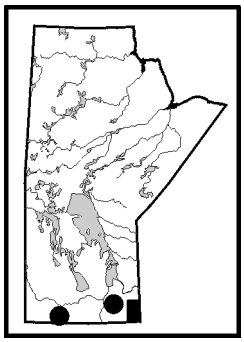
GS-35 AGGREGATE RESOURCES IN THE RURAL MUNICIPALITIES OF STE. ANNE AND TURTLE MOUNTAIN AND IN THE BUFFALO POINT AREA, MANITOBA

by H.D. Groom



Groom, H.D. 2002: Aggregate resources in the rural municipalities of Ste. Anne and Turtle Mountain and in the Buffalo Point area; *in* Report of Activities 2002, Manitoba Industry, Trade and Mines, Manitoba Geological Survey, p. 295-302.

SUMMARY

Aggregate inventories were carried out in the rural municipalities of Ste. Anne and Turtle Mountain, in the Buffalo Point area and on several crown land parcels in southeastern Manitoba. Office compilation was followed by site inspection and aggregate sampling. Samples were field sieved and a representative portion of the fine fraction sent to Winnipeg for processing. Approximately 350 sites were visited.

INTRODUCTION

This summer's aggregate inventories were carried out in three areas of southern Manitoba:

- The Rural Municipality (R.M.) of Ste. Anne, approximately 30 km southeast of the City of Winnipeg.
- The R.M. of Turtle Mountain, approximately 230 km southwest of Winnipeg.
- Seven candidate sites for the Areas of Special Interest (ASI) program in southeastern Manitoba. The largest of these is the Buffalo Point ASI in the extreme southeast corner of the province. The other six are Steve's Shape, Mensino Ridge and small additions to the existing ASIs of Vassar, Lone Sand East, St. Labre and North Hugo Lake.

The two municipalities were chosen for assessment as current aggregate information is required for inclusion in upcoming municipal development plans. The aggregate information gathered from the ASIs will be part of the mineral assessment of these areas.

RURAL MUNICIPALITY OF STE. ANNE

The R.M. of Ste. Anne lies approximately 30 km southeast of Winnipeg. It covers five townships (Twp. 8, Rge. 6–8, E 1st Mer. and Twp. 7, Rge. 7–8, E 1st Mer.) and is located on NTS map sheets 62H9 and 10 (Fig. GS-35-1). The

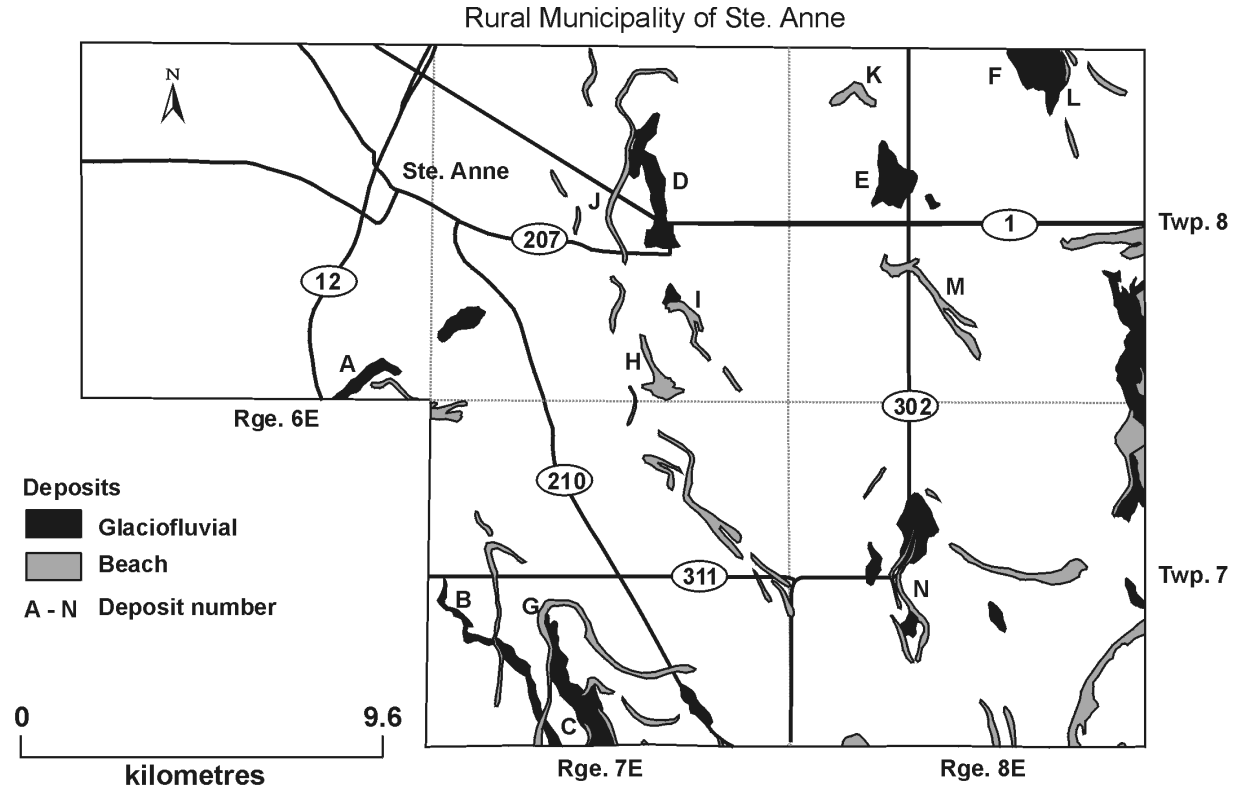


Figure GS-35-1: Aggregate deposits in the Rural Municipality of Ste. Anne (after Matile and Thorliefson1996).

major service centre is the town of Ste. Anne. Provincial highways 1 and 12, Provincial roads (PR) 207, 210, 302 and 311 as well as section roads give good access to most of the municipality. While the municipality is still largely rural and farming is a major source of income, the proximity to Winnipeg has resulted in a great increase in small acreages, subdivision developments, golf courses and campgrounds.

The R.M. is underlain by dolomitic limestones and dolomites of the Ordovician Red River Formation. Overburden thicknesses range from less than 30 m in the east to greater than 50 m along the western edge of the municipality (Little, 1980). No bedrock is used as aggregate in the municipality.

The R.M. of Ste. Anne is included on the Steinbach sheet (Matile and Thorliefson, 1996) of the Prairie NATMAP series, which mapped the surficial sediments of southeastern Manitoba at a scale of 1:100 000. The surficial geology and aggregate resources of the municipality had been mapped previously at a 1:50 000 scale (Matile and Conley, 1979).

The northwestern portion of the municipality is underlain by thick deposits of lacustrine clay. The sand and gravel deposits are primarily glaciofluvial eskers and outwash plains and lacustrine beach deposits. The eastern part of the municipality has large areas of organic accumulations, several of which are sources of high quality peat moss. These deposits resulted from late glacial and early postglacial events. The last ice flow came from the northwest depositing esker and glaciofluvial materials. Glacial Lake Agassiz formed as the ice retreated. Clay was deposited in the deeper parts of the lake and beach ridges formed at the shores. Organic deposits formed in poorly drained areas after glacial Lake Agassiz retreated from the area.

Aggregate Inventory Methodology

The aggregate inventory was carried out in two stages; office compilation followed by field work. Previously mapped deposits were transferred onto 1:20 000 township photomosaics (1997 orthophotos). The township mosaics were used as a base on which to compile aggregate information from several sources:

1) active pit locations – Mines Branch quarry database

2) quarry lease and withdrawn locations – Mines Branch plat books

3) crown versus private ownership – Manitoba Crown Lands Branch database

4) pit and sample locations - Geological Survey Pleistocene database

5) pit and sample locations - Department of Highways block files

Gravel pits, roadcuts and natural exposures were examined during the first part of the field examination. Pits were examined for type of material, degree of depletion and active/inactive/depleted status. Unopened portions of deposits were inspected and land uses that would limit aggregate extraction noted. Site locations were taken by GPS using UTM co-ordinates, as well as by section-township-range notation.

Aggregate samples were processed in two stages. In the field, samples that weighed between 75 and 100 kg were passed through 6-inch (15.2 cm), 3-inch (7.6 cm), 1½-inch (3.8 cm) and ¾-inch (1.9 cm) screens. The weights of the 3-inch, 1½-inch, ¾-inch and less than ¾-inch fractions were recorded. The relative abundance of the greater than 6-inch material, as well as deleterious material such as shale or concretions, was noted. Pebble counts on the 1½-inch to 3-inch fraction were done in the field. A representative sample of the less than ¾-inch fraction was taken for processing by the Material and Research Branch of the Department of Transportation and Government Services (Highways) under the terms of the cooperative agreement initiated in 1998. Sieve intervals and grain-size terms are given in Figure GS-35-2.

Aggregate Resources

The sand and gravel deposits in the R.M. of Ste. Anne are primarily glaciofluvial eskers and outwash plains and lacustrine beach deposits. In several locations, the beach ridges overlie or flank the glaciofluvial deposits. Figure GS-35-1 shows the location and type of deposits in the R.M. of Ste. Anne. The deposits are well distributed across the central and eastern parts of the municipality and almost all of them have been used for aggregate production either currently or at some time in the past. In general, the gravel lithology is a mix of carbonate and Precambrian clasts, with the carbonate fraction ranging between 65 and 85%. Most of the gravel is privately owned. Of the crown-owned sites, two are under lease and the other five are operated under quarry permits. Twenty-six pits have been active in the last five years. Two of these have been rehabilitated, one as a golf course and the other as a resort, and one has been removed from mining at the request of the municipality.

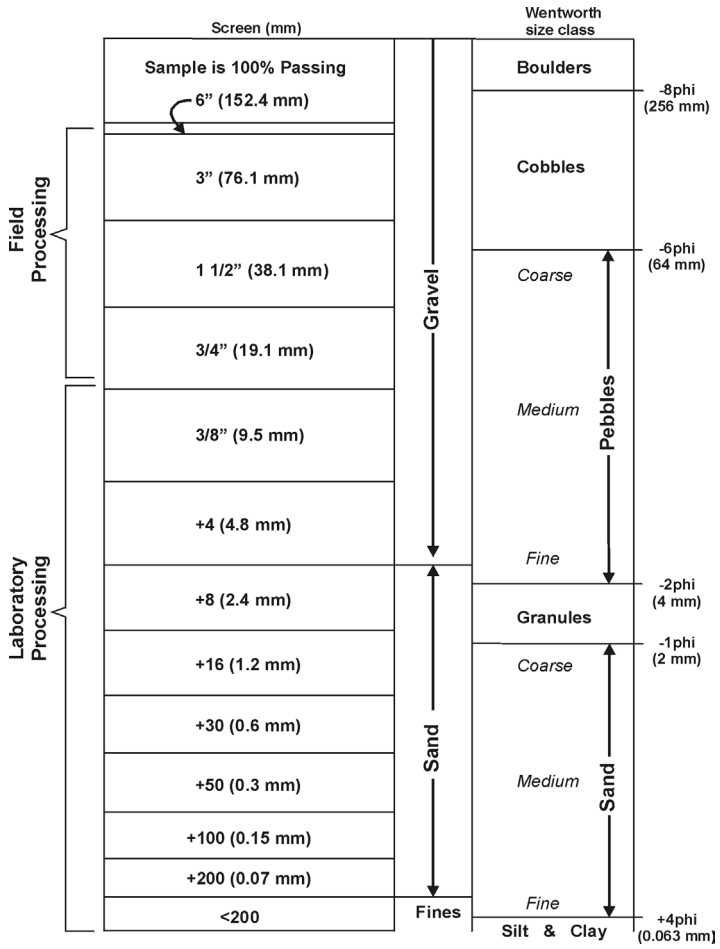


Figure GS-35-2: Grain-size classification and sieve intervals (after Folk, 1974).

Deposits

There are active pits in five glaciofluvial deposits in the municipality. Most of these pits are well established and gravel is currently being extracted from below the water table in several of them.

Deposit A (Fig. GS-35-1) in Twp. 8, Rge. 6, E. 1st Mer. (abbreviated 8-6-E1) has one active pit. The pit is water filled and reported to be greater than 8 m deep. The pit will continue to expand westward. The deposit is notable for the presence of shale. The amounts are minor but it is the only deposit in the municipality to contain any shale. The aggregate continues southwest across the section road but the owners of the gravel do not wish to open the deposit for large-scale extraction. The linear deposit (B) running through the southwest corner of 7-7-E1 is an esker. The gravel pits in this deposit have been in existence for a long time but have recently been reactivated and material is now being removed from below the water by dragline. There is a reported 15 m of gravel below the water table. Deposit C, in 7-7-E1, has been extensively mined. The pits range from 2 to greater than 6 m deep. The deposit is primarily fine sand but there are pockets of gravel suitable for crushing.

The pit in Deposit D, in 8-7-E1, was active in the last five years but the southern portion of the pit has been rehabilitated. There is now a resort with cottages beside a pond.

There are active pits in two glaciofluvial deposits in 8-8-E1. The southern deposit (E) has two gravel pits. The crown pit at the north end of the deposit is up to 4 m deep and water covers the pit floor in places. The material is mostly sand but there are areas of gravel and there are boulder piles on site. The pit to the south is adjacent to a campground and has recently been rehabilitated due to safety and land-use compatibility concerns. The northern glaciofluvial deposit (F) is being worked by dragline to remove material from below the water table. There is a very good range of material sizes in this deposit.

There are active pits in seven beach deposits in the municipality. The pits are generally 1.5 to 2.5 m deep and most often overlie till. Occasionally they flank and partially overlie glaciofluvial deposits.

Deposit G, in 7-7-E1, has one active pit at its north end. The pit has approximately 1 m of pebble gravel over sand. The pit has been rehabilitated at the south end, where it is depleted, and extraction continues to the north.

There are recently active pits in three deposits in 8-7-E1. Deposit H is depleted at the south end but there has been recent extraction at the north end where there is about 1.5 m of sandy pebble gravel. This pit is owned by the municipality. The main ridge of Deposit I has been depleted; there has been some minor removal of pebbly sand from the south end of this deposit. The one active pit is held under quarry lease. The pit is large and very shallow (less than 1 m). The material is primarily sand, which the leaseholder says he works into the heavy clay soil on his farm. While Deposit J has not been actively mined since 1999, and much of its length has been depleted or sterilized by residential development, there are still areas of aggregate reserves. From existing pits, the material in the deposit is fine pebble gravel, 1 to 2 m thick.

There are active pits in two of the beach deposits in 8-8-E1 and a recently active pit in another beach deposit. The pit in deposit K is about 1.5 m deep and till is evident in the floor. The deposit is nearing depletion. Deposit L is being worked southward along the ridge. The pit in this deposit is about 2 m deep. The material is very sandy and two test pits along the ridge indicate the proportion of sand increases to the south. Deposit M has several old pits along its length. The material is again very sandy. The deposit is nearly depleted at its south end with minor amounts of material being used in the rehabilitation of some of the old pits.

Deposit N is a large deposit that has been extensively mined at the north end. There is one pit adjacent to PR 302 that is near depletion. Northeast of this pit, old pits have been reactivated and are being expanded southwards. The pits are shallow and there is about 1.5 m of material that ranges from fine pebble gravel to pebbly sand.

RURAL MUNICIPALITY OF TURTLE MOUNTAIN

The R.M. of Turtle Mountain lies approximately 200 km southwest of Winnipeg. It covers slightly less than ten townships, Twp. 1 to 3 in Rge. 16 to 18, W 1st Mer., part of Twp. 4, Rge. 16, W 1st Mer. and Sec. 6, Twp. 4, Rge. 15, W 1st Mer. (Fig. GS-35-3); it is located on NTS map sheets 62G3, 4, 5 and 6. Provincial highways 3 and 18 bisect the area. The major service centre is the town of Killarney. Provincial Road 346 and gravel section roads give good access to all parts of the municipality. Agriculture is the major source of income in the municipality. As well as grain farms, there are livestock and mixed farms throughout the area.

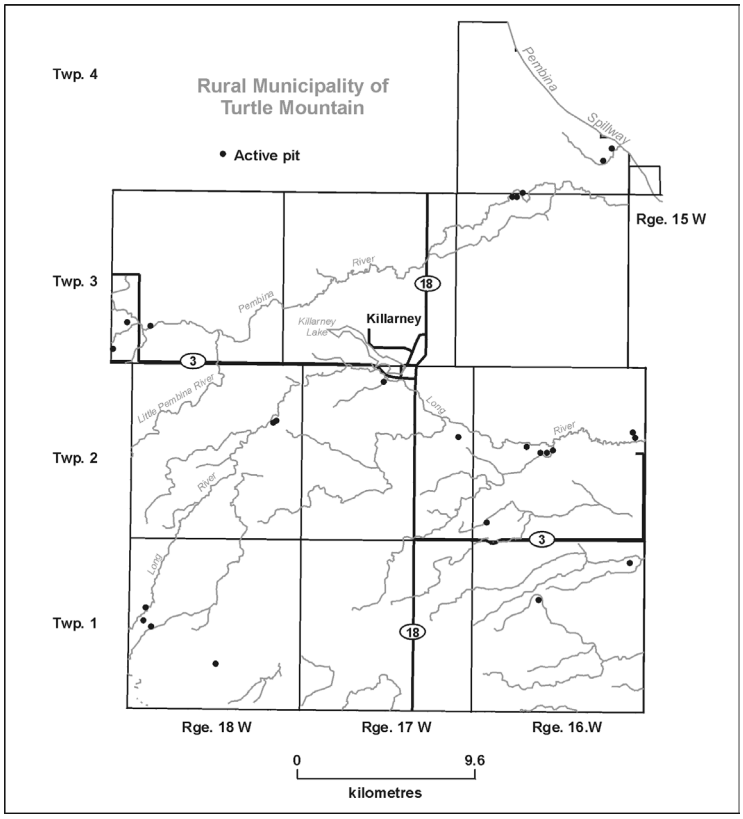


Figure GS-35-3: Rural Municipality of Turtle Mountain showing active pit locations.

While most of the municipality is a gently rolling plain, Turtle Mountain rises to over 650 m asl at the southwestern corner. Several rivers and creeks flow off the mountain and across the plain. The Little Pembina and Pembina rivers flow northeast to the Pembina spillway. Long River flows northeast to Killarney and then turns southeast. Killarney Lake occupies an old watercourse that existed before present-day drainage patterns were established.

Shale and sandstone form the bedrock underlying the municipality. On Turtle Mountain in the southwest corner of the municipality, Tertiary sedimentary rocks of the Turtle Mountain Formation overlie those of the Cretaceous Boissevain Formation. Except for this corner, the uppermost bedrock in the municipality is shale of the Odanah Member of the Cretaceous Pierre Formation (Bamburak, 1978). This is a hard siliceous shale and is commonly found in the gravel deposits in the area. Overburden thicknesses range from 20 to greater than 70 m in the municipality (Sie and Little, 1976); bedrock outcrops are rare but are occasionally present in the banks of river valleys.

The quaternary geology and glacial history of the Killarney–Holmfield area is discussed in Conley (1986). The R.M. of Turtle Mountain forms a small part of this area. The last iceflow to affect the area came from the northwest. Esker deposits, oriented along the direction of iceflow, were deposited at this time. During deglaciation, ice stagnated on Turtle Mountain, while on the plain active ice retreated north to the approximate position of Killarney. Most of the sand and gravel in the municipality was deposited by meltwater finding its way to lower elevations between these two ice masses. Several rivers and creeks carried meltwater from the stagnating ice on the mountain, depositing alluvial fans at the break in slope and as channel or overflow deposits at intermittent locations along their length. Much of the aggregate was deposited in channels that were active for short periods before deeper channels became established. Most of the outwash south of Killarney was deposited this way. The southeast trend of the outwash belt indicates the ice stood at this position during deposition. Further ice retreat caused the abandonment of the Long River channel northwest of Killarney and allowed the Pembina River to flow to the Pembina spillway, at the northeastern edge of the municipality, and for Long River and the creeks south of it to assume their present-day courses.

Aggregate Resources

The methodology for the aggregate inventory in the R.M. of Turtle Mountain was the same as for the R.M. of Ste. Anne. The orthophotos used for compilation were taken in 1995.

There is one shale quarry in the area. The sand and gravel pits are in glaciofluvial deposits scattered across the municipality. Most of the gravel is privately owned and there are only two pits held under quarry lease from the crown. Shale is present in varying quantities in all the deposits. While some percentage of shale is acceptable for most end uses (e.g., 12% for traffic gravel), the specifications for certain products require no shale be present in the aggregate. There is one gravel operator with a shale washing plant in the adjacent municipality of Morton but crushed limestone from near Winnipeg and shale-free aggregate from south of Brandon are imported into the municipality as needed. Ironstone concretions also form part of the deleterious fraction of the gravel.

Deposits

There is one small bedrock quarry located in the side of a meltwater channel in 3-18-W1. The quarry is about 2.5 m deep. The rock is Odanah Member shale that has been fractured and faulted by glacial action.

Only one esker deposit has an active pit. The ridge height varies up to 3.5 m at its highest. The active pit is about 2.5 m deep and is down to till in places. Shale content is moderate and there is a good amount of crushable material in the 5 to 8 cm range.

There are active pits in one alluvial fan deposit, which is located in 1-18-W1. There are two crown and two privately owned pits in the deposit. A portion of the deposit was tested with a backhoe in 1996. The testholes showed that the gravel was deposited over an undulating till surface. Gravel thickness varied from 0.5 to 2.5 m and overlay clay or till. The pits in the rest of the deposit are generally up to 2.5 m deep. Shale content is low to moderate and clasts range up to cobble size (20 cm).

While outwash sediments are found along most of the creeks and along some of the old watercourses, most of the gravel extraction has been from the outwash deposits adjacent to the Pembina and Long rivers. There are numerous old pits and several active pits along the length of these channels. The pits range from 1.5 to greater than 4 m deep, usually expose till in the floor and contain variable amounts of shale and ironstone concretions. The material is generally sandy pebble gravel. Unlike other areas of the province, where outwash deposits often contain a large coarse fraction, cobble- and boulder-size material is a minor component of the deposits. However, most of the deposits contain enough of the 4 to 8 cm fraction to provide adequate material for crushing.

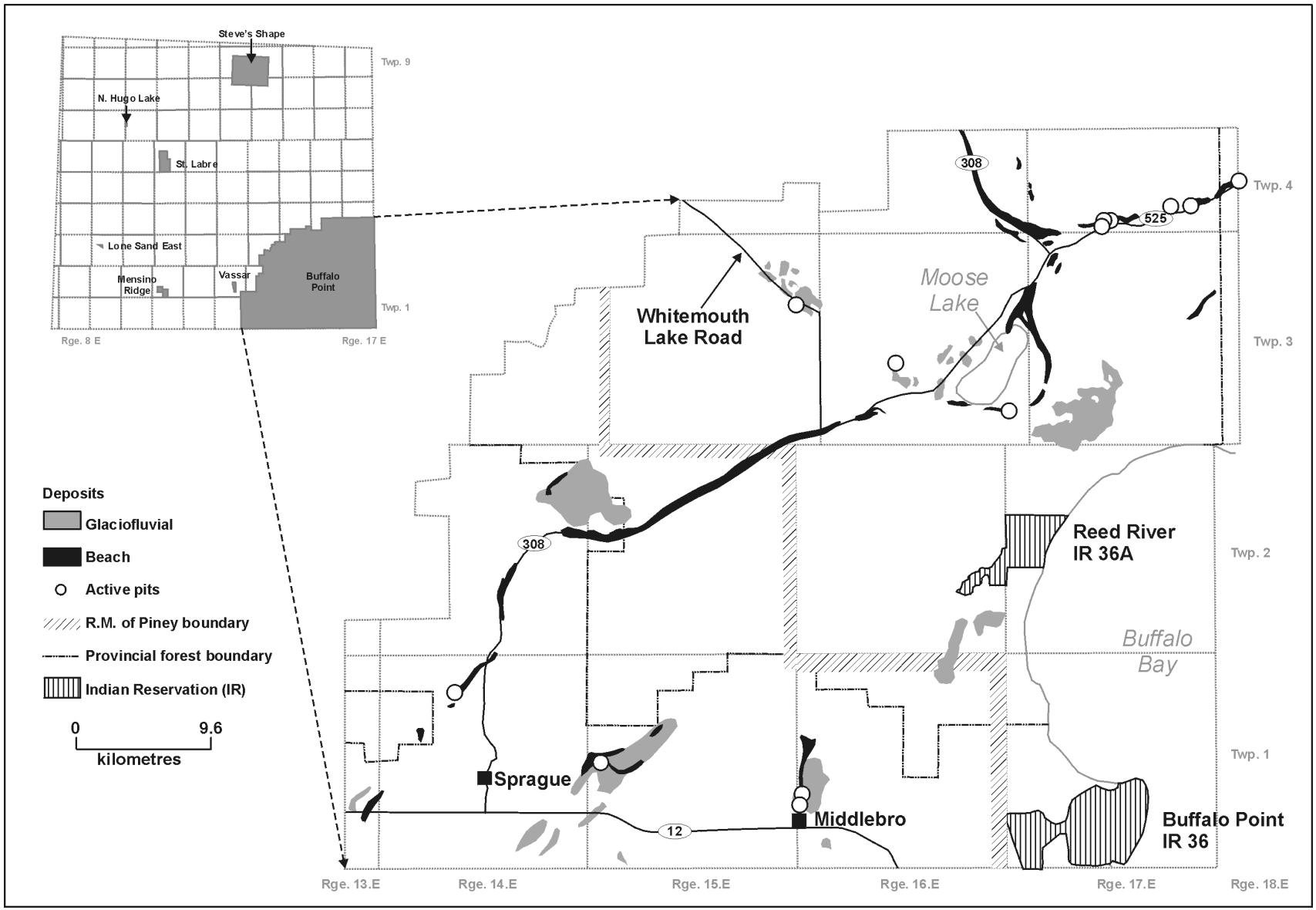


Figure GS-35-4: Location of ASIs in the study area and aggregate deposits in the Buffalo Point area (after Matile and Thorliefson, 1995).

AREAS OF SPECIAL INTEREST

Areas of Special Interest (ASIs) are parcels of land put forward as candidate sites for study in Manitoba's Protected Areas Initiative. Under this initiative, representative portions of each of Manitoba's natural regions are set aside for biodiversity protection. Mining (including aggregate extraction), forestry and hydro development are excluded activities within areas that proceed to formal protection. **Only** provincially owned lands are considered for the program so that private lands and First Nations lands are excluded unless an agreement is made with the landowners.

Seven candidate areas were assessed this year: Buffalo Point, Steve's Shape, Mensino Ridge and small additions to Vassar, Lone Sand East, North Hugo Lake and St. Labre ASIs. Their locations are given on Figure GS-35-4.

Buffalo Point Area

The Buffalo Point ASI is a large tract of land in southeastern Manitoba. It covers more than twelve townships lying in Twp. 1 to 4, Rge. 13 to 17, E 1st Mer. (Fig. GS-35-4) and is located on NTS sheets 52E3, 4, 5 and 6. Provincial Highway 12 runs through the southern part of the area and Provincial roads 308 and 525 run diagonally across it. Section roads give good access in the southwestern part of the area, but access to the rest of the area is mostly limited to forestry trails. The primary industries are agriculture, forestry and tourism. The Northwest Angle Provincial Forest occupies most of the eastern two-thirds of the area. The Catshills Provincial Forest occupies a small area in 1-14-E1. The R.M. of Piney extends into the area in Twp. 1, Rge. 13 to 16, E 1st Mer., Twp. 2, Rge. 13 to 15, E 1st Mer and Twp. 3, Rge. 14, E 1st Mer. Buffalo Point and Reed River First Nations are located on Buffalo Bay on Lake of the Woods.

The surficial sediments of the area are included on the Whitemouth Lake Area map sheet, at a scale of 1:100 000 (Matile and Thorliefson, 1995). This map is part of the Prairie NATMAP series referenced above in the R.M. of Ste. Anne section. The aggregate resources in the R.M. of Piney were previously mapped at a 1:50 000 scale (Matile, 1994). The late glacial to early postglacial events are the same as those that affected the R.M. of Ste. Anne.

The area is underlain by Precambrian bedrock but overburden thicknesses are generally greater than 15 m (G. Matile and G. Keller, Manitoba Geological Survey, pers. comm., 2002) and there was no bedrock observed during the aggregate survey. Organic deposits form the most widespread surficial unit but there are also large areas of glacial till and littoral sand. The sand and gravel units are outwash plains and beach ridges. As in the Ste. Anne area, the beaches often flank or overlie the outwash deposits (Matile and Thorliefson, 1995).

Aggregate resources

The methodology used for this area was the same as for the R.M. of Ste. Anne and Turtle Mountain. The orthophotos used for compilation were taken in 1997.

There are no bedrock quarries in the area. The gravel deposits are scattered across the area and many have been opened for aggregate extraction. The pebble lithology is primarily carbonate with Precambrian clasts making up the balance of the clasts. There is no shale and a high sand content is the greatest deleterious factor in the deposits. Due to the sparse population, there is little development pressure and most of the aggregate is used for road construction and maintenance. Most of the aggregate resources are crown owned but there are some areas where the gravel is privately held. Most of the private gravel sources are not being mined commercially and it is the crown-owned sources that account for most of the aggregate production.

Deposits

There are only two glaciofluvial deposits that have been mined recently. Aggregate extracted from the deposit near Moose Lake was used to repair the washouts caused by 2002 summer flooding. The other deposit is on the Whitemouth Lake Road. The pits in both of these deposits are up to 2.5 m deep and contain a maximum grain size of 10 cm.

Most of the past aggregate production has been from beach deposits. The main ridges are from 2 to 3.5 m high and usually consist of interbeds of sand, granules and sandy pebble gravel. Grain sizes greater than small cobbles are rare in the sediments. The large ridges often have smaller offshore, bar-type ridges associated with them. These smaller ridges are usually composed of sand with minor amounts of gravel. All of the accessible deposits have pits in them. Most are inactive but some show signs of minor amounts of removal for local use. The only pits currently used for commercial production are those along PR 525.

Along most of their extent, PR 308 and 525 are built on the crests of the largest beach deposits in the area. The deposits were extensively used during construction and there are numerous pits on both sides of the roads. The best remaining aggregate reserves are under the road. A large beach ridge runs north from the town of Middlebro. This

deposit was extensively mined in the past and in most places the remaining reserves are sand. However, a recently opened pit at the south end of the ridge shows 2 m of interbedded sand and pebble gravel. Similarly, the deposit in 1-14-E1 has several old pits and a new pit at the south end shows 2.5 m of interbedded sand, granules and fine pebble gravel.

Smaller ASIs

Airphoto interpretation and office compilation showed that the additions to Vassar, St. Labre and North Hugo Lake ASIs are all composed of organic deposits with no aggregate potential. The Lone Sand East addition also has no aggregate within it. Previous mapping of Steve's Shape (Matile, 1991) identified a few small, unopened beach deposits in the northern part and airphoto interpretation showed bedrock outcrops along the eastern edge of the ASI. However, none of these deposits were accessible due to the surrounding organic deposits. Mensino Ridge ASI was mapped and sampled previously (Matile, 1994). One gravel deposit was mapped in the northwestern part of the area. No new pits have been opened in the deposit and the existing pit is inactive. This ASI is in the Sandilands Provincial Forest and the pit is in an area newly planted with trees. Gravel occurs at two locations in the ditches along the northern boundary. The balance of the ASI appears to be sand, much of it blown into dunes.

ACKNOWLEDGMENTS

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REFERENCES

Bamburak, J.D. 1978: Stratigraphy of the Riding Mountain, Boissevain and Turtle Mountain Formations in the Turtle Mountain area, Manitoba; Manitoba Mines, Resources and Environmental Management, Mineral Resources Division, Geological Report GR 78-2, 47 p.

Conley, G. G. 1986: Surficial geology and stratigraphy of the Killarney–Holmfield area, southwestern Manitoba; MSc thesis, University of Manitoba, Winnipeg, 165 p.

Folk, R.L. 1974: Petrology of Sedimentary Rocks; Hemphill Publishing Company, Austin, 185 p.

Little, J.S. 1980: Winnipeg area (62H); Manitoba Natural Resources, Water Resources, Groundwater availability map series, map at 1:250 000 scale.

Matile, G.L.D. and Conley, G.G. 1979: Quaternary geology and sand and gravel resources of the Rural Municipality of Ste. Anne; Manitoba Energy and Mines, Mineral Resources Division, Map AR80-3, scale 1:50 000.

Matile, G.L.D. 1991: Aggregate resource inventory in the L.G.D. of Reynolds; Manitoba Energy and Mines, Aggregate Report AR89-2, 178 p.

Matile, G.L.D. 1994: Aggregate resource inventory in the Local Government District of Piney; Manitoba Energy and Mines, Aggregate Report AR94-2, 122 p.

Matile, G.L.D. and Thorliefson, L.H. 1995: Surficial geology, Whitemouth Lake area, Manitoba, Ontario and Minnesota; Manitoba Energy and Mines, Geological Services, Open File Report OFR 95-1, map at 1:100 000 scale.

Matile, G.L.D. and Thorliefson, L.H. 1996: Surficial geology, Steinbach area, Manitoba; Geological Survey of Canada, Open File Report GS OFR 3270, map at 1:100 000 scale.

Sie, D. and Little, J. 1976: Brandon area (62G); Manitoba Natural Resources, Water Resources, groundwater availability map series, map at 1:250 000 scale.