scale, with the Overlook and Headwaters thrusts having a lesser degree of lateral continuity. Stratigraphic displacement across the Headwaters-Bullmoose-East Bullmoose thrust complex is estimated to be at least 630 metres down to the northeast. Stratigraphic displacement across the Headwaters Thrust by itself is estimated to be 30 to 100 metres. The poorly-constrained stratigraphic displacement across the Overlook Thrust is estimated to be only 20 to 50 metres. It should be noted these estimates of displacement are at best approximate, owing to paucity of deep drilling through fault zones.

Fault-to-bedding cutoff angles (alpha-angles) have not yet been estimated, owing to paucity of angular measurements at EB Main. Alpha-angles of 30 degrees, in keeping with regional experience within the Foothills structural province, are considered to be plausible for competent strata. However, alpha-angles considerably less than 30 degrees (down to zero degrees in particularly weak strata such as the basal Cowmoose tuff-bearing shales of the Moosebar Formation, and within the sheared black shales overlying the Gates B coal zone) are considered to be locally possible.

Table 3-2: Drilled intersections of faults within current and historic boreholes

Borehole	metres			Asssurance of existence		Borehole	metres			Asssurance of existence
	From	To	Shear zone thickness				From	To	Shear zone thickness	
EB(MS)-1	189.57	189.59	0.02	Probable		EB07-04C	26.3	26.4	0.1	unranked
EB(MS)-1	244.73	244.75	0.02	Probable		EB07-10	109.5	109.52	0.02	unranked
EB(MS)-1	424.26	424.28	0.02	Probable		EB07-16C	90	90.02	0.02	unranked
EB(MS)-4	80	80.1	0.1	Established		EB07-20	72.01	72.5	0.49	unranked
EB(MS)-9	121.53	121.55	0.02	Established		EB07-25	58	59	1	unranked
EB(MS)-13	129.2	129.4	0.02	Possible		EB07-28	27	27.02	0.02	Probable
MS-17	38.2	38.73	0.53	Probable		EB08-07	55.55	56.1	0.55	Possible
MS-20A	169.61	171.63	2.02	Probable		EB08-07	150.85	150.88	0.03	Established
MS-22	262.8	263	0.02	Probable		EB08-07	153.05	153.1	0.05	Established
MS-22	289.18	289.2	0.02	Probable		EB08-11	86.5	87.1	0.6	unranked
MS-25A	47.98	48	0.02	Possible		EB13-03	139.08	139.1	0.02	Probable
MS-35	78.01	78.03	0.02	Probable		EB13-04	27.85	27.95	0.1	Established
EB54	114.8	114.9	0.1	unranked		EB13-06	66.5	66.52	0.02	unranked
EB55	118.38	118.4	0.02	Established		EB13-08C	207.13	207.57	0.44	Probable
EB60	120.9	120.92	0.02	Probable		EB13-09C	224.07	224.28	0.21	Established
EB61	46.8	46.82	0.02	Probable		EB13-09C	230.32	233.93	3.61	Probable
EB62	11	11.02	0.02	Possible		EB13-10C	15.2	15.22	0.02	Probable
EB63C	17.7	17.72	0.02	Possible		EB13-10C	162.26	162.69	0.43	Established
EB64	57.4	57.6	0.02	Established		EB13-11	127.9	128	0.1	Probable
EB65	79.1	79.12	0.02	Probable		MW-A	28.15	28.32	0.17	Established
EB65	97.25	97.27	0.02	Probable		MW-D	57.3	57.4	0.1	Probable

Note: shear zone thickness of 0.02 is assigned as default, in those cases in which actual measurement is unavailable.

4 Stratigraphic synopsis

The following discussion [modified from Cathyl-Huhn and Avery (2014b) and Cathyl-Huhn and Singh (2014)] presents details of the lithology, inferred origin, typical thickness and contact relationships of the various lithostratigraphic units present at EB Main, keyed to the map-unit numbers used in **Map 2-3** and **Table 3-1**. Lithostratigraphic units are discussed in stratigraphic order from uppermost (youngest) to lowermost (oldest) within the exposed sequence of strata.

Map 2-3 presents bedrock geology, upon which is overlaid the inferred extent of significantly-thick (ca. 20 metres or greater) unconsolidated sediments within the map-area.

4.1 Unconsolidated deposits (map-units M, TL and D)

Within the mapped area of **Map 2-3**, unconsolidated naturally-present and human-emplaced deposits, of Quaternary to Recent age, are shown as map-units M (made ground), TL (talus and landslide deposits) and D (alluvial, colluvial and glacial deposits, collectively mapped as ‘Drift’). Map-units M and TL are not present within the boundaries of the EB Main property, as map-unit M is associated with the old workings of Bullmoose Mine (outside the EB Main property), and map-unit TL is associated with the glacially-undercut dip-slopes of Fortress Mountain (also outside the EB Main property). Map-units D is, however, present within the EB Main property.

4.1.1 Made ground (map-unit M)

Within the mapped area, but situated three kilometres to the west of the EB Main coal property's northwestern corner, 'made ground' comprises mine waste material and coal-washery tailings associated with the historic operations of Teck Corporation’s now-closed Bullmoose Mine. The extent of these deposits was mapped from satellite imagery (Cathyl-Huhn and Singh, 2014).

4.1.2 Talus and landslide deposits (map-unit TL)

Blocky, grey-weathering, bouldery deposits of sparsely-vegetated to unvegetated material are prominently visible on the glacially-undercut, steep-sloping north- and southwest-facing flanks of Fortress Mountain, four kilometres east of the southwestern corner of the EB Main property. Interpretation of satellite imagery (Cathyl-Huhn and Singh, 2014) clearly shows the lobate shape of these deposits, which are interpreted to be talus and/or landslide deposits of Late Pleistocene to Recent age. Morphology of the deposits suggests that they post-date the most recent deglaciation; however, their age is not directly known.

4.1.3 Drift (map-unit D)

‘Drift’ is a collective term of convenience for undivided deposits of valley-filling alluvium, peat and muck, together with colluvial deposits and glacial till. The thickness and extent of Drift within and adjacent to the EB Main property has been mapped mainly by interpretation of landforms on satellite imagery and aerial photographs, supported by borehole information (**Table 4-1**), and constrained by the known occurrence of bedrock exposures.

Closely-spaced drilling has disclosed the presence of a steep-walled, deeply-infilled bedrock channel beneath the northeast-flowing upper course of Perry Creek. Maximum Drift thickness here is at least 94 metres, as indicated by borehole EB 13-12.

Table 4-1: Drilled thickness of Drift within current and historic boreholes

Borehole	Drift		Borehole	Drift		Borehole	Drift		Borehole	Drift (metres)
EB(MS)-1	0		MS-38	11.54		EB07-04C	3		EB08-04	>38.1
EB(MS)-4	3.8		MS-40	1.06		EB07-07	4.4		EB08-05	9
EB(MS)-5	27		EB45	3.25		EB07-08B	2.95		EB08-06	3
EB(MS)-6	8		EB46	2.5		EB07-09	6.1		EB08-07	2.8
EB(MS)-7	6.1		EB47	2.35		EB07-10	4.3		EB08-08	3
EB(MS)-8	10		EB48	9		EB07-11	3		EB08-09	3
EB(MS)-9	3		EB49	2.75		EB07-12	9		EB08-10	3
EB(MS)-10	24		EB50	2.7		EB07-13	6		EB08-11	18
EB(MS)-11	7.9		EB51	2.3		EB07-14	3		EB08-12	5.5
EB(MS)-13	33		EB52	2.8		EB07-15	3		EB08-13	7
EB(MS)-14	6.3		EB53	1.4		EB07-16C	9		EB11-01C	3
MS-16	6.3		EB54	0.7		EB07-17	3		EB13-03	35.5
MS-17	6.1		EB55	1.8		EB07-19	3.1		EB13-04	14.1
MS-18	7.32		EB56	3		EB07-20	5.95		EB13-05	20.27
MS-19	42.3		EB57	3		EB07-21	3		EB13-06	6.7
MS-20A	4		EB58C	3.4		EB07-22	23.76		EB13-07	14.9
MS-21	6.1		EB59C	2.1		EB07-22C	6		EB13-08C	7.63
MS-22	5.7		EB60	6.8		EB07-23	13		EB13-09C	1
MS-23	4		EB61	22.7		EB07-24	13		EB13-10C	10.8
MS-24	1		EB62	5.3		EB07-25	9		EB13-11	77.85
MS-25A	6		EB63C	10.4		EB07-26	9		EB13-12	94.2
MS-26	0.8		EB64	1.7		EB07-27	15.4		EB13-13A	68.15
MS-34	4.4		EB65	5.35		EB07-28	8.8		MW-A	1.45
MS-35	9.67		EB07-01	12.2		EB08-01	10		MW-B	21
MS-36	>8.72		EB07-02	5.3		EB08-02	>45.7		MW-C	16.5
MS-37	>4.9		EB07-03	8.85		EB08-03	3		MW-D	11.2

Note: where possible, base of Drift is determined from core descriptions or from drillers' records, supplemented by geophysical log response behind surface casing. In the absence of other data, base of surface casing is taken as being at the base of Drift.

4.2 Fort St. John Group (map-units 8a through 4ab)

An incomplete section of the Fort St. John Group is present at EB Main, owing to the group's uppermost rocks (of the Dunvegan, Cruiser and Goodrich formations) having been stripped off by erosion. The youngest remaining rocks belong to the basal part of the Hasler Formation.

4.2.1 Hasler Formation (map-unit 8a)

Only the basal 20 metres' thickness of the Hasler Formation, comprising dark grey, rusty-weathering, rubbly- to platy-weathering, locally-concretionary shale, siltstone and sandstone, of shallow-marine origin, is present within the EB Main property. These rocks are poorly-exposed as colluvial rubble and felsenmeer, within the southernmost upland areas of Coal Licences 381712 and 381713, and immediately east of the Bullmoose Thrust, within the northeastern corner of Coal Licence 381716. The Hasler Formation has not been intersected by any of the historic nor current boreholes at EB Main, owing in large measure to the formation's limited preservation from erosion.

The Hasler formation is of Late Albian age (Koke and Stelck, 1985). The Hasler's presumed upper contact with the overlying Goodrich Formation has been removed by erosion throughout the EB Main property, whilst its disconformable contact with the underlying Paddy Member of the Boulder Creek Formation is placed at the base of a few decimetres of erosive-based pebbly mudstone to silty gritstone.

4.2.2 Boulder Creek Formation (map-unit 7)

The Boulder Creek Formation comprises 145 to 160 metres of interbedded conglomerate, sandstone, siltstone, mudstone and coal. Within the EB Main property, the Boulder Creek is generally readily-divisible into three members: the upper coarse-grained Paddy Member (map-unit 7c), the medial, dominantly fine-grained coal-measures of the Walton Creek Member (map-unit 7b), and the lower coarse-grained Cadotte Member (map-unit 7a). The Paddy and Cadotte members correspond to similarly-named coarse-grained strata of the subsurface Deep Basin of northwestern Alberta, whereas the Walton Creek appears to be present only within the Foothills, including the EB Main area (Gibson, 1992b; Krawetz, 2008; Roca and others, 2008; Henderson and others, 2014).

The Boulder Creek's three members can be readily recognised in outcrop sections as two cliff-forming bands separated by a medial recessive band. As such, the three members can also be readily traced in aerial photographs and satellite imagery. Boulder Creek rocks are present within the core of the Spieker Syncline, along the crest of Mount Reesor Ridge, thus occupying the southwestern portions of Coal Licences 381712, 381713, and 381715. Only the Walton Creek and Cadotte members have been drilled at EB Main, in historic boreholes MS-16, MS-22, and MS-25A.

The basal contact of the Boulder Creek Formation with the underlying Hulcross Formation is generally abrupt and therefore considered to be conformable at local scale (Gibson, 1992b), although it may intertongue at regional scale.

4.2.2.1 Paddy Member (map-unit 7c)

The Paddy Member of the Boulder Creek Formation comprises 9 to 30 metres of thick-

bedded to massive, cliff-forming pebble-conglomerate, gritstone, sandstone and minor siltstone, within the central portion of the Spieker Syncline. No coal, other than isolated discontinuous lenses of coalified plant trash, is known from the well-exposed Paddy Member at EB West (Cathyl-Huhn and Avery, 2014b), and similarly the Paddy is expected to contain no significant amount of coal at EB Main.

The Paddy Member's age at EB Main is not directly known, owing to lack of diagnostic fossils, but its age is constrained to Late Albian by the ages of underlying and overlying rocks (Gibson, 1992b). The basal contact of the Paddy Member with the underlying Walton Creek Member is inferred to be intertonguing at property-wide scale, and abrupt to erosional at local scale.

4.2.2.2 Walton Creek Member (map-unit 7b)

The Walton Creek Member of the Boulder Creek Formation comprises 95 to 115 metres of generally-recessive siltstone, variably-carbonaceous, locally root-penetrated mudstone and thin coal beds, of which only one (designated as the V coal bed) appears to be laterally-continuous within the vicinity of EB Main (although none of the historic nor current boreholes have passed through its stratigraphic level). The swale-forming fine-grained rocks are punctuated by cliff-forming lenses of sandstone, gritstone and pebble-conglomerate, inferred to be channel-fills.

Gibson (1992b) considered the Walton Creek Member to be of probable Late Albian Age, based on angiosperm flora. The basal contact of the Walton Creek Member with the underlying Cadotte Member is generally abrupt, and regarded by Gibson (*op. cit.*) as being conformable, although Krawetz (2008) noted that the top of the Cadotte is usually distinctively 'lumpy'.

4.2.2.3 Cadotte Member (map-unit 7a)

The Cadotte Member of the Boulder Creek Formation comprises 20 to 40 metres of cliff-forming sandstone and pebble-conglomerate with rare thin interbeds of siltstone. The Cadotte generally coarsens upward, with its sandstones being at its base and its conglomerates being in its middle and at its top. Other than isolated coalified logs, the Cadotte Member is devoid of coal. The basal contact of the Cadotte Member with the underlying Hulcross Formation is generally abrupt and therefore considered to be conformable at local scale (Gibson, 1992b), although it may intertongue at regional scale.

4.2.3 Hulcross Formation (map-unit 6)

The Hulcross Formation comprises 105 to 125 metres (**Table 4-2**) of thinly-interbedded, locally-concretionary medium grey siltstone, fine-grained sandstone and dark grey mudstone with occasional very thin but extremely-persistent interbeds of soft, light grey to white, tuffaceous volcanic ash. Mesoscale (a few decimetres to a few metres thick) fining-upward sequences reminiscent of proximate turbidites or tempestites are common within the Hulcross Formation near EB Main, as are trace-fossils and poorly-preserved shell fossils. Sideritic concretions are commonly found in isolated, laterally-persistent bands.

Table 4-2: Drilled intersections of Hulcross Formation within current and historic boreholes

Borehole	metres			Attributes		Borehole	metres			Attributes	
	From	To	Thickness	Name	Lithology		From	To	Thickness	Name	Lithology
EB(MS)-1	0	0.85	0.85	Basal Grit	Marker	EB07-03	26.95	27.4	0.45	Hulcross	Coal
EB(MS)-13	33	72.3	39.3	Hulcross	Formation	EB07-03	27.4	35.2	0.8	Hulcross	Formation
EB(MS)-13	72.3	73	0.7	Basal Grit	Marker	EB07-03	35.2	36.35	1.15	Basal Grit	Marker
MS-16	52	159.55	107.55	Hulcross	Formation	EB07-08B	2.95	7.1	4.15	Hulcross	Formation
MS-16	159.55	159.67	0.12	Basal Grit	Marker	EB07-08B	7.1	7.75	0.65	Basal Grit	Marker
MS-18	7.32	60.31	53.85	Hulcross	Formation	EB07-09	6.1	29.1	23	Hulcross	Formation
MS-18	60.31	61.16	0.85	Basal Grit	Marker	EB07-09	29.1	30	0.9	Basal Grit	Marker
MS-22	93.5	217.4	123.9	Hulcross	Formation	EB08-07	2.8	8.9	6.1	Hulcross	Formation
MS-22	217.4	217.6	0.02	Basal Grit	Marker	EB08-07	8.9	9.1	0.2	Basal Grit	Marker
MS-25A	34.5	47.98	23.48	Hulcross	Formation	EB13-04	14.1	14.35	0.25	Hulcross	Formation
MS-25A	47.98	48	0.02	Fault	Possible	EB13-04	14.35	14.8	0.45	Basal Grit	Marker
MS-25A	48	174	126	Hulcross	Formation	EB13-08C	7.63	66	58.37	Hulcross	Formation
MS-25A	174	174.23	0.23	Basal Grit	Marker	EB13-08C	66	66.25	0.25	Basal Grit	Marker
EB59C	2.1	8	5.9	Hulcross	Formation	EB13-09C	1	68.99	67.99	Hulcross	Formation
EB59C	8	9.4	1.4	Basal Grit	Marker	EB13-09C	68.99	69	0.01	Basal Grit	Marker
EB62	5.3	11	5.7	Hulcross	Formation	EB13-10C	10.8	15.2	4.4	Hulcross	Formation
EB62	11	11.02	0.02	Fault	Possible	EB13-10C	15.2	15.22	0.02	Fault	Probable
EB62	11.02	40.75	29.73	Hulcross	Formation	EB13-10C	15.22	38.04	22.82	Hulcross	Formation
EB62	40.75	41.3	0.55	Basal Grit	Marker	EB13-10C	38.04	38.05	0.01	Basal Grit	Marker
EB65	5.35	20.6	20.25	Hulcross	Formation	MW-A	1.45	21.35	19.9	Hulcross	Formation
EB65	20.6	20.9	0.3	Basal Grit	Marker	MW-A	21.35	22	0.65	Basal Grit	Marker
EB07-03	8.85	26.95	18.1	Hulcross	Formation						

Fine-grained pyrite is locally-abundant within the Hulcross rocks, which are inferred to have been deposited beneath a stratified water column within a restricted-circulation seaway (Stelck and Leckie, 1988). Tuffaceous volcanic ash bands (colloquially termed as ‘ash bands’ or as ‘bentonites’ although their mineralogy may vary from that of typical bentonites) form laterally-extensive, readily-correlatable, distinctively light-weathering, locally popcorn-weathering, lithological and geophysical (high natural-gamma count rate) markers a few centimetres to a few decimetres thick (Kilby, 1985; Gibson, 1992b). Ash bands are of practical value in property-scale structural studies, as they aid the tracing of faults and folds through the Hulcross Formation. At least twenty ash-bands can be traced locally and regionally, of which six bands (from top down, designated as 20-ash, 16-ash, 12-ash, 8-ash, 5-ash, and 4-ash) are consistently-recognisable at EB Main (Cathyl-Huhn, 2014).

Coal is rarely present within the Hulcross Formation, as isolated bands of interbedded bright coal and rock, a few centimetres to a few decimetres thick. These coals lack a rooty underbed, and they are inferred to have originated as driftwood within the formation's shallow-marine setting. The maximum known thickness of Hulcross coal is 45 centimetres, in borehole EB07-03.

The Hulcross Formation is of Middle Albian age (Stelck and Leckie, 1988; Gibson, 1992b). The formation’s immediate base is marked by a thin (generally a few centimetres to decimetres, and rarely up to 1.4 metres thick) erosive-based bed of cherty pebbly sandstone or gritstone, locally informally termed the ‘Basal Grit marker’. Thicknesses of the Basal Grit marker in historic and current boreholes are presented above within **Table 4-2**.

4.2.4 Gates Formation (map-unit 5)

The Gates Formation comprises 220 to 230 metres of interbedded sandstone, siltstone, conglomerate, shale and coal at EB West, and a similar thickness is expected to occur within the core of the Spieker Syncline at EB Main. The Gates, as were the Boulder Creek and Hulcross formations, was formerly considered a member of the Commotion Formation (Stott, 1968), and that obsolete usage is evident in old coal assessment reports (*e.g.* Jordan and Dawson, 1978). At EB Main, and within the Sukunka-Quintette coalfield generally, the Gates Formation may be usefully subdivided into three members, in order from top down:

Notikewin Member, comprising 63 to 105 metres of interbedded, locally-glauconitic sandstone and siltstone, with minor conglomerate, carbonaceous mudstone and generally-thin coal;

Falher Member, comprising 75 to 85 metres of conglomerate, sandstone and generally-thick coal, with muddy siltstone, carbonaceous mudstone and silty mudstone; and

Torrens Member, comprising 45 to 55 metres of sandstone, with minor siltstone, and lacking coal.

Each of these members may in turn be further subdivided into informal or formal lithostratigraphic divisions (Leckie and Walker; 1982; Leckie, 1983; 1985; Caddel, 1999; Wadsworth and others, 2003; Caddel and Moslow, 2004), largely corresponding to changes in

the shoreline position of the Western Interior Seaway (Legun, 2006; 2007; 2008; 2009a). These finer subdivisions of the Gates Formation aid in the determination of the stratigraphic displacements of thrust-faults, and in the correct correlation of the formation's coal beds.

Details of the formation's subdivisions, as observed within the EB West coal property, are presented in Coal Assessment Report 938 (Cathyl-Huhn and Avery, 2014b). A detailed study of the internal stratigraphic geometry of the Gates Formation at EB Main is currently underway, in support of the distinction of erosive internal contacts from faulted internal contacts.

The Gates Formation is of late Early Albian age (Stott, 1982; Wan, 1996). The basal contact of the Gates Formation with the underlying Moosebar Formation is gradational by interbedding at both regional and local scale. Details of the three members of the Gates are presented below.

4.2.4.1 Notes concerning Gates Formation coals

Coals of the Gates Formation, and their enclosing sedimentary rocks, were deposited on the shoreline of the Western Interior Seaway between 108.7 and 111.0 million years ago, as part of an extensive complex of coastal plains, deltas and estuaries. Throughout the period of Gates Formation sedimentation, the shallow waters of the Western Interior Seaway generally lay a few kilometres to a few tens of kilometres northeast of EB Main, with the exception of a few isolated 'marine bands' associated with more substantial transgressions of the sea into and atop coal-forming coastal plain sediments. Such transgressions occasionally induced splitting within the Gates Formation coals (Wadsworth and others, 2003); splits were also occasionally induced by crevasse-splays from river channels, and perhaps also by drowning of coal-forming wetlands beneath lakes and ponds.

Within the EB Main coal property (Minnes, 2007; Lortie and Burton, 2012), numerous coal zones, each comprising one or more individually-recognisable coal beds, are present within the Gates Formation. Coal zones and coal beds are designated by an upward-progressing system of lettering, from the A zone near the base of the formation, to the P, Q and R zones near the top of the formation. This scheme of designation resembles the upward-progressing lettering used at Teck Corporation's nearby Bullmoose Mine (with the exception that coal zones P, Q and R are not recognised at Bullmoose), and is thus the ontological inverse of the downward-progressing lettering used at Walter Energy's Perry Creek Mine.

Coal zones A through E occur within the Falher Member of the Gates Formation, whereas coal zones P through R occur within the Notikewin Member of the Gates Formation. In some cases, laterally-persistent bed-scale subdivisions of the coal zones have been recognised. For example, the C and D coal zones of the Falher Member each contain a lithologically- and geophysically-distinctive medial rock parting, such that the CU and CL coal beds may be recognised within the C zone, and the DU and DL coal beds may be recognised within the D zone. The B coal zone may be similarly subdivided into the BU and BL coal beds, although in this case, the subdivision is based upon the presence of a persistent 'dirty'zone at the top of the BL coal bed, and less-persistent but still generally-noteworthy zone of elevated gamma-log response at the base of the overlying BU coal bed.

The presence and geometry of the Gates Formation coals at EB Main has been established mainly by historic and current drilling, supported by historic test-pitting (mostly in the late 1970s) and the driveage of six adits, as documented within historic coal-assessment reports.

Details of coal intersections within Gates Formation coal-measures, as drilled between year-2001 and year-2013, are presented in **Table 4-3**. This table is known to be incomplete, as not all minor coal beds of the Notikewin Member have yet been traced and correlated throughout the drilled area; nevertheless, the table does serve to indicate the thickness and frequency of drilled intersections of the thicker, potentially-workable, Falher Member coal beds within coal zones A through D.

4.2.4.2 Notikewin Member (map-unit 5c)

The Notikewin Member of the Gates Formation comprises 63 to 105 metres of siltstone and sandstone with minor conglomerate, variably-carbonaceous, locally root-bearing mudstone, and thin coal beds. Overall, the Notikewin is finer-grained than the underlying Falher Member of the Gates Formation (Leckie and Walker, 1982), and it tends to be more recessive-weathering than the Falher, although the Notikewin's basal sandstone/ conglomerate division locally forms a cliff band in hillside exposures.

Leckie (1985; 1989) has recognised four lithostratigraphic divisions within the Notikewin Member, of the which the uppermost division (Leckie's Facies D of the Notikewin) is most significant in that it locally contains coal of potentially-mineable thickness (within the Q coal zone, comprising the closely-adjacent Q and overlying QR coal beds).

The Notikewin Member within the Mt. Spieker area (including the EB Main property) also contains a lithologically- and geophysically-distinctive mollusc-shell reef deposit (here designated as the 'Blue marker', a mud-matrix bioherm comprising closely-packed shells of *Ostrea* and other molluscs), readily recognised in core by the presence of shell-fossils, and in geophysical logs by its anomalously-high gamma-ray log response. The Blue marker is of principal utility as a readily-distinguishable stratigraphic marker, rendering possible the recognition of thrust-faults by means of the Blue marker's locally- repeated intersections. **Table 4-4** presents details of drilled intersections of the Blue marker, and its locally-associated faults, within the EB Main coal property. The basal contact of the Notikewin Member atop the underlying Falher Member is abrupt to erosional, almost always marked by a few centimetres to decimetres of pebbly gritstone to pebble-conglomerate.

4.2.4.3 Falher Member (map-unit 5b)

The Falher Member of the Gates Formation comprises 75 to 85 m of conglomerate, sandstone and coal, accompanied by lesser proportions of muddy siltstone, carbonaceous mudstone and silty mudstone. On a regional basis, Falher coals are well-known to be generally thicker than are the coals of the Notikewin Member (Cathyl-Huhn and Avery, 2014b), and this is certainly also the case within the EB Main coal property.

Table 4-3: Drilled intersections of Gates coals within current and historic boreholes

Borehole	metres			Attributes	
	From	To	Thickness	Name	Lithology
EB(MS)-1	7.38	8.14	0.76	Q	Coal
EB(MS)-1	83.74	84.62	0.88	DU	Coal
EB(MS)-1	85.32	87.17	1.85	DL	Coal
EB(MS)-1	103.02	104.85	1.83	CU	Coal
EB(MS)-1	106.07	106.68	0.61	CL	Coal
EB(MS)-1	124.36	126.49	2.13	C2L	Coal
EB(MS)-1	138.379	141.73	3.351	BU	Coal
EB(MS)-1	141.73	148.72	6.99	BL	Coal
EB(MS)-1	161.54	162.46	0.92	A	Coal
EB(MS)-5	41.39	42.35	0.96	DU	Coal
EB(MS)-5	42.6	43.7	1.1	DL	Coal
EB(MS)-5	45	46.21	1.21	DL	Coal
EB(MS)-5	65.4	67.55	2.15	CU	Coal
EB(MS)-5	68	69.9	1.9	CL	Coal
EB(MS)-5	81.4	82.05	0.65	C2U	Dirty Coal
EB(MS)-5	87.25	88.73	1.48	C2L	Dirty Coal
EB(MS)-5	115.7	117.3	1.6	BU	Coal
EB(MS)-5	118.4	120.7	2.3	BL	Coal
EB(MS)-5	136.73	138.53	1.8	A	Coal
EB(MS)-6	17.34	17.76	0.42	DU	Coal
EB(MS)-6	17.98	18.44	0.46	DL	Coal

Borehole	metres			Attributes	
	From	To	Thickness	Name	Lithology
EB07-04C	63.3	63.45	0.15	C2U	Coal
EB07-04C	63.45	63.6	0.15	C2L	Coal
EB07-04C	82.8	83.6	0.8	BU1	Coal
EB07-04C	84.1	87	2.9	BU2	Coal
EB07-04C	87	90	3	BL	Coal
EB07-04C	105.9	107.05	1.15	A	Coal
EB07-07	45.47	46.5	1.03	DU	Coal
EB07-07	47	48.79	1.79	DL	Coal
EB07-07	67.15	67.5	0.35	CU	Coal
EB07-07	68.1	69	0.9	CU	Coal
EB07-07	69.5	69.85	0.35	CL	Coal
EB07-07	70.1	71.4	1.3	CL	Coal
EB07-07	97.15	97.395	0.245	C2U	Coal
EB07-07	97.395	97.64	0.245	C2L	Coal
EB07-07	118	120.3	2.3	BU	Coal
EB07-07	120.3	123.38	3.08	BL	Coal
EB07-08B	8	8.6	0.6	R	Coal
EB07-08B	13.6	14	0.4	Q	Coal
EB07-08B	98.11	99.1	0.99	DU	Coal
EB07-08B	99.4	101.9	2.5	DL	Coal
EB07-08B	118.3	118.6	0.3	CU	Coal

Table 4-3: Drilled intersections of Gates coals within current and historic boreholes (continued)

Borehole	metres			Attributes	
	From	To	Thickness	Name	Lithology
EB(MS)-6	18.89	20.78	1.89	CU	Coal
EB(MS)-6	26.06	26.9	0.84	CU	Coal
EB(MS)-6	27.12	27.85	0.73	CL	Coal
EB(MS)-6	31.48	31.925	0.445	C2U	Coal
EB(MS)-6	31.925	32.37	0.445	C2L	Coal
EB(MS)-6	40.84	41.51	0.67	BU	Coal
EB(MS)-6	41.51	42.52	1.01	BL	Coal
EB(MS)-6	46.39	46.96	0.57	A	Coal
EB(MS)-9	26.4	27.5	1.1	DU	Coal
EB(MS)-9	28.5	30	1.5	DL	Coal
EB(MS)-9	45.22	46.72	1.5	CU	Coal
EB(MS)-9	48.06	49.56	1.5	CL	Coal
EB(MS)-9	65	65.4	0.4	C2U	Coal
EB(MS)-9	65.4	65.8	0.4	C2L	Coal
EB(MS)-9	86.26	87.51	1.25	BU	Coal
EB(MS)-9	88.08	90.58	2.5	BL	Coal
EB(MS)-9	104.18	105.58	1.4	A	Coal
EB(MS)-9	122.44	127.12	4.68	A	Coal
EB(MS)-13	74.9	75.3	0.4	Q	Coal
EB(MS)-13	81.55	82.8	1.25	P	Coal
EB(MS)-13	187.12	187.87	0.75	DU	Coal
EB(MS)-13	189.09	190.84	1.75	DL	Coal

Borehole	metres			Attributes	
	From	To	Thickness	Name	Lithology
EB07-08B	119.45	120.1	0.65	CU	Coal
EB07-08B	120.65	120.95	0.3	CL	Coal
EB07-08B	121.2	121.9	0.7	CL	Coal
EB07-08B	140	140.3	0.3	C2U	Coal
EB07-08B	140.3	140.6	0.3	C2L	Coal
EB07-09	31.8	32.15	0.35	R	Dirty Coal
EB07-09	37.7	37.9	0.2	Q	Dirty Coal
EB07-09	127.1	128.2	1.1	DL	Coal
EB07-09	128.75	130.29	1.54	DU	Coal
EB07-09	147.7	148.2	0.5	CU	Coal
EB07-09	148.6	149.7	1.1	CU	Coal
EB07-09	150	150.2	0.2	CL	Coal
EB07-09	150.6	151.69	1.09	CL	Coal
EB07-09	167.9	168.28	0.38	C2U	Coal
EB07-09	168.28	168.66	0.38	C2L	Coal
EB07-09	183.06	183.7	0.64	BU1	Coal
EB07-09	184.15	185.6	1.45	BU2	Coal
EB07-09	185.6	188	2.4	BL	Coal
EB07-09	202.62	203.58	0.96	A	Coal
EB07-10	87.7	89	1.3	DU	Coal
EB07-10	89.2	89.65	0.45	DU	Coal
EB07-10	90.06	90.8	0.74	DL	Coal

Table 4-3: Drilled intersections of Gates coals within current and historic boreholes (continued)

Borehole	metres			Attributes	
	From	To	Thickness	Name	Lithology
EB(MS)-13	206.16	207.68	1.52	CU	Coal
EB(MS)-13	208.94	209.94	1	CL	Coal
EB(MS)-13	227.9	228.28	0.38	C2U	Coal
EB(MS)-13	228.28	228.62	0.34	C2L	Coal
EB(MS)-13	247.88	250.5	2.62	BU	Coal
EB(MS)-13	250.5	255.62	5.12	BL	Coal
EB(MS)-13	270.64	271.8	1.16	A	Coal
MS-16	159.72	160.05	0.33	R	Coal
MS-16	171.7	172	0.3	Q	Coal
MS-16	180.4	181	0.6	P	Coal
MS-16	246.4	247.38	0.98	DU	Coal
MS-16	248.08	249.93	1.85	DL	Coal
MS-16	264.8	266	1.2	CU	Coal
MS-16	266.4	268	1.6	CL	Coal
MS-16	285	285.2	0.2	C2U	Coal
MS-16	286.2	286.4	0.2	C2L	Coal
MS-16	305.4	306.89	1.49	BU	Coal
MS-16	306.89	310.39	3.5	BL	Coal
MS-16	321.27	322.6	1.33	A	Coal
MS-17	71.65	72.65	1	DU	Coal
MS-17	73.35	75.2	1.85	DL	Coal

Borehole	metres			Attributes	
	From	To	Thickness	Name	Lithology
EB07-10	105.4	106.6	1.2	CU	Coal
EB07-10	106.6	109.3	2.7	CL	Coal
EB07-10	132	132.3	0.3	C2U	Coal
EB07-10	133.7	134	0.3	C2U	Coal
EB07-10	134	134.5	0.5	C2L	Coal
EB07-10	134.7	135.4	0.7	C2L	Coal
EB07-10	171.72	173.8	2.08	BU	Coal
EB07-10	173.8	176.41	2.61	BL	Coal
EB07-10	191.51	192.61	1.1	A	Coal
EB07-11	8.53	10.79	2.26	CU	Coal
EB07-11	11.29	11.7	0.41	CL	Coal
EB07-11	12.05	13.95	1.9	CL	Coal
EB07-11	29.4	29.625	0.225	C2U	Coal
EB07-11	29.625	29.85	0.225	C2L	Coal
EB07-11	50.7	52	1.3	BU	Coal
EB07-11	52	54.8	2.8	BL	Coal
EB07-12	19.95	21	1.05	DU	Coal
EB07-12	21.8	23.57	1.77	DL	Coal
EB07-12	48.49	49	0.51	CU	Coal
EB07-12	49	51	2	CU	Coal
EB07-12	51.85	53.2	1.35	CL	Coal

Table 4-3: Drilled intersections of Gates coals within current and historic boreholes (continued)

Borehole	metres			Attributes	
	From	To	Thickness	Name	Lithology
MS-17	92.75	93.15	0.4	CU	Coal
MS-17	93.55	94.55	1	CL	Coal
MS-17	113.4	114	0.6	C2U	Coal
MS-17	114	114.75	0.75	C2L	Coal
MS-17	131.5	132.5	1	BU	Coal
MS-17	132.5	135.8	3.3	BL	Coal
MS-17	150.55	151.45	0.9	A	Coal
MS-18	62.9	63.3	0.4	R	Coal
MS-18	68.95	69.4	0.45	Q	Coal
MS-18	147.3	148.55	1.25	DU	Coal
MS-18	149.25	151.63	2.38	DU	Coal
MS-18	161.45	165.3	3.85	DL	Coal
MS-18	184.7	186.4	1.7	CU	Coal
MS-18	187	188.7	1.7	CL	Coal
MS-18	206	207	1	C2U	Coal
MS-18	207	208	1	C2L	Coal
MS-18	223.15	226.15	3	BU	Coal
MS-18	226.15	229.12	2.97	BL	Coal
MS-19	62.22	63.25	1.03	DU	Coal
MS-19	63.95	65.8	1.85	DL	Coal
MS-19	83.8	84.5	0.7	CU	Coal

Borehole	metres			Attributes	
	From	To	Thickness	Name	Lithology
EB07-12	53.8	55.36	1.56	CL	Coal
EB07-12	72.7	73	0.3	C2U	Coal
EB07-12	73	73.3	0.3	C2L	Coal
EB07-12	93.05	93.7	0.65	BU1	Coal
EB07-12	94.4	96	1.6	BU2	Coal
EB07-12	96	98.39	2.39	BL	Coal
EB07-12	113.2	114.55	1.35	A	Coal
EB07-13	40.29	41.56	1.27	DU	Coal
EB07-13	42.22	43.57	1.35	DL	Coal
EB07-13	59	59.61	0.61	CU	Coal
EB07-13	60	61	1	CU	Coal
EB07-13	61.61	62	0.39	CL	Coal
EB07-13	62.2	62.8	0.6	CL	Coal
EB07-13	78.15	78.415	0.265	C2U	Coal
EB07-13	78.415	78.68	0.265	C2L	Coal
EB07-13	104.25	104.9	0.65	BU1	Coal
EB07-13	105.4	106.8	1.4	BU2	Coal
EB07-13	106.8	109.32	2.52	BL	Coal
EB07-13	124.89	126.44	1.55	AU	Coal
EB07-13	141	142.4	1.4	A	Coal
EB07-14	53.15	54	0.85	DU	Coal

Table 4-3: Drilled intersections of Gates coals within current and historic boreholes (continued)

Borehole	metres			Attributes	
	From	To	Thickness	Name	Lithology
MS-19	85	87	2	CL	Coal
MS-19	110	110.5	0.5	C2U	Coal
MS-19	110.5	111	0.5	C2L	Coal
MS-19	128.5	129.2	0.7	BU	Coal
MS-19	129.8	131.5	1.7	BU	Coal
MS-19	131.5	134.3	2.8	BL	Coal
MS-19	151.9	153.05	1.15	A	Coal
MS-20A	36.2	37.6	1.4	BU	Coal
MS-20A	37.6	39	1.4	BL	Coal
MS-20A	51	52	1	A	Coal
MS-21	22.8	23.6	0.8	DU	Coal
MS-21	24.5	25.5	1	DL	Coal
MS-21	44	45	1	CU	Coal
MS-21	45.5	46.75	1.25	CL	Coal
MS-21	64.2	64.6	0.4	C2U	Coal
MS-21	64.6	65	0.4	C2L	Coal
MS-21	84.2	85.2	1	BU	Coal
MS-21	86	88	2	BL	Coal
MS-21	101.25	102.25	1	A	Coal
MS-22	218.2	218.9	0.7	R	Coal
MS-22	232.5	233	0.5	Q	Coal

Borehole	metres			Attributes	
	From	To	Thickness	Name	Lithology
EB07-14	54.8	56.4	1.6	DL	Coal
EB07-14	72.46	73	0.54	CU	Coal
EB07-14	73.4	73.5	0.1	CU	Coal
EB07-14	73.9	76.51	2.61	CL	Coal
EB07-14	92.12	92.71	0.59	C2U	Coal
EB07-14	92.71	93.3	0.59	C2L	Coal
EB07-14	112.32	112.8	0.48	BU1	Coal
EB07-14	113.5	115.2	1.7	BU2	Coal
EB07-14	115.2	117.6	2.4	BL	Coal
EB07-14	131.33	132.8	1.47	A	Coal
EB07-15	32.1	33	0.9	DU	Coal
EB07-15	33.75	35.38	1.63	DL	Coal
EB07-15	51.19	51.5	0.31	CU	Coal
EB07-15	52.1	53.1	1	CU	Coal
EB07-15	53.5	55.11	1.61	CL	Coal
EB07-15	71.51	72.03	0.52	C2U	Coal
EB07-15	72.03	72.55	0.52	C2L	Coal
EB07-15	90.7	91.2	0.5	BU1	Coal
EB07-15	91.65	94	2.35	BU2	Coal
EB07-15	94	96.57	2.57	BL	Coal
EB07-15	110.48	111.79	1.31	A	Coal

Table 4-3: Drilled intersections of Gates coals within current and historic boreholes (continued)

Borehole	metres			Attributes	
	From	To	Thickness	Name	Lithology
MS-22	241	241.6	0.6	P	Coal
MS-22	341.65	343.14	1.49	DU	Coal
MS-22	343.93	344.34	0.41	DL	Coal
MS-22	360.4	362.4	2	CU	Coal
MS-22	362.4	364.4	2	CL	Coal
MS-22	382.1	383.1	1	C2U	Coal
MS-22	384	384.5	0.5	C2L	Coal
MS-22	400.5	403.5	3	BU	Coal
MS-22	403.5	406.95	3.45	BL	Coal
MS-22	425.08	425.78	0.7	A	Coal
MS-23	47	48	1	BU	Coal
MS-23	48	49.4	1.4	BL	Coal
MS-23	62.5	63.9	1.4	A	Coal
MS-24	34.05	35.4	1.35	BU	Coal
MS-24	35.4	36.35	0.95	BL	Coal
MS-24	48.72	49.8	1.08	A	Coal
MS-25A	174.53	174.95	0.45	R	Coal
MS-25A	186.3	186.8	0.5	Q	Coal
MS-25A	282.25	283.67	1.42	DU	Coal
MS-25A	284.3	286.4	2.1	DL	Coal
MS-25A	299.7	300.55	0.85	CU	Coal

Borehole	metres			Attributes	
	From	To	Thickness	Name	Lithology
EB07-16C	28.39	29	0.61	DU	Coal
EB07-16C	29.2	29.4	0.2	DU	Coal
EB07-16C	29.6	30	0.4	DU	Coal
EB07-16C	30.67	32.19	1.52	DL	Coal
EB07-16C	52.83	54.78	1.95	CU	Coal
EB07-16C	55.28	56.8	1.52	CL	Coal
EB07-16C	75.5	75.925	0.425	C2U	Coal
EB07-16C	75.925	76.35	0.425	C2L	Coal
EB07-16C	120.64	123.1	2.46	BU	Coal
EB07-16C	123.1	126.2	3.1	BL	Coal
EB07-16C	140.22	141.46	1.24	A	Coal
EB07-17	79.72	80.7	0.98	DU	Coal
EB07-17	81.65	83.29	1.64	DL	Coal
EB07-17	98.18	100.25	2.07	CU	Coal
EB07-17	100.6	102.15	1.55	CL	Coal
EB07-17	117.35	117.55	0.2	C2U	Coal
EB07-17	117.55	117.75	0.2	C2L	Coal
EB07-17	141.72	143.5	1.78	BU1	Coal
EB07-17	144.1	145.7	1.6	BU2	Coal
EB07-17	145.7	148.62	2.92	BL	Coal
EB07-17	162.45	163.7	1.25	A	Coal

Table 4-3: Drilled intersections of Gates coals within current and historic boreholes (continued)

Borehole	metres			Attributes	
	From	To	Thickness	Name	Lithology
MS-25A	300.55	301.3	0.75	CL	Coal
MS-25A	316	316.5	0.5	C2U	Coal
MS-25A	316.5	317	0.5	C2L	Coal
MS-25A	341.4	342	0.6	C2U	Coal
MS-25A	342	343	1	C2L	Coal
MS-25A	354.62	356	1.38	BU	Coal
MS-25A	356	358.41	2.41	BL	Coal
MS-25A	374.65	375.7	1.05	A	Coal
MS-26	28.35	29.25	0.9	BU	Coal
MS-26	29.25	30.15	0.9	BL	Coal
MS-26	41.96	43.02	1.06	A	Coal
MS-34	12.32	13.47	1.15	DU	Coal
MS-34	13.67	15.52	1.85	DL	Coal
MS-34	31.12	33.22	2.1	CU	Coal
MS-34	33.63	35.63	2	CL	Coal
MS-34	52.38	52.68	0.3	C2U	Coal
MS-34	52.68	52.98	0.3	C2L	Coal
MS-34	72.59	73.98	1.39	BU	Coal
MS-34	73.98	76.73	2.75	BL	Coal
MS-34	90	91.34	1.34	A	Coal
MS-35	19.67	20	0.33	C2U	Coal
MS-35	20	20.33	0.33	C2L	Coal

Borehole	metres			Attributes	
	From	To	Thickness	Name	Lithology
EB07-19	20.25	20.6	0.35	BU1	Coal
EB07-19	21.1	22.3	1.2	BU2	Coal
EB07-19	22.3	23.91	1.61	BL	Coal
EB07-19	37.53	39.09	1.56	A	Coal
EB07-20	17.6	18.2	0.6	CU	Coal
EB07-20	18.4	19.7	1.3	CU	Coal
EB07-20	20.3	21.5	1.2	CL	Coal
EB07-20	35.5	35.85	0.35	C2U	Coal
EB07-20	35.85	36.2	0.35	C2L	Coal
EB07-20	59.35	59.95	0.6	BU1	Coal
EB07-20	60.35	61.4	1.05	BU2	Coal
EB07-20	61.4	64.08	2.68	BL	Coal
EB07-20	81.55	83.27	1.72	A	Coal
EB07-21	13.6	15.5	1.9	CU	Coal
EB07-21	16.1	17.75	1.65	CL	Coal
EB07-21	32.99	33.52	0.53	C2U	Coal
EB07-21	33.52	33.9	0.38	C2L	Coal
EB07-21	54.81	55.2	0.39	BU1	Coal
EB07-21	56.3	57.3	1	BU2	Coal
EB07-21	57.3	59.85	2.55	BL	Coal
EB07-21	72.4	73.76	1.36	A	Coal
EB07-22	23.76	26.2	2.44	BU	Coal

Table 4-3: Drilled intersections of Gates coals within current and historic boreholes (continued)

Borehole	metres			Attributes	
	From	To	Thickness	Name	Lithology
MS-35	41.8	44.24	2.44	BU	Coal
MS-35	44.24	46.68	2.44	BL	Coal
MS-35	61.4	63.05	1.65	A	Coal
MS-36	11.61	13.39	1.78	DU	Coal
MS-36	13.63	15.48	1.85	DL	Coal
MS-36	30.9	32.78	1.88	CU	Coal
MS-36	32.99	34.94	1.95	CL	Coal
MS-36	49.98	50.225	0.245	C2U	Coal
MS-36	50.225	50.47	0.245	C2L	Coal
MS-36	72.65	75.39	2.74	BU	Coal
MS-36	75.39	78.13	2.74	BL	Coal
MS-36	93.09	94.47	1.38	A	Coal
MS-37	28.51	29.41	0.9	DU	Coal
MS-37	30.11	31.96	1.85	DL	Coal
MS-37	58.06	60.36	2.3	CU	Coal
MS-37	60.36	63.11	2.75	CL	Coal
MS-37	79.41	80.14	0.73	C2U	Coal
MS-37	80.14	80.87	0.73	C2L	Coal
MS-37	101.45	104.255	2.805	BU	Coal
MS-37	104.255	107.06	2.805	BL	Coal
MS-37	122.54	123.78	1.24	A	Coal
MS-38	32.08	33.88	1.8	DU	Coal

Borehole	metres			Attributes	
	From	To	Thickness	Name	Lithology
EB07-22	26.2	28.8	2.6	BL	Coal
EB07-22	42.05	43.54	1.49	A	Coal
EB07-22C	24.2	25	0.8	BUR	Coal
EB07-22C	26.1	26.95	0.85	BLR	Coal
EB07-22C	28	29.4	1.4	BU	Coal
EB07-22C	29.4	32.3	2.9	BL	Coal
EB07-22C	46.4	47.76	1.36	A	Coal
EB07-23	16	18.2	2.2	DU	Coal
EB07-23	18.65	20.5	1.85	DL	Coal
EB07-23	36.22	36.7	0.48	CU	Coal
EB07-23	37	38.2	1.2	CU	Coal
EB07-23	38.7	40.3	1.6	CL	Coal
EB07-23	54.85	55.25	0.4	C2U	Coal
EB07-23	55.45	56	0.55	C2L	Coal
EB07-23	77.54	80.05	2.51	BU	Coal
EB07-23	80.05	82.82	2.77	BL	Coal
EB07-23	96.82	98.42	1.6	A	Coal
EB07-24	37.1	38.4	1.3	DU	Coal
EB07-24	39	40.59	1.59	DL	Coal
EB07-24	57.8	59.4	1.6	CU	Coal
EB07-24	59.9	61.42	1.52	CL	Coal
EB07-24	73.45	74.2	0.75	C2U	Coal

Table 4-3: Drilled intersections of Gates coals within current and historic boreholes (continued)

Borehole	metres			Attributes	
	From	To	Thickness	Name	Lithology
MS-38	34.24	36.88	2.64	DL	Coal
MS-38	53.94	55.24	1.3	CU	Coal
MS-38	55.42	57.06	1.64	CL	Coal
MS-38	93.57	95.97	2.4	BU	Coal
MS-38	95.97	98.37	2.4	BL	Coal
MS-38	111.8	113.2	1.4	A	Coal
MS-40	16.15	17.98	1.83	CU	Coal
MS-40	18.19	19.69	1.5	CL	Coal
MS-40	55.31	56.47	1.16	BU	Coal
MS-40	56.47	58.47	2	BL	Coal
EB50	17.8	18.6	0.8	CU	Coal
MS-40	71	72	1	A	Coal
EB45	8.15	9.45	1.3	DU	Coal
EB45	10	11.95	1.95	DL	Coal
EB45	30.1	30.4	0.3	CU	Coal
EB45	31.3	32.2	0.9	CU	Coal
EB45	32.4	33	0.6	CL	Coal
EB45	33.2	33.9	0.7	CL	Coal
EB45	53.2	54.1	0.9	C2U	Coal
EB45	54.1	55	0.9	C2L	Coal
EB45	78.6	79.5	0.9	BU	Coal

Borehole	metres			Attributes	
	From	To	Thickness	Name	Lithology
EB07-24	74.55	75	0.45	C2L	Coal
EB07-24	96.85	99.2	2.35	BU	Coal
EB07-24	99.2	102.29	3.09	BL	Coal
EB07-24	115.66	117	1.34	A	Coal
EB07-26	15.54	17	1.46	A	Coal
EB07-27	19.85	22.3	2.45	BU	Coal
EB07-27	22.3	25.28	2.98	BL	Coal
EB07-27	39.79	41.24	1.45	A	Coal
EB08-01	27.05	27.25	0.2	C2U	Coal
EB08-01	27.25	27.41	0.16	C2L	Coal
EB08-07	11.75	12.15	0.4	QR	Coal
EB08-01	47.32	49.5	2.18	BU	Coal
EB08-01	49.5	52.6	3.1	BL	Coal
EB08-01	65.85	66.78	0.93	A	Coal
EB08-03	4.57	6.4	1.83	DU	Coal
EB08-03	6.8	8.15	1.35	DL	Coal
EB08-03	24.4	25.75	1.35	CU	Coal
EB08-03	26.2	27.4	1.2	CL	Coal
EB08-03	37.65	38.15	0.5	C2U	Coal
EB08-03	40.6	41	0.4	C2L	Coal
EB08-03	64.4	66.3	1.9	BU	Coal

Table 4-3: Drilled intersections of Gates coals within current and historic boreholes (continued)

Borehole	metres			Attributes	
	From	To	Thickness	Name	Lithology
EB45	80.3	82.6	2.3	BL	Coal
EB45	95.4	96.85	1.45	A	Coal
EB47	4.1	4.6	0.5	BU	Coal
EB47	4.6	6.3	1.7	BL	Coal
EB47	23.8	25.6	1.8	A	Coal
EB48	32.45	33.6	1.15	DU	Coal
EB48	34.3	36.15	1.85	DL	Coal
EB48	58.6	60.575	1.975	CU	Coal
EB48	60.575	62.55	1.975	CL	Coal
EB48	78.85	79.15	0.3	C2U	Coal
EB48	79.35	79.8	0.45	C2L	Coal
EB48	80.2	80.45	0.25	C2L	Coal
EB48	98.05	103.5	5.45	BU	Coal
EB48	103.5	107.2	3.7	BL	Coal
EB48	122.6	123.8	1.2	A	Coal
EB49	3.75	5.2	1.45	BU	Coal
EB49	5.2	6.65	1.45	BL	Coal
EB49	23.45	24.85	1.4	A	Coal
EB50	17	17.5	0.5	CU	Coal
EB50	19.5	19.95	0.45	CL	Coal
EB50	20.1	20.85	0.75	CL	Coal
EB08-03	66.3	69.12	2.82	BL	Coal
EB08-03	80.25	81.2	0.95	A	Coal
EB08-05	49.06	50.06	1	DU	Coal
EB08-05	50.42	51.86	1.44	DL	Coal
EB08-05	66.97	68.17	1.2	CU	Coal
EB08-05	68.56	69.86	1.3	CL	Coal
EB08-05	81.68	82	0.32	C2U	Coal
EB08-05	82.22	82.6	0.38	C2L	Coal
EB08-05	109.6	111	1.4	BU	Coal
EB08-05	111	112.61	1.61	BL	Coal
EB08-05	122.28	123.53	1.25	A	Coal
EB08-06	7.5	8.3	0.8	DU	Coal
EB08-06	9.3	10.7	1.4	DL	Coal
EB08-06	26	27.2	1.2	CU	Coal
EB08-06	27.6	28.75	1.15	CL	Coal
EB08-06	40.95	41.3	0.35	C2U	Coal
EB08-06	42.45	43.1	0.65	C2L	Coal
EB08-06	68	70	2	BU	Coal
EB08-06	70	72.05	2.05	BL	Coal
EB08-07	12.9	13.6	0.7	Q	Coal
EB08-07	25.8	26	0.2	P	Dirty Coal

Table 4-3: Drilled intersections of Gates coals within current and historic boreholes (continued)

Borehole	metres			Attributes	
	From	To	Thickness	Name	Lithology
EB50	35.89	36.45	0.56	C2U	Coal
EB50	36.8	37.1	0.3	C2L	Coal
EB50	43.38	44.12	0.74	BU	Coal
EB50	44.12	44.8	0.68	BL	Coal
EB51	20.5	21.1	0.6	BU	Coal
EB51	21.65	23.1	1.45	BU	Coal
EB51	23.1	25.2	2.1	BL	Coal
EB51	38.3	42	3.7	A	Coal
EB52	12.2	13.5	1.3	DU	Coal
EB52	14	15.5	1.5	DL	Coal
EB52	33.4	33.6	0.2	CU	Coal
EB52	34.6	35.3	0.7	CU	Coal
EB52	35.8	37.3	1.5	CL	Coal
EB52	72.4	73.1	0.7	BU	Coal
EB52	74.3	79.7	5.4	BL	Coal
EB52	92.65	93.9	1.25	A	Coal
EB53	6.7	7.2	0.5	Q	Coal
EB53	79	80.5	1.5	DU	Coal
EB53	80.5	82.75	2.25	DL	Coal
EB53	99	99.2	0.2	CU	Coal
EB53	100	100.7	0.7	CU	Coal

Borehole	metres			Attributes	
	From	To	Thickness	Name	Lithology
EB08-07	88.14	89.15	1.01	DU	Coal
EB08-07	89.28	90.25	0.97	DU	Coal
EB08-07	90.4	90.85	0.45	DU	Coal
EB08-07	91.2	92.7	1.5	DL	Coal
EB08-07	107.9	108.15	0.25	CU	Dirty Coal
EB08-07	108.4	109.25	0.85	CU	Coal
EB08-07	109.6	111	1.4	CL	Coal
EB08-07	124.6	124.93	0.33	C2L	Dirty Coal
EB08-07	149.35	150.85	1.5	BU	Coal
EB08-07	151.85	152.85	1	BU	Coal
EB08-07	155.43	155.95	0.52	BU	Coal
EB08-07	156.3	159.7	3.4	BL	Coal
EB08-07	168.95	170.22	1.27	A	Coal
EB08-08	16.67	18	1.33	CU	Coal
EB08-08	18.36	19.72	1.36	CL	Coal
EB08-08	34.14	34.43	0.29	C2U	Coal
EB08-08	34.43	34.72	0.29	C2L	Coal
EB08-08	67.31	70.8	3.49	BU	Coal
EB08-08	70.8	71.5	0.7	BL	Coal
EB08-08	80.11	81.33	1.22	A	Coal
EB08-09	16	17.3	1.3	DU	Coal

Table 4-3: Drilled intersections of Gates coals within current and historic boreholes (continued)

Borehole	metres			Attributes	
	From	To	Thickness	Name	Lithology
EB53	101.2	101.7	0.5	CL	Coal
EB53	101.8	102.5	0.7	CL	Coal
EB53	118	118.525	0.525	C2U	Coal
EB53	118.525	119.05	0.525	C2L	Coal
EB53	138.65	138.9	0.25	BU	Coal
EB53	139	141	2	BU	Coal
EB53	142	144.05	2.05	BL	Coal
EB54	72.75	74.2	1.45	DU	Coal
EB54	74.6	76.1	1.5	DL	Coal
EB54	91.3	91.9	0.6	CU	Coal
EB54	92.15	93.3	1.15	CU	Coal
EB54	93.75	95.1	1.35	CL	Coal
EB54	113.05	113.42	0.37	C2U	Coal
EB54	113.6	114.4	0.8	C2L	Coal
EB54	118.4	119.35	0.95	C2U	Coal
EB54	119.55	120	0.45	C2L	Coal
EB54	120.25	120.45	0.2	C2L	Coal
EB55	76.5	77.8	1.3	DU	Coal
EB55	78.2	79.7	1.5	DL	Coal
EB55	96.4	96.6	0.2	CU	Coal
EB55	97.1	98.2	1.1	CU	Coal

Borehole	metres			Attributes	
	From	To	Thickness	Name	Lithology
EB08-09	17.6	19.2	1.6	DL	Coal
EB08-09	33.6	34.9	1.3	CU	Coal
EB08-09	35.2	36	0.8	CL	Coal
EB08-09	67.4	67.55	0.15	C2U	Coal
EB08-09	67.9	68.15	0.25	C2L	Coal
EB08-09	89.75	93.1	3.35	BU	Coal
EB08-09	93.1	95.3	2.2	BL	Coal
EB08-09	103.9	104.8	0.9	A	Coal
EB08-10	5.8	5.9	0.1	C2U	Coal
EB08-10	6.1	6.35	0.25	C2L	Coal
EB08-10	28.8	30.3	1.5	BU	Coal
EB08-10	30.65	32.9	2.25	BL	Coal
EB08-10	40.9	41.8	0.9	A	Coal
EB08-11	37.45	38.71	1.26	DU	Coal
EB08-11	39.08	40.58	1.5	DL	Coal
EB08-11	54.2	55.42	1.22	CU	Coal
EB08-11	55.88	57.25	1.37	CL	Coal
EB08-11	71.1	71.4	0.3	C2U	Coal
EB08-11	71.4	71.85	0.45	C2L	Coal
EB08-11	90.3	90.8	0.5	C2U	Coal
EB08-11	90.8	91.1	0.3	C2L	Coal

Table 4-3: Drilled intersections of Gates coals within current and historic boreholes (continued)

Borehole	metres			Attributes	
	From	To	Thickness	Name	Lithology
EB55	98.6	99.9	1.3	CL	Coal
EB55	124	124.4	0.4	BU	Coal
EB55	124.6	125.7	1.1	BU	Coal
EB55	126.3	127.3	1	BL	Coal
EB55	127.7	129.4	1.7	BL	Coal
EB55	146.7	147.6	0.9	A	Coal
EB55	148	148.5	0.5	A	Coal
EB58C	65.6	66.65	1.05	DU	Coal
EB58C	66.9	67.8	0.9	DL	Coal
EB58C	83.5	83.7	0.2	CU	Coal
EB58C	84	84.2	0.2	CU	Coal
EB58C	84.4	85.2	0.8	CU	Coal
EB58C	85.5	86.9	1.4	CL	Coal
EB58C	102.2	103	0.8	C2U	Coal
EB58C	105.4	105.7	0.3	C2L	Coal
EB58C	123.7	125.7	2	BU	Coal
EB58C	126.1	130	3.9	BL	Coal
EB59C	89.65	90.8	1.15	DU	Coal
EB59C	91	92.65	1.65	DL	Coal
EB59C	110.65	111.15	0.5	CU	Coal
EB59C	111.15	112.55	1.4	CU	Coal

Borehole	metres			Attributes	
	From	To	Thickness	Name	Lithology
EB08-12	8	8.65	0.65	CU	Coal
EB08-12	9	10.5	1.5	CL	Coal
EB08-12	24.8	25	0.2	C2U	Coal
EB08-12	25.1	25.55	0.45	C2L	Coal
EB08-12	48	50.1	2.1	BU	Coal
EB08-12	50.3	52.55	2.25	BL	Coal
EB08-12	60.5	61.4	0.9	A	Coal
EB08-13	10.4	11.9	1.5	DU	Coal
EB08-13	12.4	14.2	1.8	DL	Coal
EB08-13	30	31.1	1.1	CU	Coal
EB08-13	31.6	32.9	1.3	CL	Coal
EB08-13	48.42	48.8	0.38	C2U	Coal
EB08-13	48.8	49.25	0.45	C2L	Coal
EB08-13	69.75	72.1	2.35	BU	Coal
EB08-13	72.3	74.8	2.5	BL	Coal
EB08-13	88.85	89.85	1	A	Coal
EB11-01C	40.92	42.19	1.27	DU	Coal
EB11-01C	42.53	44.22	1.69	DL	Coal
EB11-01C	60.69	61.92	1.23	CU	Coal
EB11-01C	62.22	63.83	1.61	CL	Coal
EB11-01C	78.94	79.205	0.265	C2U	Coal

Table 4-3: Drilled intersections of Gates coals within current and historic boreholes (continued)

Borehole	metres			Attributes	
	From	To	Thickness	Name	Lithology
EB59C	112.8	114.05	1.25	CL	Coal
EB59C	131.85	132.45	0.6	C2U	Coal
EB59C	132.45	133	0.55	C2L	Coal
EB59C	150.05	150.35	0.3	BU	Coal
EB59C	151	152.5	1.5	BU	Coal
EB59C	153	155.6	2.6	BL	Coal
EB59C	170.37	171.7	1.33	A	Coal
EB60	14.9	15.2	0.3	CU	Coal
EB60	15.4	16.95	1.55	CU	Coal
EB60	17.25	18.95	1.7	CL	Coal
EB60	29.4	30	0.6	C2U	Coal
EB60	32.2	33.3	1.1	C2L	Coal
EB60	55.4	57.18	1.78	BU	Coal
EB60	57.78	60.35	2.57	BL	Coal
EB60	73.8	75	1.2	A	Coal
EB62	43.8	44.3	0.5	R	Dirty Coal
EB62	50.5	50.8	0.3	Q	Dirty Coal
EB62	136.6	137.85	1.25	DU	Coal
EB62	138.25	139.8	1.55	DL	Coal
EB62	158	159.8	1.8	CU	Coal
EB62	160	161.45	1.45	CL	Coal

Borehole	metres			Attributes	
	From	To	Thickness	Name	Lithology
EB11-01C	79.205	79.47	0.265	C2L	Coal
EB11-01C	105.92	107.92	2	BU	Coal
EB11-01C	107.92	109.92	2	BL	Coal
EB11-01C	125.81	127.28	1.47	A	Coal
EB13-04	85.76	86.9	1.14	DU	Coal
EB13-04	87.52	88.86	1.34	DL	Coal
EB13-04	108.25	109.8	1.55	CU	Coal
EB13-04	110.3	112	1.7	CL	Coal
EB13-04	126.46	127	0.54	C2U	Coal
EB13-04	127	127.61	0.61	C2L	Coal
EB13-04	149.24	151.4	2.16	BU	Coal
EB13-04	151.4	154.29	2.89	BL	Coal
EB13-04	168.54	169.75	1.21	A	Coal
EB13-05	36.16	37.4	1.24	DU	Coal
EB13-05	38.88	39.3	0.42	DL	Coal
EB13-05	56.4	56.6	0.2	CU	Coal
EB13-05	56.88	57.47	0.59	CU	Coal
EB13-05	57.95	59.37	1.42	CL	Coal
EB13-05	68.35	69	0.65	C2U	Coal
EB13-05	72.6	72.72	0.12	C2L	Coal
EB13-05	94.6	95.9	1.3	BU	Coal

Table 4-3: Drilled intersections of Gates coals within current and historic boreholes (continued)

Borehole	metres			Attributes	
	From	To	Thickness	Name	Lithology
EB62	177.85	178.65	0.8	C2U	Coal
EB62	178.65	179.45	0.8	C2L	Coal
EB62	194.75	195.2	0.45	BU	Coal
EB62	195.5	200.3	4.8	BL	Coal
EB62	215.95	216.95	1	A	Coal
EB63C	17.8	18.1	0.3	R	Coal
EB63C	24.65	24.95	0.3	Q	Dirty Coal
EB63C	95.45	96.69	1.24	DU	Coal
EB63C	97.15	98.7	1.55	DL	Coal
EB63C	114.2	116.2	2	CU	Coal
EB63C	116.44	117.8	1.36	CL	Coal
EB63C	135.85	136.675	0.825	C2U	Coal
EB63C	136.675	137.5	0.825	C2L	Coal
EB63C	153.7	153.9	0.2	BU	Coal
EB63C	153.9	155	1.1	BU	Coal
EB63C	156.5	158.9	2.4	BL	Coal
EB64	13.2	15.2	2	CU	Coal
EB64	15.45	19	3.55	CL	Coal
EB64	39.35	40.5	1.15	C2U	Coal
EB64	58.65	60.2	1.55	C2L	Coal
EB64	77.7	80	2.3	BU	Coal

Borehole	metres			Attributes	
	From	To	Thickness	Name	Lithology
EB13-05	95.9	99.4	3.5	BL	Coal
EB13-05	112.8	113.96	1.16	A	Coal
EB13-06	67.6	68.6	1	DU	Coal
EB13-06	69.22	70.75	1.53	DL	Coal
EB13-06	87	87.3	0.3	CU	Coal
EB13-06	88	88.8	0.8	CU	Coal
EB13-06	89.35	89.8	0.45	CL	Coal
EB13-06	90	90.9	0.9	CL	Coal
EB13-06	106.25	107	0.75	C2U	Coal
EB13-06	107	107.45	0.45	C2L	Coal
EB13-06	131.6	134	2.4	BU	Coal
EB13-06	134	136.75	2.75	BL	Coal
EB13-08C	75.03	75.55	0.52	QR	Coal
EB13-08C	76.8	77.35	0.55	Q	Coal
EB13-08C	145.71	145.89	0.18	E	Dirty Coal
EB13-08C	151.8	152.75	0.95	DU	Coal
EB13-08C	153.7	155.35	1.65	DL	Coal
EB13-08C	176.55	177.62	1.07	CU	Coal
EB13-08C	178.1	179.45	1.35	CL	Coal
EB13-08C	189.4	190.2	0.8	C2U	Coal
EB13-08C	191.7	192.7	1	C2L	Coal

Table 4-3: Drilled intersections of Gates coals within current and historic boreholes (continued)

Borehole	metres			Attributes	
	From	To	Thickness	Name	Lithology
EB64	80	82.55	2.55	BL	Coal
EB64	95.55	96.85	1.3	A	Coal
EB65	22.7	23.1	0.4	R	Coal
EB65	28.6	29	0.4	Q	Coal
EB65	123	124.4	1.4	DU	Coal
EB65	124.7	126.5	1.8	DL	Coal
EB65	141.2	141.6	0.4	CU	Coal
EB65	141.95	143.1	1.15	CU	Coal
EB65	143.3	144.5	1.2	CL	Coal
EB65	180.7	182	1.3	BU	Coal
EB65	182	184.4	2.4	BL	Coal
EB07-01	32.15	33.3	1.15	DU	Coal
EB07-01	33.95	35.6	1.65	DL	Coal
EB07-01	59	59.8	0.8	CU	Coal
EB07-01	60.5	61.2	0.7	CU	Coal
EB07-01	62.5	62.8	0.3	CL	Coal
EB07-01	62.8	63.27	0.47	CL	Coal
EB07-01	79.58	80.39	0.81	C2U	Coal
EB07-01	80.39	81.2	0.81	C2L	Coal
EB07-01	97.27	99.5	2.23	BU	Coal
EB07-01	99.5	102.65	3.15	BL	Coal

Borehole	metres			Attributes	
	From	To	Thickness	Name	Lithology
EB13-08C	214.67	216.5	1.83	BU	Coal
EB13-08C	216.5	219.1	2.6	BL	Coal
EB13-08C	231.72	232.95	1.23	A	Coal
EB13-09C	71.55	72.05	0.5	QR	Coal
EB13-09C	72.4	73.65	1.25	Q	Coal
EB13-09C	158.45	159.62	1.17	DU	Coal
EB13-09C	160.18	161.77	1.59	DL	Coal
EB13-09C	178.6	179.8	1.2	CU	Coal
EB13-09C	180.15	181.9	1.75	CL	Coal
EB13-09C	197.1	197.43	0.33	C2L	Coal
EB13-09C	222.46	224.07	1.61	BU	Coal
EB13-09C	233.93	235.66	1.73	BU	Coal
EB13-09C	235.66	239.18	3.52	BL	Coal
EB13-09C	253.07	254.85	1.78	A	Coal
EB13-10C	40.91	41.12	0.21	R	Dirty Coal
EB13-10C	52	52.1	0.1	Q	Dirty Coal
EB13-10C	117.36	118.54	1.18	DU	Coal
EB13-10C	119.17	120.69	1.52	DL	Coal
EB13-10C	137.57	138.37	0.8	CU	Coal
EB13-10C	138.75	140.07	1.32	CU	Coal
EB13-10C	162.71	163.58	0.87	CL	Coal

Table 4-3: Drilled intersections of Gates coals within current and historic boreholes (continued)

Borehole	metres			Attributes	
	From	To	Thickness	Name	Lithology
EB07-01	121.1	122.57	1.47	A	Coal
EB07-02	80	81.15	1.15	DU	Coal
EB07-02	81.95	83.3	1.35	DL	Coal
EB07-02	99.6	101.05	1.45	CU	Coal
EB07-02	101.05	102.3	1.25	CU	Coal
EB07-02	102.65	103.05	0.4	CL	Coal
EB07-02	103.3	104.05	0.75	CL	Coal
EB07-02	126	126.9	0.9	C2U	Coal
EB07-02	126.9	127.8	0.9	C2L	Coal
EB07-02	143.54	145.9	2.36	BU	Coal
EB07-02	145.9	148.8	2.9	BL	Coal
EB07-02	167.9	169.79	1.89	A	Coal
EB07-03	38.75	39.05	0.3	R	Dirty Coal
EB07-03	118.41	119.5	1.09	DU	Coal
EB07-03	120	121.49	1.49	DL	Coal
EB07-03	138.72	139.3	0.58	CU	Coal
EB07-03	139.7	140.3	0.6	CU	Coal
EB07-03	140.7	142.25	1.55	CL	Coal
EB07-03	157.37	158.675	1.305	C2U	Coal
EB07-03	158.675	159.98	1.305	C2L	Coal
EB07-03	179.54	182.7	3.16	BU	Coal

Borehole	metres			Attributes	
	From	To	Thickness	Name	Lithology
EB13-10C	163.99	165.69	1.7	CL	Coal
EB13-10C	183.02	183.49	0.47	C2U	Coal
EB13-10C	183.49	183.96	0.47	C2L	Coal
EB13-10C	198.58	199.03	0.45	BU	Coal
EB13-10C	199.31	200.31	1	BL	Coal
EB13-10C	200.73	203.44	2.71	BL	Coal
EB13-10C	218.23	219.13	0.9	A	Coal
EB13-11	103.22	104.58	1.36	BU	Coal
EB13-11	104.58	107.9	3.32	BL	Coal
EB13-11	122.68	124.57	1.89	A	Coal
EB13-13A	68.9	69.15	0.25	P	Coal
EB13-13A	132.22	133.07	0.85	DU	Coal
EB13-13A	134	135.4	1.4	DL	Coal
EB13-13A	152.76	152.88	0.12	CU	Coal
EB13-13A	153.2	153.86	0.66	CU	Coal
EB13-13A	154.25	154.54	0.29	CU	Coal
EB13-13A	154.72	154.8	0.08	CL	Coal
EB13-13A	155.06	155.6	0.54	CL	Coal
EB13-13A	191.65	193.12	1.47	BU	Coal
EB13-13A	193.12	196.58	3.46	BL	Coal
EB13-13A	208.9	209.43	0.53	A	Coal

Table 4-3: Drilled intersections of Gates coals within current and historic boreholes (concluded)

Borehole	metres			Attributes			Borehole	metres			Attributes	
	From	To	Thickness	Name	Lithology			From	To	Thickness	Name	Lithology
EB07-03	182.7	184.61	1.91	BL	Coal		MW-A	30.85	31.1	0.25	QR	Dirty Coal
EB07-03	200.5	201.48	0.98	A	Coal		MW-A	32.5	32.95	0.45	Q	Coal
EB07-04C	12.5	12.75	0.25	DU	Coal		MW-A	103.89	105.35	1.46	DU	Coal
EB07-04C	13	13.29	0.29	DL	Coal		MW-A	106.18	107.71	1.53	DL	Coal
EB07-04C	38.91	39.2	0.29	CU	Coal		MW-A	123.82	124.93	1.11	CU	Coal
EB07-04C	39.75	40.95	1.2	CU	Coal		MW-A	125.56	126.67	1.11	CL	Coal
EB07-04C	41.4	41.9	0.5	CL	Coal		MW-A	138.86	139.28	0.42	C2L	Dirty Coal
EB07-04C	42.25	43.35	1.1	CL	Coal		MW-B	24.55	26.35	1.8	A	Coal

Table 4-4: Drilled intersections of the 'Blue marker' within current and historic boreholes

Borehole	metres			Attributes		Borehole	metres			Attributes
	From	To	Thickness				From	To	Thickness	
EB(MS)-13	95.2	95.6	0.4	Blue Marker		EB63C	48.2	48.9	0.7	Blue Marker
EB(MS)-13	129.2	129.4	0.02	*Fault, Possible*		EB65	42.55	42.8	0.25	Blue Marker
EB(MS)-13	133.8	134.4	0.6	Blue Marker		EB07-02	34.6	35.3	0.7	Blue Marker
MS-16	197.05	198.33	1.28	Blue Marker		EB07-03	72.2	72.6	0.4	Blue Marker
MS-18	91.79	93.39	1.6	Blue Marker		EB07-08B	36.7	37	0.3	Blue Marker
MS-22	257.2	258.27	1.07	Blue Marker		EB07-09	61.5	62.2	0.7	Blue Marker
MS-22	262.8	263	0.02	*Fault, Probable*		EB07-10	24.5	25.4	0.9	Blue Marker
MS-22	282.59	287.4	4.81	Blue Marker		EB13-04	34.6	35.1	0.5	Blue Marker
MS-25A	222.5	222.84	0.34	Blue Marker		EB13-08C	103.6	107.36	3.76	Blue Marker
EB53	31.85	32.5	0.65	Blue Marker		EB13-09C	107.6	109.15	1.55	Blue Marker
EB55	11.5	11.75	0.25	Blue Marker		EB13-10C	63.65	63.8	0.15	Blue Marker
EB59C	40.7	41	0.3	Blue Marker		EB13-13A	81.85	85.5	3.65	Blue Marker
EB62	74.75	75	0.25	Blue Marker		MW-A	57.55	61.05	3.5	Blue Marker

The Falher Member is of Late Early Albian age (Wan, 1996). The basal contact of the Falher Member atop the Torrens Member is universally abrupt, and locally-undulating in detail.

4.2.4.4 Torrens Member (map-unit 5a)

Within the Sukunka-Quintette coalfield, the term ‘Torrens Member’ is often applied as a local name for the thick sandstone underlying the lowest of the mineable Gates coal beds. Within the Mt. Spieker area (including the EB Main, EB Trend and EB West coal properties), however, there are two of these sandstone units, the Quintette and Torrens sandstones, separated by a thick medial fine-grained ‘silty zone’ of interbedded siltstone, sandstone and shale. The medial silty zone of the Torrens Member lacks mineable coal at Mt. Spieker, despite its being the host of the K coal zone in the Quintette mines, further to the south within the coalfield (Cathyl-Huhn and Avery, 2014c).

The top of the Quintette Sandstone is almost always root-penetrated, at times distinctly softer, darker and carbonaceous to coaly (likely a paleosol), readily distinguishable from the harder, lighter-coloured and cleaner main body of the sandstone. The Quintette Sandstone is characteristically immediately overlain by the A coal bed (the basal coal of the Falher Member).

At EB Main, the Torrens Member is often 'tagged' by boreholes testing the Falher coals, as the Quintette Sandstone affords a ready indication that the basal section of Falher coal-measures has been completely drilled. The entire thickness of the Torrens Member is seldom drilled, as it is well-understood to lack significant coal, but some holes have gone through both sandstones and the intervening medial silty zone, and the Torrens is now established to be 45 to 55 metres thick, of which the upper 25 metres comprises the Quintette Sandstone (Jordan and Dawson, 1978), whereas the medial silty zone is about 13 metres thick, and the basal Torrens Sandstone is about 12 metres thick.

The age of the Torrens Member is not directly known, as no diagnostic fossils have been found, but it is presumed to be Late Early Albian. The basal contact of the Torrens Member with the underlying Spieker Member of the Moosebar Formation is gradational by interbedding.

4.2.5 Moosebar Formation (map-unit 4)

The Moosebar Formation comprises 225 to 380 metres of dark grey, locally-concretionary mudstone and siltstone, with minor thin interbeds of sandstone and tuff, and a thin basal conglomerate. The wide variation of the Moosebar’s thickness is likely due to overthrusting and concomitant tectonic thickening of its incompetent shales.

The Moosebar Formation is of Early Albian age (Stott, 1968). Its basal contact with the underlying Gething Formation is abrupt, and generally erosional, characteristically marked by a very thin band of variably-glauconitic gritty sandstone or pebbly gritstone.

At EB Main, and within the Sukunka-Quintette coalfield generally, the Moosebar

Formation may be divided into three units. In order from top down, these are:

- Spieker Member (map-unit 4c): thinly-interbedded siltstone and sandstone, 150 to 170 metres thick;
- Cowmoose member (map-unit 4b): massive-appearing dark grey to black mudstone, with occasional thin bands of tuff, generally 75 to 110 metres thick, but possibly tectonically-thickened to 230 metres thick (Cathyl-Huhn and Avery, 2014b);
- Basal glauconitic zone, locally designated as the 'Green marker' (map-unit 4a): variably-glauconitic gritty sandstone or pebbly gritstone, nil to 3 metres thick. Occurrences and thickness of this zone are summarised in **Table 4-5**.

In the geological map (**Map 2-3**) presented with this report, map-units 4a and 4b are mapped together as ‘map-unit 4ab’, insofar as the Green marker (map-unit 4a) is so thin that it cannot be mapped separately at any property-wide scale.

4.2.5.1 Spieker Member (map-unit 4c)

The Spieker Member comprises 150 to 170 metres of thinly-interbedded, overall coarsening-upward sandy siltstone and sandstone, pervasively-bioturbated and possibly originating as proximal shallow-marine turbidites (Leckie, 1983) in front of the advancing Falher paleodelta. Sandstone beds become thicker, coarser, and more abundant towards the top of the Spieker, and on the whole the Spieker Member is a transitional unit (Duff and Gilchrist, 1981) between the lower Moosebar mudstone and the overlying Torrens sandstones. In some earlier reports, the Spieker Member was termed the ‘Sukunka Member’ of the now-deprecated Commotion Formation (*vide* Wallis and Jordan, 1975).

The age of the Spieker Member is not directly known, but presumed to be Early Albian to possibly late Early Albian. Lithologically, the basal contact of the Spieker Member with the underlying Cowmoose Member is drawn at the base of the lowest band of sandy siltstone overlying the mudstones of the Cowmoose. In geophysical logs (see borehole EB13-02 at 141.9 metres’ depth), the Spieker/Cowmoose contact is marked by an abrupt upward decrease in natural gamma-ray count-rate and a slightly less-abrupt upward increase in density-log response.

4.2.5.2 Cowmoose Member (map-unit 4b)

The Cowmoose Member of the Moosebar Formation comprises 75 to 90 metres of rubbly-weathering, massive-appearing black mudstone, punctuated by laterally-persistent bands crowded with ironstone concretions, and several thin (a few millimetres to a few decimetres) but laterally-persistent bands of light olive drab to white tuff. The tuff bands are useful as local structural markers (Duff and Gilchrist, 1981; Kilby, 1984a; Jordan and Dawson, 1988). The name ‘Cowmoose’ is newly-coined (Cathyl-Huhn and Singh, 2014) as an informal but practically-useful stratigraphic name, for the purposes of Walter Energy’s geological studies; these rocks were previously referred to as the ‘basal mudstone member’ of the Moosebar Formation (Cathyl-Huhn and Avery, 2014b) or simply as the ‘mudstone member’ (Duff and Gilchrist, 1981).

The recommended type-section of the Cowmoose Member is on the northeastern face of Cowmoose Mountain, ten kilometres northwest of the EB Main property. The

recommended alternative reference-section of the Cowmoose Member is on the western face of Mount Spieker, within the EB West coal property, immediately north of the EB Main property.

Within the EB Main property, the Cowmoose Member is locally well-exposed in shale-pits with the lowland portion of Coal Licence 381716. The Cowmoose mudstones are sparsely-bioturbated, and locally contain sparse to abundant burrow-fillings, irregular blebs and euhedral crystals of pyrite, indicative of overall anoxic depositional conditions. Pyrite is particularly abundant near the base of the Cowmoose Member.

The age of the Cowmoose Member is Early Albian (as noted for the mudstones of the Moosebar Formation by Stott, 1968). The basal contact of the Cowmoose mudstones over the underlying basal glauconitic zone (the Green marker) is gradational to abrupt, and generally easily-recognised on geophysical logs.

4.2.5.3 Green marker (basal glauconitic zone -- map-unit 4a)

The basal glauconitic zone of the Moosebar Formation (**Table 4-5**) comprises 0.2 to perhaps 3 metres of variably-glauconitic, chert-rich lithic arenite, locally containing stringers or lenses of gritstone or pebble-conglomerate. This zone is locally altogether absent (Cathyl-Huhn and Avery, 2014b), whereas it also occasionally scours deeply down into the underlying Chamberlain coal-measures.

Table 4-5: Drilled intersections of the 'Green marker' within current and historic boreholes

rehole	metres			Attributes
	From	To	Thickness	
EB(MS)-1	422.45	424.26	1.81	Green Marker
EB(MS)-1	424.26	424.28	0.02	*Fault, Probable*
EB(MS)-1	437.08	439.52	2.44	Green Marker
EB(MS)-4	72.8	74.2	1.4	Green Marker
EB(MS)-4	80	80.1	0.1	*Fault, Established*
EB(MS)-4	83.4	85.3	1.9	Green Marker
EB(MS)-7	236.52	237.74	1.22	Green Marker
EB(MS)-8	83.5	85.16	1.66	Green Marker
EB(MS)-10	39.08	39.52	0.44	Green Marker
EB(MS)-11	145	145.88	0.88	Green Marker
EB(MS)-14	94.65	95.62	0.97	Green Marker
MS-20A	306.02	306.1	0.08	Green Marker
EB13-03	47.6	48.3	0.7	Green Marker
MW-D	80.25	80.85	0.6	Green Marker

Glauconite development within this unit is patchy, in contrast with its more obvious presence in other parts of the Sukunka-Quintette coalfield. Earlier reports (Wallis and Jordan, 1975; Jordan and Dawson, 1978) denoted this zone as the Bluesky Formation, on the grounds of its lithologic similarity to the typical Bluesky rocks of the Alberta Syncline and Deep Basin, but that correlation is now understood to be incorrect (Kilby, 1984b; Legun, 1990; Gibson, 1992a). The Bluesky Member *sensu stricto* is currently understood to form a sub-unit within the Gething Formation, underlying the Gething's Bullmoose Member, and overlying the Gaylard Member. The age of the basal glauconitic zone of the Moosebar Formation is not directly known, but presumed to be Early Albian. Its basal contact with the underlying Chamberlain Member of the Gething Formation is abrupt, and locally erosional, with several metres of relief at local scale.

4.3 Bullhead Group (map-units 3 and 2)

The Bullhead Group consists of two formations, the Gething Formation which comprises the majority of the group's thickness, and the underlying and consistently thinner Cadomin Formation (Stott, 1963; 1968; 1973; McLean, 1977). The Gething Formation is inferred to form bedrock within the northern tributary valley of Perry Creek, whereas the Cadomin Formation is known (from natural-gas exploration wells) to occur at greater depths within the subsurface.

The uppermost coal-measures of the Gething Formation's Chamberlain Member have been tested by coal-exploration drilling at several locations within the EB Main property, whereas the lowermost coal-measures of the Gething's Gaylard Member have thus far been only once been effectively tested by a coal-exploration borehole (EB13-07, within Coal Licence 381716). This borehole is interpreted to have reached the uppermost part of the Cadomin Formation (at a depth of 169.4 metres, thus encountering a drilled thickness of 146.9 metres of Gaylard coal-measures).

4.3.1 Gething Formation (map-unit 3)

The Gething Formation, of Hauterivian to Early Albian age within the Early Cretaceous (Gibson, 1992a), comprises thin to thick interbeds of siltstone, sandstone, mudstone and coal, with lesser amounts of gritstone, pebble-conglomerate, ironstone and tuff.

The Gething Formation originated as a complex of non-marine to shallow-marine sedimentary deposits, laid down by meandering and braided streams and rivers within a widely-extensive belt of coastal deltas, of which two (the younger Chamberlain and older Gaylard paleodeltas) extended into the Mt. Spieker area, including the EB Main coal property.

Coals of the Gething Formation at EB Main, and their enclosing sedimentary rocks, were deposited between 111 and 123 million years ago (Gibson, *ibid.*), on the basis of regional plant-fossil and foraminiferal zonations.

Following upon suggestions made by coal-company geologists (Wallis and Jordan, 1975) and subsequent correlation by the British Columbia Geological Survey (Duff and Gilchrist, 1981; Legun, 1990), Gibson formally divided the Gething Formation into three members: the upper, non-marine to transitional Chamberlain Member, the middle marine Bullmoose Member, and the basal, non-marine to transitional Gaylard Member. A fourth member of the Gething Formation, the Bluesky Member, is one the basis of more recent work (Cathyl-Huhn

and Avery, 2014b) also inferred to be present between the base of the Bullmoose Member and the top of the Gaylard Member.

Complete (albeit often broken by thrust-faults) sections of the Chamberlain and Bullmoose members have been drilled at EB Main, and apparently-unfaulted sections of the Bluesky and Gaylard members have been drilled as well.

In the geological map accompanying this report (**Map 2-3**), the Gething Formation is mapped as two rather than four divisions: the conjoint Chamberlain, Bullmoose and Bluesky members (map-unit 3bcd) and the underlying Gaylard Member (map-unit 3a). Correlation studies and structural studies of the Gething rocks are presently being undertaken to better clarify the mappability of all four of the Gething Formation's members within the Mt. Spieker area (including at EB Main); the discussion given below is therefore preliminary in scope.

4.3.1.1 Chamberlain Member (map-unit 3d)

At EB Main, the Chamberlain Member comprises 45 to 55 metres of thickly-interbedded, brown-weathering sandstone and siltstone, containing three regionally-significant coal zones (as first described by Wallis and Jordan, 1975): the Bird Zone (containing the Upper Bird and Lower Bird coal beds) near the member's top, and the Skeeter and Chamberlain coal zones (containing the Skeeter and Chamberlain coal beds respectively) within the member's middle.

The Chamberlain Member may be readily divided into two divisions on the basis of lithology: an upper coal-measures unit comprising interbedded siltstone, sandstone and coal, and a lower dominantly-sandy unit (informally denoted as the 'Chamberlain sandstone'). The Chamberlain sandstone forms a consistent marker bed in the northern half of the Sukunka-Quintette coalfield, including the EB Main area.

The age of the Chamberlain Member is late Early Albian (Gibson, 1992a). The basal contact of the Chamberlain Member with the underlying Bullmoose Member is drawn at the base of the lowest of the (usually two) thick sandstones beneath the Chamberlain coal bed. This contact is generally abrupt at local scale, but probably gradational by interfingering at the regional scale.

4.3.1.2 Details of Chamberlain Member coals

The coal-measures unit has a drilled thickness of 45 metres within its one complete drilled section (in EB13-03) at EB Main. In the two boreholes (EB13-03 and MW-C) which intersected the a complete section of the underlying Chamberlain sandstone, it has a drilled thickness of 12 metres.

Unlike the situation at the nearby EB West coal property, neither test-pitting nor seam-tracing has been done within the Chamberlain Member at EB Main. The Chamberlain Member coals, in particular the Upper Bird, Lower Bird and Skeeter beds have, however, been drilled at several points, with intersected coal thicknesses presented below in **Table 4-6**.

Table 4-6: Drilled intersections of Chamberlain Member coals within current and historic boreholes

Borehole	metres			Attributes		Borehole	metres			Attributes	
	From	To	Thick-ness	Name	Lithology		From	To	Thick-ness	Name	Lithology
EB(MS)-1	449.43	451.84	2.41	Upper Bird	Coal	EB(MS)-10	51	51.88	0.88	Lower Bird	Coal
EB(MS)-1	456.8	458.33	1.53	Lower Bird	Coal	EB(MS)-10	65.36	66.62	1.26	Skeeter	Coal
EB(MS)-1	478.51	479.69	1.18	Skeeter	Coal	EB(MS)-11	145.88	149.6	3.72	Upper Bird	Coal
EB(MS)-1	488.59	488.9	0.31	Chamberlain	Coal	EB(MS)-11	153.83	155.81	1.98	Lower Bird	Coal
EB(MS)-4	75.2	77.5	3.3	Upper Bird	Coal	EB(MS)-14	96.32	98.76	2.44	Upper Bird	Coal
EB(MS)-4	86.15	89.3	3.15	Upper Bird	Coal	EB(MS)-14	102.81	104.52	1.71	Lower Bird	Coal
EB(MS)-4	102.2	104.2	2	Lower Bird	Coal	EB(MS)-14	135.33	136.4	1.07	Skeeter	Coal
EB(MS)-7	237.74	242.25	3.51	Upper Bird	Coal	MS-20A	306.1	309.58	3.48	Upper Bird	Coal
EB(MS)-7	246.07	247.13	1.06	Lower Bird	Coal	MS-20A	312.44	313.93	1.49	Lower Bird	Coal
EB(MS)-7	262.22	264.72	2.5	Skeeter	Coal	EB13-03	48.3	50.7	2.4	Upper Bird	Coal
EB(MS)-8	85.16	88.76	3.6	Upper Bird	Coal	EB13-03	54.48	56.78	2.3	Lower Bird	Coal
EB(MS)-8	90.74	92.7	1.96	Lower Bird	Coal	EB13-03	84.19	85.42	1.23	Skeeter	Coal
EB(MS)-8	93.48	95.05	1.57	Lower Bird	Coal	MW-C	22	22.7	0.7	Chamberlain	Dirty Coal
EB(MS)-8	110.83	112.17	1.34	Skeeter	Coal	MW-D	81.2	83.4	2.2	Upper Bird	Coal
EB(MS)-10	39.56	42.88	3.32	Upper Bird	Coal	MW-D	87.92	89.4	1.48	Lower Bird	Coal
EB(MS)-10	48.2	50.2	2	Lower Bird	Coal						

Table 4-7: Drilled intersections of Gaylard Member coals within current and historic boreholes

Borehole	metres			Attributes		Borehole	metres			Attributes	
	From	To	Thickness	Name	Lithology		From	To	Thickness	Name	Lithology
EB13-07	26.72	27.42	0.7	Gething A	Coal	EB13-07	49.56	49.68	0.12	Gething B	Coal
EB13-07	46.6	46.86	0.26	Gething B	Coal	EB13-07	93	93.8	0.8	Gething C	Coal
EB13-07	47.28	47.37	0.09	Gething B	Coal	EB13-07	120.4	121.44	1.04	Gething D	Coal
EB13-07	48.1	49.08	0.98	Gething B	Coal						

The Bird, Skeeter and Chamberlain coal zones are well-known from the Sukunka and Bullmoose coal properties, further to the northwest of EB Main, and as well, these zones have been drilled to a limited extent at Walter Energy's Perry Creek property, to the southeast of EB Main.

At EB Main, only the Upper Bird and Lower Bird coal beds consistently attain mineable thicknesses of potential interest for underground mining (for purposes of this discussion, considered to be a minimum of 1.5 metres). Thin (a few decimetres thick) beds of coal or dirty coal occasionally occur within the rock parting between the Upper Bird and Lower Bird coals; these thin bands are considered likely to represent isolated lenses of coalified logs, caught up within the body of sediment.

Both the Upper Bird and Lower Bird coals themselves are characteristically bounded by one to two decimetres of coaly rock or dirty coal; existence of these inferior selvages is inferred from the characteristic 'shoulder' responses seen on geophysical density logs.

The Skeeter coal bed does not generally attain workable thickness at EB Main, although a 2.5-metre intersection is reported from historic borehole EB(MS)-7. A more typical thickness of the Skeeter bed is 1.2 to 1.3 metres.

The Chamberlain coal bed is almost always represented at EB Main by a few decimetres of carbonaceous mudstone or coaly rock, and thus it is sparsely-represented in Table 4-6. Thin coals are, however, locally present at the Chamberlain horizon: 0.7 metres of dirty coal in groundwater well MW-C, and 0.31 metres of coal in EB(MS)-1

Although the Upper Bird and Skeeter coal beds at least locally attain plausible thickness for underground mining at EB Main (given good structural conditions, as yet unproven) they are generally thinner than the Bird coal seen at EB West (locally over 4 metres, as reported by Cathyl-Huhn and Avery, 2014b).

4.3.1.3 Bullmoose Member (map-unit 3c)

The Bullmoose Member comprises 35 to 40 metres of thinly-interbedded, recessive-weathering mudstone, siltstone and minor sandstone of turbiditic aspect, forming several fining-upward sequences within an overall coarsening-upward sequence.

At EB Main, and possibly elsewhere within the Mt. Spieker area, three lithologic divisions may be recognised within the Bullmoose Member: an uppermost siltstone/sandstone unit (16 to 21 metres thick), a medial sandstone/siltstone unit (1.5 to 3 metres thick), and a basal mudstone/siltstone unit (15 to 17 metres thick). The Bullmoose Member possibly forms bedrock within parts of the lowland portion of Coal Licence 381714, but insufficient outcrop mapping has been done to establish its contacts and extent. The Bullmoose has been drilled in three year-2013 boreholes at EB Main -- its basal portion only within EB13-07, and most of its thickness within EB13-03 and groundwater-monitoring borehole MW-C.

Where seen in outcrop within the nearby EB West coal property (Cathyl-Huhn and Avery, 2014b), the Bullmoose Member does not contain any coal, other than isolated coalified logs and coarse, poorly-preserved ‘plant trash’, likely of drifted origin. The general lack of coal is also seen in the three year-2013 boreholes which

intersected the Bullmoose Member at EB Main. The Bullmoose Member does, however, contain abundant molluscan fossils, including *Pecten (Entolium)* cf. *irenense* McLearn (Gibson, 1992a) and *Yoldia kissoumi* (Duff and Gilchrist, 1981), which, although not age-diagnostic are, by dint of their abundance locally-characteristic of the unit. The Bullmoose Member is of late Early Albian age (Gibson, 1992a); its basal contact with the Bluesky Member is generally gradational, but locally abrupt.

4.3.1.4 Bluesky Member (map-unit 3b)

Within the Mt. Spieker area (including EB Main and the adjoining EB West and EB Trend properties) the Bluesky Member comprises 0.3 to 3 metres of distinctively-heterolithic, characteristically-intensively bioturbated and locally-shellbearing pebbly mudstone to gritty sandstone, at times slightly to moderately glauconitic, with occasional pyrite flecks. The basal contact of the Bluesky with the underlying Gaylard Member has not been observed at outcrop at EB Main (although it was intersected by borehole EB13-07 at a depth of 22.5 metres, beneath a drilled Bluesky Member thickness of 1.8 metres); however, elsewhere within the Sukunka-Quintette coalfield, the Bluesky-Gaylard contact is generally abrupt to erosional.

The age of the Bluesky Member is not directly known, owing to lack of determinable fossils, but it is likely to be late Early Albian. The Bluesky Member of the Gething Formation, as its name implies, is likely to be correlative – if not strictly coeval – with the Bluesky Formation of the Dawson Creek area.

4.3.1.5 Gaylard Member (map-unit 3a)

The Gaylard Member comprises 145 to 150 metres of thickly-interbedded siltstone, mudstone and brown-weathering channel-filling sandstone, accompanied by minor ironstone, tuff, gritstone and conglomerate. Numerous poorly-exposed coal beds are known to be present within the Gaylard Member at the nearby EB West coal property (Shima and Nishio, 1975; Cathyl-Huhn and Avery, 2014b), but no Gaylard coals have thus far been seen at outcrop at EB Main.

One year-2013 borehole at EB Main (EB13-07) drilled a complete section of the Gaylard Member at EB Main, where four coal zones (informally designated from top down as the Gething A through Gething D zones: see **Table 4-7**, above) were intersected within an overall Gaylard thickness of 147 metres. No assurance of correlation is implied with the similarly-named 'Lower Gething' coals within the Sukunka coal property. In addition to the tabulated coals, several thinner (decimetres to a metre thick) zones of coaly rock and associated dirty coal were encountered within borehole EB13-07.

The age of the Gaylard Member is Hauterivian to late Early Albian (Gibson, 1992a). Its basal contact with the underlying Cadomin Formation is abrupt to possibly erosional at the local scale (Cant, 1996) and interfingering at the regional scale (Stott, 1968; Gibson, 1992a), drawn at the top of a bed of coarse-grained, often gritty and occasionally pebbly sandstone which may laterally grade into more typical pebble-conglomerate characteristic of the Cadomin.

4.3.2 Cadomin Formation (map-unit 2)

Regionally within the Sukunka-Quintette coalfield, the Cadomin Formation immediately underlies the Gething Formation, forming the basal part of the Bullhead Group (Stott, 1968). The Cadomin is resistant to erosion, and typically forms ledges to cliffs beneath the more-subdued slopes of the Gaylard Member.

The Cadomin comprises one or more thick beds of coarse-grained, gritty to pebbly sandstone and pebble-to cobble-conglomerate (McLean, 1977; Jordan and Dawson, 1978) with occasional lenses of siltstone and pebbly gritstone, and rare thin lenses of dirty coal. Sandy phases of the Cadomin Formation thus strongly resemble the basal pebbly sandstones of the Gaylard Member, and the Cadomin's distinction from the Gaylard locally rests mainly upon the Cadomin Formation's greater lateral continuity.

The top of Cadomin Formation has reached by only one borehole at EB Main (EB13-07, at a depth of 169.4 metres), a unique circumstance amongst all of Walter Energy's coal properties in the Mt. Spieker-Wolverine River area. The Cadomin has also been intersected by several natural-gas exploration wells within and near to the EB Main property. The Cadomin Formation is not, however, interpreted to outcrop at any point within the EB Main property, as suggested by its mapped outcrop trace (as shown on **Map 2-3**) lying completely outside the property's boundaries.

At EB Main and within the Mt. Spieker area in general, the Cadomin Formation is estimated to be 50 metres thick (Jordan and Dawson, 1978). Its basal contact with the underlying Monach Formation is likely to be erosional, with considerable local scour into the older sediments. Regionally, the base of the Cadomin marks a northeastward-deepening angular contact, cutting down into successively-older rocks of the Minnes Group (Stott, 1973).

4.4 Minnes Group (map-unit 1)

The Minnes Group is virtually unexplored in the vicinity of the EB Main property, owing to its outcropping position in valley-bottoms, where thick Drift cover generally obscures bedrock. The total thickness of the Minnes Group is at least 2000 metres (Stott, 1998). The Minnes Group within the Sukunka-Quintette coalfield comprises three formations: from top down, the Monach, Beattie Peaks and Monteith formations. Of these three, only the sandstone-rich, potentially coal-bearing Monach Formation is expected to outcrop near EB Main, within the valley of South Bullmoose Creek, one kilometre southwest of the southwestern corner of the property.

6 Reclamation

Disturbance associated with year-2001 through year-2013 drilling at EB Main comprised the reactivation of a pre-existing network of drilling roads and trails dating back to the period of historic work, and the construction of additional trails to serve new drilling sites which were not otherwise-accessible via pre-existing roads and trails. Drill pads were built as needed, with efforts made to limit the size and depth of disturbance.

Following completion of each year's drilling programme, trails not expected to be re-used were generally reclaimed according to standards of their day, through construction of water-bars, local restoration of soil prisms, and limited scattering of coarse woody debris within forested areas where timber had been cut during trail construction. Also as a standard practice, drill sites and laydown areas were cleared of equipment, supplies and trash concomitant with demobilisation of drilling rigs and support vehicles. Appropriate revegetation seed mixtures were applied to roads, trails and drill pads, again according to the standards of their day.

Some higher-grade access roads have remained open, either to support other land uses such as the oil and gas industry, or in the reasonable expectation that these roads will be needed to support future coal exploration, or the anticipated development of the EB mine.

7 Statement of costs

'Current work' within the EB Main coal property, for purposes of the present report, comprises exploratory work done between the years 2001 and 2014. All such work was done during years 2001, 2007, 2008, 2011, 2013 and 2014.

Table 7-1: Estimated exploratory cost breakdown by activity

Item / Year	Rotary-drilling Holes / length	Cost	Core-drilling Holes / length	Cost	Geophysical logging Holes / length	Cost	Analytical work Holes / length	Cost	Road and site construction/ maintenance/reclamation Holes / length	Cost	Year totals
Years 2001, 2007, 2008 and 2011 are estimated from provincial average unit costs:											
2001	18 / 1796.88 m	$361,783.82	3 / 470.29 m	$98,920.80	19 / 2246.03 m	$39,440.29	3 / 470.29 m	$37,449.29	21 / 2267.17 m	$52,825.06	$590,419.26
2007	25 / 3194.60 m	$643,200.76	12 / 1072.04	$215,844.53	29 / 3254.54 m	$57,149.72	25 / 3194.60 m	$254,386.00	37 / 4266.64 m	$99,412.71	$1,270,443.72
2008	13 / 1200.56 m	$241,720.75	----- none during year ----		11 / 1116.37 m	$19,603.46	----- none during year ----		13 / 1200.56 m	$27.973.05	$289,297.26
2011	5 / unknown	unknown	1 / 133.39 m	$28,057.25	1 / 133.39 m	$2342.33	1 / 133.39 m	$10,621.85	6 / >133.39 m	$3107.99	$44,129.42
Years 2013 and 2014 are from costs reported by J.B. Snodsmith from Alabama office:											
2013	16 / 1793.96 m	$80,101.00	3 / 767.08 m	$299,542.74	16 / 2430.89 m	$4,975.00	3 / 767.08 m	-- not reported	-19 / 3197.97 m	$372,842.84	$757,461.58
2014	2 / 88.38 m	see note below	9 / 859.92 m	see note below	9 / 840.98 m	$19,549.00	9 / 840.98 m	-- not reported	- 11 / 929.36 m	$273,623.00	$565,305.00

Note re 2014 costs: drilling costs not broken down core vs. rotary. Total is $272,133.00.

Total for years 2001, 2007, 2008, 2011, 2013 and 2014: $3,517,056.24

Notes: unit costs for work are on a per-metre (of drilled length) basis, derived from Provincial averages by L.R. Avery (methodology as reported in Coal Assessment Report 936 – Cathyl-Huhn and Avery, 2014a). Geophysical log metreage is slightly lower than drilled metreage (as reported on geophysical logs) owing to geophysical sonde commencing logging slightly above bottoms of holes; this is a normal occurrence. Depths of all year-2011 rotary-drill holes are unknown, owing to records having not been found. Year costs for 2011 drilling very likely to be substantially underestimated. Year-2014 drilling costs not broken down into coring vs. non-coring: total year-2014 drilling cost is $272,133.00. Year-2014 costs may be incomplete owing to not having received all invoices.

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9 Conclusions

The present report has been written by members of Walter Canadian Coal Partnership's regional geological staff, as part of a broader examination of coal properties within the Brazion and Sukunka-Quintette coalfields of northeastern British Columbia, Canada.

The EB Main coal property contains coal-measures of Early Cretaceous age, within the Bullhead and Fort St. John groups of sedimentary rocks. These rocks are deformed by thrust faults and associated folds, consistent with the overall thin-skinned structural style of the Rocky Mountain Foothills of northeastern British Columbia. Coal of potentially-mineable thickness is known to occur within the Gething and Gates formations, with the bulk of work to date having been devoted to the Gates Formation coals.

Historic exploration work at EB Main comprised geological mapping on behalf of coal companies, an oil company, and both federal and provincial geological survey agencies, the driveage of six adits into potentially-mineable coal beds, and the drilling of 31 boreholes with a total length of 5,758.72 metres. Historic work is well-documented by means of coal-assessment reports, previously-submitted by past operators to the British Columbia government, as referenced within the present report.

Current work at EB Main (years 2001 onward to the present), here-reported, comprises geological mapping, and the drilling of 108 boreholes with a total length of at least 11,428.78 metres, done between years 2001 and 2014. The total length of drilling is a minimum, as complete records are not available for some of the boreholes. Total estimated cost of current work is $3,517,056.24.

Appendices to the present report contain information regarding in-situ ('raw') coal quality, washed ('clean') coal quality, coal petrography (including vitrinite reflectance and maceral composition), and coking characteristics of the EB Main coal. Data concerning clean coal quality, petrography and coking characteristics have been submitted on a confidential basis in keeping with the provisions of the *Coal Act Regulation*. The EB Main property merits further work, as a developed prospect.

10 Statements of qualifications

I, Preetpal Singh M.A.Sc., do hereby certify that:

a) I am currently employed on a full-time basis by Walter Canadian Coal Partnership, a subsidiary of Walter Energy, in their Northeast British Columbia office in Tumbler Ridge, British Columbia.

b) This certificate applies to the current report, titled *Coal Assessment Report for the EB Main coal licences, Mt. Spieker area, British Columbia*, dated December 18, 2014.

c) I am a member of the IEEE Computer Society since 2006.

d) I am in the process of applying for registration with the Association of Professional Engineers and Geoscientists of British Columbia.

e) I received my Bachelor of Science in Computer Science from Laurentian University in 2008, and my Master's of Applied Science in Mineral Resource Engineering, also from Laurentian University, in 2012.

f) I have worked as a data analyst for Walter Canadian Coal Partnership since July of 2013.

g) I am a contributing author of this report, titled *Coal Assessment Report for the EB Main coal licences, Mt. Spieker area, British Columbia*, dated December 18, 2014, concerning the EB Main coal property.

I, Laura Rose LeMay B.Sc. B.Ed., do hereby certify that:

a) I am currently employed on a full-time basis by Walter Canadian Coal Partnership, a subsidiary of Walter Energy, in their Northeast British Columbia office in Chetwynd, British Columbia.

b) This certificate applies to the current report, titled *Coal Assessment Report for the EB Main coal licences, Mt. Spieker area, British Columbia*, dated December 18, 2014.

c) I am in the processes of applying for my Professional Engineers and Geoscientists of British Columbia status.

d) I received my Bachelor of Science from Saint Mary's University in Halifax in 2006.

e) I have worked in the coal industry for 3 years and 3 months.

f) I have been pit geologist for the Brazion group of mines since March 2012.

g) I am a contributing author of this report, titled *Coal Assessment Report for the EB Main coal licences, Mt. Spieker area, British Columbia*, dated December 18, 2014, concerning the EB Main coal property.

I, C.G. Cathyl-Huhn P.Geo.(BC) Lic.Geol.(WA) RMSME, do hereby certify that:

a) I am currently employed on a full-time basis by Walter Canadian Coal Partnership, a subsidiary of Walter Energy, in their Northeast British Columbia office in Tumbler Ridge, British Columbia.

b) This certificate applies to the current report, titled *Coal Assessment Report for the EB Main coal licences, Mt. Spieker area, British Columbia*, dated December 18, 2014.

c) I am a member (Professional Geoscientist, Licence No.20550) of the Association of Professional Engineers and Geoscientists of British Columbia, licensed as a geologist (Licence No.2089) in Washington State, and a founding Registered Member of the Society for Mining, Metallurgy and Exploration (SME, Member No.518350). I have worked as a colliery geologist in several countries for over 36 years since my graduation from university.

d) I certify that by reason of my education, affiliation with professional associations, and past relevant work experience, having written numerous published and private geological reports and technical papers concerning coalfield geology, coal-mining geology and coal-resource estimation, that I am qualified as a Qualified Person as defined by Canadian *National Instrument 43-101* and a Competent Person as defined by the Australian *JORC Code*.

e) My most recent visit to the EB Main coal property was in July 2014.

f) I am principal author of this report, titled *Coal Assessment Report for the EB Main coal licences, Mt. Spieker area, British Columbia*, dated December 18, 2014, concerning the EB Main coal property.

g) As of the date of the writing of this report, I am not independent of Walter Canadian Coal Partnership and Walter Energy, pursuant to the tests in Section 1.4 of *National Instrument 43-101*.

"original signed and sealed by"
Dated this 18th day of December, 2014. C.G. Cathyl-Huhn P.Geo. Lic.Geol. RMSME

Appendix A: Geological and geophysical data for current boreholes

This appendix presents scanned geophysical logs, and available supporting information such as borehole summary sheets and core descriptions, for current boreholes drilled between years 2001 and 2014. For year-2014 boreholes, only geophysical logs are presently available; their core descriptions are not yet available, owing to that compilation still being underway following the recent completion of the year-2014 drilling programme.

Scanned data are presented in digital format on a CD (optically-readable compact disk) accompanying the original printed copy of this report. Each borehole's data are presented within an appropriately-named folder. Digital format is here employed owing to the great physical volume of the geophysical logs and supporting data, which would be otherwise impracticable to distribute in printed form.

All positional, elevation and depth data concerning boreholes are given in metres. Depths are drilled or logged depths (‘measured’ depths, as opposed to ‘true vertical’ depths), uncorrected for deviation of the boreholes from vertical. Positional data is given in terms of Zone10N of the Universal Transverse Mercator grid system, relative to the North American Datum of 1983 (NAD 83).

A.1 Methodology of geophysical logging

Geophysical logging (**Table A-1**) was performed by Century Wireline Services, using their slimhole suite of coalfield sondes. Gamma, caliper, resistivity and compensated sidewall density logs were acquired with Century’s Model 9239 sonde, whereas neutron and verticality logs were acquired with their Model 9055 sonde. Depths reached by each sonde are generally different, on account of each sonde having different physical length and different vertical location of its respective measurement points.

All geophysical logs follow similar presentations, with rightward-increasing gamma response in the left track, and rightward-increasing neutron response in the right track. Gamma and neutron readings are given in API (American Petroleum Institute) units. Density logs are calibrated to indicate apparent bulk density of the strata, increasing rightward from 1.0 to 3.0 grams/cubic centimetre. The top of the logged sections is presented at the top of the logs, and the base of the sections is presented at the base of the logs, to constant vertical scale.

A.2 Lithological interpretations of geophysical logs

Lithological interpretations of geophysical logs are presented in **Tables 4-1** through **4-7**, within **Section 4** of this report. Interpretations within these tables focus primarily upon coal beds (**Tables 4-3**, **4-6** and **4-7**), and on specific lithostratigraphic units such as unconsolidated Drift (**Table 4-1**), the Hulcross Formation and its basal grit unit (**Table 4-2**), and 'Blue' and 'Green' marker beds (**Tables 4-4** and **4-5** respectively). Interpretations are based primarily on natural-gamma, caliper, compensated density, and neutron log responses, following industry-standard methods recommended by Hoffman, Jordan and Wallis (1982).

Table A-1: Downhole geophysical logs run in current boreholes

Borehole	Easting	Northing	Elevation	Gamma/Caliper/ Resistivity/Density	Gamma/Density through rods	Gamma/ Neutron	Verticality/ Deviation	Dipmeter
EB45	601787.007	6108460.814	1726.052	100.8		100.94	100.9	
EB46	601931.801	6108593.003	1676.029	52.84		52.82	52.6	
EB47	601853.644	6108528.661	1706.759	40.5		40.46	40.5	
EB48	601560.779	6108536.528	1737.271	125.99		125.85	125.9	
EB49	602140.634	6108373.315	1681.374	31.32		31.4	31.4	
EB50	602222.031	6108084.169	1676.066	65.09		64.91	64.9	
EB51	602330.59	6107798.788	1647.145	43.12		43.06	43.1	
EB52	601930.149	6107776.365	1699.194	98.99		98.99	98.3	
EB53	601854.765	6108109.092	1763.435	147.48		147.48	147.5	
EB54	601693.489	6108361.811	1758.084	131.92			130.9	
EB55	601446.405	6107697.268	1699.49		153.5	153.47	153.5	
EB56	601744.115	6107398.986	1588.128	no geophysical logs run				
EB57	601743.507	6107247.502	1549.764	no geophysical logs run				
EB58C	601442.318	6107335.935	1581.596	133.05	[note: no core log]	132.87	132.9	
EB59C	601704.144	6107968.03	1770.849	176.97		176.39	176.3	
EB60	601566.081	6106967.845	1550.877	153.79		153.75	153.8	
EB61	601751.706	6106913.203	1530.69	99.22		99.2		
EB62	601507.288	6108172.922	1811.454	227.18		227.1	227.1	
EB63C	601633.636	6108266.779	1778.532	161.09		160.99	161	

Table A-1: Downhole geophysical logs run in current boreholes (continued)

Borehole	Easting	Northing	Elevation	Gamma/Caliper/ Resistivity/Density	Gamma/Density through rods	Gamma/ Neutron	Verticality/ Deviation	Dipmeter
EB64	601646.377	6107457.819	1615.909	105.39		105.33	105.3	
EB65	601300.785	6107538.869	1627.611	197.79		197.93	197.9	
EB07-01A	601458.23	6108557.44	1731			132.34		
EB07-02	601415.56	6108487.85	1766.85	180.39		183.96		
EB07-03	601342.9	6108448.6	1800.35	209.21		208.69		
EB07-04C	601637.9	6108536.13	1728.16		108.28			
EB07-05	601562.87	6108452.18	1748.17	borehole caved in; logs were not run				
EB07-06	601457.2	6108353.16	1783.92	borehole caved in; logs were not run				
EB07-07	601865.99	6108339.85	1735.88	135.06			131.33	
EB07-08	not surveyed				154.34			
EB07-08A	not surveyed			169.55				
EB07-08B	601649.85	6108116.09	1778.74	178.16		178.05	177.52	
EB07-09	601521.15	6107988.42	1798.33	212.39		212.43	212.44	
EB07-10	601403.9	6107874.82	1759.58	216.75		216.73		
EB07-11	602176.91	6108230.24	1679.56	35.46			35.48	
EB07-11A	not surveyed			62.72		62.9	62.9	
EB07-11B	not surveyed			no geophysical logs run				
EB07-11C	not surveyed			no geophysical logs run				
EB07-12	602114.57	6108192.94	1702.64	131.52		131.80	130.17	

Table A-1: Downhole geophysical logs run in current boreholes (continued)

Borehole	Easting	Northing	Elevation	Gamma/Caliper/ Resistivity/Density	Gamma/Density through rods	Gamma/ Neutron	Verticality/ Deviation	Dipmeter
EB07-12A	not	surveyed		no geophysical logs run				
EB07-12B	not	surveyed		no geophysical logs run				
EB07-12C	not	surveyed		no geophysical logs run				
EB07-12D	not	surveyed		no geophysical logs run				
EB07-13	602057.56	6108096.38	1721.24	143.06		143.02	143.02	
EB07-14	601917.77	6107978.98	1738.71	141.25		137.23	137.22	
EB07-15	601793	6107839.43	1713.01	119.82		118.62	71	
EB07-16C	601558.53	6107604.6	1660.55		143.36	143.28		
EB07-17	601445.47	6107494.46	1626.59	171.89		171.56	171.56	
EB07-18	no borehole of this number is known to have been drilled							
EB07-19	602353.48	6107957.26	1640.97	52.64		54.33	54.34	
EB07-20	602258.07	6107878.69	1683.65	90.01		89.97	89.98	
EB07-21	602197.1	6107822.47	1682.14	79.76		85.34	79.62	
EB07-22	601727.54	6107355.9	1575.53	65.35		65.21	65.2	
EB07-22C	601720.24	6107356.13	1576.41		48.85	48.87		
EB07-23	601547.3	6107178.35	1556.09	104.42		104.47	104.48	
EB07-24	601480.26	6107108	1557.67	126.29		126.17	126.18	
EB07-25	601777.01	6107186.62	1539.32	93.05		93.07	93.08	
EB07-26	601738.08	6107153.06	1539.29	92.89		93.27	93.28	

Table A-1: Downhole geophysical logs run in current boreholes (continued)

Borehole	Easting	Northing	Elevation	Gamma/Caliper/ Resistivity/Density	Gamma/Density through rods	Gamma/ Neutron	Verticality/ Deviation	Dipmeter
EB07-27	601667.18	6107075.09	1541.41	65.99		65.93	65.76	
EB07-28	601855.06	6107262.82	1541.71	59.74		59.78	59.78	
EB08-01	601610.85	6106741.71	1536.64		72.75	72.6		
EB08-02	601705.72	6106549.99	1510.61	no geophysical logs run				
EB08-03	601952.15	6106375.22	1521.36	111.64		110.7	110.6	
EB08-04	601766.04	6106604.88	1511.87	no geophysical logs run				
EB08-05	602182.09	6106178.89	1590.92	129.57		129.89	129.7	
EB08-06	602216.17	6106217.87	1579.41	77.65		77.55	77.38	
EB08-07	602436.04	6106000.33	1673.78	181.63		181.59	181.42	
EB08-08	602505.2	6106062.93	1634.65	87.18		87.32	87.14	
EB08-09	602691.99	6105842.73	1635.44	111.7		110.13	109.96	
EB08-10	602751.66	6105893.8	1626.5	77.93		77.97	77.98	
EB08-11	602712.23	6105701.04	1587.46	99.04		99.08	98.92	
EB08-12	602828.32	6105690.95	1570.6	64.85		64.6	64.8	
EB08-13	601569.31	6107222.77	1556.54	102.43		101.95	102.38	
EB11-01C	602055	6108094	twin 07-13	113.37		133.39	133.18	
MW 11-1	600916.3	6106749.49	1682.39	no geophysical logs run				
MW 11-2	603230.16	6107679.12	1429.25	no geophysical logs run				
MW 11-5	601904.11	6106948.19	1517.78	no geophysical logs run				

Table A-1: Downhole geophysical logs run in current boreholes (continued)

Borehole	Easting	Northing	Elevation	Gamma/Caliper/ Resistivity/Density	Gamma/Density through rods	Gamma/ Neutron	Verticality/ Deviation	Dipmeter
WW 1	602356.42	6107144.92	1477.99	no geophysical logs run				
WW 2	601333.55	6106964.89	1561.62	no geophysical logs run				
EB13-03	603188	6107570	1429.6	151.52		151.46	151.26	
EB13-04	601348.8	6107249	1576.66	174.82		174.86	174.86	174
EB13-05	601447.3	6106915	1557.66	139.34		139.22	139.22	
EB13-06	601924.8	6108148	1753.22	151.98		154.78		
EB13-07	602537.7	6108891	1544.88	173.79		173.67		
EB13-08C	601868.4	6106172	1548.23	280.51		280.37	280.38	
EB13-09C	602572.4	6105735	1655.17	262.76		262.64	262.64	217
EB13-10C	601290.5	6107787	1716.61	223.95		223.89	224.11	
EB13-11	601698.6	6106544.6	1516.65	131.34		131.34	131.44	130.5
EB13-12	601761	6106604	1517.47	107.84		107.88	107.68	
EB13-13	601563.7	6106465	1515.57	42.33		42.41		
EB13-13A	601595.55	6106420.2	1507.57	213.71		212.75	92.78	
MW13-A	601907.28	6106248.09	1555.23	145.41		145.35	143	
MW13-B	602988.68	6105557.23	1525.2	69.05		69.07	66	
MW13-Bs	602991.57	610557.71	1524.22	no geophysics run				
MW13-C	603527.06	6106005.78	1444.03	68.87		68.79	68.8	
MW13-Cs	603529.69	6106006.65	1443.8	no geophysics run				

Table A-1: Downhole geophysical logs run in current boreholes (concluded)

Borehole	Easting	Northing	Elevation	Gamma/Caliper/ Resistivity/Density	Gamma/Density through rods	Gamma/ Neutron	Verticality/ Deviation	Dipmeter
MW13-D	603154.33	6106997.62	1439.16	93.67		93.61	93.62	
MW13-Ds	603152.51	6106996.11	1439.3	no geophysics run				
EB14-01C	601870.346	6108340.45	1736.425	140.26		140.16	139.96	139.5
EB14-02C	601793.311	6107838.808	1714.555	114.48		115.08		113.3
EB14-03C	601485.958	6107109.14	1558.87	113.93		113.99	113.8	113.1
EB14-04C	602393.578	6107964.485	1624.395	26.85		26.67		
EB14-05C	602323.135	6107942.369	1662.184		60.54			
EB14-06C	602275.948	6107917.019	1682.742	82.05		81.99	81.8	
EB14-07C	602230.308	6107894.957	1692.704	96.71		96.67		96
EB14-08C	602192.546	6107922.759	1699.27	99.14		99.16	98.96	98.5
EB14-09C	602159.683	6107947.219	1703.268	107.02	106.84			
EB14-10G	603184.427	6107387.914	1430.116	no geophysics				
EB14-11G	603349.289	6107487.692	1413.554	no geophysics				

Note: Table compiled by Preetpal Singh, M.A.Sc. Depths reached are in metres, derived from tool depth information noted on geophysical-log headers.

Appendix B: Raw coal quality

This appendix presents scanned copies (in the machine-readable CD version of this report) of analytical results for raw coal samples taken from borehole cores during the ‘current’ year-2001 and year-2007 drilling programmes.

- No year-2008 coal core samples were taken, owing to that year's work having solely been rotary-drilling.
- Coal-quality data of any sort has not yet been located for the year-2011 borehole EB11-01C.
- Raw coal quality analyses were not done for year-2013 coal core samples.

Analytical certificates are as found during the senior author’s diligent search of Walter Canadian Coal Partnership’s Vancouver office records. Accompanying the analytical certificates are copies of the respective instructions to the analysts, together with supporting data (where available), such as lists of sample tags.

Not included in this appendix are quality results for year-2014 samples, as this part of the exploration programme is currently still underway as of the date of this report.

The following analytical instructions have been located thus far:

Instructions EB2001-1, dated November 30, 2001

Instructions EB2001-2, dated November 30, 2001

Instructions EB2001-3, dated January 21, 2002

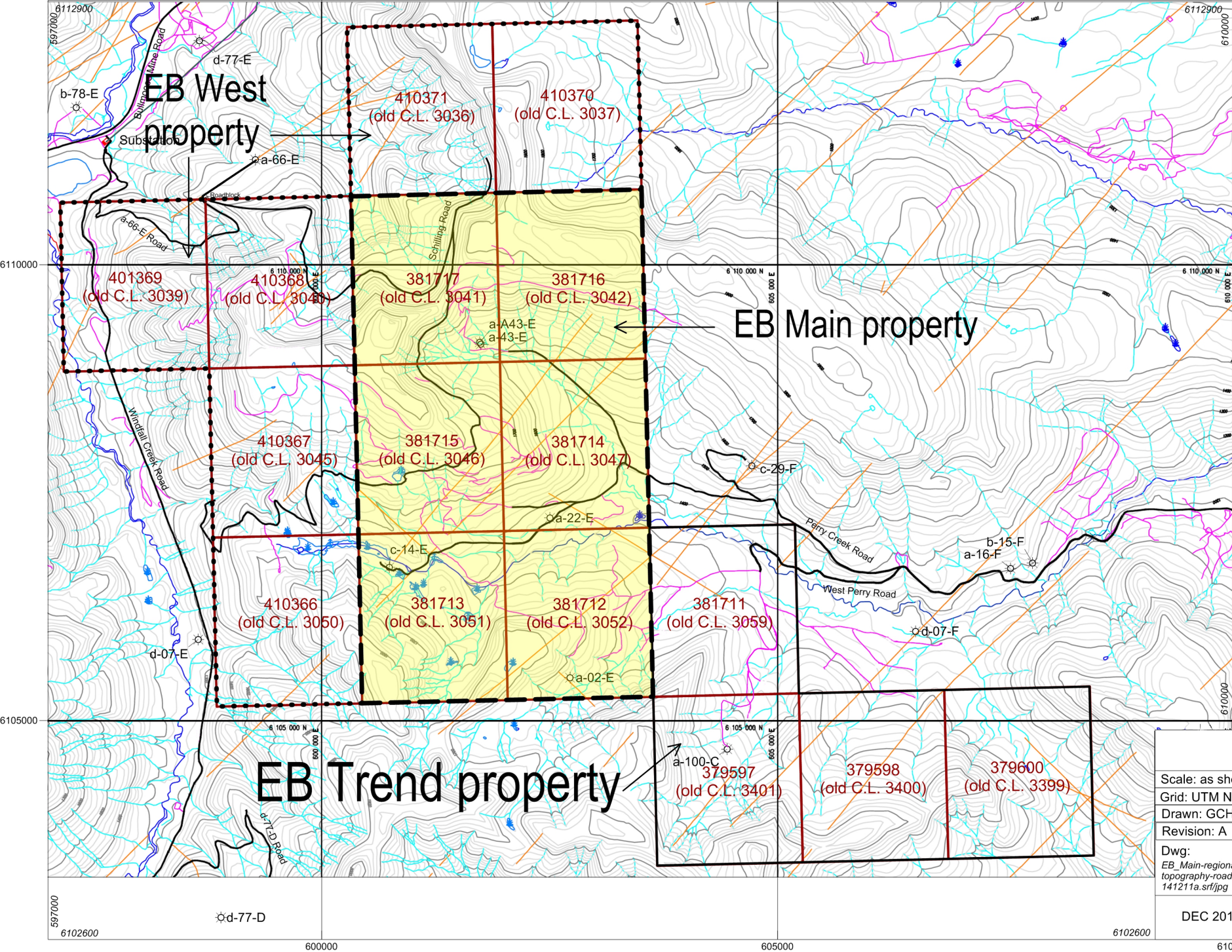
Instructions EB2003-1, dated December 8, 2003

Instructions EB2007-1, dated April 23, 2007

Instructions EB2007-3, dated June 4, 2007

Instructions EB2007-4, dated June 6, 2007

Instructions EB2007-9, dated August 14, 2007



metres

0 1000 2000 3000 4000

Access (not classified as to trafficability):

- Road
- Trail
- Seismic line

Land classification:

- Coal licence (with historic and current tenure number)

Drainage:

- Creek (perennial flow)
- Stream (perennial or intermittent flow)

a-16-F — Natural gas wells (not classified as to activity)

- Power line (230 KV)

UTM NAD 83 zone 10

Scale: as shown	WALTER ENERGY
Grid: UTM NAD 83	
Drawn: GCH	
Revision: A	COAL TENURE AND TOPOGRAPHY
Dwg: *EB_Main-regional-topography-roads_141211a.srf/jpg*	
DEC 2014	EB MAIN COAL ASSESSMENT REPORT — MAP 2-2

UTM NAD83

MOUNT SPIEKER

CANADA
NTS 93P/03

STRUCTURAL GEOLOGY

Thrust fault -- ornament on leading-edge of overthrust structural plate

Anticline

Syncline

Monocline -- arrow shows downfold

Bedding attitude (28)

Outcrop, lacking attitude data

ACCESS AND TRANSPORT

Road -- major, minor (unclassed as to trafficability or composition); restored

Pipeline -- right-of-way not under road

Seismic line -- (unclassed as to trafficability)

metres
0 500 1000 1500 2000 2500 3000

STRATIGRAPHIC LEGEND

MADE GROUND (Recent)

M — Mine dumps and tailings pond (Bullmoose Mine)

DRIFT (Pleistocene to Recent)

TL — Talus and landslide deposits (undivided); extent is interpreted from imagery

D — Valley-filling alluvium, peat and muck; colluvium and moraines (undivided)

FORT ST JOHN GROUP (Albian)

8a — Hasler Formation -- marine shale and siltstone

7 — Boulder Creek Formation -- sandstone, shale, conglomerate and coal

7c — Paddy Member -- conglomerate and sandstone

7b — Walton Creek Member -- siltstone, sandstone, conglomerate and coal (V zone)

7a — Cadotte Member -- conglomerate and sandstone

6 — Hulcross Formation -- marine shale and siltstone; minor tuff; basal gritstone

5 — Gates Formation -- sandstone, mudstone, conglomerate and coal

5c — Notikewin Member -- sandstone, siltstone; minor coal (P, Q and R zones)

5b — Falher Member -- conglomerate, sandstone, coal and siltstone (A, B, C2, C, D and E zones); variably-carbonaceous to coaly mudstone

5a — Torrens Member -- sandstone (Quintette and Torrens sands), minor siltstone and mudstone (Medial silty zone)

4 — Moosebar Formation -- marine siltstone and mudstone; minor sandstone and tuff; basal pebbly glauconitic sandstone

4c — Spieker Member -- marine siltstone and sandstone

4ab — Cowmoose member (informal) -- mudstone; minor tuff; pebbly glauconitic sandstone at base (not Bluesky Member)

BULLHEAD GROUP (Barremian to Aptian)

3 — Gething Formation -- siltstone, sandstone, conglomerate and coal

3bcd — Chamberlain, Bullmoose and Bluesky Members (undivided) -- sandstone, siltstone, coal (Bird, Skeeter and Chamberlain zones); marine mudstone and siltstone in basal part; Bluesky glauconitic sandstone at base (not mapped separately at this scale)

3a — Gaylard Member -- sandstone, siltstone and coal; lenses of conglomerate near base

2 — Cadomin Formation -- cliff-forming conglomerate and sandstone; minor siltstone

MINNES GROUP (Berriasian to Valanginian)

1 — Monach Formation -- sandstone, conglomerate and coal

Drawing file:EB-Main-workmap-geology-141211c.srf/jpg
Date: 2014 December 11 Horizontal datum: UTM Zone 10N NAD83
Scale: as shown on bar-scale
Imagery: Compiled from work by A. Legun P.Geo.(BC), B.C. Geological Survey, and by staff of Robertson Research, Mitsui Mining and Ranger Oil
Drawn by: C.G. Cathyl-Huhn P.Geo.(BC) Lic.Geol.(WA) RMSME
Caution to the user: locations of historic boreholes are not consistently shown on available base-maps; field-check is required

COAL LICENCES

EB Trend Property

Other tenures within the East Bullmoose properties

REV	DATE	DESCRIPTION
C	Dec/11/2014	Structural geology

WALTER ENERGY

Drawn by:	GCH
Checked by:	GCH
Approved by:	GCH
Revision No.	C
Dwg. No.	

GEOLOGY OF THE EB MAIN PROPERTY

DEC 2014 — EB MAIN COAL ASSESSMENT REPORT — Figure No. MAP 2-3

BOREHOLES AND WELLS

Walter Energy / Western Coal drilling:

- Current (year-2001 to year-2014) drilling
- Hydrologic test hole or groundwater well
- Historic drilling (before year-2001) by others
- Off-property drilling by others (may be incomplete)
- Natural-gas exploration wells (current status varies)

ADITS

- Historic adits (pre-2001)

UTM Grid North

Schilling Thrust; Overlook Thrust; Birdbath Thrust; Barrens Anticline; Duckpond Thrust; Bullmoose Thrust; Headwaters Thrust; East Bullmoose Thrust; Spieker (Main) Syncline; East Bullmoose Anticline; Jones Syncline; Fortress Mountain Syncline; Fortress Mountain Anticline; Fortress Mountain West Anticline

6114000 6113000 6112000 6111000 6110000 6109000 6108000 6107000 6106000 6105000 6104000 6103000

597000 598000 599000 600000 601000 602000 603000 604000 605000 606000 607000 608000