PHYSIOGRAPHY, GEOGRAPHY AND BATHYMETRY OF THE DIGBY NECK AREA, BAY OF FUNDY

Prepared by

Gordon Fader
Atlantic Marine Geological Consulting Ltd.
2901 Parkdale Avenue
Halifax, Nova Scotia
B3L 3Z2

March, 2005

TABLE OF CONTENTS

Physiography

The location of a proposed quarry and marine terminal on Digby Neck falls within one major physiographic province of eastern Canada known as the Appalachian Region (Figure 1). Within the Appalachian Region there are two divisions: the Atlantic Uplands and the Carboniferous-Triassic Lowlands. The proposed site falls within the Atlantic Uplands division. It borders a region known as the Fundian Lowlands which is a subdivision of the Carboniferous-Triassic lowlands (Williams et al., 1972).

The development of the Appalachian Region began during the late Jurrassic to early Cretaceous time with the modification of the landscape by fluvial drainage systems. It is a mature surface. The Atlantic Uplands division includes both the onshore area of North Mountain and the adjacent neashore submerged portion as a continuum. It is a low angle southeastwardly sloping surface developed across resistant lithologies of granite, basalt, slate, quartzite, schist and gneiss. The adjacent Fundian Lowlands cover most of the Bay of Fundy and deeper parts of the Gulf of Maine. Drainage from the Digby Neck area of this division is both to the northwest in the Bay of Fundy and to the southeast in St. Marys Bay.

Geography

The Bay of Fundy is part of a much larger regional marine system that includes the Gulf of Maine and Georges Bank and is often referred to as the FMG for research purposes. The Bay of the Fundy is the dominant large scale geographic feature of the region. It is a linear embayment, 155 km in length that tapers to 48 km wide at its northeastern end where it bifurcates into Chignecto Bay and Minas Channel. The Bay also shallows in a northwest direction from 233 m water depth in Grand Manan Basin at the entrance, to 45 m at the bifurcation. The Bay of Fundy connects to the northeastern corner of the Gulf of Maine between the islands of Grand Manan, New Brunswick; and Brier Island, Long Island and Digby Neck, Nova Scotia. At this location the water is very deep, extending to 233 m in the narrow constricted depression.

The presence of Grand Manan Island and its associated shallow shoals off the south coast act as a major topographic barrier at the entrance to the Bay of Fundy. Brier and Long Islands together with Digby Neck, are part of a narrow and high terrain resulting from volcanic basalt flows that extend into the Bay of Fundy and Gulf of Maine from the northwest mainland of Nova Scotia. St. Marys Bay occurs as a shallow water large re-entrant along the south coast of Brier Island, Long Island and Digby Neck and separates them from the mainland of Nova Scotia. St. Marys Bay opens into the Gulf of Maine to the north of Yarmouth.

Water passages occur between Briar Island and Long Island and Long Island and Digby Neck. These represent offsets along the axis of North Mountain formed as a result of faulting. To the north of Brier Island, another shallow and narrow ridge of submerged basalt extends to the southwest for over 20 nautical miles (King and MacLean, 1976). It is an underwater equivalent of North Mountain, but not as high. The shoreline extending to the northeast from Brier Island along the entire south coast of the Bay of Fundy is straight and uniform. This is the result of the consistency of North Mountain volcanic

flows and the overlying Triassic-Jurassic sedimentary rocks that define conditions along the coast.

Divisions of the Bay of Fundy

The Bay of Fundy has been divided into geographic regions for research purposes. One system divides the Bay into what is referred to as the "Upper Bay" and the "Lower Bay" with the dividing line running from Cape Spencer east of Saint John to Parkers Cove northeast of Digby (Figure 2). A further subdivision is sometimes used to divide the Bay into four quadrants. Another dividing line runs parallel to the axis of the Bay from Cape Chignecto to the southwest, south of Grand Manan Island.

Within this divisional system the Whites Point area of Digby Neck falls into the south outer Bay of Fundy division. The boundary of the outer Bay of Fundy is universally accepted as a line that runs from Brier Island to the southwestern tip of Grand Manan Island.

Other divisional systems define the boundary between the inner and outer Bay of Fundy as a line that runs in a more southerly direction from Cape Spencer in NB to the Digby Gut area. Dadswell et al, (1984), in a review of fisheries in the Bay of Fundy, divided it into three geographic regions: lower, mid and upper (Figure 3). Others have proposed yet another divisional system in the Bay of Fundy that separated the outer Bay from the inner by a line extending much further out the Bay from Digby to Point Lepreau. Fisheries divisions of the Bay of Fundy term the inner Bay as area 55 and the outer Bay as area 54. The dividing line in this case is between Digby and Musquash Head in NB. In all cases the Whites Point area of Digby Neck occurs within the outer or lower Bay of Fundy.

Bathymetry

The following is a description of the bathymetry of the region taken from Canadian Hydrographic Charts 4011 (Figure 4). The Bay of Fundy extends from Grand Manan Basin at the entrance to the Bay and shallows uniformly in a northeastward direction to the inner area of Minas Channel and Chignecto Bay. The deepest water closest to land along the south shore of the Bay occurs at the entrance to the Bay of Fundy off Digby Neck. Here the water rapidly deepens from the shoreline to 100 m water depth less than 2 nautical miles offshore. The shortest distance to deep water at the entrance to the Bay is adjacent to Whites Point, Digby Neck. The proposed shipping route from the marine terminal follows this channel and is largely confined to the deepest and shortest route to land.

Adjacent to the Whites Point proposed quarry and marine terminal the water depths range to 24 m with the terminal site centered at 16 m. The detailed bathymetry shows that the seabed is a generally uniform slope extending from the shoreline. A few isolated bedrock controlled mounds occur close to shore and the most rugged area of seabed generally occurs in less than 6 m water depth. The largest and anomalous local feature is the large ridge which projects to the west from the coastline adjacent to Sandy Cove.

Figures

Figure 1. Major Physiographic divisions in Atlantic Canada from Williams et al., (1972).

Figure 2. Divisions of the Bay of Fundy into inner and outer.

Figure 3. Divisions of the Bay of Fundy into lower, mid and upper, Dadswell, 1984.

Figure 4. Canadian Hydrographic Chart "Approaches to the Bay of Fundy", Chart 4011. Note the chart is in fathoms and the deepest water approach to Nova Scotia from the Gulf of Maine is at Whites Point, Digby Neck.

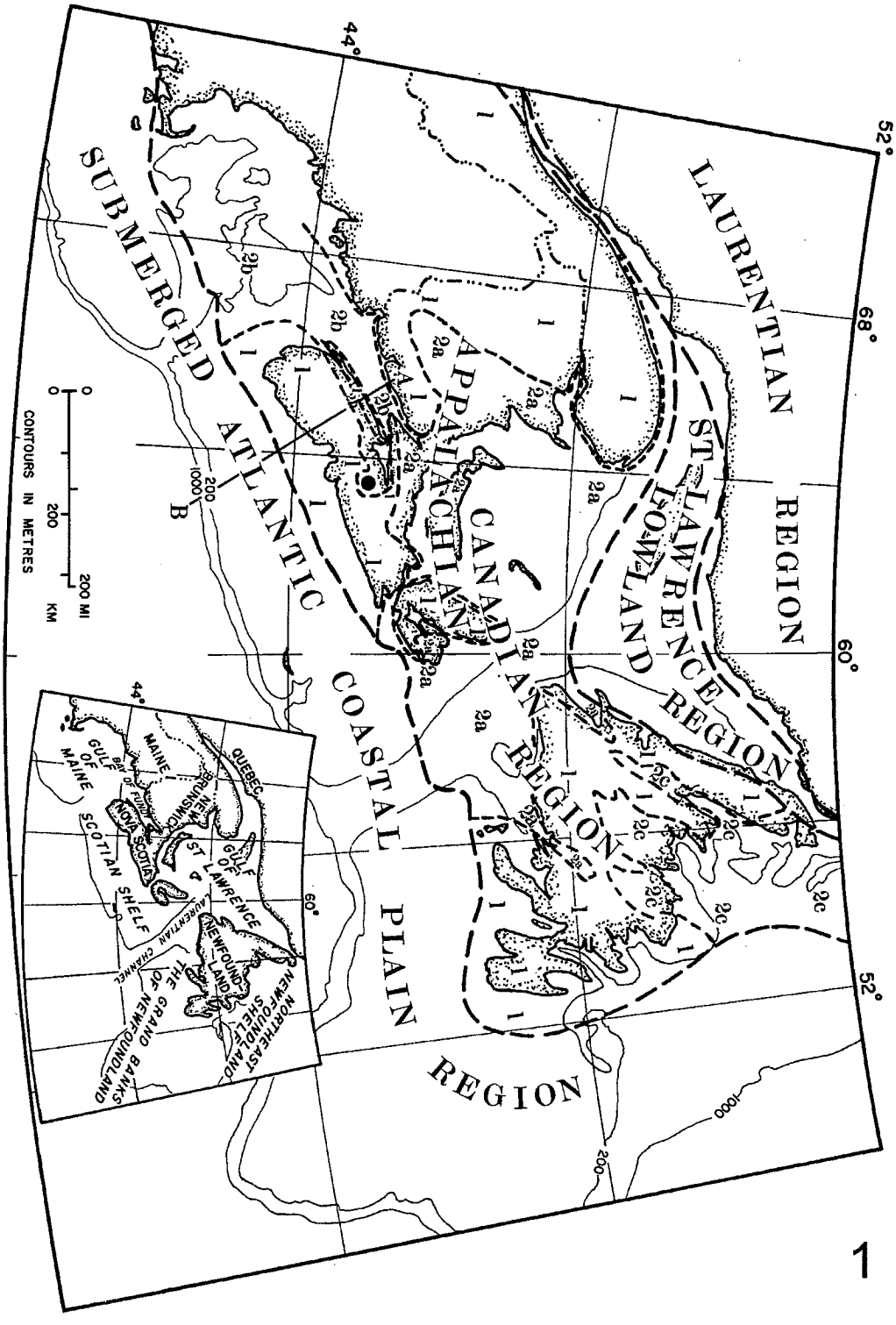
References

Dadswell, M. J., Bradford, R., Leim, A. H. and Scarratt, D. J., 1984. A review of the research on fishes and fisheries in the Bay of Fundy between 1976 and 1983 with particular reference to its upper reaches. *In*, Update on the marine environmental consequences of tidal power development in the upper reaches of the Bay of Fundy by Gordon, D. C. and Dadswell, M. J., Canadian Technical Report of Fisheries and Aquatic Sciences No. 1256, Fisheries and Oceans Canada.

King, L. H., and MacLean, B., 1976. Geology of the Scotian Shelf, Geological Survey of Canada, Paper 74-31, 31 p.

Williams, H., Kennedy, M. J. and Neale, E. R.W., 1972, The Appalachian Stuctural Province, p. 181-261. *In* R. A. Price and R. J. W. Douglas (ed.). Variations in Tectonic Styles in Canada. Geol. Assoc. Can. Spec. Pap. 11: 181-261.

Figure 1


LAURENTIAN REGION
ST LAWRENCE LOWLAND REGION
APPALACHIAN REGION
CANADIAN
COASTAL PLAIN
REGION
SUBMERGED ATLANTIC B
CONTOURS IN METRES
KM
200 MI
44°
52°
68°
60°
MAINE
QUEBEC
NEW BRUNSWICK
NOVA SCOTIA
GULF OF MAINE
BAY OF FUNDY
GULF OF ST LAWRENCE
SCOTIAN SHELF
LAURENTIAN CHANNEL
THE GRAND BANKS OF NEWFOUNDLAND
NEWFOUNDLAND
NORTHEAST NEWFOUNDLAND SHELF
1000
200

1

Figure 1a

EXPLANATION FOR FIGURE 1

REGIONS	DIVISIONS	SUBDIVISIONS			
APPALACHIAN (Onshore and inner continental shelf)	1 Atlantic Uplands	1A	Southern Uplands of Nova Scotia and the inner Scotian Shelf	1F	Notre Dame Mountains
		1B	North Mountain	1G	Eastern Quebec Uplands
		1C	Nova Scotia Highlands	1H	Southern Uplands of Newfoundland and the inner Grand Banks of Newfoundland
			1Ca *Cobequid Highlands*		
			1Cb *Antigonish Highlands*		
			1Cc *Cape Breton Highlands*	1I	Newfoundland Highlands
		1D	New Brunswick Highlands		1Ia *Long Range Mountains*
			1Da *Miramichi Highlands*		1Ib *Serpentine Range*
			1Db *St. Croix Highlands*		1Ic *Annulls*
			1Dc *Caledonian Highlands*		1Id *Long Range*
					1Ie *Topsail Hills*
		1E	Chaleur Uplands		1If *Dunamogon Highland*
	2 Sutton Mountains (Green Mountains)				
	3 Magantic Hills (White Mountains)				
	4 Carboniferous-Triassic Lowlands	4A	Maritime Plain	4C	Central Lowland of Newfoundland and inner Northeast Newfoundland Shelf
			4Aa *New Brunswick Lowland*		4Ca *Grand Lake Lowland*
			4Ab *Prince Edward Island*		4Cb *Notre Dame Lowland*
			4Ac *Cumberland Lowland*		
			4Ad *Cape Breton Lowlands*		
			4Ae *St. George's Lowland*		
			4Af *Baie D'Espoir Lowland*		
			4Ag *Southern Gulf of St. Lawrence and southern approaches*		
		4B	Fundian Lowlands		
			4Ba *Bay of Fundy and northern and central Gulf of Maine*		
			4Bb *Annapolis Lowland*		
			4Bc *Minas Lowland*		

1a

Figure 2

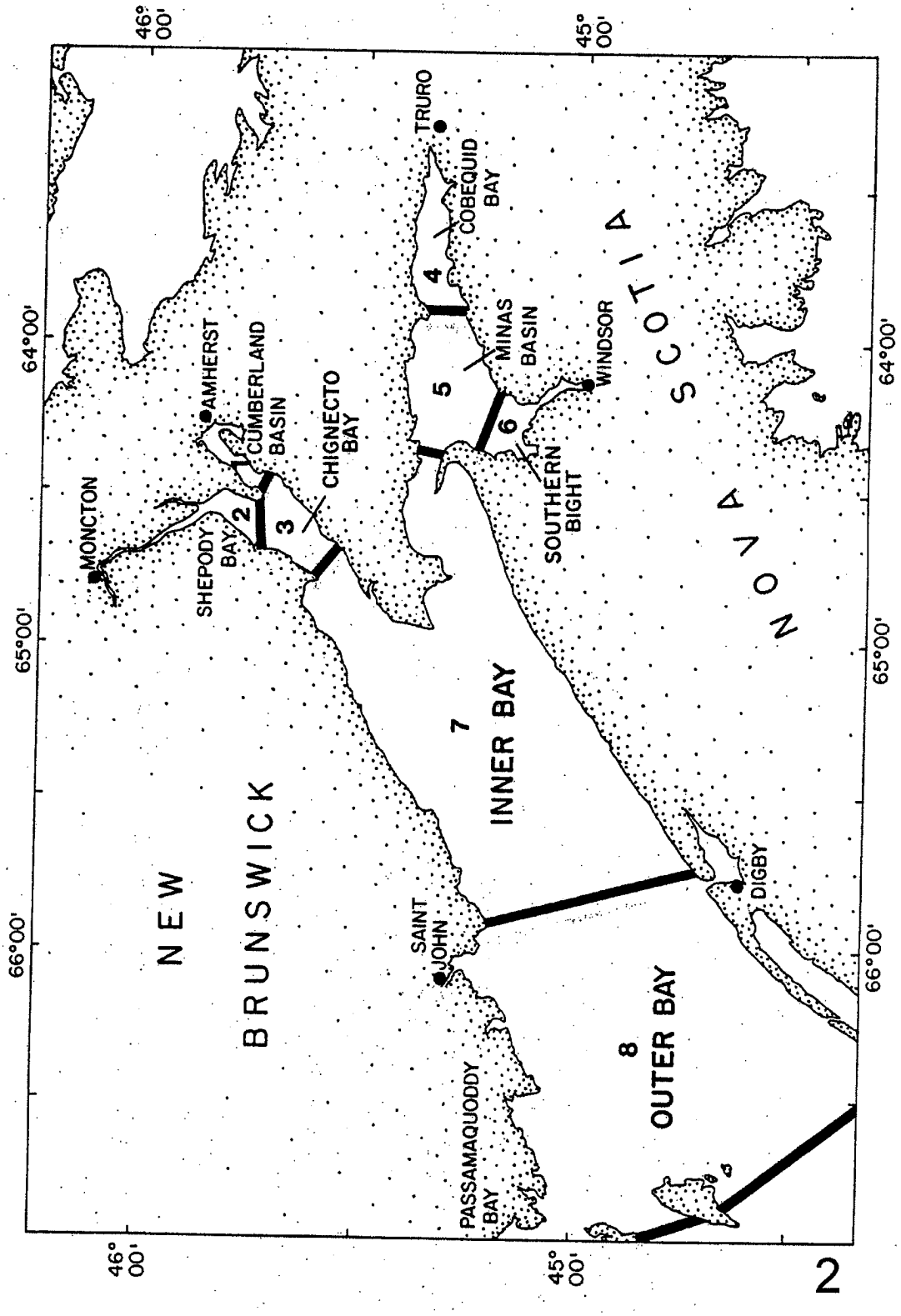
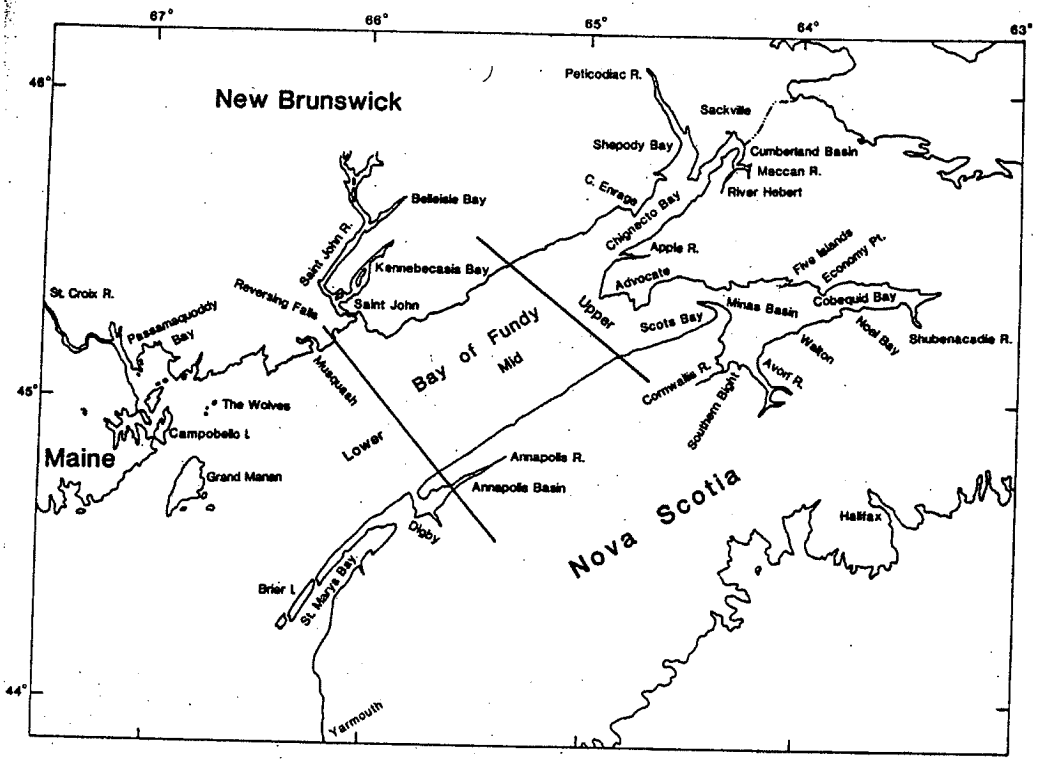
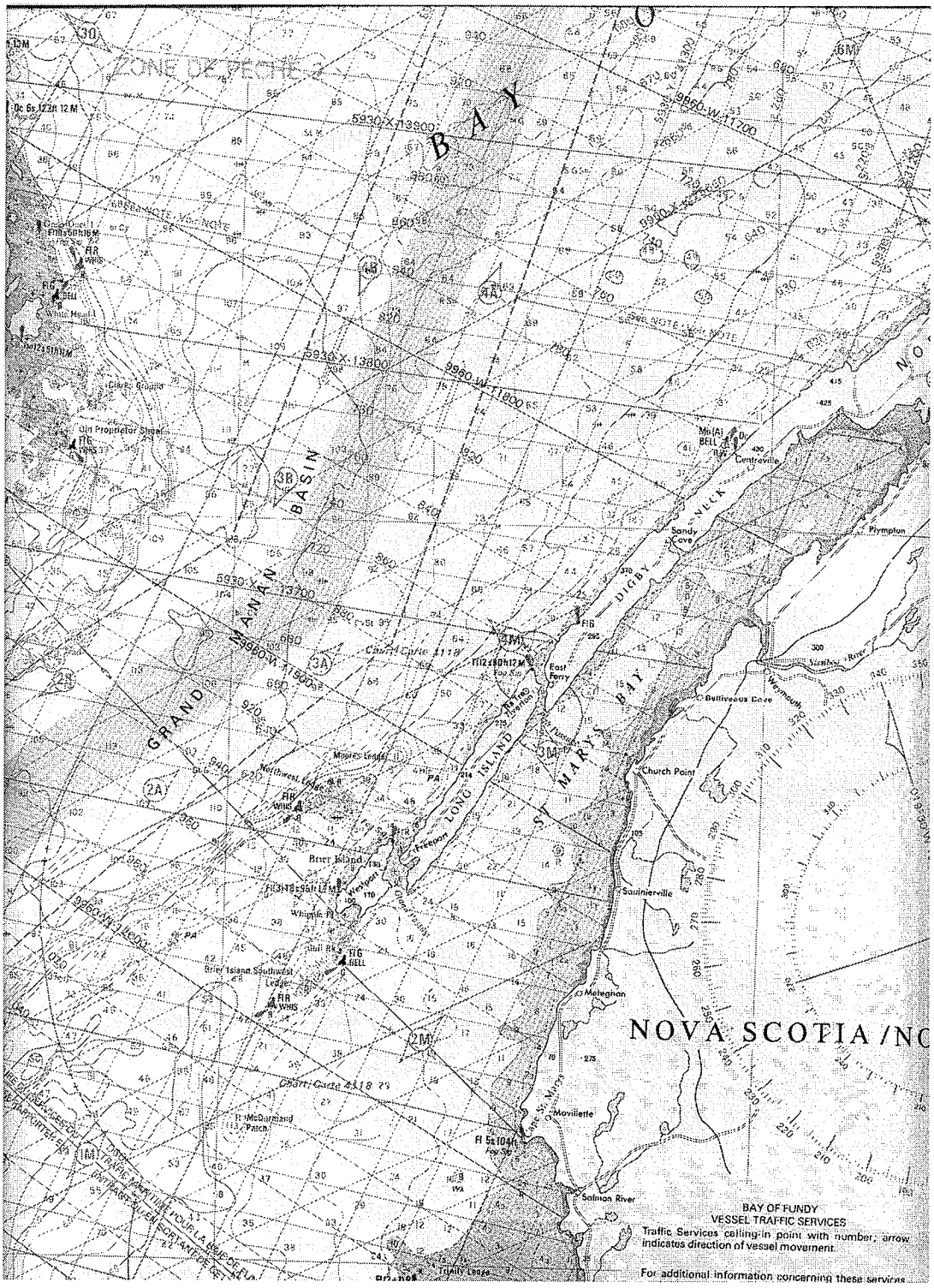

NEW BRUNSWICK
NOVA SCOTIA
INNER BAY
OUTER BAY
SOUTHERN BIGHT
MINAS BASIN
CUMBERLAND BASIN
CHIGNECTO BAY
COBEQUID BAY
SHEPODY BAY
PASSAMAQUODDY BAY
MONCTON
AMHERST
TRURO
WINDSOR
SAINT JOHN
DIGBY
1
2
3
4
5
6
7
8
64°00'
65°00'
66°00'
46° 00'
45° 00'
2

Figure 3


67°
66°
65°
64°
63°
46°
45°
44°
New Brunswick
Maine
Nova Scotia
Bay of Fundy
Mid
Upper
Lower
Peticodiac R.
Sackville
Shepody Bay
Cumberland Basin
Maccan R.
River Hebert
C. Enragé
Chignecto Bay
Belleisle Bay
Saint John R.
Kennebecasis Bay
Saint John
Reversing Falls
Apple R.
Advocate
Five Islands
Economy Pt.
Minas Basin
Cobequid Bay
Scots Bay
Noel Bay
Shubenacadie R.
Walton
Avon R.
Cornwallis R.
Southern Bight
St. Croix R.
Passamaquoddy Bay
Musquash
The Wolves
Campobello I.
Grand Manan
Annapolis R.
Annapolis Basin
Digby
Brier I.
St. Marys Bay
Halifax
Yarmouth

3

Figure 4


BAY OF FUNDY
VESSEL TRAFFIC SERVICES
Traffic Services calling-in point with number, arrow indicates direction of vessel movement.
For additional information concerning these services
NOVA SCOTIA
GRAND MANAN BASIN
LONG ISLAND
DIGBY NECK
ST MARYS BAY
Brier Island
Meteghan
Moviliette
Saulnierville
Church Point
Centreville
Sandy Cove
Plympton
Bettiveaux Cove
Weymouth
Salmon River
East Ferry
Brier Island Southwest Ledge
Maples Ledge
Northwest Ledge
Whipple Pt
Gannet Rock
Old Proprietor Shoal
Trinity Ledge