SITE INVESTIGATION FOR LOCATION OF ALBERTA FOREST SERVICE TREE NURSERY

by

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Site Investigation for Location of Alberta Forest Service Tree Nursery

To provide assistance to the Alberta Forestry Service (A.F.S.) on the selection of a site for a new coniferous tree nursery, the Canadian Forestry Service (C.F.S.) participated in an examination of soil maps, field trips for examination and soil sampling of candidate sites, and limited laboratory analyses of chemical and physical characteristics of the soils sampled.

This investigation is a preliminary one. When potentially suitable sites have been identified, it is recommended that they be examined in more detail.

Methods

An examination of soil maps and reports (2, 4, 5, 6, 7, 8, 9, 13) was conducted in order to select candidate nursery sites most likely to possess the best biological qualities of soil and climate, in combination with physical factors such as topography, elevation, drainage, and wind erosion hazard. In addition, economic restraints such as nearness to irrigation water, labor supply, power, and road access were considered. The specific soil requirements (10, 11, 12) are for a loamy sand texture in the surface and subsurface horizons, preferably overlying a porous, gravelly substratum at depth. In addition, a pH in the range of 5.5 to 6.5 is desirable, along with organic matter content of 5 to 8%, and low quantities of soluble salts.

A.F.S. personnel were accompanied on a field trip for the

purpose of site examination, description and soil sampling. Sites that had obvious limitations (e.g. stoniness, impeded drainage) were not sampled in detail. On virgin sites, the soil sampling was for the L-H, Ae, Bm, and C horizons, and on cultivated sites the sampling was Ah, Bm, and C horizons.

The soil samples were analyzed for texture, pH, electrical conductivity and organic matter content. Texture was determined by the Bouyoucos hydrometer method (1) but without prior removal of organic matter. Where silt-plus-clay was less than 10 percent, the weight of the very fine sand fraction was also determined. The pH and electrical conductivity were determined by the soil paste method (3, p.48 and p.229). The Walkley-Black wet oxidation method was used for the determination of organic matter (3, p.219). Alkaline samples were tested for the presence of carbonates using 10 per cent hydrochloric acid.

Samples of water for irrigation purposes were not collected at this time. A.F.S. information is that water sources are very similar in salts and pH. However, the water source must be thoroughly analyzed before a final site is chosen.

Results and Discussion

Figure 1 shows the areas examined. Their legal and general descriptions, and the soil sample identification are given in Table 1. Site 2 was found to have restricted subsurface drainage; hence it was not suitable for further soil sampling. Site 4 had a severely rolling topography, indicating probable frost pockets, slopes unsuitable for tree nursery machinery, and poor location; thus, the soil was not

sampled. Likewise, Site 5 was eliminated for soil sampling, because of silty surface texture and economic restraints resulting from poor location. Site 8 was not soil sampled, again mostly because of location. Site 11 was felt to be reasonably similar to Site 6 and so was not sampled at this time. Site 12 was eliminated because of topography. The soils of Site 16 (4; Table 32, Page 72) are similar to Site 6 and were not sampled. Site 17 was eliminated because of obvious salt accumulations on the east side of Lost Point Lake and rolling topography on the west side.

Figures 2 to 12 are portions of published soil maps. They locate the soils examined and illustrate the soil pattern.

A generalized site analysis is presented in Table 2. Site limitations, soil limitations, and economic restraints are tabulated. Table 3 contains the laboratory results of the physical and chemical analyses conducted. Interpretation of these results are incorporated into Table 2.

Laboratory Analyses

Texture:

Results of the laboratory analyses are shown in Table 3. Most of the soils are sandy loam in texture, with a silt plus clay content of 29 percent or greater. Site 6 is sand (more than 92 percent), Site 13 is a loam and portions of Site 7 are clay loam. The ideal texture for a conifer nursery has been described (10) as loamy sand i.e. 10-25 percent silt plus clay. On this basis, most of the sites are unsuitable. Site 6 had only 1.2 percent very fine sand and the total of this fraction plus silt plus clay amounted to less than 9 percent. The next finer texture is Site 15 (silt plus clay = 29 percent)

but the loamy B horizon makes it unsatisfactory. Therefore Site 6, while not of ideal texture, is preferred above the others.

pH

Most of the sites are moderately acid to neutral (pH 5.6-7.0) in the A horizons but pH generally increases with depth. Sites 1, 3 and 6 are moderately acid throughout their profiles and are most suitable. Sites 7, 10, 13 and 15 have acid topsoil but alkaline subsoils and are less satisfactory. Sites 9 and 14 have alkaline A horizons and would be unsuitable.

Electrical Conductivity

The soluble salt concentration as expressed by electrical conductivity was low in all samples. No problems from soil salinity should develop on any of the sites sampled.

Carbonates

Free carbonate was detected in portions of the B horizons of Sites 9 and 13 and would make them unsuitable. The C horizons of Sites 7, 9 and 15 are very calcareous and, unless drainage can be improved, these sites should be avoided. In such areas, it is possible that an elevation of the water table could bring carbonates into the root zone.

Organic Matter

The organic matter content in the A horizon is low at all sites except those with the heavier loam and clay loam textures. However, where the L-H horizon is present,(Sites 1, 3 and 6) this could be plowed into the underlying A horizon during preparation of the site. Peat could be

applied, when necessary, to supplement the natural organic matter present.

On the basis of laboratory analysis, Site 6 appears to be most suitable. Next in decreasing order of suitability are Sites 14 and 15.

Conclusion

Tables 2 and 3 indicate that the following sites are definitely unsuitable for location of a nursery: 1, 2, 3, 4, 5, 7, 9, 10, 12, 13, 14, 15, and 17.

Possibly suitable sites are 6, 8, 11, and 16. The soils of these sites appear to be similar in such characteristics as texture, drainage, topography and vegetation. Site 6 (South Heart River) has desirable soil characteristics (Table 3) but is in a possible frost pocket and should be carefully monitored climatically before a location decision is made. Site 8 (Sandhill Lake) is also mapped as Heart soil series and appears to be very similar to Site 6 but is not in a frost pocket. However, the frost-free period at Fairview is short, being only 105 days (8) and the location of Site 8 is slightly remote (i.e. about 15 miles from Fairview).

Site 11 (southwest of Grande Prairie) has two soil series in the area; Heart and Leith. The Heart soils appear similar (7) to Site 6 in all respects, but the Leith soil has some disadvantages to the extent that it has a high pH and fine textured subhorizons (7, page 67). The area would have to be surveyed and sampled in more detail to determine whether there is a sufficient acreage of Heart soil

to meet the needs of a nursery. Other advantages of this site are its proximity to a service and labor centre, accessibility, and availability of irrigation water (from the Wapiti River).

Site 16 (Egremont) has favorable soil characteristics similar to Site 6. The reference (4, Table 32, page 72) indicates the similarity of the Nestow soil series to the Heart soil sampled at Site 6, Table 3. Its location is an advantage in that it is close to administration services, and is centrally located in the province. Also, according to the reference (4, page 72) the pH and texture are suitable. An examination of Site 16 indicated sufficient acreage occurs, see Appendix I.

Each of the above sites is subject to wind erosion and should any be selected, it is recommended that clearing be done in such a way as to provide shelterbelts for the nursery.

It is recommended that further investigation be concentrated on Sites 6, 11, and 16.

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Table 1

AREAS EXAMINED FOR NEW A.F.S. TREE NURSERY

Site No.	Legal Description	General Location	Soil Sample No.	Soil Horizon and Depth in Inches		Laboratory Soil Sample No.
1	Tp. 66, R. 13, W. 4th Mer.	North shore of Beaver Lake, Lac La Biche	W731	L-H	5-0	1
				Ae	0-3	2
				Bm	3-10	3
				BC	10-22	4
				C	22 +	5
2	Tps. 68 & 69, Rs. 13 & 14, W. 4th Mer.	Owl River area, north shore of Lac La Biche				
3	Tp. 67, R. 23, W. 4th Mer.	Northwest of Athabasca	W732	L-H	2-0	6
				Ae	0-4	7
				AB	9-12	8
				Bm	17-22	9
4	Tp. 67, R. 22, W. 4th Mer.	Northeast of Athabasca				
5	Tps. 70 & 71, Rs. 14 & 15, W. 5th Mer.	East Prairie Metis Reserve No. 4; southeast of Enilda and High Prairie				
6	Tp. 76, R. 17, W. 5th Mer.	South Heart River north of High Prairie	W733	L-H	2-0	10
				Ahe	0-8	11
				Bm	8-14	12
				C	37-40	13
7	Tp. 83, R. 22, W. 5th Mer.	Shaftesbury Settlement, Southwest of Peace River	W734	Ah	0-6	14
				C	6-12	15
				Ck	30	16
			W734(centre)	Ah	0-6	17
			W734(west)	Ah	0-6	18
8	Tps. 82 & 83, Rs. 4 & 5, W. 6th Mer.	Sandhill Lake area; southwest of Lake George and northwest of Fairview				
9	Tp. 71, R. 5, W. 6th Mer.	East of Grande Prairie	W735	Ah	0-6	19
				Bm	6-14	20
				Ck	14-18	21
10	Tps. 70 & 71, Rs. 6 & 7, W. 6th Mer.	West of Grande Prairie	W736	Ah	0-14	22
				Bm		23
11	Tp. 70, R. 6, W. 6th Mer.	South of Grande Prairie				
12	Tp. 59, Rs. 11 & 12, W. 5th Mer.	Southeast of Whitecourt				
13	Tp. 55, R. 21, W. 4th Mer.	5½ miles northeast of Fort Saskatchewan - on south bank of river	W737	Ah	0-10	24
				Bm	10-22	25
14	Tp. 55, R. 22 W. 4th Mer.	Gem Sod Farms - NE of Fort Saskatchewan - on north bank	W738	Ah	0-6	26
15	Tp. 55, R. 22, W. 4th Mer.	1 mile east of Gem Sod Farm	W739	Ah	0-12	27
				Bm	12-24	28
				Ck	24 +	29
16	Tp. 58, R. 22, W. 4th Mer.	West of Egremont				
17	Tp. 56, R. 23, W. 4th Mer.	Lost Point Lake (both sides)				

Table 2

SITE ANALYSIS FOR NEW A.F.S. TREE NURSERY

Candidate Site No.	General Location	Site Limitations	Soil Limitations	Economic Restraints	Advantages
1	Beaver Lake, Lac La Biche	Soil pattern; the suitable soil (sampled) is a long narrow strip varying from 50-100 feet in width, occurring just above the beach.	Most of the area is a stony clay loam till - NOT suitable for tree nursery. Texture unsuitable. Sandy loam on surface. Sandy clay loam below.		Long growing season.
2	Owl River, Lac La Biche	Topography too rolling. Restricted drainage in subsoil.	Thin deposit of sandy soil overlying poorly drained clay.	Too far from labor source.	
3	Northwest of Athabasca	Cold climate; shortage of acreage.	Some gravelly outcrops on south edge of area. Texture unsuitable. Silt plus clay too high.	High lift for irrigation water; would probably have to buy 3 quarters of land in order to assemble sufficient acreage.	
4	Northeast of Athabasca	Rolling topography.		Too far from labor.	
5	East Prairie Metis Reserve No. 4		Soil field textures too silty.	Too far from service centre.	
* 6	South Heart River; north of High Prairie.	Possible frost pocket.	Texture too coarse. Very fine sand plus silt plus clay too low (< 9%).	Power and road access must be provided. Land clearing required.	Suitable soil pH.
7	Shaftesbury Settlement; Peace River		Variable soil texture - too much silt and clay; high pH; evidence of soil crusting. Texture unsuitable.	Cost of land.	Climatic hot-house effect.
8	Sandhill Lake area; northwest of Fairview	Severe rabbit damage noted.		Too far from labor; power and road required; land clearing required. Long irrigation line needed from Lake George.	
9	East of Grande Prairie		Texture unsuitable. Silt plus clay too high. pH too high.		Close to labor supply.
10	West of Grande Prairie		pH too high. Texture unsuitable. Silt plus clay too high. Wet clayey II C horizon.	Source of irrigation water.	
*11	South of Grande Prairie.	None apparent.	2 soil series encountered.	Cost of land, clearing.	Close to labor, irrigation water.
12	Southeast of Whitecourt.	Rolling topography. Climatic limitation.			
13	5½ miles NE of Fort Saskatchewan - on south bank.		Texture - too much silt and clay; B horizon calcareous.		
14	Gem Sod Farms		Texture - silt plus clay too high.	Privately owned; land costs probably high.	
15	1 mile east of Gem Sod Farm.	Some wind erosion hazard.	Texture - A horizon sandy loam, B horizon loam.	Cost of land.	Soil, topography, air drainage, appear to be advantageous.
*16	West of Egremont	None apparent.	None apparent.	Cost of land and clearing.	Close to administration; central shipping; labor.
17	Lost Point Lake	Rolling topography on west side.	Too much alkali on east side.		

* These sites are possibly suitable. More detailed sampling is recommended.

Table 3

SOIL ANALYSIS - PROSPECTIVE A.F.S. NURSERY SITES

Candidate Site No.	Laboratory No.	Site Location	Horizon	Depth (inches)	Sand (%)	Silt (%)	Clay (%)	Textural Class	Organic Matter (%)	pH	Elect. Conductivity (mmhos/cm)	Carbonates
	1	W731	L-H	5-0	-	-	-		55.2	6.6	0.18	
	2		Ae	0-3	56.4	31.6	12.0	Sandy loam	1.7	6.8	0.05	
1	3		Bm	3-10	50.4	27.6	22.0	Sandy clay loam	1.6	6.5	0.05	
	4		BC	10-22	76.4	9.6	14.0	Sandy loam	0.4	6.4	0.03	
	5		C	22+	88.4	5.6	6.0	Sand	0.2	6.4	0.01	
	6	W732	L-H	2-0	-	-	-		29.3	6.0	0.07	
3	7		Ae	0-4	62.4	27.6	10.0	Sandy loam	0.6	6.1	0.03	
	8		AB	9-12	58.4	27.6	14.0	Sandy loam	0.3	6.4	0.09	
	9		Bm	17-22	72.4	19.6	8.0	Sandy loam	0.2	6.2	0.09	
	10	W733	L-H	2-0	-	-	-		8.6	5.3	0.03	
6	11		Ahe	0-8	92.4[a]	3.6	4.0	Sand	2.4	5.6	0.02	
	12		Bm	8-14	92.4	3.6	4.0	Sand	0.3	6.1	0.01	
	13		C	37-40	92.4	3.6	4.0	Sand	0.2	6.1	0.01	
	14	W734	Ah	0-6	66.0	20.0	14.0	Sandy loam	3.8	6.1	0.03	
	15		C	6-12	68.0	16.0	16.0	Sandy loam	0.7	6.3	0.03	
7	16		Ck	30	80.4	7.6	12.0	Sandy loam	1.0	7.6	0.11	*
	17	W734 Centre	Ah	0-6	36.0	34.0	30.0	Clay loam	10.0	7.0	0.04	
	18	W734 West	Ah	0-6	38.0	28.0	34.0	Clay loam	5.6	6.8	0.04	
	19	W735	Ah	0-6	66.0	22.0	12.0	Sandy loam	5.1	7.8	0.07	
9	20		Bm	6-14	50.0	22.0	28.0	Sandy clay loam	1.1	7.8	0.07	Tr
	21		Ck	14-18	54.4	23.6	22.0	Sandy clay loam	1.7	7.9	0.03	*
10	22	W736	Ah	0-14	66.0	22.0	12.0	Sandy loam	3.9	6.8	0.07	
	23		Bm		70.0	14.0	16.0	Sandy loam	0.8	7.5	0.03	
13	24	W737	Ah	0-10	43.2	37.4	19.4	Loam	5.9	6.7	0.05	
	25		Bm	10-22	50.4	34.0	15.6	Loam	1.4	7.6	0.14	*
14	26	W738	Ah	0-6	65.2	17.4	17.4	Sandy loam	4.0	7.2	0.07	
	27	W739	Ah	0-12	71.4	15.6	13.0	Sandy loam	4.1	6.6	0.06	
15	28		Bm	12-24	35.2	41.4	23.4	Loam	1.1	7.4	0.07	
	29		Ck	24+	57.4	28.6	14.0	Sandy loam	0.8	7.7	0.10	*

[a] Very Fine Sand fraction = 1.2%

* Carbonates present: effervescence with 10% HCl

Table 4

ESTIMATED AVAILABLE ACREAGES BY AIR PHOTO INTERPRETATION

Site No.	Legal Description	General Location	Section	Estimated Acreages
6	Tp. 76, R. 17, W. 5th Mer.	South Heart River, north of High Prairie	W½ of Sec. 3	97 acres
			NE¼ of Sec. 4	125 "
			S½ of Sec. 9	190 "
			S½ of Sec. 10	125 "
				Total 537 acres
11	Tp. 70, R. 6, W. 6th Mer.	South of Grande Prairie	Secs. 19 & 20	200 acres
16	Tp. 58, R. 22, W. 4th Mer.	West of Egremont	NE¼ of Sec. 20	57 acres
			N½ of Sec. 21	102 "
			W½ of Sec. 28	75 "
			S½ of Sec. 29	107 "
				Total 341 acres

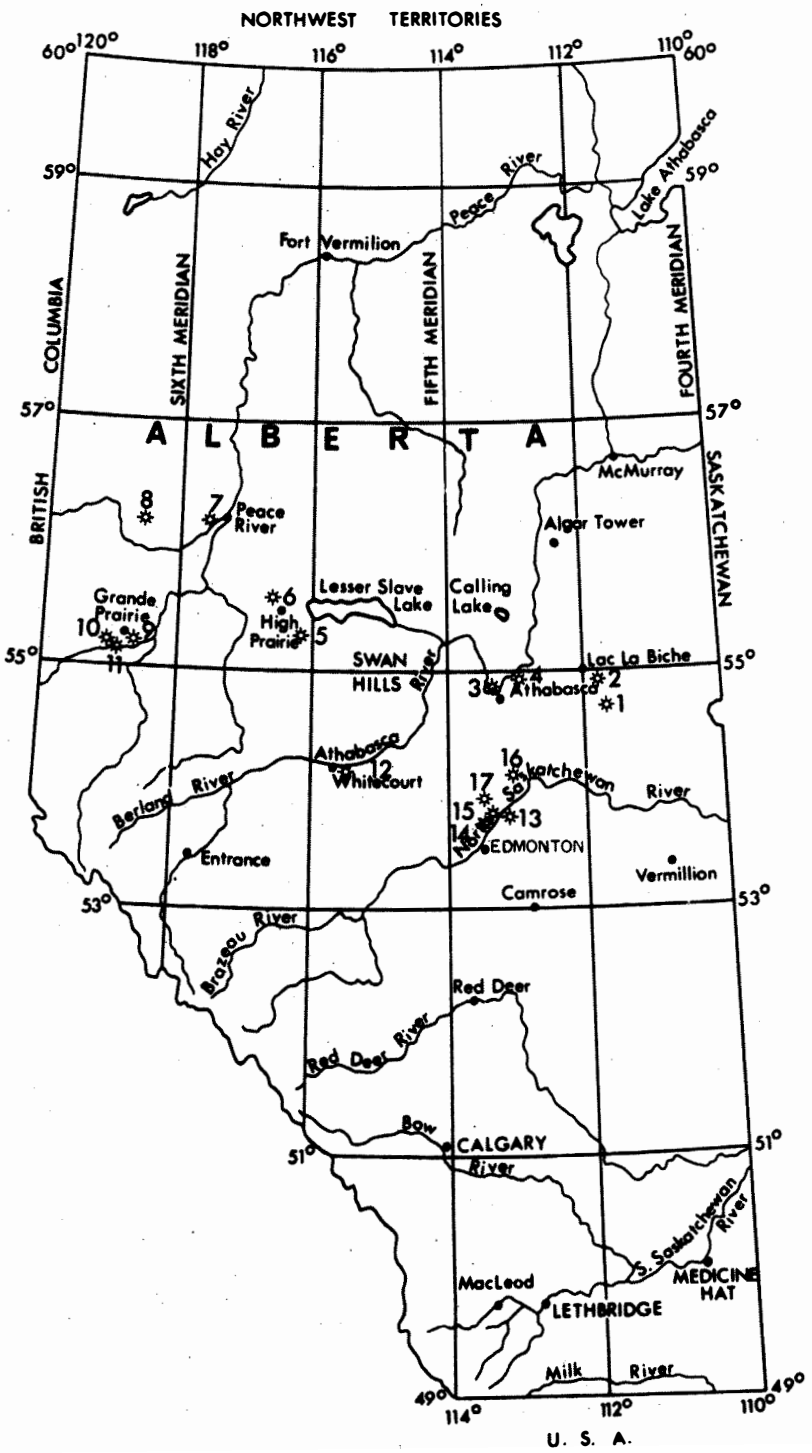


Figure 1. Location of Candidate Nursery Sites.

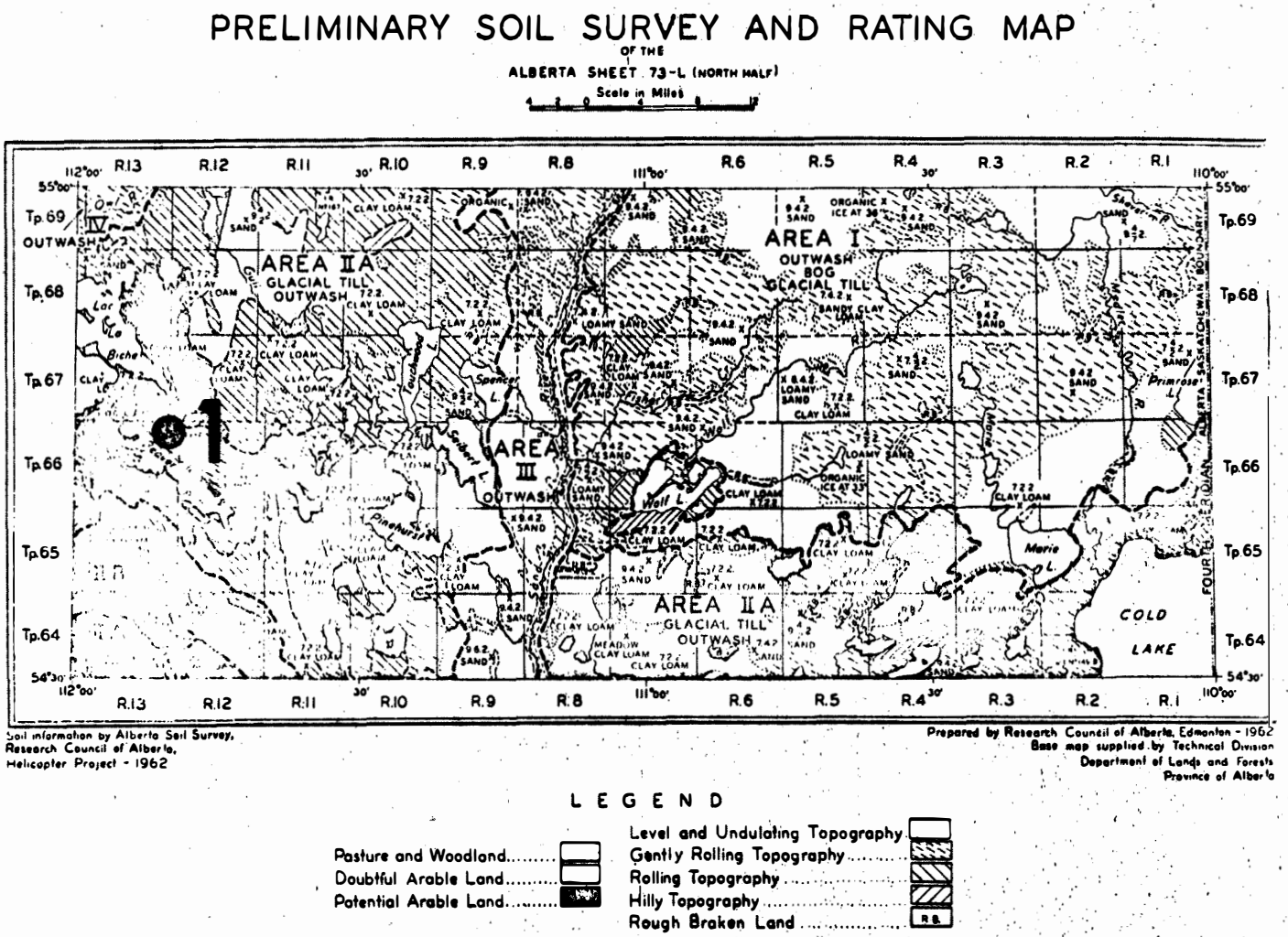


Figure 2. Location of Candidate Site Number 1.

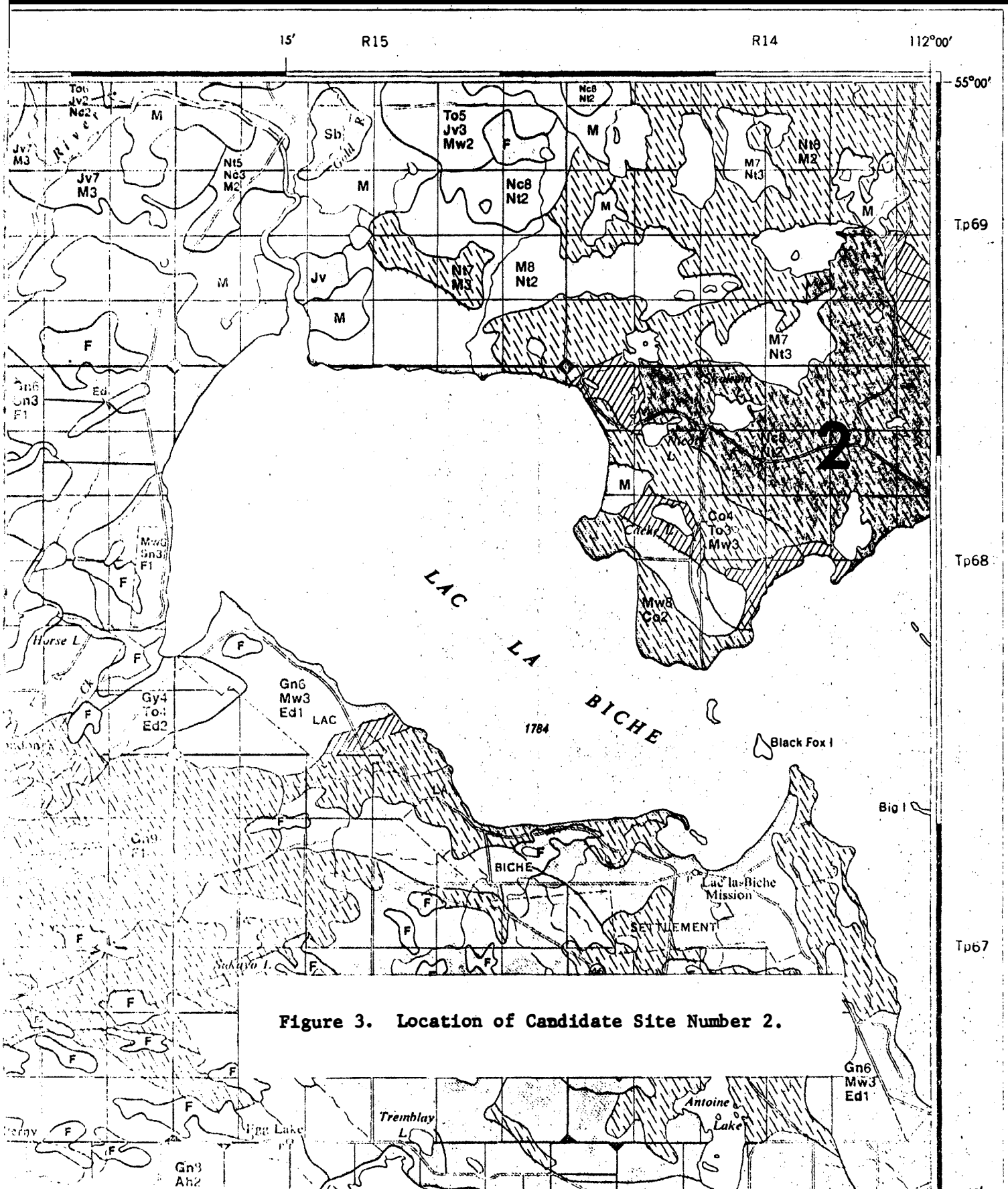


Figure 3. Location of Candidate Site Number 2.

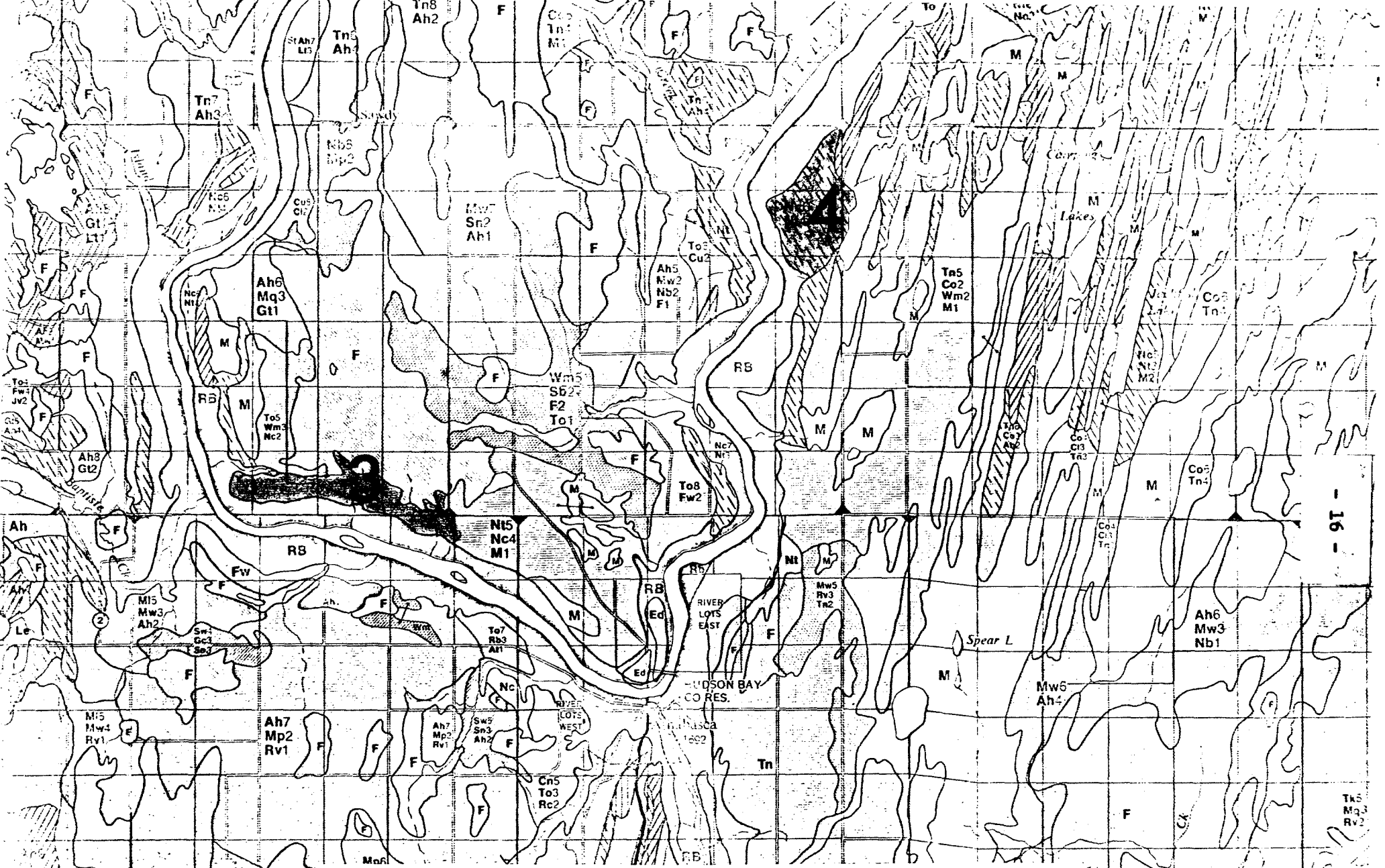
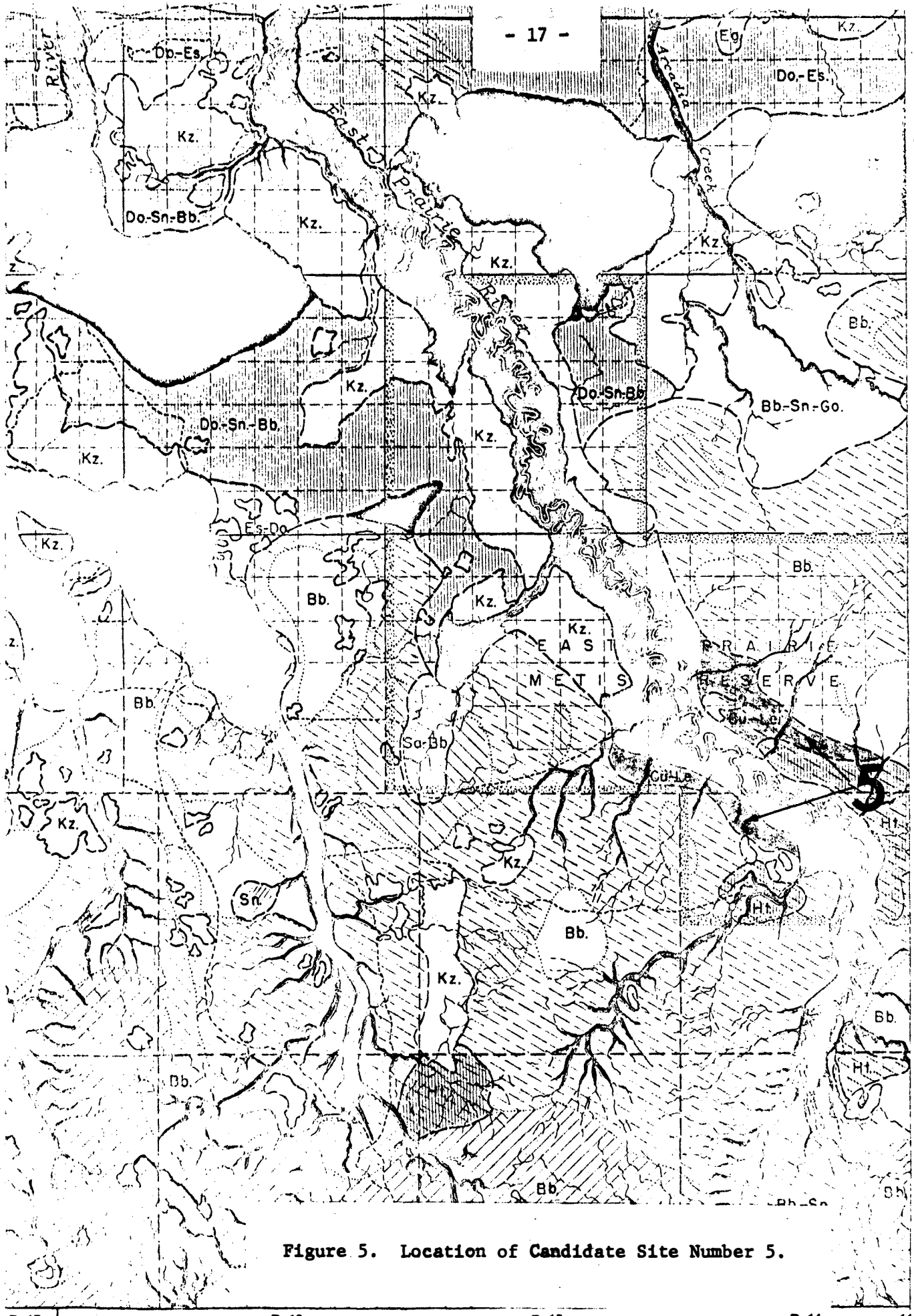


Figure 4. Location of Candidate Site Numbers 3 and 4.



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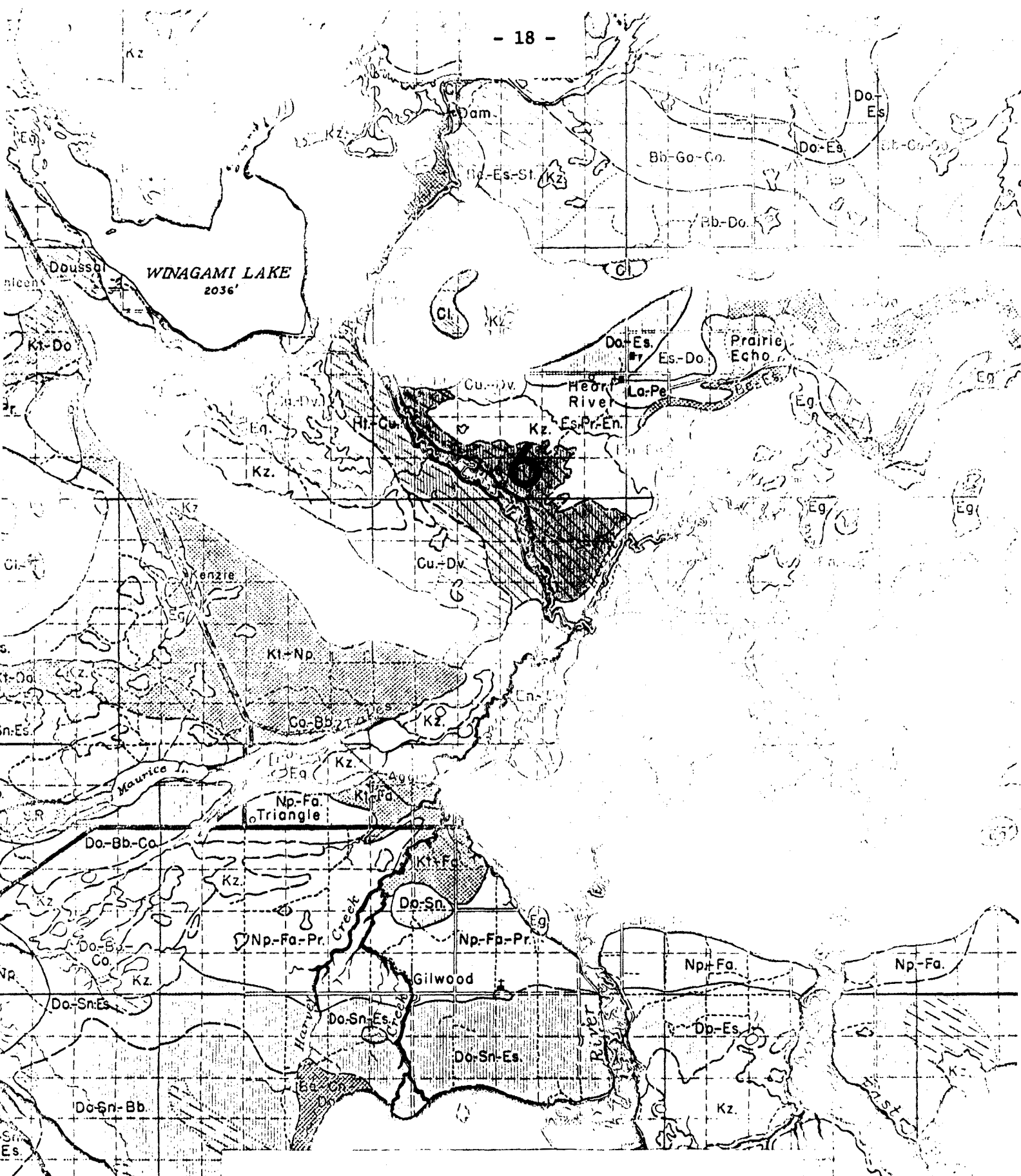


Figure 6. Location of Candidate Site Number 6.

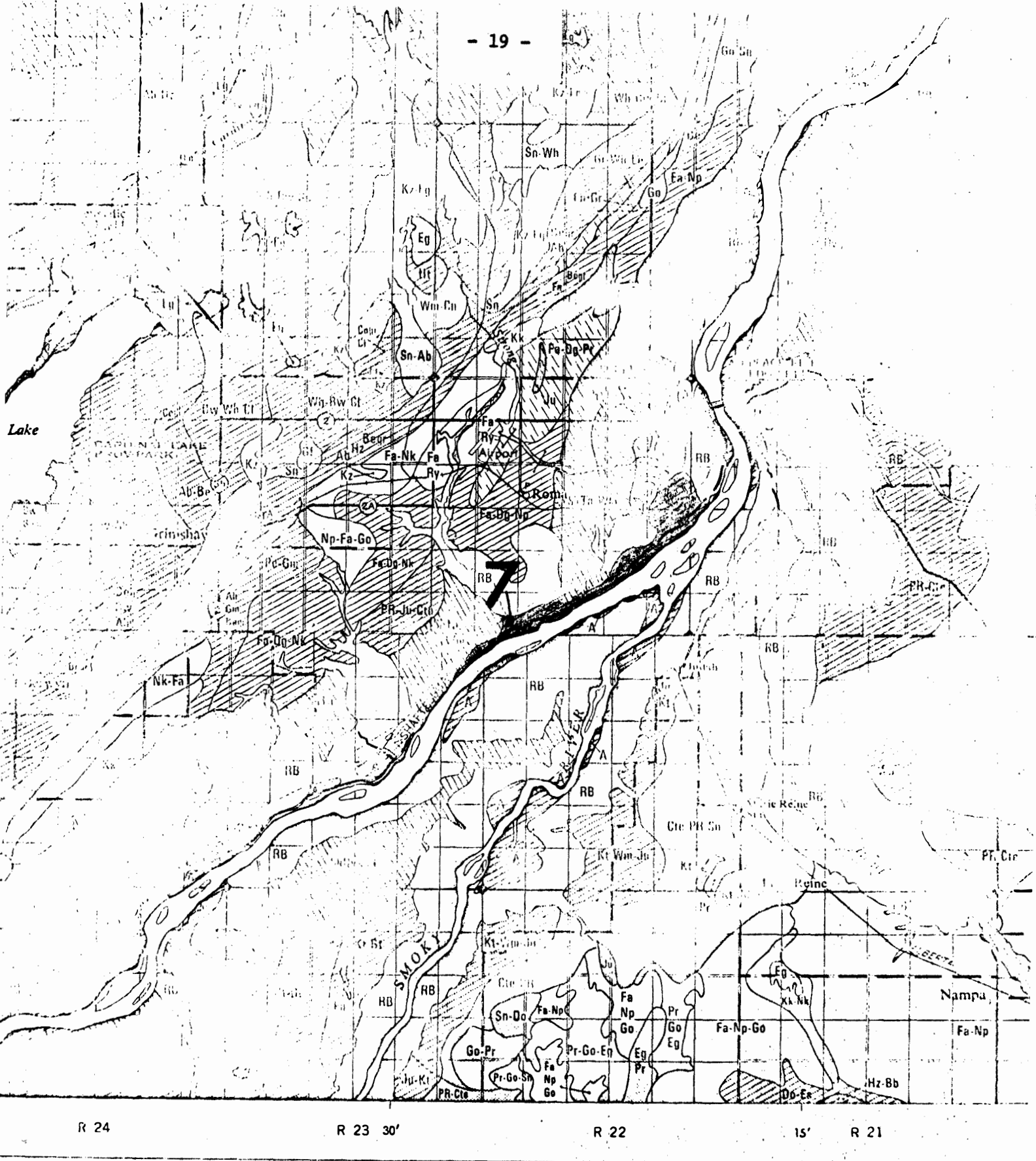
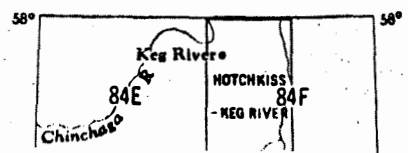


Figure 7. Location of Candidate Site Number 7.



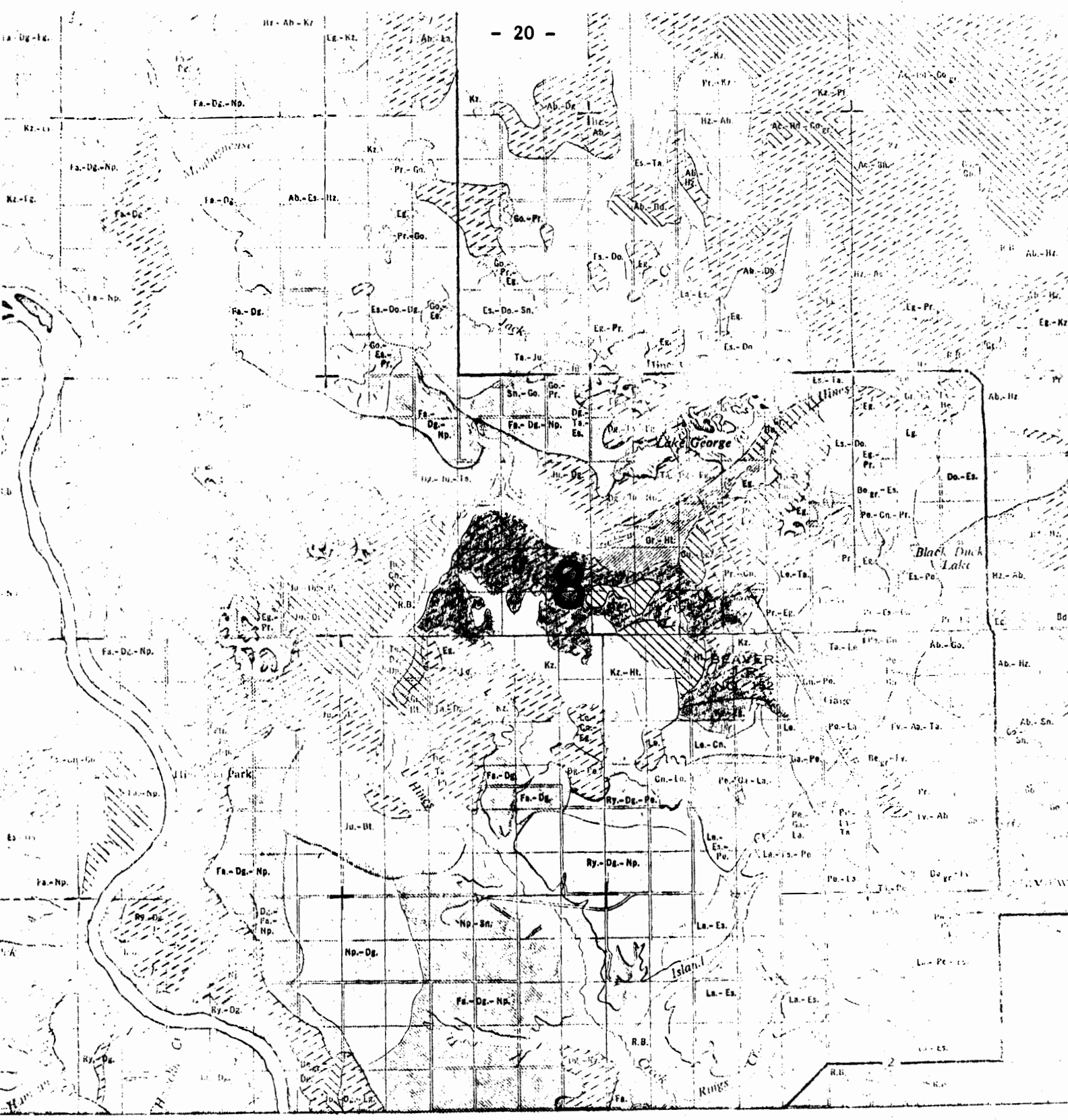


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Figure 8. Location of Candidate Site Number 8.

or 1:190,080

6 9 12 MILES

derately calcareous, saline, clay loam to clay with strata of yellowish brown

Grey to dark greyish brown, moderately calcareous, saline, cl

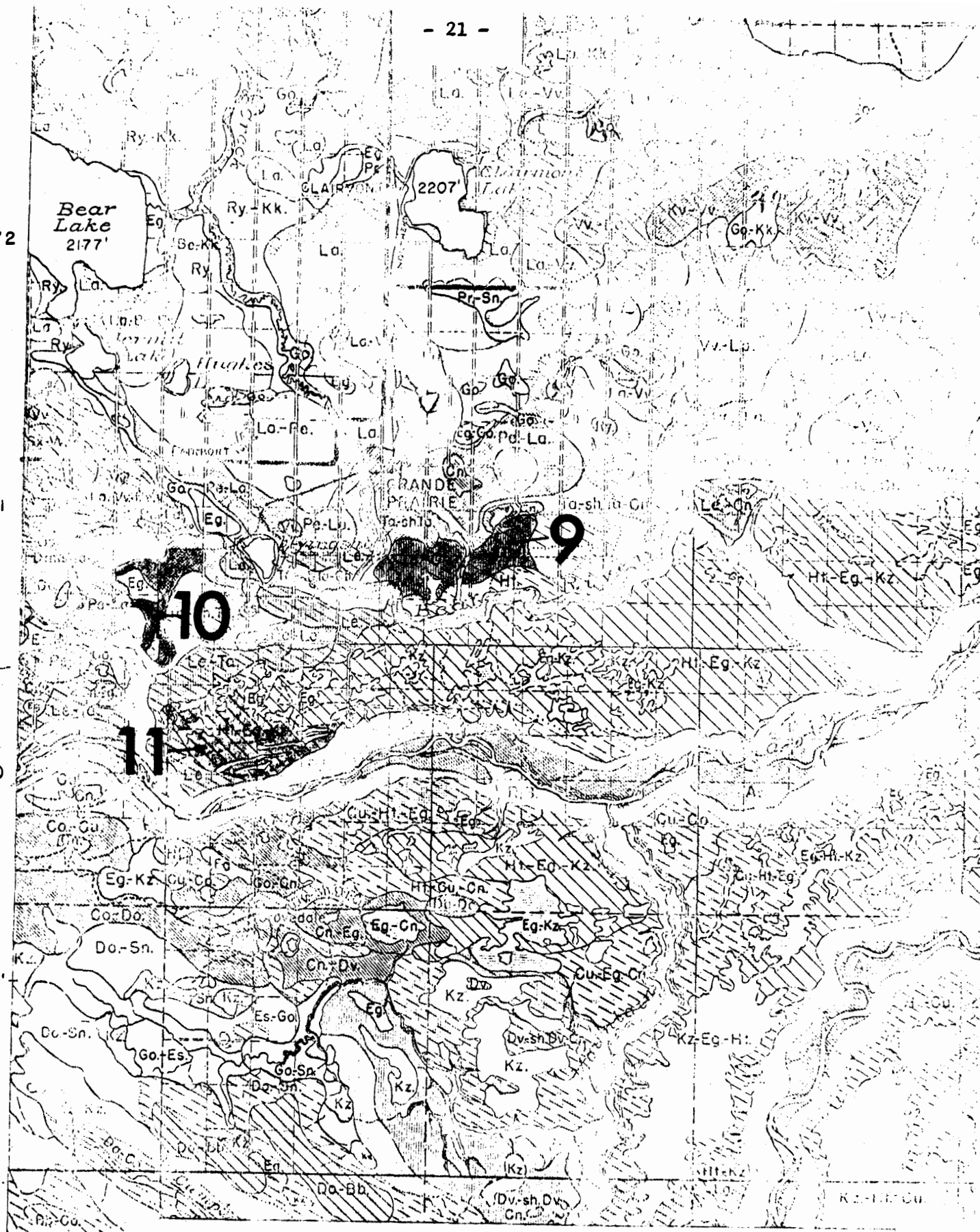

Figure 9. Location of Candidate Site Numbers 9, 10 and 11.

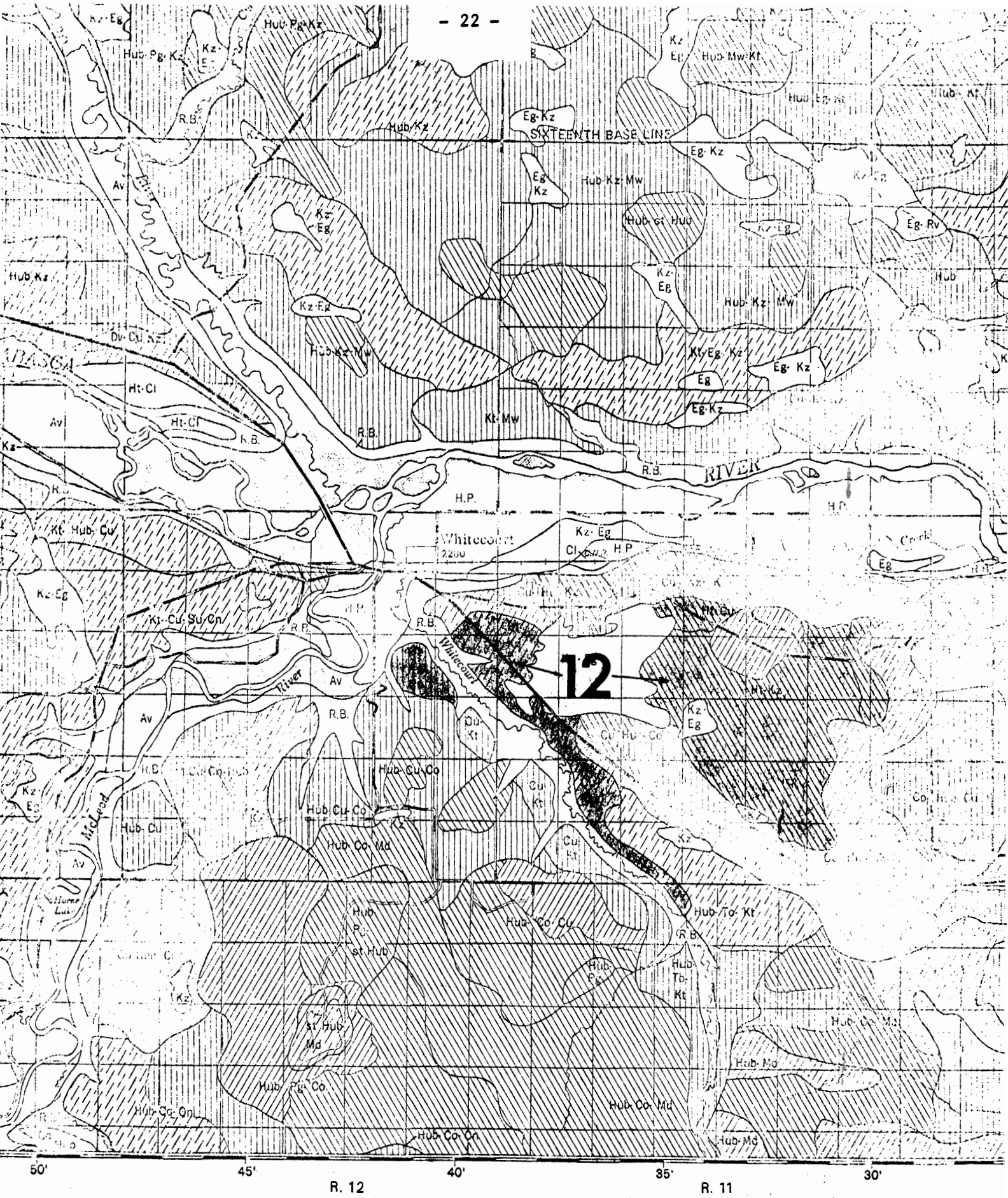

Figure 10. Location of Candidate Site Number 12.

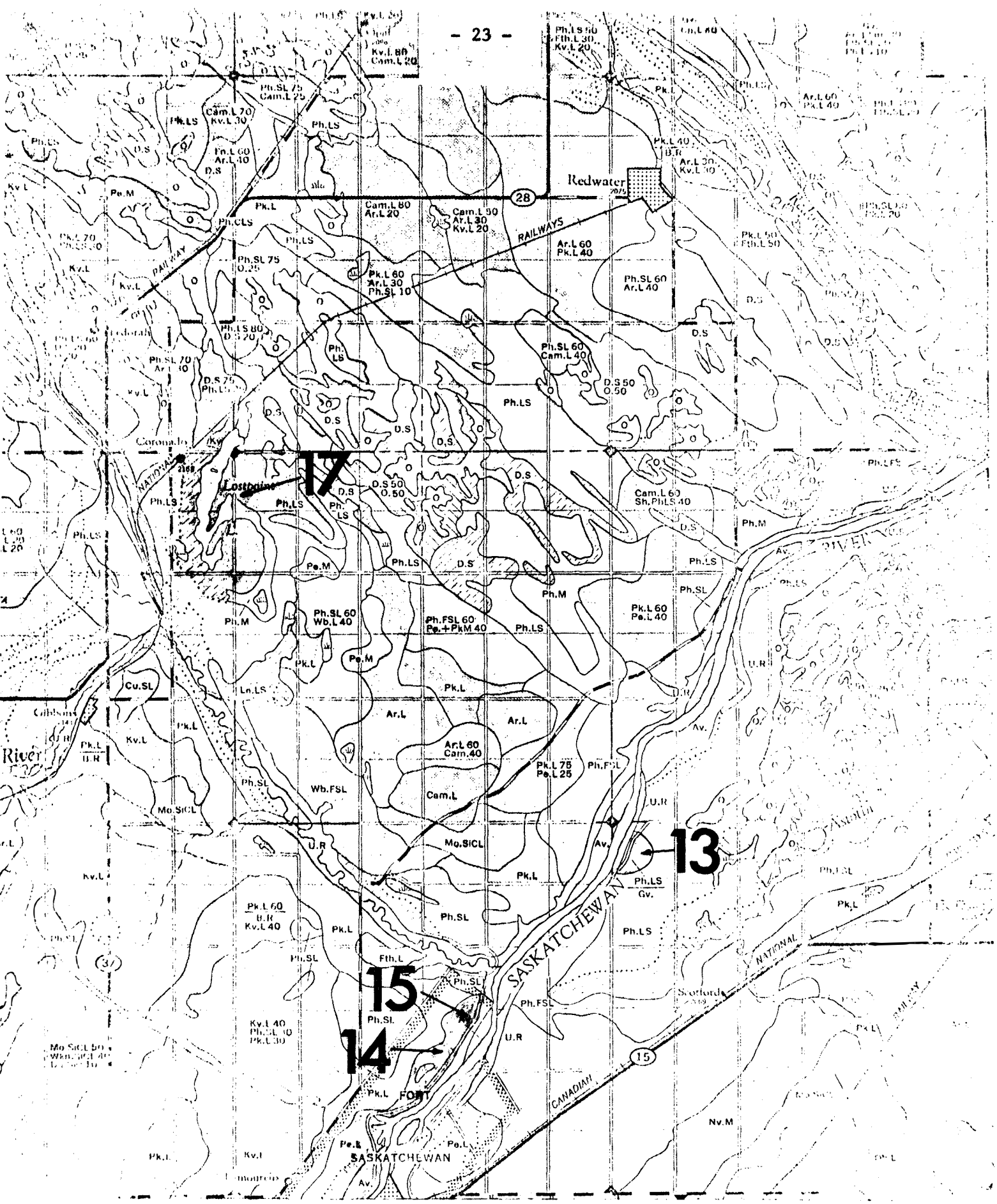

Figure 11. Location of Candidate Site Numbers 13, 14, 15 and 17.

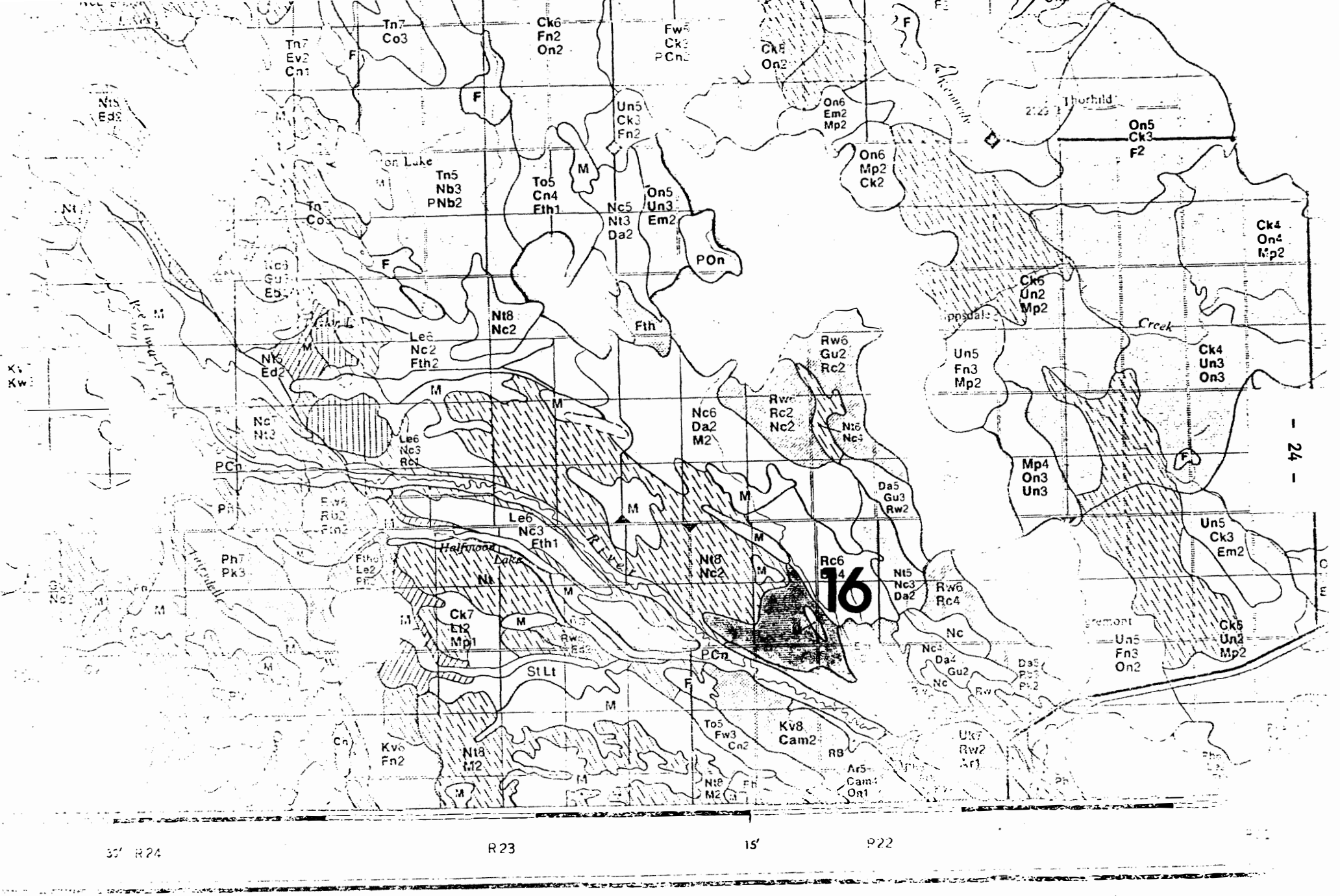

Figure 12. Location of Candidate Site Number 16.

SOIL GROUP	DOMINANT TEXTURE	PARENT MATERIAL	DRAINAGE CLASS	TOPOGRAPHY	STONINESS	ACREAGE	MAP SYMBOL	MAP UNIT	SOIL GROUP