Section 4.0 – Earth Resources

Section 4.1 - Geological Resources of the La Salle River Watershed (Source: Manitoba Science, Technology, Energy and Mines)

Surficial Geology:

The surficial sediments in the watershed are primarily glaciolacustrine sand and clay; alluvial sediments occur near Portage La Prairie. The units are shown on the surficial geology map and the depth to bedrock map which accompany this report.

Approximately two thirds of the watershed is underlain by clay deposited in glacial Lake Agassiz. Clay thicknesses range from up to 50 m of clay in the Portage La Prairie area (Ringrose, unpublished) to < 5 m at the eastern edge of the watershed. The clay deposits consist of a lower, dark grey clay and a thinner upper unit of lighter coloured, calcareous silty clay. The clay plain has a gentle ridge ans swale surface particularly in the eastern portion. The ridges are 1-3 m high, with 1- 3 km spacing and are oriented southeast. The western part of the watershed is underlain by medium to fine sand that forms the distal edge of the Assiniboine delta. This sand has been blown into dunes in the area of the Portage sandhills. A Lake Agassiz beach ridge runs along the eastern edge of the delta sediments. In the watershed, this ridge consists primarily 3 m of fine sand over clay. There is a very small glaciofluvial gravel deposit on the northeastern edge of the watershed. Sediments of an alluvial fan that extends to Lake Manitoba occur in the north central part of the area.

Late Glacial History:

The general sequence of events during the Late Wisconsinan glaciation of Manitoba has been outlined by several authors and the following is a compilation of their work. Manitoba was glaciated by ice from two centres of outflow; the Labradorean and Keewatin ice domes. During the Late Wisconsinan, in southern Manitoba, ice first advanced from the northeast to an undetermined western limit. Retreat of this ice was followed by an advance of the Red River Lobe flowing southeastwards down the Manitoba Lowlands, eventually reaching Iowa. Along the western edge of the province, ice advanced from the Keewatin sector. During deglaciation this ice stagnated on the uplands while the ice in the Lowlands remained active. A series of readvances characterize the overall retreat of the Red River ice from southern Manitoba. Since natural drainage is to the north, meltwater ponded against the retreating ice front, forming glacial lakes. Glacial Lake Agassiz was the largest of these, covering parts of Ontario, Manitoba and Saskatchewan during its existence. The lake has a four part history: the high water Lockhart phase during which the lake drained south to the Mississippi River and the Gulf of Mexico, the low water Moorehead phase during which the lake drained through eastern outlets to the Atlantic Ocean, the high water Emerson phase when drainage was again south to the Gulf of Mexico and the Morris phase when the lake finally disappeared from the continent.

Within the watershed area, the Red River lobe deposited a calcareous silty till, often in southeast oriented ridges (flutes). These are particularly common in the eastern part of

the area; the clay ridges in that area are a result of clay deposits reflecting the underlying fluted till surface. As the ice retreated, the Lockhart phase of Lake Agassiz began and the deep water dark clays were deposited in the basin. The Keewatin ice to the west had retreated, leaving stagnating ice on the uplands. The Assiniboine River formed as a spillway draining glacial lakes formed from meltwater from the retreating ice front and the stagnating ice. The Assiniboine delta was deposited where the spillway entered Lake Agassiz. The fine sand and silts of the distal edge of the delta overlies clay in the LaSalle River watershed. The delta had completely formed by the end of the Lockhart phase about 11 000 yrs. B. P.. Outlets opening in Ontario allowed the lake to drain to the low water Moorehead level. An ice advance closed these outlets, starting the Emerson phase as water levels rose again. The calcareous silty clays were deposited at this time. The beach ridge was deposited during the Morris phase as the lake drained from the area. As the lake retreated the Assiniboine river entrenched itself across the newly exposed delta sediments. When it reached the change in slope at the edge of the delta, the river began to deposit the Portge La Prairie alluvial fan. The fan was built by a series of channels. Initially the river entered Lake Manitoba through what is now the Willowbend channel. The river changed course several times as the fan built up and local slope changed. The current LaSalle river occupies an Assiniboine river paleochannel that was active approximately 2 890 yrs B.P. (Rannie et al, 1989).

Mineral Rights:

There is no simple answer as to who owns the mineral rights on a parcel of land. It depends on what is on the title. There are some broad general rules but each time the land changes hands, the seller could have retained certain rights or split titles. Often there are the words "excepting out" followed by a list of minerals, meaning the seller has retained ownership of those minerals, however occasionally the title states "valuable stone". In some instances, that has been considered to mean sand and gravel. In other cases, quarter or half interests of the mineral rights have been retained or split among heirs. So the only certain way to tell who owns what rights is to go to the appropriate Land Titles office and examine the wording on the title.

Having said that, the following is the case for most titles. There are usually three parts to the title of any piece of land: the surface rights, the sand and gravel rights and the mineral underrights. Whether these rights are crown or private depends on when the land was homesteaded (or first title issued):

- Prior to Jan 11, 1890 everything went to the purchaser except gold & silver with some exceptions. For example, the lands given to the Hudson Bay Co. when they deeded their charter lands to Canada.
- Between 1890 & July 15, 1930 mineral underrights were retained by the Canadian government. Sand & gravel was not included in this. During this time, sand & gravel ran with the surface title unless specifically excepted out on the new title when the land was resold.
- Subsequent to July 15, 1930 Manitoba became the Crown. Only the surface rights went to the purchaser and the sand & gravel and mineral underrights were retained by the Crown.

Unless the land reverts to the Crown during a tax sale, the private rights on the original title are conveyed to the new owner - unless the seller "excepts out" things they want to retain rights to.

Crown-owned mineral rights, excluding oil and gas, are administered by the Mines Branch of the Department of Science, Technology, Energy and Mines. Petroleum Branch regulates oil and gas production in the province. Under the Mines Branch, minerals are divided into quarry minerals and other minerals, primarily metals. Quarry Minerals Regulation (Manitoba Regulation 65/92) lists the minerals which are considered “quarry minerals”. Crown quarry minerals are extracted either under a quarry lease, which gives the holder exclusive rights to the commodity listed on the lease, or by casual quarry permit. The permit is for a designated area and many contractors can remove material from the deposit. Minerals other than those designated as “quarry” are regulated under the Mineral Disposition and Mineral Lease Regulation (Manitoba Regulation 64/92). Initially an exploration company will take out a mineral claim, often several claims as a block covering a large area. If a viable deposit is discovered, the claim will be converted into a mineral lease before mining takes place.

Regulation of Aggregate Resources:

Aggregate extraction is regulated through the Quarry Minerals Regulation (Manitoba Regulation 65/92) under the Manitoba Mines and Minerals Act, through policies under the Planning Act and through municipal development plans and their zoning by-laws. Policy #9 under the Planning Act is designed to protect high quality mineral resources from conflicting land uses until the resource has been extracted. Most development plans include maps showing high quality aggregate deposits. Zoning by-laws identify where extraction is allowed or excluded; the by-laws may set strict land use controls on mining.

The Quarry Minerals Regulation sets standards for such things as safety slopes, setbacks from adjacent property lines and waterways, noise levels and location of petroleum storage, etc. it also provides for the “Pit and Quarry Rehabilitation” program. Under this program, landowners can apply to have depleted or abandoned gravel pits and quarries rehabilitated to a standard that is “safe, environmentally stable and compatible with adjoining lands”.

Mineral Resources in the LaSalle River Watershed:

There has been very little economic use made of the mineral resources in the area. The Mines Branch has only two records of aggregate extraction. Gravel was removed from the glaciofluvial deposit in 1994 and ~40 000 tonnes of sand was extracted from the deltaic sands in 1996. Silty clay from the eastern part of the delta area has been used in brick manufacturing in the past. However, none of the extraction sites were within the LaSalle watershed.

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Suggested References:

Rannie, W.F., Thorleifson, L.H. and Teller, J.T. 1989: Holocene evolution of the Assiniboine River paleochannels and Portage La Prairie alluvial fan; *in* Canadian Journal of Earth Sciences, Vol. 26, No 9, p. 1834-1831.

Teller, J.T., Thorleifson, L.H., Matile, G. and Brisbin, W.C. 1996: Sedimentology, geomorphology and history of the central Lake Agassiz basin (Field trip B2); Geological Association of Canada – Mineralogical Association of Canada Joint Annual Meeting, 1996, 101 p.

SECTION 4.1.3

Q

E

A

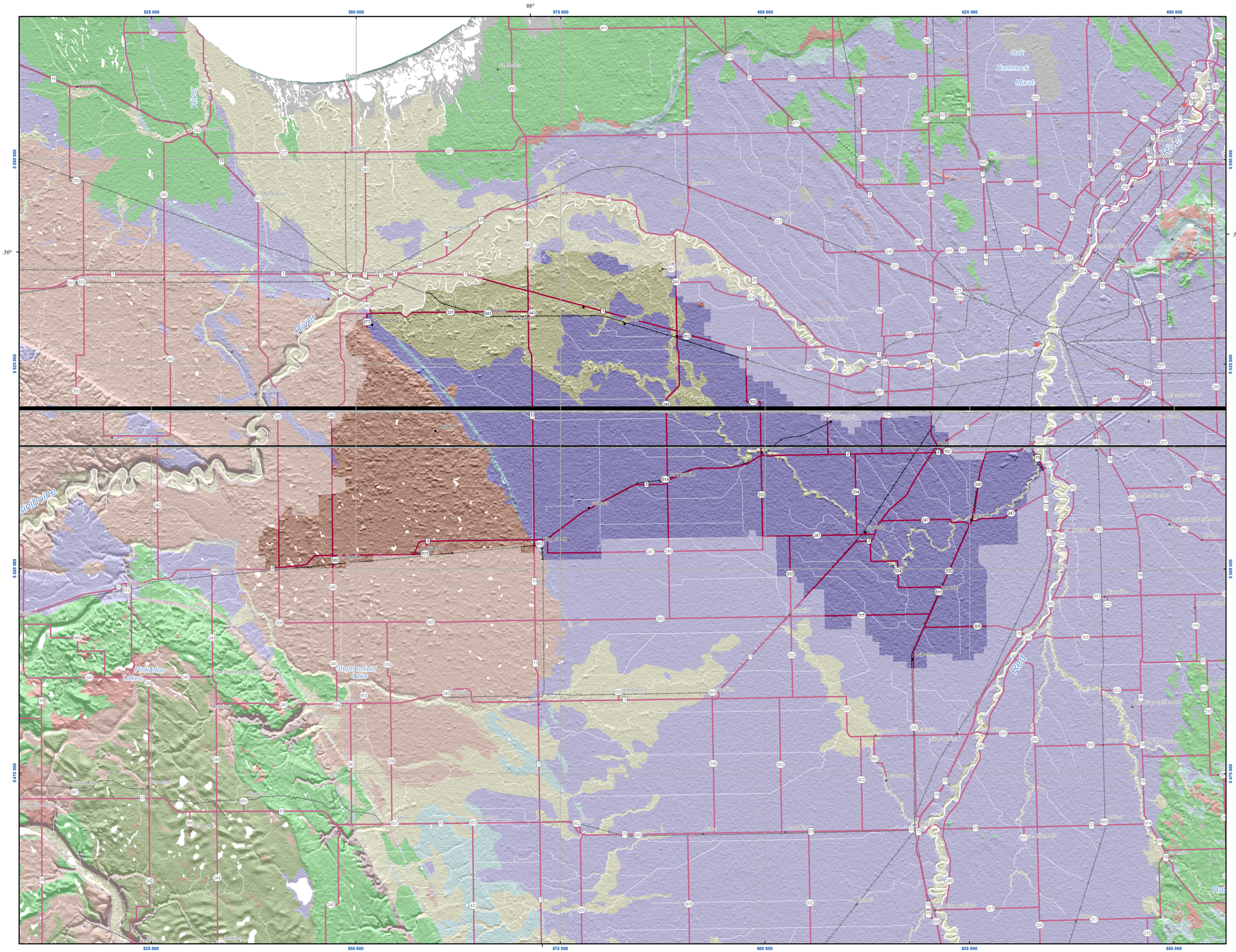
Ls

TILL:
Ag
a
co

Tm

Tc

SECTION 4.1.2



Scale 1:250 000

0 10 20 30

Kilometres

North American Datum 1983
Universal Transverse Mercator Projection, Zone 14
Shuttle Radar Topography Mission elevation data provided by NASA (2003)
100X vertical exaggeration

LEGEND

Quaternary

O — ORGANIC DEPOSITS: peat, muck; 1–5 m thick; very low relief wetland deposits; commonly in low-lying areas; accumulated in fen, bog, swamp, and marsh settings; in permafrost areas commonly includes permafrost features such as patterned ground and peat palsas.

Lm — SHORELINE SEDIMENTS: sand and gravel; 1–2 m thick; beaches; formed by waves at the margins of modern lakes

C — COLLUVIUM: landslide debris, eroded slopes, mass flow deposits associated with steep slopes

E — EOLIAN: sand and minor silt; dunes, blowouts and undulating plains; generally overlies deltaic sediments, coarse lacustrine sediments, or glaciofluvial deposits

A — ALLUVIAL SEDIMENTS: sand and gravel, sand, silt, clay, organic detritus; 1–20 m thick; channel and overbank sediments; reworked by existing rivers and deposited primarily as bars

Ms — MARGINAL GLACIOMARINE SEDIMENTS: littoral sand and gravel; 1–10 m thick; beach ridges, spits, bars; formed by waves at the margin of the glacial Tyrell Sea and present-day Hudson Bay

M — OFFSHORE GLACIOMARINE SEDIMENTS: clay, silt, minor sand; 1–20 m thick; very low relief massive and laminated deposits which are commonly overlain by peat; deposited from suspension in the offshore, deep water of the glacial Tyrell Sea and present-day Hudson Bay

Ls — MARGINAL GLACIOLACUSTRINE SEDIMENTS: sand and gravel; 1–20 m thick; beach ridges, spits, bars, littoral sand and gravel; formed by waves at the margin of glacial lakes Agassiz, Souris and Hind, and other small proglacial lakes in the extreme northwestern portion of the province

Lc — OFFSHORE GLACIOLACUSTRINE SEDIMENTS: clay, silt, minor sand; 1–20 m thick; low relief massive and laminated deposits; deposited from suspension in offshore, deep water of glacial Lakes, primarily Lake Agassiz; commonly scoured and homogenized by icebergs

Gs — DISTAL GLACIOFLUVIAL SEDIMENTS: fine sand, minor gravel, thin silt and clay interbeds; 1–75 m thick; subaqueous outwash fans; deposited in glacial Lake Agassiz by meltwater turbidity currents; commonly reshaped by wave erosion and reworked by wind

G — PROXIMAL GLACIOFLUVIAL SEDIMENTS: sand and gravel; 1–20 m thick; complex deposits, belts with single or multiple esker ridges and kames, as well as thin, low-relief deposits; deposited in contact with glacial ice by meltwater

TILL: diamicton; unsorted glacial debris; 1–75 m thick; generally low-relief, commonly streamlined deposits; in Lake Agassiz basin areas, the till can be wave-washed, covered discontinuously by a thin veneer of glaciolacustrine sediments and scoured by icebergs; thicker sequences, primarily above the Manitoba Escarpment and in the Hudson Bay Lowland, consist of multiple units of varying texture and provenance

Tm — clay diamict; calcareous, primarily composed of Mesozoic shale from above the Manitoba Escarpment

Tc — silt diamicton; calcareous, largely composed of Paleozoic rocks from the Hudson Bay Lowland and the Interlake region of southern Manitoba

Tp — sand diamicton; non-calcareous, often bouldery, predominantly composed of Precambrian crystalline rocks

Pre-Quaternary

ROCK: > 75% bedrock outcrop; generally subglacially eroded and unweathered; in areas of permafrost includes frost shattered, angular, monolithic boulder fields (Felsenmeer)

Rm — Mesozoic terrane; shale-dominated rocks above the Manitoba Escarpment, exposed in the base of spillways and along the Manitoba Escarpment in association with colluvium

Rc — Paleozoic terrane; carbonate-dominated rocks in areas west of Lake Winnipeg, exposed typically as glacially striated, low-relief surfaces, and along large river valleys in the Hudson Bay Lowland

Rp — Precambrian terrane; intrusive, metasedimentary, and metavolcanic rocks having a glacially scoured irregular surface with high local relief

Uncoloured legend blocks indicate units that do not appear on this map.
Letter symbols on legend blocks (not shown on map face) are used to identify units in the map legend database included on the Manitoba SGCMS DVD.
To aid the reader, a shadow effect has been added to exaggerate the topographic relief based on data from the Shuttle Radar Topography Mission Digital Elevation Model.[1]

[1] United States Geological Survey 2002: Shuttle radar topography mission, digital elevation model, Manitoba. United States Geological Survey, URL <ftp://edcsgs9.cr.usgs.gov/pub/data/srtm/>, portions of files N48W98W.hgt.zip through N60W102.hgt.zip, 1.5 Mb (variable), 90 m cell, zipped hgt format [Mar 2003].

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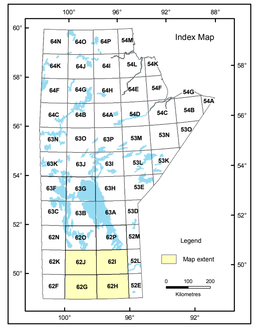
Compiled by: G.L.D. Matile and G.R. Keller

Modified from:
Matile, G.L.D. and Keller, G.R. 2006: Manitoba Surficial Geology Compilation Map Series; Manitoba Science, Technology, Energy and Mines, Manitoba Geological Survey, Surficial Geology Compilation Map Series SG-CMS, 1 DVD-ROM, scale 1:250 000, 1:500 000.

INTEGRATED WATERSHED MANAGEMENT PLAN

Surficial geology of the La Salle River watershed
Portions of: NTS 62G, 62H, 62I, 62J Manitoba



Manitoba