CHAPTER 4 METHODOLOGY

The study confined to *Mukim* Rungkup. Altogether 3 JKKK areas were studied namely Sg. Batang, Sg. Belukang, and Sg. Tiang Baroh as shown in Figure 4.1. Each of these areas has experienced severe erosion damages in the past and present due to land use development pressures. The figures in parenthesis refer to the number of household.

4.1 Methodology Used to Address Coastal Problem in *Mukim* Rungkup

The study utilises both primary and secondary data. Secondary data were obtained from materials published by related agencies. Primary data for this study were collected through survey and fieldwork. Historical changes in mangrove-line position in this study were obtained from: -

4.1.1 Aerial Photography

Changes in the position of the coastline/mangrove fringe in this study were determined by comparing aerial photographs of 1966 and 1981 (Table 4.1). Stereoscopic pair of photographs was studied and major changes regarding each study area recorded e.g. the location of buildings, roads etc. Accuracy of measurement is in the range of +/- 2m/yr.

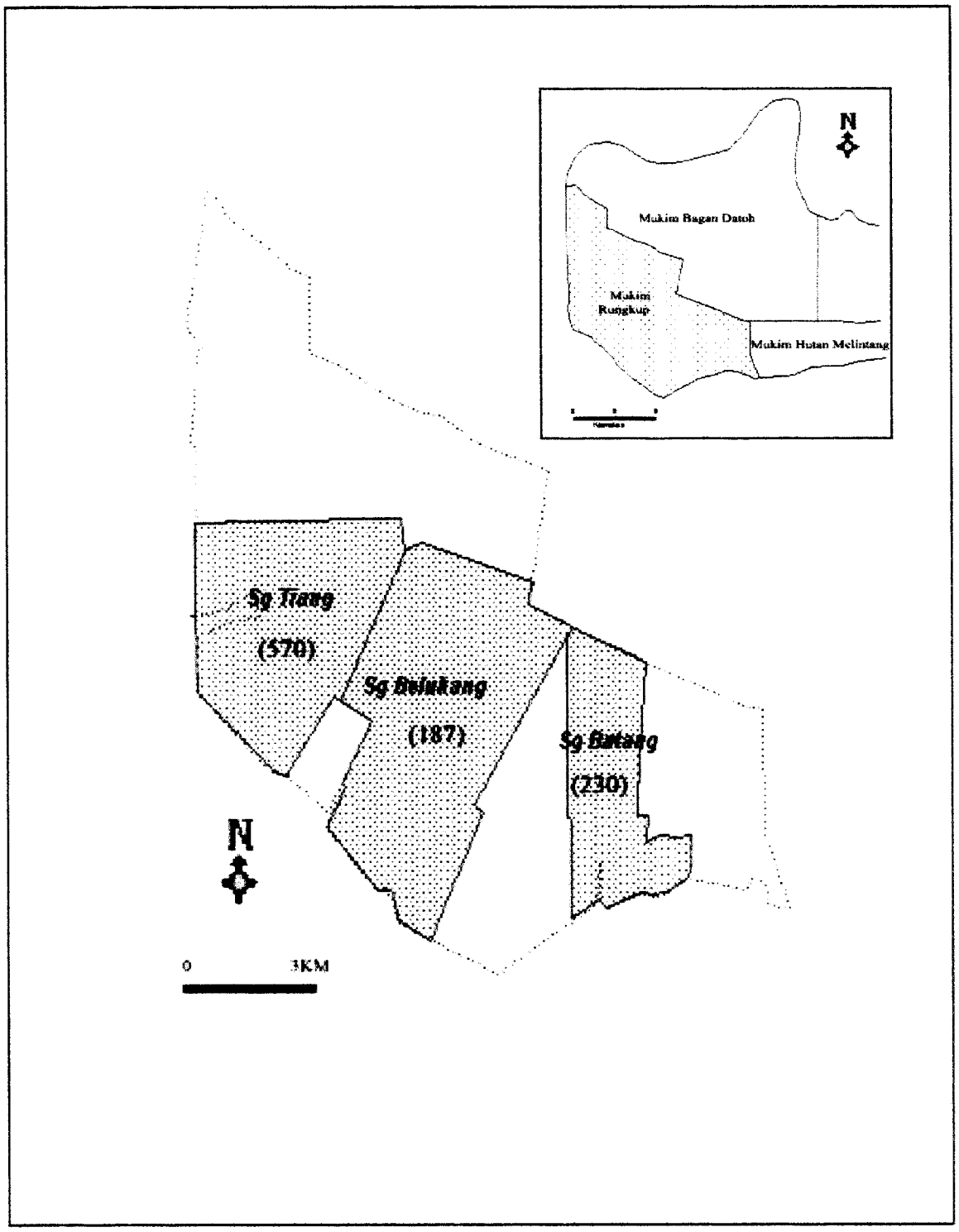

Figure 4.1. Study area of *Mukim* Rungkup

Table 4.1. Details of the aerial photography used

No	Flight No.	Photograph No.	Scale	Year	Area
1	C 17 L 17S	92 93 94 95 96 97 98	1:25000	1966	Bagan Datoh
	C 11 L18N	92 93 94 95 96 97 98			
	C 11 L 19S	80 82 83 84 85 86			
	C 11 L 20N	5 6 7 10			
	C 42 L 21N	99 100 104 105			
2	F 496 L 1S	203 204 205 206 207 208 209 210	1:25000	1981	Bagan Datoh
	F 496 L 2N	162 163 164 165 166 167 169			
	F 496 L3S	152 153 154 155 156 157 158			
	F 496 L 4N	218 219 220 221			
	F 500 L 5N	178 179 180 181			

4.1.2 Literary Documents

Historical or literary documents were adopted in assessing coastline changes. Published data such as annual reports by Department of Irrigation and Drainage (DID), newspaper reports, Malaysia Plans etc were fully utilised and analysed (Table 4.2).

Table 4.2. Documents used and analysed

No	Documents	Year
1	DID / JPT / JPS Annual Reports	1931 1932 1933 1935 1936 1937 1938 1939 1940 1946 1947 1948 1949 1951 1952-1954 1955-1957 1958-1960 1961-1963 1966 1967 1968 1970 1971 1973 1974 1977-1979 1980-1982 1983-1985 1993-1994 1996 1997 1999
2	Malaysia Plans	1st 2nd 3rd 4th 5th 6th 7th 8th

Table 4.3. Newspaper reports on *Mukim* Rungkup

No	Source	Date	Title
1	Consumer	Mid Oct 1991	Severe erosion in Bagan Datoh
2	The Star	7/9/1992	RM20m rock bund to stop sea erosion
3	The Star	22/5/1995	Sea water floods coconut plantations
4	Utusan Malaysia	16/8/1995	Hakisan Pantai Rungkup dikaji
5	Berita Harian	13/10/1995	Ban kedua selamatkan kampong
6	The Star	13/10/1995	DID bid to halt erosion
7	New Strait Times	2/11/1995	Plan for a higher bund to stop sea water
8	Utusan Malaysia	9/10/1996	Beribu-ribu kera rosakkan hasil kelapa
9	Utusan Malaysia	7/8/1997	Tanaman kelapa musnah diserang kumbang tanduk
10	Utusan Malaysia	9/8/1997	Beribu hektar tanaman diancam air masin

4.1.3 Topographical Maps

Comparison of topographic maps improves the understanding of dynamic processes of the coastline and the impacts of man's activities upon the area. Such a comparison provides documentation of:

i. coastline changes both natural and human induced

ii. loss of mangrove

iii. patterns of land use changes

The maps are divided into 5 sheets that include the following:

Table 4.4. List of topographic maps referred to in study

No	Area	Sheet Number	Date Published	Scale	Reliability
1	Bagan Datoh	3A/3 & 4 (4^{th} Edition)	1944	1:63360	Basic map from F.M.S. Survey up to June 1933, revised 1941
2	Bagan Datoh	74a 74b 74e	1963	1:25000	RAF & Jabatan Ukur Air Survey photography of whole sheet dated 1963 Topographical field surveys of whole sheet during 1963

3	Bagan Datoh	74 (1st Edition)	1965	1:63360	RAF Air Survey photography of whole sheet dated 1950-1956 Topographical field surveys of whole sheet during 1964 FMS Topo Survey 1932 to 1933
4	Bagan Datoh	74 (4th Edition)	1976	1:63360	Map information correct at 1972
5	Bagan Datoh	3460 (1st Edition)	1987	1:50000	Compiled graphically from sheet L7010-1976 Additional information from Aerial Photography 1981 & Field Completion 1985 Amendments to state

Information on infrastructure and public amenities were extracted from topographical maps for comparison with aerial photograph. Historical coastline positions of the Rungkup coast were digitized using Map Info for 4 periods of time. Data was transferred to Map Info for analysis and display. Erosion rates for Rungkup coastline were calculated in Map Info and a discussion of the causes and effects of erosion will be presented in the following chapter. Methods to monitor

future erosion rates will also be discussed. 1941 topographic map was used as a base map for this study.

4.1.4 Cadastral Maps

Cadastral maps were used to identify the location of the sample area, inundated lots and in measurement of inundated land.

Table 4.5. List of cadastral maps

No	Sheet No	Scale	Area
1	885/903	10 inches to 1 mile/ 8 chains to an inch	Lower Perak
2	922	~	Lower Perak
3	941	~	Lower Perak
4	942	~	Lower Perak
5	943	~	Lower Perak
6	944	~	Hutan Melintang
7	960	~	Lower Perak
8	961	~	Lower Perak
9	962	~	Lower Perak

Elevation map of the whole *mukim* was obtained from DID Teluk Intan and land use map from Department of Agriculture and Fishery were fully utilised.

4.1.5 Field Survey (Ground Truthing)

Each study area has been visited from time to time throughout the research period. A survey of all coastal defences was undertaken by the researcher

between 2000 and 2001. This was done to establish the state of coastal defences in order to assess risk and the need for investment. Ground studies were carried out with the help of a global positioning system equipment (GPS). Coastal structure changes that occur between visits was analysed and related to estimated known climatic events and human activities. A Garmin GPS unit was used during field survey not only to locate the coastal structures along Rungkup coast but also to sample houses in each study area. Information collected also consisted of photographs of the condition of the coast and the present rock bund or earth bund. Any construction activity was noted and necessary information regarding quantity and duration of such activity was gathered. Information of the existing conditions of coast was also gathered from briefing and discussion with officers from DID.

4.1.6 Coastal Profile and Road Profile

Coastal profiles were obtained from DID Teluk Intan whereas road profiles were obtained from JKR. Figure 4.2 shows the location of coastline surveyed and Figure 4.3 shows the stretch of new coastal road being constructed in *Mukim* Rungkup. Coastal profile data and road profile data were shown in Table 4.6 and 4.7.

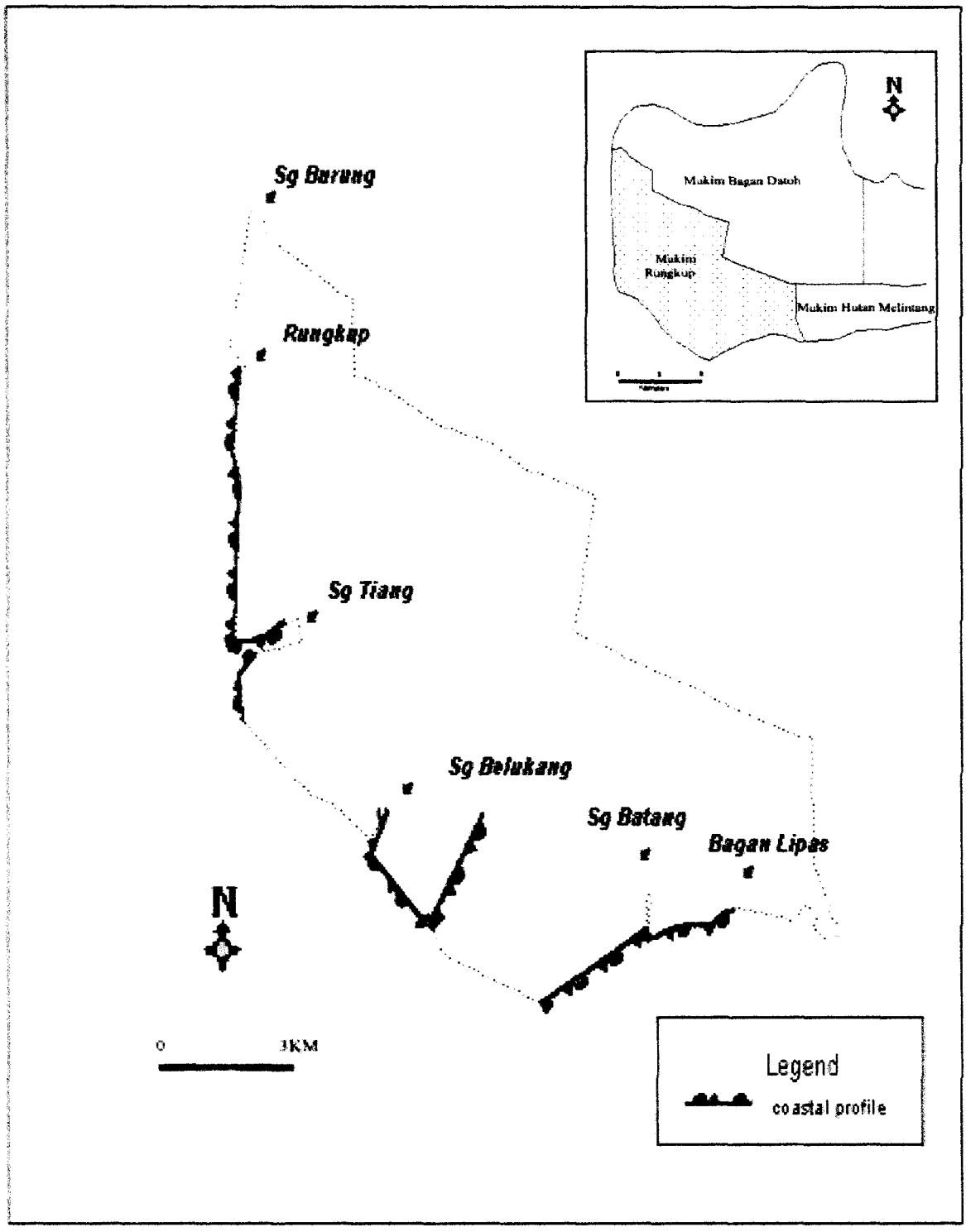

Figure 4.2. Coastal profiles of Rungkup coast

Table 4.6. Compilation of coastal profile data

No	Area/Project	Scale	Plan/Sheet	Year	Consultant
1	Kerja-kerja Pengukuran untuk Cadangan Perlindungan Pantai dari Sg. Belukang Tidal Gate ke Tebuk Semani, Bagan Datoh	1:6336	AUK 87/96/K2	1991	Aneka Ukur Konsultant
		1:750	AUK 87/96/B1 AUK 87/96/B2 AUK 87/96/B3 AUK 87/96/B4 AUK 87/96/B5		
2	Kerja-kerja Pengukuran untuk Cadangan Perlindungan Pantai dari Sg. Tiang Utara Tidal Gate to Rungkup Pumphouse	1:6336	AUK 87/96/K1 (Pelan Lokasi)	n/a	Aneka Ukur Konsultant
		1:750	AUK 87/96/A1 AUK 87/96/A2 AUK 87/96/A3 AUK 87/96/A4 AUK 87/96/A5 AUK 87/96/A6 AUK 87/96/A7 AUK 87/96/A8 AUK 87/96/A9 AUK 87/96/A10 AUK 87/96/A11 AUK 87/96/A12		

3	Kerja-kerja Pengukuran untuk Cadangan Perlindungan Pantai dari Bagan Lipas Tidal Gate to Parit A, Sg. Belukang, Bagan Datoh, *Mukim* Rungkup, Perak	1:6336	JS/IP/C20077/96/PTI (Pelan Tapak dan Pelan Kunci)	n/a	Jurukur Selatan
		1:750	JS/IP/C20077/96 A1 (Bagi kawasan pantai di Sg Batang (Selat Melaka) dari CH 00A-CH 500A JS/IP/C20077/86/A 2 CH500A-CH600A CH1500B-CH1600B JS/IP/C20077/96/A 3 CH1100B-CH1400B JS/IP/C20077/96/A 4 CH500B-CH900B JS/IP/C20077/96/A 5 CH00B-CH500B JS/IP/C20077/96/A 2 CH00C-CH400C		

4	Projek Mencegah Hakisan di Sg. Tiang Selatan, Bagan Datoh	1:2000	General Arrangement Plan	1992	Jurukur Konsultant
		1:1000	Layout Plan From CH00-CH400 CH400-CH900 CH900-CH1490		

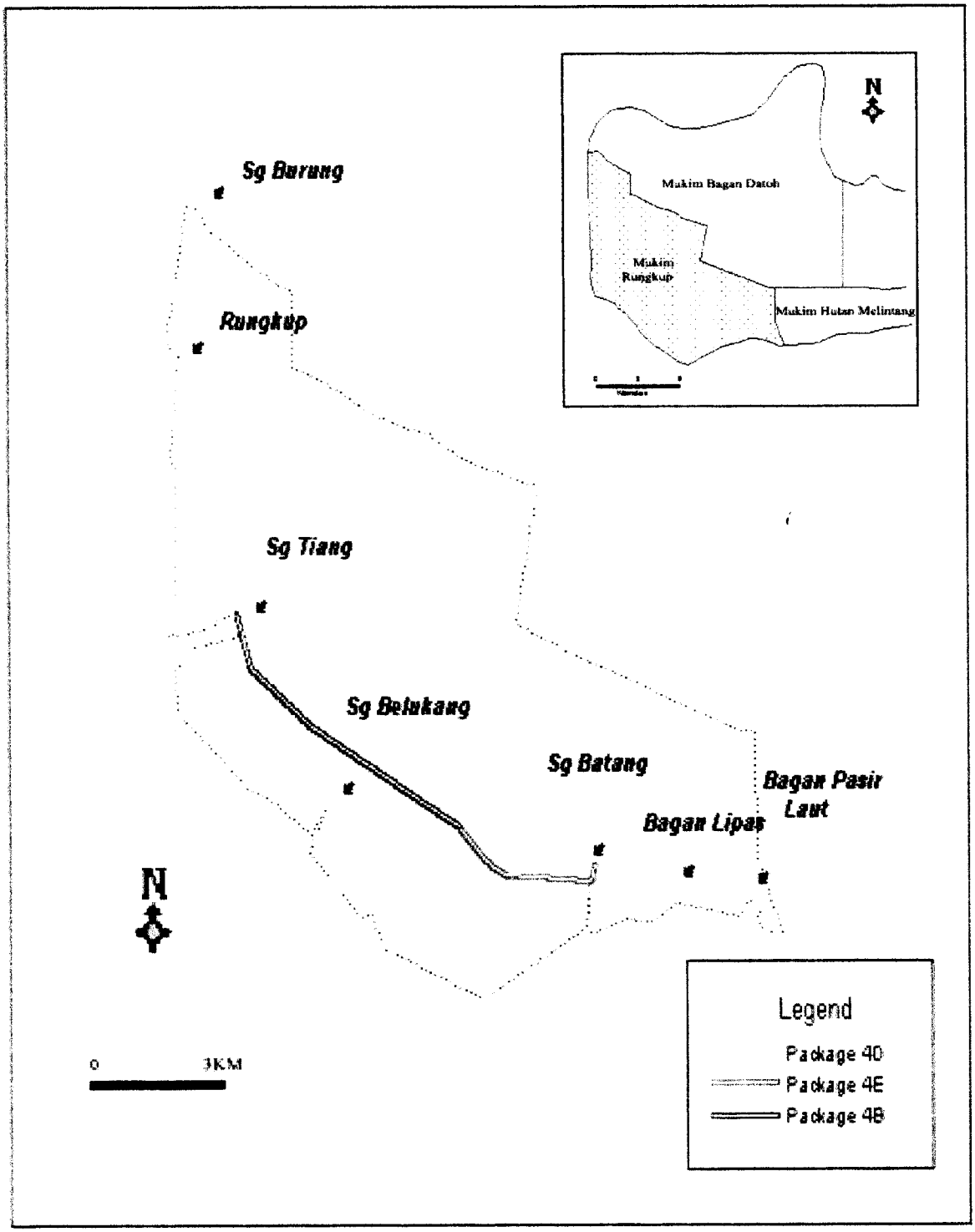

Figure 4.3. Road profiles of new coastal road

Table 4.7. Compilation of road profile data

No	Area/Project	Scale	Plan/Sheet	Year	Consultant
1	Menaikkan taraf jalan dari Sg. Tiang ke Hutan Melintang (Package 4B)	1:1000	A11 A12 A13 A14 A17 A18 A19 A20	n/a	Jurukur Express
2	Kerja-kerja ukur untuk menaikkan taraf jalan dari Sg. Tiang ke Hutan Melintang (Package 4D) (Package 4E)	1:1000	WUC/KB/94/40/A1 Alignment Plan CH00-CH725 WUC/KB/94/40/A2 CH725-CH1450 WUC/KB/94/40/A3 CH1450-CH2175 WUC/KB/94/40/A4 CH2175-CH2900 WUC/KB/94/40/A5 CH2900-CH3600 WUC/KB/94/40/A6 CH3600-CH4300 WUC/KB/94/40/A7 CH4300-CH5025 WUC/KB/94/40/A8 CH5025-CH5700 WUC/KB/94/40/A9 CH5700-CH6425 WUC/KB/94/40/A10 CH6425-CH7100	n/a	

	(Package 4B)		WUC/KB/94/40/A11 CH7100-CH7800 WUC/KB/94/40/A12 CH7800-CH8525 WUC/KB/94/40/A13 CH8525-CH9225 WUC/KB/94/40/A14 CH9225-CH9900 WUC/KB/94/40/A15 CH9900-CH10600 WUC/KB/94/40/A16 CH10600-CH11300 WUC/KB/94/40/A17 CH11300-CH12000 WUC/KB/94/40/A18 CH12000-CH12650 WUC/KB/94/40/A19 CH12650-CH13325 WUC/KB/94/40/A20 CH13325-CH13798.262		
4	Kerja-kerja untuk menaikkan taraf jalan dari Sg. Tiang ke Hutan Melintang	1:6336 1:1000	JSS/KLG/2000/02/LOKA JSS/KLG/2000/02/1 CH4000-CH4525 JSS/KLG/2000/02/2 CH4550-CH5225	Jan 2000	Jurukur Sejati

			JSS/KLG/2000/02/3 CH5250-CH5925 JSS/KLG/2000/02/4 CH5950-CH6625 JSS/KLG/2000/02/5 CH6650-CH7225		

The information gathered from coastal profile included survey measurements of distance and vertical values along each profile. Multiple measurements were made along the beach face, 100 meters apart. The data set also contains profiles of segments of coast from coastal bund to variable distances off coast (approximately 100 meters to several kilometres past the low water mark. Therefore the coastal data obtained were detailed and accurate. They were used to construct a cross section profile by the researcher. Coastal data was used to determine the coast width, steepness and height of the existing coastal bund, which was used as an indicator of short term coastline change and future sea level rise. It is also used for assessing the conditions of the coast.

The road profile obtained was also used to determine the road width, steepness, height and distance from the rock bund. Road profile was constructed together with the coastal profile to see the viability of the existing road as a second form of defence system against coastal flooding. Diagrams of cross section profiles are shown in Chapter 6.

4.1.7 Questionnaire Survey

Stratified sampling was used and a percentage of 30 per cent of the household sampled in each study area. A total of 296 completed interviews were obtained. The questionnaire which was used in this activity is shown in Appendix 1.

The decision to limit the sample to 30 per cent was based on various considerations mostly practical in nature. The selected sample should be sufficient to provide a representative picture of the socio-economic characteristic of the study area.

A standard set of questionnaire was used for all the 3 study areas. The time spent on each sample varied in length from 20 minutes to 30 minutes depending upon the volubility of the respondents. In addition to answers to the standard question, as many impromptu comments and unsolicited responses were recorded. Open ended questions allowed respondents to express their feelings about their experiences. The questionnaire consists of sub topics:

a. Background information

The first series of questions were concerned with personal data on the respondent's age, sex, occupation, education, income, land title, and similar background information.

b. Landholdings

Information obtained included types of land held.

c. Economics Sectors

Two types of major occupations can be found in the study areas namely small holders and fishermen. Information such as main crop, inter cropping, problems of farming in these areas etc will be collected from respondents. Whereas fishermen will be asked to compare the catch over the years.

d. Coastal Flooding and Erosion

Respondents were asked to compare the past and present coastal flooding problem and its severity. They were asked to perceive the magnitude of erosion. Estimates of the amounts of land eroded over specific time periods and cost of loss were obtained from each respondent. Respondents were asked to perceive future risk of erosion, mitigation measures and possible resettlement. Respondents were also asked to perceive causes of erosion whether they were supernatural forces, human activities or physical processes and adjustment strategies to overcome the problem.

All the surveys were carried out on site, covering a number of days within the month of June and September 2001 with good weather condition. The surveys were undertaken by fully brief interviewers who were able to converse in the local dialects. The stratified interviewees were all Rungkup resident adults aged 30 years and above. The results obviously don't directly reflect the views of young

people and children. A map was drawn for each area sampled shown in Chapter 5. The plotting was made possible by using a GPS.

4.1.8 Assessing Coastal Vulnerability to Future Sea Level Rise

In order to assess the impact of sea level rise, a combination of coastal profile, road profile, latest land use map (1997) and elevation map of Bagan Datoh map were used.

It is estimated that the sea level rise at a rate of 17-90cm on an eustatic basis by the year 2100 (IPCC 1992). For the analysis a 50cm rise was chosen as a base for preliminary assessment of impacts and responses. The impacts of bund failure under present sea level condition and that of the future sea level rise of 50cm, 100cm in the study area were assessed under a 'do nothing' option. The assessment was based on the worst possible scenario during Highest Astronomical Tide (HAT).

4.2 Limitations

Historical records are commonly short. Map analysis is by lack of up to date maps, while photo analysis by radial distortion and tilt. Questionnaire results are site specific, temporally and spatially discontinuous and of varying quality. Qualitative results can be misleading and many methods have severe limitations.

In general, coastal phenomenon can be reliably anticipated only where extensive research and monitoring data exist. A lack of current changes is no assurance of continued stability in the future, but information on changes in the

coastline position especially over the longer term may be useful for short term empirical predictions.