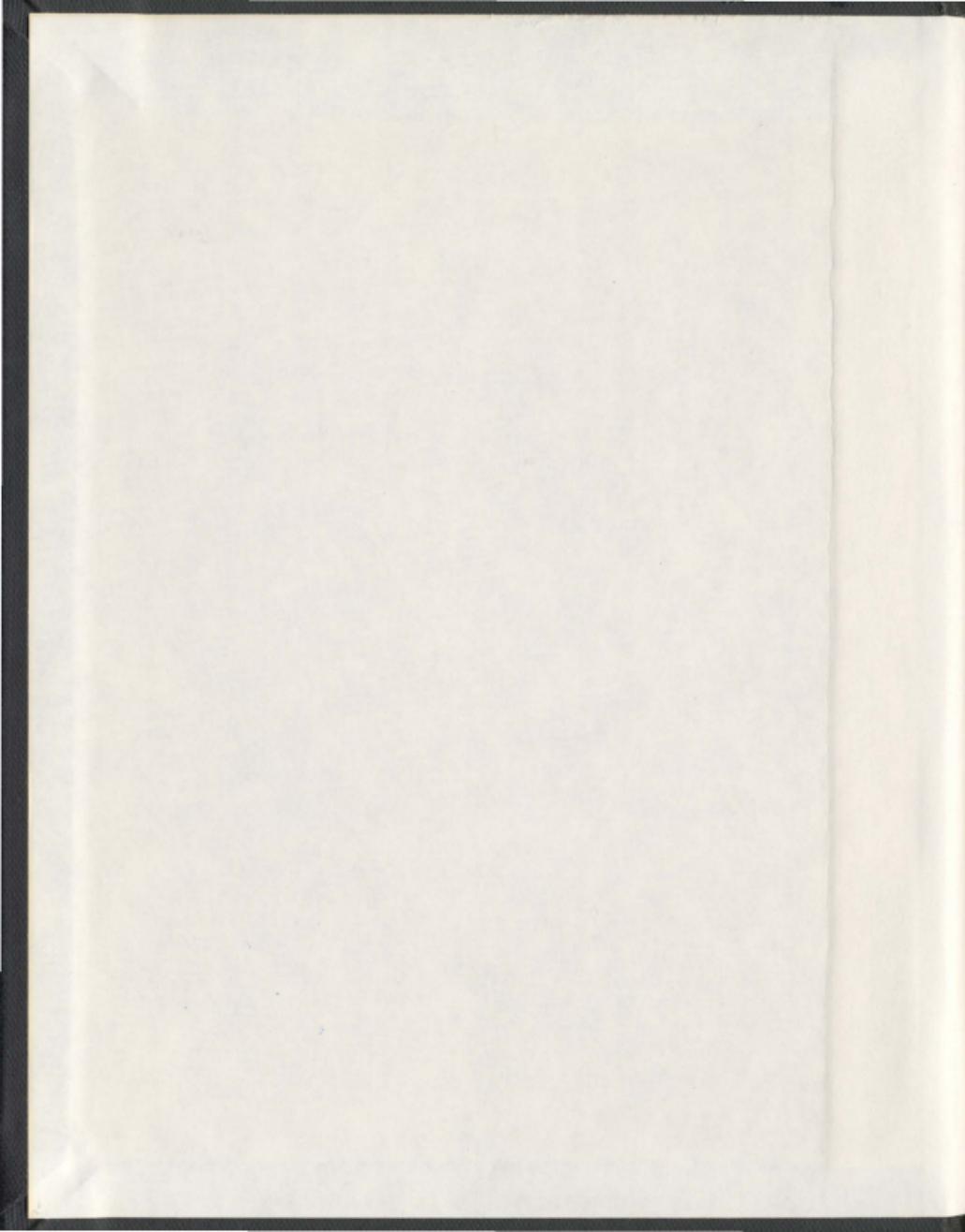


THINGS CHANGE, WE CHANGE:
PLANNING FOR RESILIENCE IN THE
CANADIAN ARCTIC

KATHLEEN PAREWICK



001311



**THINGS CHANGE, WE CHANGE:
PLANNING FOR RESILIENCE IN THE CANADIAN ARCTIC**

by

© Kathleen Parewick

A dissertation submitted to the

School of Graduate Studies

in partial fulfillment of the requirements for the degree of

Doctor of Philosophy

Department of Geography/Faculty of Arts

Memorial University of Newfoundland

January, 2012

St. John's

Newfoundland

ABSTRACT

This dissertation addresses climate and coastal changes in three small communities across the Canadian Arctic. The most pressing physical hazards were observed in Tuktoyaktuk, Northwest Territories (NWT) where erosive storm action and floods act on low-lying thermokarst terrain and shoreline infrastructure. Sachs Harbour, NWT is also experiencing rapid coastal erosion and permafrost ablation, although risks are moderated by the greater elevation of the townsite. Relatively few physical hazards were identified in Gjoa Haven, Nunavut but a sudden reservoir failure above the townsite in 2005 highlighted latent risks in infrastructure engineered to suit former climatic norms.

In concert with physical hazard evaluations, community assessments were undertaken which revealed a variety of factors conditioning changes at the local level. They exposed significant community adaptation challenges stemming from human resource, organizational and relational factors. This approach also contributed to a working understanding of the many cross-scale interactions that ongoing physical changes are precipitating, in tandem with globalizing economic and social influences, on northern populations. Rapid changes in ice-rich terrain have raised concerns in relation to traditional Inuit livelihoods, knowledge and practices, but significant implications for northern community governance must also be recognized. Resilience is rendered as a dynamic, composite property of communities. A basic analytical framework derived from resilience theory was developed and used in the three Things Change, We Change community-based adaptation case studies. Adjustments were made along the way to suit arising local circumstances, in keeping with an exercise of adaptive as well as adaptation planning. The process has highlighted a number of factors conditioning community responses to environmental changes: examples are outlined using the Four Dimensions of Community Resilience defined and presented in a variety of ways to enhance legibility.

Community resiliency is explored as a frame of reference for local governance and in relation to the significant ontological challenges presented by the necessary interchange among the multiple cultures entrained by global sustainability discourse. Consequently, community planning is re-imagined as an institutional practice which must seek to enhance or restore critical capacities to foster greater adaptability in every aspect of the community – ‘built’ and otherwise.

ACKNOWLEDGEMENTS

I know I'm not alone in seeing so clearly in hindsight the obstacle course that my research process has traversed. It is surely a good thing that we don't know what we're getting into when, as students, we launch ourselves into a doctoral program. Starting out, I also had no idea just how many kind souls I would need standing by to help me through it all, and had I realized how often I'd be calling on them, I would probably have been way less inclined to begin.

I am forever grateful to my advisor, Dr. Norm Catto for standing by me every inch of the way and demonstrating over and over a transcendent commitment to teaching. Great thanks are also due my stalwart advisory committee members: to Dr. Don Forbes for inviting me into the family of remarkable Northern researchers associated with the Bedford Oceanographic Institute and Natural Resources Canada more generally; to Dr. Roger White for insisting on cross-country ski debrief sessions and other regular infusions of inspiring conversation; and Dr. John Scott for all his patient and insightful prompting on some of the ethical dilemmas and thought experiments that I blundered into along the way. Also at Memorial University, I need to acknowledge my debts to Mario Blaser for pointing me towards other perspectives that at a critical juncture have "messed with my head" in the best of ways, and to Jean Briggs for insisting from the outset that "the Inuit don't *plan*" and giving me the best part of the title for this volume.

A huge thank-you is due to the Memorial University Geography Department for all kinds of support along the way and to Dr. Kelly Vodden and Dr. Arn Keeling for their examination of this dissertation. I'm also very grateful to Dr. Fikret Berkes for his detailed review and encouragement – we all wished you'd been in the room rather than on the phone with us back in November Fikret!

I am also very conscious of all the wonderful people who have contributed to my research in other fashions big and small, and the impossibility of naming you all here (David, Bernie, Raymond, Priscilla, Betty, Peter, Wayne, Doreen, Beverley, Lawrence, Mannie, Sarah, Joey, Donna, Adella, Andy, Bob, Joanne, Donna, James, Benedict, Agnes, Tommy, Jean...and so many more). I'll apologize in advance for any and all oversights in this regard, and for my consequent recourse to a blanket expression of gratitude: Thank-you all for helping in the many and varied ways that you did. Topping this list must be all the residents of the three hamlets where I conducted my fieldwork: Tuktoyaktuk and Sachs Harbour in the Inuvialuit Settlement Region of the Northwest Territories, and Gjoa Haven, Nunavut. I have encountered and relied on so many kindnesses in the North and nowhere more so than in the time spent in these communities. In each one, there were also all the Council members, local government workers and staff of other organizations who became, by association, partners in my research project. You all showed me what 'wearing many hats' really looks like.

There were many friends made along the way, many of whom put up with me as a house guest. The Inuvik RCMP detachment graciously extended an much-appreciated invitation to me to stay at their Sachs Harbour premises but, once there, it was really their tenant Mary Connolly who hosted and helped me settle into the first of my winter fieldwork. Bridget Wolki also put me up in Sachs Harbour. My thanks go out to Charlie Cahill for the stay in his house in Gjoa Haven. In Tuktoyaktuk, Sarah McKay, Harry DeBastien, Persis Gruben and their extended family opened their homes to me and kept me grounded in their day-to-day experience. And to everyone else who boiled the kettle when I visited: the best parts of community-based research are measured in teabags.

Then there were all those minor miracle workers: Ken Gay and his wife Vickie for conjuring up vivid pictures of the marine services that haul so much of what the Arctic region needs; Brad Vardy for beating the odds and retrieving the incident report on that Sachs Harbour plane crash; to Dr. Joanne Lacelle for listening at a critical juncture, and Gavin Manson, who was there to help me on my way into Tuktoyaktuk for the first time and, on the other end, to help resolve the last of my copyright queries for these deposit copies!

Among the many regional and territorial government staff who have given generously of their time and advice, I need to especially thank Emerald Murphy in Yellowknife; John Picek in Inuvik David Haogak in Sachs Harbour; and Alan Johnson in Gjoa Haven for his innumerable favours to several Memorial University researchers. The staff of the Nunavut and Aurora Research Institutes also provided invaluable support over the course of my fieldwork.

I must also acknowledge once more the financial support provided to me by Memorial University; ArcticNet; the Climate Change Impacts and Adaptations Program; Natural Resources Canada; the Northern Science Training Program; the Stuart Nesbitt White Fellowship for Emergency Preparedness, and Infrastructure Canada's Knowledge, Outreach and Awareness Program. Numerous in-kind contributions were provided by Parks Canada; various departments of the Government of the Northwest Territories and the Government of Nunavut. I also gratefully acknowledge the researchers in each of the Centre for Community Enterprise and the Resilience Alliance for the inspiration their work provided me.

Sadly, there were a few good-byes that had to be said over the last few years: Harry DeBastien, Gideon Qitsualik, and Steve Solomon, you will be very much missed.

To my parents, who no doubt worried that their eldest might be embarking on a major midlife mistake but who nonetheless believed in me: I couldn't have done this without you. Finally, to my daughter Julia who has adapted with only the occasional grumble to a mother who reads, writes and rants for lengthy intervals rather than cleaning up the house: 'I loves you to bits'.

Kathleen Parewick, 24 January 2012, St. John's, NL

Table of Contents

ABSTRACT.....	ii
ACKNOWLEDGEMENTS.....	iii
Table of Contents.....	v
List of Tables.....	ix
List of Figures.....	xi
List of Abbreviations and Symbols.....	xv
List of Appendices.....	xvi
1.0 Introduction.....	1
1.1 This Thing Called Change.....	1
1.2 Change at the Community Scale.....	3
1.3 Examining the Experience of Change.....	4
1.4 Change in the Arctic.....	5
1.4.1 Northern Community Resilience.....	5
1.4.2 Arctic Climate.....	8
1.4.3 Periglacial Environments.....	9
1.4.4 Arctic Climate Change Implications.....	13
1.5 Study Objectives and Design.....	15
1.6 Organization of Dissertation.....	17
2.0 Arctic Development, Resilience and Planning.....	19
2.1 Overview.....	19
2.2 Arctic Development.....	20
2.2.1 From the Outside, Looking In.....	21
2.2.2 Emerging Inuit Resistance.....	24
2.2.3 Future Northern Development Policy Directions.....	28
2.3 Resilience.....	32
2.3.1 A Multidisciplinary Knowledge Domain.....	33
2.3.1.1 Risks and Hazards Approaches.....	34
2.3.1.2 Criticality and Critical Infrastructure.....	37
2.3.1.3 Systems Theory.....	39
2.3.1.4 Global Environmental Change Approaches.....	40
2.3.1.5 Community-based Sustainability Approaches.....	43
2.3.1.6 Common-Pool Resources.....	45
2.3.2 Other Ways of Knowing.....	45
2.3.3 Commonalities and Incompatibilities.....	48
2.4 Planning.....	50
2.4.1 Planning as a Discipline.....	50
2.4.2 Critique: Planner as 'Professional'.....	52
2.4.3 Planning: A Functional Critique.....	55
2.4.4 Planning as Public Process.....	59
3.0 Framework and Methods.....	65
3.1 Outline.....	65
3.2 Towards Resilience-based Assessment.....	66

3.2.1	Additional Factors Determining Research Design.....	67
3.2.2	Adapting a Local Resilience Assessment Framework.....	68
3.2.3	Incorporating the Adaptive Cycle.....	73
3.3	Research Licensing.....	76
3.3.1	Preliminary Visits.....	76
3.3.2	Ethics and Regional Licensing Submissions.....	76
3.3.3	Primary Project Partnerships.....	77
3.4	Community-Based Process.....	77
3.4.1	Preliminary Familiarization Visits and Local Pre-Planning.....	78
3.4.2	Climate Change and Community Data Compilation.....	81
3.4.3	Adaptation Planning Consultations.....	81
3.4.4	Adaptation Plan Preparation and Stakeholder Review.....	83
3.4.5	Contingencies.....	84
3.5	Analysis.....	85
3.5.1	Physical Geographies and Human Dimensions.....	85
3.5.2	Local Planning Process Review.....	86
3.5.3	Local Development and Change Narratives.....	88
3.5.4	Local Consultation Outcomes and Discussion.....	90
3.5.5	Plan and Adaptation Scenarios.....	92
3.5.6	Synthesis.....	93
4.0	The West of the Northwest: The Inuvialuit Settlement Region.....	95
4.1	The Evolving Northwest Territories.....	95
4.2	Narrative One – Creating communities in the North.....	95
4.2.1	Mapping.....	95
4.2.2	Devolution Begins.....	97
4.3	Narrative Two – Recovering the peoples’ land.....	101
4.3.1	Land Claims in Canada.....	102
4.3.2	Inuit Organizations.....	102
4.4	Contemporary Governance and Development Context.....	104
5.0	Tuktoyaktuk.....	113
5.1	Tuktoyaktuk, N.W.T.....	113
5.2	Physical Geographies and Human Dimensions.....	114
5.2.1	Climate.....	115
5.2.2	Geomorphology.....	117
5.2.3	The Beaufort Sea.....	120
5.2.4	The Coastal Zone.....	121
5.3	Local Research Process.....	125
5.4	Contemporary Development and Change Narratives.....	128
5.4.1	Early Community Development.....	129
5.4.2	Development Planning in Tuktoyaktuk.....	132
5.4.2.1	Tuktoyaktuk Community Plan (1984).....	133
5.4.2.2	The Health Planning Project - Tuktoyaktuk Community Profile of Needs.....	134
5.4.2.3	Tuktoyaktuk Future Search: Together we fly into the Future (1998).....	135

5.4.2.4	Tuktoyaktuk General Plan and Zoning By-Laws.....	136
5.4.2.5	Let's Begin...Social Impact Planning 2006.....	137
5.4.3	Contemporary Change Observations.....	138
5.4.3.1	Public Works Staff Observations.....	138
5.4.3.2	Elders' Observations.....	142
5.5	Consultation Outcomes and Discussion.....	147
5.5.1	Community Lands and Physical Hazards.....	150
5.5.2	Core Community Services and Utilities.....	156
5.5.3	Transportation and Communications.....	160
5.5.4	Residential Infrastructure and Services.....	166
5.5.5	Economic Infrastructure and Services.....	171
5.5.6	Public Services.....	176
5.5.7	Community Wellness.....	180
5.6	Plan and Adaptation Scenarios.....	180
5.7	Synthesis.....	189
6.0	Sachs Harbour.....	191
6.1	Sachs Harbour, N.W.T.....	191
6.2	Physical Geographies and Human Dimensions.....	193
6.2.1	Climate.....	195
6.2.2	Geomorphology.....	197
6.2.3	The Coastal Zone.....	197
6.3	Local Research Process.....	199
6.4	Contemporary Development and Change Narratives.....	203
6.4.1	Early Community Development.....	204
6.4.2	Contemporary Change Observations.....	207
6.5	Consultation Outcomes and Discussion.....	209
6.5.1	Community Lands and Physical Hazards.....	212
6.5.2	Core Community Services and Utilities.....	217
6.5.3	Transportation and Communications.....	227
6.5.4	Residential Infrastructure and Services.....	234
6.5.5	Economic Infrastructure and Services.....	236
6.5.6	Public Services.....	243
6.5.7	Community Wellness.....	247
6.6	Plan and Adaptation Scenarios.....	251
6.7	Synthesis.....	256
7.0	Nunavut.....	261
7.1	The Emerging Nunavut.....	261
7.2	A Diverging Narrative.....	261
7.3	Contemporary Governance and Development Context.....	271
8.0	Gjoa Haven.....	274
8.1	Gjoa Haven, NU.....	274
8.2	Physical Geography.....	278
8.2.1	Climate.....	278
8.2.2	Geomorphology.....	278
8.2.3	Surrounding Waters.....	279

8.3	Local Research Process.....	280
8.4	Contemporary Development and Change Narratives.....	283
8.4.1	Early Community Development.....	283
8.4.2	Transition and Tradition?	284
8.4.3	Contemporary Change Observations.....	287
8.4.3.1	High School Class Consultation Project.....	288
8.4.3.2	Community Radio Station Phone-in	292
8.4.3.3	Other Community Elders' Observations.....	302
8.4.3.4	Public Works and Housing Staff Observations	307
8.5	Consultation Outcomes and Discussion.....	311
8.5.1	Community Lands and Physical Hazards.....	313
8.5.2	Core Community Services and Utilities.....	316
8.5.3	Transportation and Communications.....	319
8.5.4	Residential Infrastructure and Services.....	323
8.5.5	Economic Infrastructure and Services.....	325
8.5.6	Public Services.....	326
8.5.7	Community Wellness.....	329
8.6	Plan and Adaptation Scenarios.....	329
8.7	Synthesis.....	334
9.0	Things Change, We Change.....	337
9.1	A Basis for Comparison.....	337
9.1.1	Scale.....	337
9.1.2	Institutional Change.....	338
9.1.3	Practice.....	339
9.2	Arctic Community Challenges and Adaptations.....	340
9.2.1	Community Lands and Physical Hazards.....	340
9.2.2	Core Community Services and Utilities.....	343
9.2.3	Transportation and Communications.....	350
9.2.4	Residential Infrastructure and Services.....	352
9.2.5	Economic Infrastructure and Services.....	352
9.2.6	Public Services.....	354
9.2.7	Community Wellness.....	358
9.3	Arctic Community Capacity.....	361
9.4	Arctic Community Planning.....	365
10.0	Planning for Resilience.....	371
10.1	Addressing the Capacity for Change.....	371
10.2	Relationships, Relationships, Relationships.....	373
10.3	Learning Systems, Learning Organizations.....	374
10.4	Towards a more adaptive planning practice in the North.....	375
	Bibliography.....	380
	Appendices.....	404

List of Tables

1.1	Case Study Community Selection Factors	16
2.1	Population Data by Northern Territory, 2001-2006.....	20
2.2	Enabling Conditions for Sustainable Common-Pool Resources.....	46
2.3	Planning Logic Sequence III.....	57
3.1	Comparison of Community Planning and Resilience Approaches.....	70
3.2	Case Study Community Visits - Project Chronology	80
3.3	Example of Theme Break-out Table format	92
3.4	Concluding 'Ten Key Observations' framework	93
4.1	ISR Communities by Incorporation Year.....	105
5.1	Tuktoyaktuk Field Work.....	125
5.2	Tuktoyaktuk Community Lands and Physical Hazards	151
5.3	Tuktoyaktuk Core Community Services and Utilities.....	157
5.4	Tuktoyaktuk Transportation and Communications.....	162
5.5	Tuktoyaktuk Residential Infrastructure and Services.....	168
5.6	Tuktoyaktuk Economic Infrastructure and Services.....	173
5.7	Tuktoyaktuk Public Services.....	178
5.8	Tuktoyaktuk Community Wellness	181
5.9	Ten Key Observations – Tuktoyaktuk	184
5.10	Tuktoyaktuk Adaptation Plan - Consolidated Recommendations	186
6.1	Sachs Harbour Field Work.....	201
6.2	Sachs Harbour Environmental Change Observations	204
6.3	Sachs Harbour Community Lands and Physical Hazards	213
6.4	Sachs Harbour Core Community Services and Utilities.....	218
6.5	Sachs Harbour Transportation and Communications.....	229
6.6	Sachs Harbour Residential Infrastructure and Services.....	235
6.7	Sachs Harbour Economic Infrastructure and Services.....	237
6.8	Sachs Harbour Public Services.....	244
6.9	Sachs Harbour Community Wellness.....	248
6.10	Ten Key Observations – Sachs Harbour.....	252
6.11	Recommendations arising from 2005 Geophysical Assessment.....	254
6.12	Council Meeting content explored using Resilience framework	257
7.1	The Bathurst Mandate.....	266
7.2	IQ Guiding Principles.....	268
8.1	Kitikmeot Region Communities	277
8.2	Gjoa Haven Field Work	280
8.3	High School Class Consultation Project Outcomes (a & b).....	290
8.4	Kitikmeot Region Observations as per ACIA (2005).....	291
8.5	Elder's Change Observations by Category (Age: 60s).....	303
8.6	Elder's Change Observations by Category (Age: 80s).....	305
8.7	Staff Change Observations by Category	308
8.8	Prospective Development Areas.....	315
8.9	Gjoa Haven Community Lands and Physical Hazards	317

8.10	Gjoa Haven Core Community Services and Utilities.....	318
8.11	Gjoa Haven Transportation and Communications.....	322
8.12	Gjoa Haven Residential Infrastructure and Services.....	324
8.13	Gjoa Haven Economic Infrastructure and Services.....	327
8.14	Gjoa Haven Public Services.....	328
8.15	Gjoa Haven Community Wellness.....	330
8.16	Ten Key Observations - Gjoa Haven.....	335
9.1	Consolidated Themes.....	344
9.2	Imputed Dimensional Attributes by Community.....	365
9.3	Ten Key Observations – Synthesis.....	370

List of Figures

1.1	Study Region Permafrost Distribution by Type.....	11
1.2	Periglacial features on Banks Island.....	12
1.3	Shoreline slumping, Sachs River, NWT.....	13
2.1	Inuit-owned Assets as of 2011.....	28
2.2	Lifetime Scenario - Infrastructure Constructed on Permafrost.....	31
2.3	Three Public Approaches	35
2.4	Problem Assessment – The Geographical Approach	35
2.5	Two fundamental planning reconciliations.....	52
2.6	Planning Logic Sequence I	56
2.7	Planning Logic Sequence II.....	56
2.8	Planning as Change Management.....	58
2.9	Scope of potential ‘work’ defined by foundational planning	59
2.10	The Ladder of Citizen Participation	60
2.11	Conceptual Array of Sustainability Approaches by Cohort.....	63
3.1	Architecture of knowledge integration in embedded case studies.....	66
3.2	Four Dimensions of Community Resilience (<i>as adapted</i>).....	73
3.3	The Adaptive Cycle and Panarchy.....	74
3.4	The Coloured Adaptive Cycle	74
3.5	Preliminary Community Visit Questions.....	79
3.6	Adaptation Planning Consultations Subject Matter.....	82
3.7	Experiential Colour Key for the Adaptive Cycle.....	92
4.1	The Northwest Territories today	96
4.2	The Northwest Territories Regional Structure c. 1977.....	100
4.3	Case Study Communities Map.....	101
4.4	Inuvialuit Settlement Region Land Distribution.....	106
4.5	Current rates of land uplift or subsidence.....	108
4.6	Coastal Sensitivity to Sea-level Rise (Beaufort Region).....	109
4.7	The language loss lifecycle	110
4.8	Inuvialuit Settlement Region development chronology.....	112
5.1	Tuktoyaktuk.....	113
5.2	The Tuktoyaktuk Peninsula.....	114
5.3	Tuktoyaktuk Hamlet Boundary.....	116
5.4	Permafrost section, Tuktoyaktuk Ice House	118
5.5	Floodplain on west side of community	118
5.6	Ibayuk, Pingo Canadian Landmark	120
5.7	Sensitivity of Northern Canadian coasts to global sea-level rise	121
5.8	North Spit	122
5.9	Rip-rap shore protection	123
5.10	Armourstone at the Point	123
5.11	Inner Harbour	124
5.12	Annual Programme Consultation 2006.....	126
5.13	Previously recorded Tuktoyaktuk observations of environmental change.....	129

5.14	Our Lady of Lourdes	134
5.15	Anglican Church	134
5.16	Community development chronology (1998)	136
5.17	50-year reconstruction of shoreline retreat (NRCan)	139
5.18	Residents' observations of changes in barrier islands	139
5.19	Public Works Staff observations	140
5.20	The Point and North Spit	148
5.21	Storm Surge Flooding simulation (Map – NRCan)	149
5.22	Property armouring on Inner Harbour	152
5.23	Flood-prone neighbourhood to central east side of community	154
5.24	Panorama shot in vicinity of former DEW Line (NWS)	155
5.25	On approach to Tuktoyaktuk	158
5.26	Ice blocks outside Kiglavak House	159
5.27	Sewage lagoon and dump station	159
5.28	Dumpyard panorama	160
5.29	Panorama of west-central neighbourhood area, Part 1	163
5.30	As above, Part 2	163
5.31	View from road south of airport	164
5.32	Retired schooner	165
5.33	Wharf on Inner Harbour	165
5.34	On approach to southern extent of Tuktoyaktuk	167
5.35	North Spit and upper harbour mouth viewed from pingo	169
5.36	Looking southeast towards 'Green Gables' from same pingo	169
5.37	Housing Association units east of RCMP Compound	170
5.38	Land Assembly housing panorama	170
5.39	Kiglavak Elders' Residence	171
5.40	Rosie Ovayouk Health Centre	171
5.41	Northern Store and Gas Station	172
5.42	Sod structures	174
5.43	In Tuktoyaktuk Ice House	174
5.44	Boss Camp and other exploration-related industrial infrastructure	175
5.45	Looking southwest from second pingo	175
5.46	Kiti Hall	177
5.47	Cemetery	179
5.48	Notional adaptive phase interactions	182
6.1	Sachs Harbour seen from west	191
6.2	Banks Island, N.W.T.	192
6.3	Fred Carpenter's original cabin	194
6.4	Fred Carpenter c. 1958	194
6.5	Sachs Harbour as of 6 March 1958	194
6.6	Grizzly (2006)	195
6.7	Belugas (2008)	195
6.8	Gully feature to west side of community	196
6.9	Sediments at base of eroding shoreline bluff	196
6.10	Satellite imagery of community area	198

6.11	Sachs Harbour shoreline change 1961-2003	199
6.12	Annual NRCan/DFO consultations in 2006.....	200
6.13	Completed lanterns on parade.....	202
6.14	Aerial view of community with infrastructure notes.....	208
6.15	Surveyed terrain conditions and development notes.....	208
6.16	Parks Canada House and eroding bank.....	210
6.17	Condemned shoreline housing.....	210
6.18	Sachs Harbour Concept Plan Map (c. 1970s).....	214
6.19	Panorama – East side of Hamlet.....	214
6.20	Contemporary Sachs Harbour area infrastructure.....	216
6.21	Recently resurfacing landfilled vehicle.....	216
6.22	Panorama shot from Hamlet garage.....	217
6.23	Sachs Harbour water plant and intake.....	217
6.24	Truck fill station.....	221
6.25	Sachs Harbour sewage and water supply ponds.....	222
6.26	Harbour sewage lake dump station.....	222
6.27	Elevations Details – Water Supply and Sewage Ponds.....	222
6.28	Children playing in vicinity of fuel contaminated culvert.....	224
6.29	Area condition prior to fuel line leak clean-up.....	225
6.30	Area condition after fuel leak clean-up commenced.....	225
6.31	Aerial view of northeast corner of Hamlet area.....	228
6.32	Examples of drainage system infrastructure problems.....	228
6.33	Road wash-out on east side of community.....	230
6.34	Poorly draining children’s playground.....	230
6.35	Angus Lake.....	231
6.36	The well-used community beach.....	232
6.37	Two barges being towed back to the HBC ship (1957).....	233
6.38	Arrival of NTCL barge.....	233
6.39	Shore-side housing on east side of community.....	234
6.40	The <i>Fox</i>	238
6.41	Ikaahuk Co-operative Building.....	239
6.42	Muskoxen harvest and primary processing facility.....	242
6.43	View of west side of Sachs Harbour from beach.....	243
6.44	Boarded-up Church.....	245
6.45	Sachs Harbour Clinic.....	247
6.46	Sachs Rangers on parade.....	250
6.47	Site overlooking hamlet beach as prepared for development.....	255
7.1	Map of Nunavut.....	262
7.2	Eastern Kitikmeot Timeline.....	263
7.3	Recovery of Language as adaptation.....	270
8.1	Gjoa Haven.....	274
8.2	King William Island and region.....	275
8.3	The <i>Gjøa</i>	276
8.4	Roald Amundsen and crew members.....	276
8.5	Inuit Camp at Gjoa Haven, King William Island c. 1931.....	283

8.6	Aerial Photo Composite 1960.....	285
8.7	Aerial Photo Composite 1966.....	285
8.8	Aerial Photo Composites 1975, 1983 and 1993.....	286
8.9	Class commentary – surrounding area	292
8.10	Class commentary – townsite composite.....	293
8.11	Class commentary – area composite.....	294
8.12	Map Sheet detail with elder’s observations suggestive of local uplift.....	304
8.13	Staff commentary respecting townsite.....	310
8.14	Lower Gully near beach.....	310
8.15	Upper Gully.....	311
8.16	Surficial geology map of Gjoa Haven and surrounding area.....	314
8.17	Areas recommended based on preliminary terrain condition assessment.....	314
8.18	Gully comparison 1960-1993.....	315
8.19	1992 Air photo with reservoir highlighted.....	320
8.20	Reservoir failure.....	320
8.21	Proposed river crossing sites.....	321
9.1	Notional ‘averaged’ circumstances and community ranges.....	361

List of Abbreviations

- AANDC** - Aboriginal Affairs and Northern Development Canada (*effective 13 June 2011, formerly the 'Department of Indian Affairs and Northern Development'*)
- ACDGNWT** – Advisory Commission on the Development of Government in the N.W.T
- ARI** – Aurora Research Institute
- CEAA** – Canadian Environmental Assessment Agency
- COPE** - Committee for Original Peoples' Entitlement
- CWS** - Canadian Wildlife Service
- DFO** - Department of Fisheries and Oceans
- DIAND** - Department of Indian Affairs and Northern Development (1966-2011)
- DOT** - Department of Transportation
- DENR** - Department of Environment and Natural Resources (ENR)
- EIRB** - Environmental Impact Review Board
- EISC** - Environmental Impact Screening Committee
- FJMC** - Fisheries Joint Management Committee
- GNWT** - Government of the Northwest Territories
- HTC** - Hunters and Trappers Committee (*NWT*)
- HTO** - Hunters and Trappers Organization (*Nunavut*)
- ICC** - Inuit Circumpolar Conference
- IFA** - Inuvialuit Final Agreement
- IGC** - Inuvialuit Game Council
- ILA** - Inuvialuit Land Administration
- ILAC** - Inuvialuit Land Administration Commission
- INAC** – Indian and Northern Affairs Canada
- IQ** - *Inuit Qaujimajatuqangit*
- IRC** - Inuvialuit Regional Corporation
- ISR** - Inuvialuit Settlement Region
- ITC** – Inuit Tapirisat of Canada
- ITK** - *Inuit Tapiriit Kanatami*
- MACA** – Municipal and Community Affairs (*GNWT*)
- MOT** – Ministry of Transportation
- NPC** - Nunavut Power Corporation
- NRI** – Nunavut Research Institute
- NTI** - Nunavut Tunngavik Incorporated
- NTPC** - Northwest Territories Power Corporation
- NWMB** - Nunavut Wildlife Management Board
- NWT** - Northwest Territories
- PWNHC** - Prince of Wales Northern Heritage Centre
- SAO** – Senior Administrative Officer
- WMAC** - Wildlife Management Advisory Council (*Northwest Territories*)

List of Appendices

A - Ethics Application Materials.....	404
B - Gjoa Haven Map Sheet 1 – Gjoa Haven Elder Observations (c. 1960s –present).....	<i>pocket insert</i>
C – Gjoa Haven Map Sheet 2 - Public Works and Housing Staff Observations.....	<i>pocket insert</i>

Introduction

1.1 This Thing Called Change

What is it to 'change'? In a North American domestic context, it can be as unremarkable as a haircut, rearranged furniture, the insertion of a new activity into a routine, or a barely perceptible tone detected in a familiar voice. On the other end of the spectrum, more significant life transformations are marked: a marriage, a move to a different community, or the arrival of a child. Changes are experienced and perceived in any number of forms, some more tangible than others, and some certainly more desired. Whether positioned at its centre or on the periphery, innumerable potential combinations of change influence, information and personal bias act on individual viewpoints. Great diversity may be present among observations of a given change.

In 2004, several hundred contributors to the Arctic Climate Impact Assessment (ACIA) report concluded the following about the changes occurring in the global North:

1. Arctic climate is now warming rapidly and much larger changes are projected.
2. Arctic warming and its consequences have worldwide implications.
3. Arctic vegetation zones are very likely to shift, causing wide-ranging impacts.
4. Animal species' diversity ranges, and distribution will change.
5. Many coastal communities and facilities face increasing exposure to storms.
6. Reduced sea-ice is very likely to increase marine transport and access to resources.
7. Thawing ground will disrupt transportation, buildings, and other infrastructure.
8. Indigenous communities are facing major economic and cultural impacts.
9. Elevated ultraviolet radiation levels will affect people, plants, and animals.
10. Multiple influences interact to cause impacts to people and ecosystems.

(ACIA 2004, p.10-11)

The human act of directly registering a change is a function of innate pattern recognition processes. From infancy, individual observations are ordered into an ever-expanding framework (i.e. shapes, faces, expressions, sounds, language) and refined over time using a variety of feedbacks. This foundational construction of information continues on a more or less conscious level over a lifetime, influenced by the unique context and predominant stimuli acting on the individual. In other words, human awareness of and sensitivity to particular types of change will vary with life experience.

Humanity also gauges change using indirect means. Contemporary media feed consumers a steady diet of news, which commentators may further qualify by linking it to longer-term trends. Historians engage in pattern recognition procedures, deducing what they can from prior human actions. Similarly, geographers seek and interpret patterns in the physical and cultural world across varying spatial and temporal scales. Institutions of higher learning foster systematic study of innumerable patterned domains (i.e. physical, social, behavioural). Harvesting the significant from murky ponds of data relies on institutionalized practices such as the scientific method, logical enquiry, and dissemination to provide checks and balances en route to new understandings.

However unique an individual's perception of change may be, discerning the meaning and import in it is a larger human project with significant cultural dimensions. As there are also limits to what individuals may expect to observe or assimilate, attitudes towards change often develop by default as well as by design.

Change is a defining personal and collective human experience. In many instances, however, the changes of greatest immediate concern are those stimuli, negative and sometimes positive, that trigger human coping mechanisms or adaptations. Changes

falling in this category include familiar patterns of choice embedded in human evolution. In retrospect, when times have been toughest and survival questionable, living things are typically described as having three stark options to choose between: moving to avoid the influence of the change, adapting to it, or dying. As few people consider the latter a 'choice', the lesson learned is that when any decision affects survival, the only choices worth examining are those of movement and adaptation.

1.2 Change at the Community Scale

Human communities are the products of numerous change influences accumulated over time and space. Some continue to exercise the option of movement, through either a tradition of transhumance or the tragic circumstances of the refugee. Most communities today, however, are rooted in place by an extensive array of infrastructure and interlocked services. How do these relatively immobile communities cope with change and uncertainty? Among them, what distinguishes the ones that bounce back from hard knocks from the ones that come apart at the seams? Is there a formula for community resilience in the face of contemporary categories of change?

Kooiman and Bavinck (2005, p.17) define governance as "...the whole of public as well as private interactions taken to solve societal problems and create societal opportunities. It includes the formulation and application of principles guiding those interactions and care for institutions that enable them." Addressing community challenges – economic, environmental, social, or health-related – at the local level has long been a job for community members active or employed in local government, community services, law enforcement, and a host of related non-governmental organizations.

Community planning and development work comprise a suite of institutionalized practices that could be seen as having emerged in the course of collective efforts to keep pace with the continual adaptation needed to sustain a settled population. These established mechanisms for 'managing' change processes represent both a body of accumulated experience to be mined as well as key community governance functions that must be carefully examined by those seeking to support communities in hard times. Risk and hazards scholarship has explored these themes, as have sociologists, anthropologists and a variety of other disciplines contributing to the international and economic development literatures. From an understandable early preoccupation evident in each domain with 'putting out fires' – documenting and characterizing various kinds of development problems or risk scenarios and the results of response strategies used – there have emerged new lines of enquiry leading to an expanding body of policy, practice and theory. A rich array of experience and experimentation is recorded in local case studies the world over.

1.3 Examining the Experience of Change

The concept of 'experience' is particularly significant in relation to human adaptation: the appraisal and response by humans to risks, hazards, and any number of systemic failures depending almost entirely on individual and collective learning from prior occurrences. Life experience throughout the past 50 years, however, has been one for which human history is less and less of a guide for *responding* to difficulties, and more a cache of cautionary tales respecting our shortcomings in adaptation (Diamond, 2005). As the global human population strains the very limits of the planet's carrying

capacity, creating environmental conditions never before encountered by surviving species, uncertainty must accompany any prior experience used to shape future actions. Human survival is a much more speculative prospect relying on something akin to societal *reverse-engineering* to avoid the most unsustainable of possible futures.

Where change has usurped a formerly stable view of the world, so has uncertainty become a new constant. Also, solely focusing on negative stimuli and the contributing factors to 'down times' fails to satisfy the range of information needed to determine whether or not a given set of conditions fall within or outside those of prior experience. Comprehensive understanding of not simply a range of defining characteristics, but their dynamic interplay, is required. Increasingly, systemic models are crafted and fed multiple scenarios to bracket a range of more-likely outcomes. Balancing the potential system crash, other potential states of being can be teased from this process along with formerly overlooked variables. This can allow more thorough examination of possible contributors to new adaptation options, or the means to reassert or augment older ones.

1.4 Change in the Arctic

1.4.1 Northern Community Resilience

Students of Arctic history and development quickly become acquainted with the momentous challenges that Arctic people have faced and are continuing to grapple with. Like their Southern counterparts, Inuit and Inuvialuit children of the early new millennium in many Canadian Arctic communities experience a world that is very different from that of their grandparents. In the North, however, the degree, pacing and nature of these differences has attained a disorienting order of magnitude: the

practicalities and physical demands of Elders' lives spent entirely on the land two generations ago contrasting starkly with the virtual experiences made available to youth everywhere through globalizing on-line and popular culture vehicles.

Accelerating Arctic climate changes have been added to a lengthy list of factors distinguishing 'then' from 'now'. Reporting of dramatic northern climate change observations has increased markedly since 2000 but older Canadian Arctic residents describe their awareness of changes stretching back several more decades. Along the coasts of the region, rising sea levels, increased wave action and permafrost melting are contributing to accelerated rates of erosion, altering ecosystems, displacing wildlife, and putting community infrastructure at risk. The Arctic peoples of Canada are very resilient and expert in the practice of adaptation, having lived in a harsh climate and sustained protracted technological, social and political changes from the time of their first contacts with traders and missionaries. The rates of physical change that residents of relatively recently established, year-round, coastal settlements are currently observing, however, are without precedent in their history, comparable only to the ongoing rate of cultural change. Whether in retrospect this time will be seen as a true 'tipping point' (*sensu* Gladwell 2000) for the Inuit and Canadian Arctic communities more generally, it is clear that a very significant threshold is in the process of being crossed. A considered and coordinated response is required to address current and forthcoming community impacts.

The contemporary experience in the Canadian North certainly speaks to both the implications of discrete and cumulative social and ecological changes. It also suggests a context for a more broadly framed examination of the dynamics, mechanisms and potential limits on human adaptation. In the wake of International Polar Year, an

expansive literature respecting climate change in the global North is available as are a number of excellent reviews, compendiums and summaries treating the Canadian Arctic (for instance, *AMBIO* 2009, 38(5), various authors; Forbes 2011). This dissertation seeks to address these change themes on a relatively intimate, local scale. Gjoa Haven in Nunavut, and Sachs Harbour and Tuktoyatuk in the Northwest Territories are the three case study communities considered here. They share much and yet also offer sufficient differences to support a fruitful comparison. It is expected that the documentation presented here will be enhanced through use by subsequent researchers as one element in their time series data. At its core, however, it is hoped that each of the following case studies will be seen to stand on its own as a record of a particular circumstance and experience of community change.

In as much as the social science subject matter and methodologies exercised in this work may be compared with established community planning and governance practices, this research also addresses the roles of contemporary institutions and practitioners in relation to change processes. Adaptation occurs across scales and may exhibit paradigm-shifting trajectories in some or all of them. Whether adjustments are interpreted as tips or 'flips' of a given system into some new state, or perhaps as a response to a complete failure of a prior order, the impulse to make sense of transitional states engages the human psyche at a primal level. The mechanisms by which we replicate our communities are themselves a product of embedded biological, social and cognitive processes that are not readily disengaged (Robbins and Kreuger 2000, Robbins and Aydede 2009). Individuals may perceive changes to a greater or lesser extent and similarly, on a conscious or subconscious level. The path of that perception in turn will

influence the nature and degree of response. Conversely, there can be circumstances where human apprehension of differences and change is attributable more to a social construction than an elusive objective reality. Separating one from the other may not be possible, but the effort to do so remains warranted.

1.4.2 Arctic Climate

To say the Arctic has long dark winters and short cool summers may seem obvious, but it is one of the only generalizations that holds true across the region. Notwithstanding the archetypal snow-covered state, the arctic climate of Northern Canada exhibits great seasonal and regional diversity.

The high-latitude variability of insolation is the defining characteristic of the arctic climate system. North of 66.7°, conditions cycle annually between extremes of 24 hours of darkness and 24 hours of light. The multiple interactions of land, water and air under these extreme light regimes in turn fuel global wind and ocean currents, redistributing heat and cold from the equator to both poles. The 'polar opposites' are aptly named: Antarctica is a continent while the Arctic is a sea. The global north's climate is thus particularly influenced by arctic sea ice; its extent, duration and movement.

The Archipelago and the northern continental landmass of North America heat and cool quicker than the surrounding ocean water, and their irregularities contribute to significant spatial and temporal variability across the Arctic in seasonal attributes such as freeze-up and break-up. Surface differences, especially the reflective properties of snow and ice versus the darker and absorptive nature of open water and bare ground, also

generate variations in convection air flows and distinctive local wind conditions, another determinant of regional temperatures.

Precipitation is a function of all of the above: the distance from the source of the water, temperature, and prevailing wind conditions. It displays marked regional variability across the arctic in the amounts received and in the proportions falling as rain or snow.

Little in the Arctic is well-represented using averages except annual average temperatures. These are the primary reference values in contemporary descriptions of climate change the world over, but nowhere do they speak to such a significant and systemic phase shift as they do in those areas whose defining landscape attributes are snow and ice. As global temperatures trend upwards, much in the arctic climate depends on the extent to which regional or summer averages remain below the freezing point.

1.4.3 Periglacial Environments

A periglacial environment exists where the climate supports intensive frost action. Permafrost, or 'perennially frozen ground' (ground remaining frozen for two or more consecutive years), characterizes many periglacial areas, including Arctic Canada. Permafrost underlies approximately 40% of Canada and occurs in four distinctive regimes:

- Continuous permafrost – developed where the mean annual air temperature (MAAT) is $\leq -7^{\circ}\text{C}$; snow cover is $\leq 30\text{cm}$; and total annual snowfall is $\leq 100\text{cm}$;
- Discontinuous permafrost (interspersed with unfrozen zones known as talik) – developed where the MAAT is $\leq -0.5^{\circ}\text{C}$ and total annual snowfall is $\leq 300\text{cm}$;

- Subsea – terrestrial permafrost regions inundated by rising sea level; and
- Alpine – occurring at elevations producing sufficient frost action.

All four styles of permafrost occur in Northwest Territories and Nunavut, but alpine permafrost is not present in the vicinity of any of the three study communities (Fig. 1.1). Currently, the transition zone between discontinuous and continuous permafrost is located near Inuvik, NWT (Kettles et al. 1997). All three study communities fall within the zone of continuous permafrost with Tuktoyatuk lying nearest the southern margin. Subsea permafrost underlies the southern Beaufort Sea adjacent to both Sachs Harbour and Tuktoyatuk.

Permafrost features and the consequent effects of permafrost ablation vary based on the sediments and drainage of the affected area. The surface tension produced by the contact area of water and very fine sediments can obstruct the flow of water. As sediment grain-size increases, there is also more space between them where ice may accumulate. As freezing begins, water is preferentially drawn to an existing frozen surface. This leads to the formation of both interstitial ice (between sediment clasts and within pore spaces), and segregated ice lenses. Ice lenses are most readily formed in silt where the freezing action is supported by an optimal balance of sediment permeability and water retention. Over time, repeated freeze and thaw episodes act in this way to both accumulate and consolidate pockets of ice and generate movement through water expansion (by 9.2%). In poorly drained soils, this is evidenced by the development of ice wedges: ice-filled cracks which progressively widen, and which may propagate up or down to several metres depth.

Seasonal variation in MAAT leads to the freeze-thaw cycles which over time give rise to characteristic patterned ground features of permafrost terrain. Melting and refreezing only occurs near the surface of frozen soils, comprising a zone called the 'active layer'. Thick active layers occur where MAAT ranges from -2 to -3°C each year. As snow cover will have the effect of insulating the ground, active layer development is also a function of the period each year that the ground is bare.

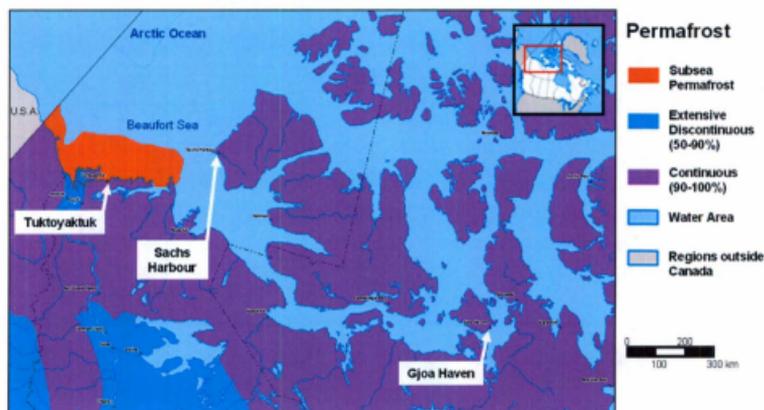


Figure 1.1: Study Region Permafrost Distribution by Type
Source: Adapted from *Permafrost*, Natural Resources Canada, The Atlas of Canada (www.atlas.gc.ca)
© Her Majesty the Queen in right of Canada, 2012

Active layer depth significantly influences terrestrial vegetation by favouring shallow-rooted varieties/species. In this fashion, permafrost distribution correlates to a significant extent with vegetation. The northern extent of the taiga forests in Canada approximates the southern extent of continuous permafrost which is associated with

tundra plant assemblages. Trophic levels consequently support a lesser array of wildlife in higher latitudes.

Iterations of freeze and thaw actions in the forms of frost heaving (vertical motion), thrusting (lateral motion), and cryoturbation (non- or multi-directional disturbance) have produced a characteristic array of periglacial landscape features. They include vertically sorted layers of sediments; frost blisters, boils or hummocks (small circular mounds with central ice lens) and the aforementioned ice wedges. Larger scales of patterning include stone circles, stone nets and terracettes (low-slope features), stripes (found on moderate slopes) (Fig. 1.2). Still larger mass movements of note include gelifluction creep (where a saturated surface layer behaves as a viscous liquid); lobes



Figure 1.2: Periglacial features on Banks Island. (*Left*): Gullying of permafrost terrain, east of Sachs Harbour; (*right*) patterning (frost boils) on low slope in community. 28 July 2005.

(low-slope features occurring where gelifluction creep dominates), active layer detachment slides or ‘skin flow’ (where the mass moves as a unit, usually detaching along the permafrost table); and, retrogressive thaw flow (producing flows of melted material and rapid scarp retreat).

Community site selection and related engineering works in the Arctic need to take all of these features into account. Ongoing instability in ground conditions presents significant challenges to conventional 'fixed' infrastructure. Numerous adapted northern infrastructure forms and processes have been developed to prevent, in effect, the active layer from getting too active. Measures undertaken are designed to eliminate or cope with movement caused by freezing (heave) and thawing (slump) of ice-enriched ground (Fig. 1.3). As this movement is insignificant in well-drained larger clast materials, most Arctic construction occurs atop of gravel pads and employs floating frames erected across pylons driven deep into permanently frozen underlayers. These conventions optimize site drainage and minimize change in the existing thermal regime by both insulating the permafrost and minimizing ground contact and consequent heat transfer from buildings to the ground.



Figure 1.3: Shoreline slumping, Sachs River on approach to Angus Lake, Banks Island, N.W.T.
28 July 2005

1.4.4 Arctic Climate Change Implications

The implications of climate change on Arctic Canadian land and seascapes are significant. The generalized warming forecast for the Arctic region exhibits the most dramatic expected warming nationally and globally (ACIA 2005; Forbes 2011). Working

with a terrain held together in many respects by ice, the combination of rising sea levels (where not countered by comparable rates of isostatic rebound), changing seasonality (longer summers, shorter winters), enhanced active layer development and accentuated permafrost ablation, present multiple sources of new problems in an already challenging environment for development. Accelerated melting of exposed ice features makes coastal terrain even more susceptible to erosion. In addition, lessened extent and duration of sea ice, and consequent increased storm wave action will lead to accelerated erosion of shorelines, particularly those comprised of sand, silt and clay-dominated sediments.

A northward migration of the discontinuous/continuous permafrost transition, treeline, and invasive species is expected and has already been observed in many parts of the Arctic (Fox 2000; Krupnik and Jolly 2002; ACIA 2004, 2005). The north-south gradient of landforms and periglacial processes would also be expected to shift northward. This movement would also depend, however, on a number of other factors in addition to temperature; particularly the form, amounts, and seasonality of precipitation experienced. Areas receiving more of their annual precipitation as rain will be expected to experience accelerating erosion and mass movements.

Reduced seasonal ice extent will also facilitate transport and tourism by lengthening the shipping season. Resultant increases in commercial development, changed economic activity, and potential for coastal pollution will also affect the North. Taken in combination with the variety of climate changes that a given area would likely experience simultaneously, anthropogenic degradation may be magnified by the uncertain dynamics of a transitional phase. Areas required for new development, including aids to navigation and transport support facilities, will be limited by permafrost ablation, coastal

erosion, and previous land uses. The limited availability of “good” or relatively stable development sites suggests that there will remain significant potential for land use conflicts among and between residents and incoming parties for some time to come.

Many communities will have to examine potential terrain changes in relation to local infrastructure – existing and planned. Local risk and hazard assessments are required to identify likely climate change impacts as a basis for sound longer-range community development and planning. These assessments and planning processes must constructively engage as many knowledgeable parties as possible. Moreover, in that conditions will be expected to continue to change in the foreseeable future, means will need to be found to support both regular reassessments and correspondingly responsive modes of local development planning and practice.

1.5 Study Objectives and Design

The objectives of this research are:

- To analyze and compare the results of three community climate change adaptation planning case studies from Arctic Canada;
- To draw conclusions respecting local governance and climate change adaptation; and,
- To derive general recommendations respecting the institutional and professional parameters of change management.

The research focused on three communities where geophysical work by project associates was either in progress or recently completed: Tuktoyaktuk, Sachs Harbour and Gjoa Haven. Their selection was also influenced by their representativeness with respect

to a number of other factors including their position across a west-east isostatic transect, their respective political jurisdictions and community size (Table 1.1). Engaging Arctic community members in timely discussion, analysis and planning respecting their ongoing adaptation was an important short-term objective of this project, with the primary longer-term goal being the fostering of social learning in support of more resilient and sustainable communities.

Table 1.1: Case Study Community Selection Factors

Community	Pop. 2001	Latitude/ Longitude	Physiographic region	Ecozone	Climate Zone	Isostatic status
Tuktoyaktuk, NWT	870	69°N 133°W	Interior Plains	Southern Arctic	Low Arctic	Submergent
Sachs Harbour, NWT	122	72°N 125°W	Arctic Lowlands	Northern Arctic	Middle Arctic	
Gjoa Haven, Nunavut	1,064	68°N 96°W				

Sources: Statistics Canada (2001), Prowse et al. (2009), Forbes et al. (2004)

Having identified local planning and development functions as a key domain of governance activity, this research initially aimed to determine how these might better serve to build community resilience and support local climate change adaptation. Researcher-facilitated, open community planning processes were envisaged with the targeted outcomes being a series of local climate change adaptation plans. Close and collaborative working relationships with the residents of Gjoa Haven, Sachs Harbour, and Tuktoyaktuk, three representative coastal Arctic communities, were sought. The technical and ethical groundwork was laid to allow prospective planning exercise participants to consider geophysical scientific findings, local knowledge and existing governance mechanisms. For each community, the case study proceeded along similar lines:

preliminary familiarization visits and local pre-planning; environmental change and community data compilation; local planning consultations; and, adaptation plan preparation with stakeholder review and editing. Throughout the project, broad participation and partnerships with many community groups were pursued and the tremendous contributions made by local people each step of the way were regularly acknowledged.

As a professional planner, the writer set out to approach this research as a participant-observer, guided by participatory action methodology and principles derived from resilience theory. As the project was conducted in conjunction with the ongoing research programs of other physical and life science researchers involved in climate change-related projects across the Arctic, however, an epistemological project metanarrative respecting ongoing processes of translation and reconciliation among the diversity of cultures at hand – disciplinary, ethnic, and otherwise – soon emerged. The discourse brought into play by an interdisciplinary research program undertaken in a distinctive geographic region that many residents of this nation of colonial origins still quietly regard as a ‘frontier’, is a justifiably contentious one. Trigger points abound in this increasingly frequent boundary zone of practice, ranging from the very idea of rigorous scientific enquiry to conflicting interpretations of terms in common usage.

1.6 Organization of Dissertation

The dissertation is divided into 10 chapters, including the Introduction. Of the remaining nine chapters, Chapter 2 reviews and discusses theory and themes addressed by

the project with reference to relevant literature. Chapter 3 details the methods and approach employed in the research.

A regional overview of the physical, social and political history and existing conditions in the Inuvialuit Settlement Region (ISR) and the Northwest Territories governance context is presented in Chapter 4, followed by discussion of the case studies conducted in Tuktoyaktuk (Chapter 5) and Sachs Harbour (Chapter 6). Chapter 7 offers a similar regional overview for Nunavut. The case study for Gjoa Haven is presented in Chapter 8.

Chapter 9 offers a comparative analysis and synthesis of the research outcomes, addressing the challenges, adaptations and planning implications, and existing capacity and 'resilience' for each community.

The conclusion, Chapter 10, builds on the research outcomes and makes recommendations for addressing contemporary Arctic community governance challenges and the practice of planning for change more generally.

The Appendices contain the ethics and licensing details of the project and large-format community map sheets.

Arctic Development, Resilience and Planning

2.1 Overview

At its most fundamental level, this research project seeks to understand how human communities address change – how ‘we’ adapt. The already expansive literature that addresses themes of human adaptation is growing rapidly due to the threats presented by global climatic change and variability. The discussion presented in this chapter is limited to the following three themes: Arctic Development, Resilience and Planning.

This chapter will address each of these themes in turn. First, a conceptual chronology of Canadian Arctic development is explored. Historic and physical developments of the last fifty years are emphasized: a period marking the transition of the Inuit from a highly mobile and dispersed population to one that now resides for much of the year in a series of incorporated communities. It has also been a timeframe characterized by growing public awareness of environmental change and deterioration.

Next, the emphasis this project places on ‘resilience’ is elaborated with reference to a variety of contemporary theoretical and disciplinary perspectives on human sustainability and responses to change. This trajectory of knowledge construction begins with early work on hazards, their assessment, and management by various means, followed by approaches drawing particularly on systems thinking, and finally those derived in large measure from international and rural development practice.

Finally, the section on ‘Planning’ discusses human governance as it relates to adaptation, both in a general sense and with specific reference to factors influencing the management of change in Canadian communities. Selected community planning practices

and experience will be examined in relation to the larger arena of contemporary public policy and process.

2.2 Arctic Development

Development of the North has proceeded out of sight and mostly outside of the awareness of all but a handful of Canadians. In many respects, it is important to be alert to the colonial outsider's viewpoint: what has a predominantly non-northern Canadian public come to know about the Arctic?

In lieu of direct experience, a variety of other informants have influenced the prevailing impressions of not only what the Canadian Arctic 'is' but also its 'place' in relation to the larger ambitions of the rest of the country. As of Canada's 41st General Election in 2011, the Yukon, Northwest Territories, and Nunavut were represented by a single Member of Parliament each; not quite 1% of the 308 total seats, but in turn representing just 0.3% of the Canadian population and 39% of its land area (Table 2.1). The combination of a considerable land base and a disproportionately small population means that even today as some of the fastest growing population groups of the country, Northern residents have to be especially vocal to be heard above other interests.

Table 2.1: Population Data by Northern Territory, 2001-2006

Geographic Region	Total Population		Land Area (km ²)	Population Density (per km ²)
	2006	2001		
Canada	31,612,897	30,007,094	9,017,698.92	3.5
Yukon	30,372	28,674	474,711.02	0.1
Northwest Territories	41,464	37,360 *	1,140,834.90	0.04
Nunavut	29,474	26,745	1,932,254.97	0.02

Source: Census Canada (www12.statcan.gc.ca)

* Net Northwest Territories undercount in 2001 was estimated at 8.11%

2.2.1 From the Outside, Looking In

"The landscape conveys an impression of absolute permanence. It is not hostile. It is simply there – untouched, silent and complete. It is very lonely, yet the absence of all human traces gives you the feeling you understand this land and can take your place in it."

Edmund Carpenter, 1973

The above appears among the frontispiece quotes from *Arctic Dreams* (1986), Barry Lopez's northern polar travel log and reflections on the history, heritage and imaginative impact of the Canadian North. Edmund "Ted" Carpenter was a respected anthropologist and the original quotation is found in his 1973 publication, *Eskimo Realities*. A coffee-table book with a suitably evocative dust-jacket, the title is embossed on an off-white image ground of fog out of which emerge a small faint line of caribou. The teaser text on the back sells the 'hauntingly beautiful' photographs contained therein and the content, drawn from Carpenter's extensive professional interest in Inuit material culture:

"...Art to the Eskimo is an act, not an object; a ritual, not a possession. This blind-white universe acquires form only through man; poet and carver reveal form; they cancel nothingness."

Carpenter and his 1950s colleague at the University of Toronto, Marshall McLuhan, have been described as 'academic iconoclasts' and lifelong friends (Soules 2007). They collaborated in media analysis projects including a journal launched in 1953:

"Explorations explored the grammars of such languages as print, the newspaper format and television. It argued that revolutions in the packaging and distribution

of ideas and feelings modified not only human relations but also sensibilities. It further argued that we are largely ignorant of literacy's role in shaping Western man [and woman], and equally unaware of the role of electronic media in shaping modern values."

From *Explorations in Communications* (1960),
Introduction, p. ix, (cited in Soules 2007)

The juxtaposition of their sophisticated media-is-the-message consciousness and the messages conveyed in the quotes from *Eskimo Realities* is an interesting one to consider in relation to the lengthy and romantic tradition of portrayals of the North as a pristine, vacant space. The cultural construction by outsiders of the North as an empty wilderness or resource frontier has from the start significantly influenced attitudes towards northern development. As elegantly deconstructed by Shelagh Grant (1998), prevailing conceptions of the Canadian Arctic owe much to their treatment by a succession of popular media.

Grant identifies two great mythologies and their inherent contradictions: 'The Arctic Wilderness Myth' promoting the image of a landscape devoid of people notwithstanding the expansive and lengthy history of occupation there by the Inuit and their predecessors; and, 'The Myth of the North' as an integral part of the Canadian identity so belying the fact that it has remained almost entirely unknown and unseen to most of the nation's population. Highlighted in the myths' emergence is a 'sublime' phase of 19th century Arctic portrayals of surreal icebergs and polar bears as backdrops for heroic early explorers but which neglected to include references to existing occupants. A period of renewed colonial interest in finding the Northwest Passage, epic polar voyages

provided vivid settings for each of Mary Shelley's *Frankenstein* (1818) and Coleridge's *Rime of the Ancient Mariner* (published in 1863).

Prevailing narrative treatments soon shifted from 'conquest' to 'frontier'. The market resource-based exploitation pattern continuing in the Arctic to this day took hold as whaling and the fur trade became established in evermore northern regions. This phase of Arctic history is a tragic one, marked by disease epidemics that decimated indigenous populations all across the region. These dire conditions fueled benevolent colonial misinterpretations: the 'backward' Eskimaux being in need of assistance; missionaries answering the call.

Britain granted Canada the Arctic Islands in 1880. By the turn of the century, the Klondike Gold Rush set in motion the first significant migration of fortune-seekers to the North with policing services not far behind. Thanks to more resident observers and the advent of photography, by the 1920s the foundational imagery of the region had evolved to include the Inuit as exotic and ennobled subject matter. The famous silent film of the period, *Nanook of the North* ("A Story of Life and Love in the Actual Arctic") was shot in the vicinity of Inukjuaq on Hudson Bay. The film's maker, Robert Flaherty, had developed relationships with and appreciation of the Inuit through working as a prospector in the region. Considered the first feature-length documentary (notwithstanding later criticism aimed at some of its staged action), the film was the first to accurately showcase many aspects of the traditional Inuit way of life. It proved very successful with North American and European audiences.

Group of Seven member Lawren Harris painted in the North during the 1930s, reviving a sublime brand of imagery attributing to the landscape "a source of spiritual

flow" (Revelation of Art in Canada, cited in Grant 1998). Done from the vantage point of an Eastern Arctic patrol vessel, Harris' iconic portraits of marine and coastal spaces were also devoid of a human presence. His experience would perhaps have been quite different a decade or so later when the events of WWII and the Cold War were visited upon the region in the form of air, sea and submarine surveillance and a pronounced military presence, including the development of the Distant Early Warning (DEW) Line infrastructure all across the North.

2.2.2 Emerging Inuit Resistance

The Inuit finally received the right to vote as Canadian citizens in the 1950s, more or less coinciding with the beginning of their 'settlement' in year-round communities. Sedentarizing the traditionally mobile people did serve to somewhat improve their living conditions and to facilitate their access to some services. It is well-recognized, however, as also setting the stage for extensive social problems (i.e. alcoholism, gambling, loss of language and traditional values) that continue to plague many Northern communities today.

The early engineering of new Inuit communities extended well beyond the notorious 'matchbox' units of early northern housing design. The *Q-book*, a 1964 publication of the Welfare Division, Northern Administration Branch of the Department of Northern Affairs and National Resources attempted to explain to the Inuit, most of whom were still not literate, the fundamentals of everything from colonial history and government frameworks, to the employer expectations attending the enterprise and industrial activities then spreading across the region. The stated aim of the three versions

of the *Qaujivaallirutissat* text (produced in English, syllabics, and a newly introduced roman orthography) was to "...share with Eskimos, ideas, knowledge and experiences from other parts of the world which other people have learned and found helpful", especially in light of "...the many new things which are happening in the north." (p. 8) Alternatively, "Eskimos have to learn these things too like any other Canadian people because they are Canadian people too." (p.12)

In contrast, the pronounced changes in the North were also taken by many as evidence of the corrupting values of white man on a formerly 'noble savage'. The prominence of mining and exploration in the region were at odds with the prevailing view of the North as a frontier and refuge from industrial capitalist society. Grant (1998) refers to this significant political shift in her application of the Wilderness Myth in relation to emerging conflicts between the values held by Southern conservationists and the Inuit. In 1968, oil was discovered offshore at Prudhoe Bay, Alaska. Environmentalists mobilized to address very significant pollution threats and concerns respecting forthcoming oil and gas development activity. Their actions surely benefited from the myth of the 'pristine' Arctic environment still embedded in the popular imagination. By the time of the Berger Enquiry final report publication in 1977 and its far-reaching indigenous empowerment recommendations, however, Canadian Inuit were also feeling the full impact of anti-sealing activists' use of slaughter imagery to shock consumers.

Outsiders' efforts to preserve the North and its inhabitants from environmental degradation and other ills of modernity fueled political resistance from the Inuit. Paradoxically, as Grant points out, the Myth of Wilderness had the effect of appropriating the North as a 'White Man's Refuge'. Colonial governance practices were long met with

incomprehension, skepticism and varying degrees of tolerance by Inuit across the North but had not until this period presented such direct challenges to their ways of life. Efforts to conserve lands and species in the North often failed to account for the longstanding Inuit use of the region (Berkes 1999; Nuttall and Callaghan 2000) and continue to show conflicting observations between residents and outsiders.

The Quebec Cree and Inuit land claims process began in the early 1970s in Quebec in response to the James Bay hydroelectric development. It inspired similar Inuit processes in the NWT, including the establishment of the Committee for Original Peoples' Entitlement (COPE) in the Western Arctic. In 1977, Inuit leaders from Alaska, Canada and Greenland met to form the Inuit Circumpolar Conference (ICC), an organization concerned with preserving Inuit culture. In 1984, COPE had succeeded in negotiating the Inuvialuit Region land claim agreement with its provisions for eventual regional self-government. In the 1990s, other processes leading towards self-government were active in the Eastern Arctic, Northern Quebec and Labrador. In 1992, the political accord respecting the creation of the Government of Nunavut was signed, just prior to the final land claims settlement and enacting legislation (*Nunavut Act* and *Nunavut Land Claims Agreement Act*, 1993); self-governance provisions and the new federal territory of Nunavut came into force on 01 April 1999. Canada's first experiment with a regional, ethnic (Inuit) self-government structure was initiated with the launch of Nunatsiavut on 01 December 2005. The authorities of each of these new governments vary, as do their implementing measures. It is clear too that they will all be 'works in progress' for some time to come. They share, however, central founding objectives built around a recovery and perpetuation of Inuit values.

The economic [re]development of the Arctic has been slowed by competitive disadvantages due to limited penetration and tenure of commercial and industrial interests in a resource-rich but relatively consumer-free and workforce-poor environment. Externally-driven spurts of activity might have something of the character of 'booms' seen in resource-based towns to the south, but succeeding 'busts' in Arctic communities would more aptly be described as periods of relative quiescence. Where outside development interests (oil and gas companies in the Beaufort Region; mining in Nanisivik near Arctic Bay) have come and gone, original resident Inuit populations have remained. Although affected by local wage-sector declines, prior generations of Inuit could resume traditional economies and utilize land skills. Concerns about the loss of these capacities temper the contemporary Inuit development discourse, which questions the long term value of the trade-off of a couple of generations' engagement with outside institutions. Nonetheless, the ongoing direction in the recovery of Inuit autonomy can be read in a series of strategic economic investments. Norterra Inc. is jointly owned by the Nunasi Corporation, representing the Inuit of Nunavut, and the Inuvialuit Development Corporation (Fig. 2.1). Since 1985, it has been systematically acquiring control of critical regional infrastructure, commencing with regional marine freight services, followed by a regional air carrier and the means to produce and maintain heavy equipment, and most recently the logistical and supply system capacities to serve regional industrial interests. These corporate investments have in turn leveraged supportive employment and training avenues for Inuit that ensure they will build and manage the new Northern economy as well as govern it.

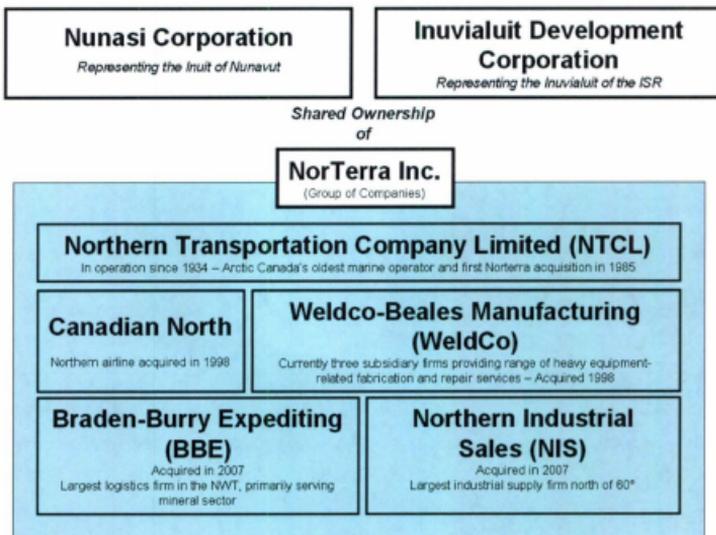


Figure 2.1: Inuit-owned Assets as of 2011 (as per www.norterra.com)

2.2.3 Future Northern Development Policy Directions

Earlier generations of Northern Canadian development emphasized federal infusions of government workers and funding, primarily for infrastructure development, but also for a variety of social supports addressed at transforming a resident population. As the Inuit continue to work toward attaining controlling interests in regional industry, particularly in respect of mineral, oil and gas exploration and exploitation, they are repositioned once again in relation to what remains of the Wilderness Myth. Certainly the easier shipping access occasioned by the diminishing sea ice in the Northwest Passage will make the former hinterland and the growing resource-based wage economy there

both more viable and more visible in the coming decade. Where federal government resources now are directed to regulatory oversight in the region, Inuit organizations are implementing their own bureaucratic mechanisms in order to inform and manage future negotiations where overlaps of interest remain with other jurisdictions.

Devolution has redistributed public sector expenditures so 'savings' that may be apparent at the federal level are presumably offset now by new costs being borne by the Inuit governments. It is of course hoped that the spirit of the relationship between the new governments and federal authorities in particular will remain clear of what a cynical observer would see as an avenue for Canada to 'wash its hands' of 'native problems'. Redressing past errors is going to continue to require substantial public allocations for many years to come. Energy and human resources are required in the context of the sad legacy of residential schools; generational social problems (drug, alcohol and gambling addictions; domestic abuse); and the long-term health care implications of the northern contaminants legacy and Fetal Alcohol Syndrome (FAS). New programming and policy respecting traditional language and cultural knowledge in coming years will also determine the extent to which these aspects of the indigenous Northern cultures will survive.

Ongoing declines in remaining traditional economies and the need to offer new employment, products and services to a rapidly growing Northern population mean that economic diversification and regional infrastructure spending will continue to preoccupy regional leaders for years to come. With cruise ship traffic increasing in the region and a system of northern parks in place, significant hope has been placed in new tourism development opportunities. 'Authentic' experiential packages capitalizing on unique

regional cultural activity, including community arts programmes patterned after existing printshop, sculpting and crafts production, are expected to attract a higher-end market and augment opportunities for many Inuit artists currently unable to support their households on their creatively-derived incomes.

Sovereignty and governance more generally will remain a public sector concern at all levels of government. The current national security preoccupations are reintroducing a substantial military presence to the region. The former lead-zinc minesite at Nanisivik has been decommissioned but the excellent deepwater port there is to be repurposed as a Canadian Forces naval support facility, in full operation by 2015 (Green 2009). Working partnerships with local troops of Canadian Rangers have grown since 2004 and are expected to continue to expand in years to come (CBC 2007).

The very particular conditions governing infrastructure development in the Arctic cannot be forgotten in the larger policy discourse concerning community adaptation to current and future climate changes. The ubiquity of frozen ground combined with succeeding generations of colonial developments have led to contemporary Northern Canadian communities which may appear in many respects similar to their Southern cousins, but which in fact are substantially different in many significant ways. Infrastructure lifecycles (Fig. 2.2) associated with the rapid development of the Inuit settlement phase in the 1950s and 1960s may already have reached a critical stage. With or without the additional complications presented by climate change within the next decade, significant infrastructure replacement and upgrading will be necessary across the North, creating significant financial challenges for local, territorial and federal government.

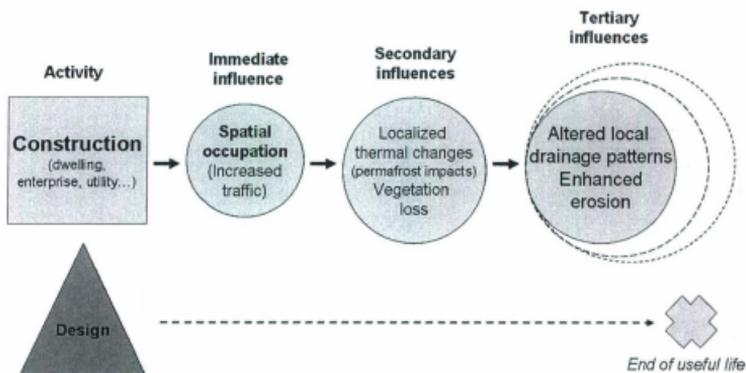


Figure 2.2: Lifetime Scenario - Infrastructure Constructed on Permafrost

Ongoing attention will also need to be given to governance education, experimentation and skills development. Lessons learned through resource co-management practices will hopefully be able to be applied in other domains and between levels of government. Efforts aimed at alternative conflict resolution and punitive measures (e.g. restorative justice) represent another area where the knowledge, abilities and values of first peoples are receiving new levels of respect and interest (Bazemore *et al.* 2001).

There is a new generation of very media-savvy Northerners making its way through the school system today. Circumpolar communications have, as elsewhere, been facilitated through the internet. New media – video and DVD production in particular – are being employed by Inuit and their associates to tell their own stories to the world. At the time of writing, what it is that Canadians think they know about the North is once

again in transition. Certainly it is no longer seen so much as silent, empty, lonely, or untouched. It remains to be seen, however, whether more embedded attitudinal and institutional legacies remain from the period when it was a region seen as inviting (or requiring) outside intervention.

2.3 Resilience

The prominence of the Arctic in relation to global sustainability themes has grown dramatically over the last decade. Precariously perched on the edge of the freezing point, as mean annual temperatures in the region climb, the magnitude and extent of Northern climate changes have received extensive research and media attention.

What might it be that in years to come would distinguish between Northern communities as they cope with continued environmental change? Would they 'bounce back' from adverse circumstances? Were there lessons to be learned from the changes Inuit had already sustained? In considering these questions, the concept of 'resilience' seemed to best capture the elusive quality or characteristics this study was seeking to better understand. This term, and related ones such as 'adaptive capacity' and 'vulnerability' were in use throughout the ACIA (2004, 2005) reporting of cascading system changes, the Arctic Human Development Report (Arctic Council 2004) respecting human system challenges, and recur throughout the International Polar Year (2007-9) discourse of sustainable Arctic development.

The discussion that follows aims to explain why 'resilience', a term that continues to inspire multiple interpretations, was chosen as a guiding principle for this project.

2.3.1 A Multidisciplinary Knowledge Domain

The language employed to address sustainability themes has evolved significantly since the Brundtland Commission's Report was released in 1987, in tandem with scientific and political understandings of the great complexity and interconnected nature of the living Earth. New ideas can be seen variously as building on, repackaging or 'repositioning' older ones. New paradigms (Kuhn 1962) arise from time to time, but ideas may also simultaneously emerge across a variety of domains, each with their own legacy of earlier understandings. How human communities respond to change is a broader topic area when viewed through the various perspectives provided by diverse and dynamic disciplinary approaches.

Representing an early human ecology perspective, H.H. Barrows (1923) observed people "reacting and adjusting to environments while at the same time attempting to adjust the environment to [their] needs" (Johnston 1979, p. 39 cited in Chester). Cultural ecology perspectives originating in the work of anthropologist Julian Steward (1902-72) referred to "ways in which culture change is induced by adaptation to the environment". Steward conceived of cultural evolution as 'multilinear', or propelled in a variety of directions by factors such as technology, economics, political and religious influences (1955). His ideas resonate with the kind of multi-system, multi-scalar heuristic that most researchers employ today in engaging sustainability themes, although they can be seen to have traced different courses across a variety of domains.

2.3.1.1 Risks and Hazards Approaches

Evidence of numerous adaptations to natural hazards is present in the archaeological record, suggesting a lengthy conditioning of human behaviour by environmental risks. The first systematic scientific study of natural hazards, however, is attributed to Gilbert Fowler White (1911-2006) and his doctoral research regarding potential measures to reduce flood losses in the United States. “Human Adjustment to Floods” (submitted in 1942 and published widely in 1945) is still touted as one of the most influential dissertations in the history of American geography (Burton, 2007), and White went on to make numerous additional contributions to the field, both from scientific and governance perspectives.

White identified the three major public approaches then working in parallel to address the ‘flood problem’ (Fig. 2.3). He next proposed a more comprehensive theoretical framework which he termed “a geographical approach” (White, 1945, p.) to respond to flooding risks more systematically (Fig. 2.4). This body of work serves as a theoretical stepping off point for examining all natural risks and hazards assessment practice since, in many respects, the fundamental questions White responds to remain the same today.

Then as now, environmental risk and hazard assessments are typically government-driven. Geoscientists often play a key role in multi-hazard risk assessments, identifying baseline physical risk factors in the environment and evaluating how they may respond to change, human-induced or otherwise. In this context, risk may be thought of

Three Public Approaches

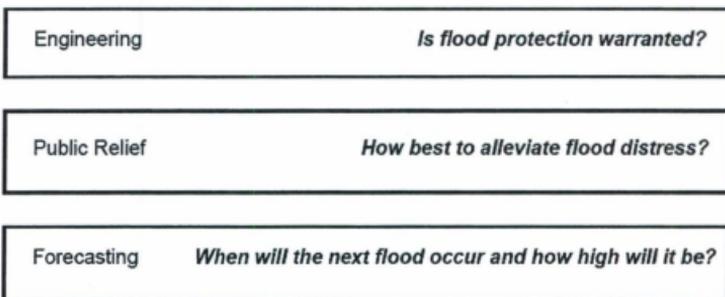


Figure 2.3: Three Public Approaches adapted from Gilbert F. White's *Human Adjustment to Floods* (1945). His work provides the earliest systematic approach to risks and hazards assessment.

Problem Assessment – The Geographical Approach

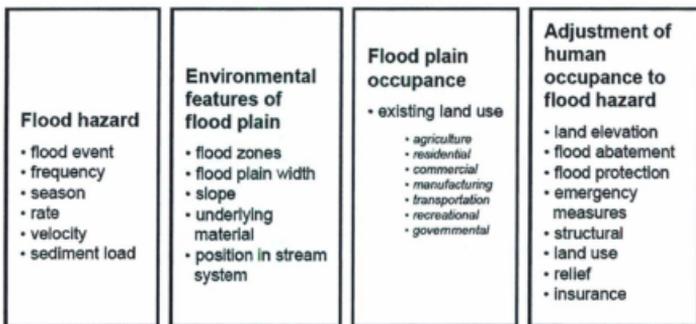


Figure 2.4: A Geographical Approach to Problem Assessment after White (1945)

as, "...the expected losses as a result of potentially damaging phenomena within a given time period and within a given area" (ITC 2006). Risk assessments generally characterize:

- event probability and magnitude;
- the exposure and sensitivity of aspects of the human community (i.e. population, infrastructure, communications, economic and other activities) in relation to various magnitudes of event; and,
- cost projections (potential losses) following from the above.

Chester (1993) addressed this as the 'dominant' or most extensively adopted institutional approach to natural hazard analysis, but contrasted it with a second 'radical' approach. In practice described as largely reliant on scientific expertise and solutions, the dominant paradigm emphasized the scope of physical hazards over societal factors as determinants of potential risk. Hewitt (1983, p. 7-8) criticized the dominant paradigm as constituting,

“...a technological approach [and] that means the work subordinates other modes and bases of understanding or action to those using technical procedures. More precisely, technocracy gives precedence in support and prestige to bureaucratically organized institutions, centrally controlled and staffed by or allocating funds to specialized professionals.”

By repositioning natural hazards as 'normal' occurrences (though preferably infrequent) in the greater realm of social experience, major 'disasters' (i.e. entailing substantial societal losses) could often be seen to correlate with regions also experiencing significant social, economic and environmental changes (Hewitt, *ibid*). Susman et al. (1983) elaborate on this, proposing a theory of marginalization as a corrective to disaster risk appraisal methods. Their critique in part asserted that, “...poorest classes continue to suffer most losses...”, “[d]isaster mitigation based on high technology reinforces

underdevelopment and increases marginalization", and that successful mitigation models would be those applied within development plans as part of a larger 'struggle against exploitation'.

2.3.1.2 Criticality and Critical Infrastructure

A corollary and recurrent concept in the appraisal of risks and hazards, is that of the 'critical'. In the vernacular, to say something is 'critical' is to underline its necessity and importance, and often suggests a uniqueness to its function. In its oldest usage in the physical sciences, critical points or states are defined by the conditions present at the normally irreversible boundary between phases (solid, liquid, gas, plasma) of a subject material. Critical points may be shifted by altering such key variables as temperature or pressure. This provides the central metaphor for risk and hazard research: the concept of a variety of contributing factors which may be altered to avoid or mitigate potential threats, and the 'solving' of some descriptive equation for predictive and preventative outcomes.

Similarly, 'criticality' may refer to a 'point of no return', for instance in relation to the 'equilibrium' of a sustained nuclear chain reaction. This scientific lineage may also be seen in descriptors used in the earth science and hazards literature relating in the context of slope failure calculations (e.g. 'critical threshold' in the factor of safety formula); to explosive phase changes in volcanoes (e.g. 'critical water content' as introduced by Anderson and Fink, 1990); or in the wide array of natural and human system phenomena addressed by self-organized criticality (SOC) theory (i.e. earthquakes, financial system crashes).

Public reference to 'critical infrastructure' increased following the attacks on the World Trade Centre on 11 September 2001 as part of the new language of homeland security. In their 2004 report to Congress, *Critical Infrastructure and Key Assets: Definition and Identification*, John Moteff and Paul Parfomak provided a chronology commencing in the 1980s for the term's usage in the United States. They highlighted its ambiguity and the need for guiding definition in light of the significant national security 'oversight challenge' (p. 19) Congress then faced in reconciling many divergent players, roles and jurisdictions. If a source of confusion on the one hand, the lack of a stable definition in this case could also be seen to signal the unpacking of otherwise implicit valuations of what is 'most important'. Risks are contestable and subject to negotiation in public arenas. Individuals assessing local risks might be expected to employ a basic hierarchy of needs (i.e. food, water, shelter, safety) in identifying critical infrastructure. Whereas their first order of priority may logically be accorded to potable water distribution systems, hospitals and firefighting stations ahead of a local manufacturer or the electronic communications that support financial system transactions, these latter two are also 'critical' infrastructure in the North American governance lexicon in respect of their importance to economic recovery.

In Canada, the two federal government departments with the greatest contemporary attachment to the term are Infrastructure Canada (responsible for the provision and maintenance of public infrastructure) and Public Safety Canada (broadly responsible for public safety and security). As described by Public Safety Canada (2009), national critical infrastructure comprises the following ten sectors:

1. **Energy and utilities** (e.g. electrical power, natural gas, oil production and transmission systems)
2. **Communications and information technology** (e.g. telecommunications, broadcasting systems, software, hardware and networks including the Internet)
3. **Finance** (e.g. banking, securities and investment)
4. **Health care** (e.g. hospitals, health care and blood supply facilities, laboratories and pharmaceuticals)
5. **Food** (e.g. safety, distribution, agriculture and food industry)
6. **Water** (e.g. drinking water and wastewater management)
7. **Transportation**
8. **Safety**
9. **Government**
10. **Manufacturing** (www.publicsafety.gc.ca/prg/em/nciap/about-en.asp)

2.3.1.3 Systems Theory

Systems theory has been interpreted broadly to encompass holistic perspectives existing across the range of disciplines examining 'complex systems'. Distinctions are currently made between systems 'theory' and systems 'thinking' as the former is used with greater precision to refer to the 1950s development of General Systems Theory (GST) and the work of biologist and theorist Karl Ludwig von Bertalanffy (1901-1972). Bertalanffy introduced the concept of the open system to address inadequacies in traditional closed system model. GST was however "...a mathematically-expressed general theory of systems. It was supposed that this would provide a meta-level language and theory in which the problems of many different disciplines could be expressed and solved; and it was hoped that doing this would help to promote the unity of science." (Checkland 1999:A3)

GST concepts appealed to economists, sociologists, and psychologists and fed into the emerging field of cybernetics. Anthropologists Margaret Mead and Gregory Bateson played major roles in bringing systems science to the social sciences. Although the systems metaphors did resonate widely, no 'grand theory' was seen to coalesce, giving rise to the terminology of 'systems thinking' and 'systems science' by the 1980s to capture the extensive array of disciplinary sub-field discourses (François 1997).

During the 1970s, the concept of self-organization in living systems was elaborated. Physicist and chemist Ilya Prigogine (1917-2003) and philosopher Isabelle Stengers (1949-) popularized the self-organization and complexity in systems with their collaborative publication *Order out of Chaos: Man's new dialogue with Nature* (1984). This period also marked the expansion of system concepts into the domain of management. In this vein, Checkland's Soft Systems Methodology (SSM) attempted to apply systems engineering to the non-technical sphere of human interchange and activity systems. As it developed, this domain has emphasized an iterative dynamic within complex systems that is equated with learning.

2.3.1.4 Global Environmental Change Approaches

In parallel with the more applied orientation of the hazards discourse, the literatures of other disciplines have shown a growing preoccupation with risks arising from global change over the last four decades. Three terms have emerged as qualifiers for the scientific theory in this realm: to the earliest, 'adaptation' (used in anthropology since the early 1900s), have been added the terms 'resilience' and 'vulnerability'. Their respective genealogies are examined by recent bibliometric analyses (Janssen et al. 2006;

Janssen 2007) of works published between 1967 and 2007 and specific to human dimensions research respecting global environmental change. Although these datasets appear both to exclude significant bodies of work in health and community development, and to downplay the significance of previously noted risks and hazards researchers, they associate 'resilience' with the relatively new science of ecology (Holling 1973, 1986) and an emphasis on theoretical models; whereas 'vulnerability' (as seen in Ford and Smit) and 'adaptation' (for instance Troadec 2000; Berman et al. 2004; Air & Waste Management Association 2003) were more commonly associated with geography, natural hazards case studies, and climate change research.

Greater interchange between practitioners across these three generalized streams of change-related research has led to both conflation and variability in the definition of shared terms, particularly in public sector applications. Clear, if complementary, distinctions in orientation remain however. For instance, while risk assessment is often linked to the dominant technological approach, 'vulnerability assessment' clearly considers a wider range of social factors. In the context of their Regional Vulnerability Assessment (ReVA) Program, the U.S. Environmental Protection Agency (EPA) refers to 'vulnerability' simply as "...the degree to which a system is likely to experience harm as a result of exposure to perturbations or stress" (U.S.EPA 2011). Canada's Public Infrastructure Engineering Vulnerability Committee (PIEVC) elaborates that, in the context of climate change, vulnerability is,

"the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate, including climate variability and extremes. It is a function of the

character, magnitude and rate of climate variation to which a system is exposed, its sensitivity, and its adaptive capacity.”

PIEVC website
<http://www.pievc.ca/e>

Adaptation is “an adjustment in practices, processes, or structures in response to, or in anticipation of, changes in conditions” (ibid). Risk and vulnerability are a result of both exposure to stress and the ability to anticipate, cope with and adjust to both short-term stressors and longer-term change, an ability also referred to as ‘adaptive capacity’.

Recent literature emphasizes continual interactions and interdependence between social and ecological systems; their sustainability associated with traits fostering a ‘resilience’ to change rather than capitalizing on or contributing to stability, the latter described as an unrealistic and even ill-advised goal (Markey *et al.* 2005, Holling *et al.* 2002, Iyer-Raniga and Trelor 2000; Scoones 1999). The more commonly referenced Resilience Alliance definition is as follows: “The capacity to absorb disturbance, undergo change and still retain essentially the same function, structure, identity, and feedbacks.” (www.resalliance.org), but Folke and other prominent members (2002:22) also refer to resilience as the “capacity to buffer perturbations, self-organize, learn and adapt’. Processes of planning for community sustainability might well benefit from a greater appreciation of the unpredictable nature of complex social-ecological systems (SES) and efforts to build community capacity to adjust (adapt) to unexpected external shocks or disturbances (Holling and Gunderson 2002).

2.3.1.5 Community-based Sustainability Approaches

Susman et al.'s caution (1983) respecting the marginalizing potential of more technologically-oriented approaches suggests that reference be made to domains emphasizing more accessible means. Rural and international development literatures are replete with community case studies that entail approaches suited to very limited resources. 'Low-tech' practices tend to emphasize learning, collective or mutual measures, and process experiments equated with capacity-building. Sustaining characteristics of human populations (i.e. determination, mutual aid, ingenuity) are conceived of as learned from experience or coping with difficulties, giving rise to models of development assistance which attempt to leverage these traits (i.e. micro-lending programmes). As noted by Frank Tester (pers. comm.), this construction of experientially-gained capacity is open to the critique that it could equally be used to argue *against* offering assistance to distressed populations, i.e. "They don't need our help - they'll build *even more* capacity if we stay out of things".

Correctives and qualifications in case studies recognizing cultural, economic and other variables (i.e. literacy) yield approaches that emphasize discursive methods and inventories (i.e. community strengths/assets and weaknesses). That necessary knowledge is already located in the community remains a prominent working principle in development literature.

This strain of 'resilience' is evident in the Canadian economic development sphere. One notable example is the "The Community Resilience Manual for Rural Recovery and Renewal" published in 2000 by the Centre for Community Enterprise (CCE) and field-tested with numerous small resource-dependent communities facing

difficulties during the forestry sector decline in British Columbia. It presents a model of community resilience that includes a 23-item list of characteristics associated with 'resilient' human communities. These characteristics reflect a particular cultural view, in this case a democratic ideal (i.e. an engaged public, representativeness, diversity, an openness to other ideas, inclusive public processes) and its related functional values (i.e. capitalism). Markey *et al.* (2005) similarly discuss community assets in terms of multiple forms of community capital: human, economic, social and ecological. This holistic approach is also found among many community health organizations where 'resilience' is a broadly-framed correlate of wellness in groups and individuals.

Through the concepts of resilience and identifying both vulnerabilities and sources of strength or resilience, the opportunity exists to connect often disparate literatures - and toolkits. This includes those that attempt to assess and build community development capacity more generally (Aspen Institute 1996; Kusel 1996; Colussi and Rowcliffe 1999; Chaskin *et al.* 2001) with those focused on assessing managing climate-related risks and vulnerabilities. From a community perspective this provides the critical benefit of integrating information and awareness in an environment where risks may be mounting without corresponding increases in human and financial resources. Assessing climate-related risk as part of broader planning processes can also aid in the prioritization of how to allocate limited resources.

Innumerable conceptual frameworks can be found in development literatures which seek to elaborate on the dynamics of various aspects of the community. Many of these now incorporate resilience, vulnerability or adaptation phraseology in their construction of system feedbacks and other networked or interdependent processes.

2.3.1.6 Common-Pool Resources

Another stream of inquiry within the Resilience Alliance is effecting the translation of social-ecological system insights into lessons for governance practice. Chief among a growing body of case studies are works addressing common-pool resources. In *The Drama of the Commons* (2002), Ostrom *et al.* offer an extensive review of the scholarship that has responded to Hardin's original thesis (1968).

In a chapter by Arun Agrawal, enabling conditions for sustainable common-pool resources are compiled from three research projects (Table 2.2). Their observations of collectively-managed resource systems reveal a number of factors that resonate with international and rural development case studies, but which benefit from more empirical rigour thanks to applications of a common assessment approach. Developed in a collaborative think tank led by Elinor (Lin) and Vincent Ostrom, the Institutional Analysis and Development (IAD) framework emphasizes such determinants as scale ('local') and clarity and effect of feedback mechanisms affected by the system itself.

2.3.2 Other Ways of Knowing

Today, it is certainly better recognized that each and every party potentially touched by a given issue could bring their own contributions to systematic processes of assessment and planning respecting a range of responses. Postmodern influences on scholarship have included a reappraisal and challenging of the conventions of what is to be understood as 'knowledge' and who is involved in generating it. Other voices have consequently been included in discourses previously pursued by very few or an elite cohort with 'expert' knowledge. The means of successfully facilitating complex

Table 2.2: Enabling Conditions for Sustainable Common-Pool Resources (after Agrawal 2002)

<p>Resource System Characteristics</p> <ul style="list-style-type: none"> • Small size • Well-defined boundaries • Low levels of mobility • Possibilities of storage of benefits from the resource • Predictability 	<p>Group Characteristics</p> <ul style="list-style-type: none"> • Small size • Clearly defined boundaries • Shared norms • Past successful experiences – social capital • Appropriate leadership – young, familiar with changing external environments, connected to local traditional elite • Interdependence among group members • Heterogeneity of endowments, homogeneity of identities and interests • Low levels of poverty
<p>External Environment</p> <ul style="list-style-type: none"> • Technology <ul style="list-style-type: none"> ○ Low-cost exclusion technology ○ Time for adaptation to new technologies related to the commons • Low levels of articulation with external markets • Gradual change in articulation with external markets • State <ul style="list-style-type: none"> ○ Central governments should not undermine local authority ○ Supportive external sanctioning institutions ○ Appropriate levels of external aid to compensate local users for conservation activities ○ Nested levels of appropriation, provision, enforcement, governance 	<p>Institutional Arrangements</p> <ul style="list-style-type: none"> • Rules are simple and easy to understand • Locally devised access and management rules • Ease in enforcement of rules • Graduated sanctions • Availability of low-cost adjudication • Accountability of monitors and other officials to users
<p>Resource System Characteristics ↔ Group Characteristics</p> <ul style="list-style-type: none"> • <i>Overlap between user group residential location and resource location</i> • <i>High levels of dependence by group members on resource system</i> • <i>Fairness in allocation of benefits from common resources</i> • <i>Low levels of user demand</i> • <i>Gradual change in levels of demand</i> <p>Resource System Characteristics ↔ Institutional Arrangements <i>Match restrictions on harvests to regeneration of resources</i></p>	

Sources: Wade 1988; Ostrom 1990; Baland & Platteau 1996.

evaluation and decision-making processes among parties holding diverse perspectives have been explored by researchers and practitioners in business, political science, public administration, international development and planning. The challenge remains however of effectively engaging the potential and translating it into meaningful outcomes within available means. Numerous theoretical perspectives have been used to inform a great array of applied strategies and the literature offers no shortage of case studies across the spectrum from the 'top down' through the 'bottom up'.

On one end of the spectrum, political ecology has studied the influences of political, social and economic forces on environmental issues. Tied to the greater awareness of the impacts of globalization, much of the literature examines the particular state, corporate and transnational power relationships shaping both environmental policies and the products of their implementation. Outcomes related to the redress of environmental problems are examined with an eye for their unforeseen consequences, especially those generating new problems. Themes such as resource access, conservation, degradation and failure, development control, and conflict resolution mechanisms have figured prominently here. Contemporary research has increasingly addressed emerging risks and hazards in a context of multiple change influences. Community structure and behaviour are seen to both influence and be influenced by these features of the environment; their intertwined dynamics being the 'ecology' in political ecology.

The field of science studies has challenged the notion that scientific approaches are themselves totally objective. Not only is the designation of one way of knowing inappropriate, but other ways of knowing cannot be dismissed. Although far from universally accepted or acted upon, there is a growing recognition and experience

demonstrating that indigenous, local and, in the case of aboriginal peoples, traditional (environmental) knowledge (TK or TEK) offers insights that would not otherwise be available to a non-resident researchers or consulting practitioners (Berkes 1999, Berkes *et al.* 2002). Notwithstanding critics' concerns respecting subjective interpretations and bias, and the relative merit of 'opinions', 'observations', and the anecdotal compared to 'hard' evidence, the local informant is a more regularly represented actor in a wide range of research activities. The pragmatic middle ground tends to accept the benefits of engaging indigenous or local participants' contributions in that investigators might learn something new and, in the process establish some relationships with people that will serve the ultimate end of ensuring the outcomes of the study are realized.

2.3.3 Commonalities and Incompatibilities

Is there common ground in these constructions? They all address themes of system change. They all appear to acknowledge complex systemic characteristics and interactions leading to outcomes that in varying degrees may at least be anticipated if not foreseen in precise detail. Within all of these spheres there has been active cross-disciplinary scientific discourse, in some instances being translated into ideas that may inform public governance.

There is also significant divergence. Resilience thinking has a socio-ecological orientation that has appealed to those grounded in the life sciences and which has made inroads in a variety of human dimensions research domains. Systems theory generally appears to retain a technologically grounded construct with engineering, computing/modeling, government and business-oriented adherents. Vulnerability has

been adopted across numerous domains but with significant variability in usage. Cross-fertilization in these discourses however is readily apparent as the multidisciplinary encounters around sustainability and adaptation to global change continue. Actions in the public domain are exhibiting consequent experimentation with new models: resilience thinking playing a role in conservation and resource management, vulnerability and systems theory continuing to influence technocratic and business spheres, and adaptation science perspectives engaging significant legal and moral dimensions of society. Evaluating and responding to risks and hazards is pursued in a cross-disciplinary context with extensive applied dimensions (i.e. community planning and governance, risks and hazards mitigation, resource management, rural development) and will thereby continually need to seek ways to bridge understandings to facilitate 'good' decision-making. Global change literatures highlight the value of different knowledge bases and the importance of effectively integrating them in research.

Diverse perspectives tend to present communications challenges, and communications concerning risks of whatever derivation can produce particularly complex circumstances. A commitment to communicating across disciplines and cultures is thereby a critical first step in any risk-oriented assessment. As suggested by the above, an understanding of the common and complementary features of various approaches aids in understanding and appreciating their potential role in relationship to the continuum of risk and hazard identification, assessment and response.

2.4 Planning

The ubiquity of contemporary references to 'planning' means that its use here requires qualification. It is 'community', 'municipal', 'urban' or 'land use' planning that will be discussed, although even that categorization can dissemble further into a multiplicity of roles and processes. As a diverse practice, and increasingly since the mid-1900s as a distinct *profession*, planning has come to play a major role in human settlement. With ongoing migration from rural areas affecting the globe, half of the nearly 7 billion people alive now reside in urban settings. Where land is scarce, planners have joined a growing bureaucracy dedicated to making the most of available space in the midst of existing development. The practice has expanded well beyond urban limits though to other regulatory domains, particularly in resource and environmental governance.

2.4.1 Planning as a Discipline

Notwithstanding the ample numbers of academic institutions granting degrees in the field, community planning has been characterized as lacking endogenous theory (Sorenson, cited in Allmendinger, 2002:17), relying instead on those of other disciplines (architecture, geography, engineering, law, economics, management, sociology, psychology). This might be dismissed as a logical consequence of seeking to govern the lively amalgam comprising the human needs, enterprise, and ambitions of community. The core assumption of this all-encompassing domain, however, is that an exceptionally complex and multifaceted human system can be poked and prodded in the desired

direction by a skilled practitioner. Unfortunately, community plans have fallen well short of intended outcomes on numerous occasions (Jacobs 1961, Scott 2005).

But plan we do. Overcoming all-too-apparent conceptual shortcomings entails feats of modern rationalization, typically accomplished by apportioning the unknowable into more familiar, bite-size chunks. The human technologies that give material form to our communities have been the most readily entrained by this practice: the most recognizable components of the professional planning toolkit, community plans, development regulations or by-laws, seek to constrain the design and development of our physical infrastructure. Embedded in these prescriptions are the values, assumptions and 'tricks of the trade' held by the authors, in turn informed by their own education, experience and identification with their professional peers.

Although the multidisciplinary terrain might suggest an equally diverse critical tradition, history tends to substitute for theory in contemporary planning. Conventional "planning history" in Western Europe and North America is extracted from that of architecture or engineering until the Industrial Revolution. Subsequently, it is portrayed as acquiring more of a life of its own, both through the efforts of an emerging manufacturing elite to cultivate suitable workers by creating the places they would live in, and in response to the health and sanitation problems of dense, smoky cities. Like the older design traditions, practical ideas about form and function co-mingled with desires to improve conditions through material and mandated changes. Planning as it was to emerge by the early 1900s rendered the community as a mechanically predictable unit wherein issues arising with infrastructure and inhabitants might be resolved through design. Architectural theories were overlaid by those of politics, economics, and the rule of law.

Planning's vocabulary and methods borrowed from all of these and more, leading to numerous hybrid practices.

The ongoing processes of negotiation characterizing community functioning mean that the planner is expected to exercise judgment, repeatedly reconciling form with function and vice-versa. Imperfect knowledge can be assumed. Individual practitioners' choices respecting how to approach the 'work' of planning and their relationships with the others being planned for (Fig. 2.5) will be influenced by a variety of epistemological and ontological factors.

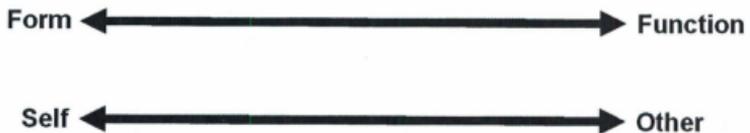


Figure 2.5: Two fundamental planning reconciliations

2.4.2 Critique: Planner as 'Professional'

While presumably susceptible to critiques from multiple 'parent' disciplines, planning seems to have made a remarkably rapid assent to join several of them in staking independent professional peerage claims. Barely a century has passed since the first collegial associations were built around community planning interests, but thanks to protracted campaigning since the 1990s for professional recognition, membership in the Canadian Institute of Planners has been systematically mandated by legislation in several provinces. Legitimation through designation could be seen to follow as a convention of

the sectors where urban planners operate: it is understandable that they would wish to stand as professional equals with the engineers, architects and lawyers with whom they must regularly negotiate. In local government contexts, however, where political discretion will often overstep planning advice, it can be difficult to distinguish professional inputs from the vagaries of process.

Given the many types and persuasions of planners, their diversity also begs numerous questions about how they can be bound together by a conformist tradition and a single code of practice. The fundamental post-modern insight of equivalency between knowledges, as they are all constructed, also presents planning practitioners with a particularly humbling dilemma. Who are they to be insisting on the cloistered professional claim that they alone know enough about what they do to be able to judge one another's performance, even as what they purport to know is by today's standards decidedly unknowable? How tolerant can anyone be of disingenuous acceptance of professional responsibility when no particular insight can be claimed to start with nor culpability assessed since cause and effect stemming from their actions is so difficult to judge?

As suggested in Section 2.3, community-scale examination of adaptation necessitates a discussion of institutional involvement in the process. Community governance is a socially constructed and culturally grounded undertaking, so it is important to be mindful of the variety of sub-cultures populating it. To the extent that planning remains an effort to manage change, practitioners must also critically assess the role that their own activities and background might play. As the writer, trained and employed for many years as a professional community planner, had to ask herself in the

course of this project: What habits of mind are present in the planning practitioner? Are they constructive relative to the conditions at hand? How do they address uncertainty? How might they influence emergent and transformative processes that will be present in a society facing an uncertain future? Similarly, what planning conventions have emerged in contemporary northern governance and how well do they suit conditions 'on the ground' there?

Planning and development literatures offer some guidance to practitioners seeking to deconstruct their part in existing governance regimes. One of the most influential writings on North American planning, *The Death and Life of Great American Cities* (1961) continues to stand as an example of why the practice of careful observation will never go out of style. Jane Jacobs was not a planner but her version of what was and was not working in cities and urban renewal efforts in Post-War America has been required reading for planning students for years. It remains a cautionary tale of sorts respecting the kinds of [bad] habits (*dyspraxia*) that may take root in professional practice. In her last book, *Dark Age Ahead*, she recontextualized this recurring - though somewhat less acknowledged - theme in her life's work as a critique of the self-governing nature of those communities of practice dubbed 'the learned professions'. As one of her five crumbling pillars of civilization, the professions are portrayed as increasingly susceptible to the temptation of placing their own interests ahead of those of a lay population ill-equipped to identify or address their disadvantage thanks to the relative incomprehensibility of highly specialized knowledge domains. Calculated or not, self-organization in practitioner communities tends to evolve from loose networks of individuals with some level of self-identified commonality of content interests, toward

enculturation effected through entry into an elite, limited and ultimately fee-based membership in an increasingly formalized organizational structure promising ever-improving levels of member services and collective benefits. Just as so many unsustainable practices in hindsight have been traced to an unquestioned premise of continuous economic growth, so must the seemingly unquestioned merit of ongoing professionalization be examined. Any elite vested with significant influence over substantially public functions must be scrutinized for implicit interests running contrary to those of the public. In the event that scrutiny can be shown to be lacking or compromised, a key question has to be whether the organization's influence should be limited and, if so, by what means?

2.4.3 Planning: A Functional Critique

The terms 'planning' and 'planner' are used widely in relation to activities and practitioners preoccupied with discerning trends in given contexts, projecting their consequences, and then envisioning means to guide the course of succeeding events to obtain desired outcomes. Multiple methods, scales and timeframes attend the many domains where these iterated processes can be identified. Notwithstanding variations on the theme, planning (in a 'small p' sense) is a defining component of human governance practice where judgments are qualified by degree (informing everything from relatively mundane individual choices to highly circumscribed interstate decisions) and derivation (based on tradition, experience, or other ways of knowing). One critical approach to resolving this diversity seeks to reveal implicit functions, as follows.

In its institutional manifestations, planning is embedded in a larger managerial logic that is in turn instrumental to the modernist project. To 'plan' implies that not only is there a predictable path to a future outcome but that the startpoint **A** can be known and assessed relative to an imagined endpoint **B** which is to be expected to be 'better'. The conventional admission is that the 'real' may intrude on the ultimate predictability of the outcome giving rise to a **B'**: the plan will be substantially realized if not exactly 'as planned'. Similarly, the intrusion of the 'real' may be the attributed cause for an entirely unplanned outcome **C**, (Fig. 2.6) not to mention the regularly observed combination of these three scenarios.

Figure 2.6: Planning Logic Sequence I

A → **B** **A** → **B'** **A** → **C**

A less conventional corollary – at least from the pragmatic standpoint maintained by most planning practitioners - is to acknowledge the frailty of any assumptions made based on a startpoint **A**. Drawing on a more philosophical stance, any purported startpoint may be considered as one of an accurate representation (**A**), a good approximation (**A'**), a mistaken interpretation (**X**), or an entirely unknowable condition of potentially infinite variety (∞) (Fig. 2.7).

Figure 2.7: Planning Logic Sequence II

A = **A** **A** = **A'** **A** = **X** **A** = ∞

Thus we have quickly multiplied our potential planning scenarios (Table 2.3), but, in so doing, we capture some of the texture and complexity of our relations with the 'real'. We also have a measure of the range of our practice: from the reductionist ideal of a straightforward and predictable transformation (i.e. **A** really is **A** and through our actions becomes **B** and just **B**), to the entirely unknowable and thereby entirely unassessable circumstance of both start and end points, which begs the question of how any plan could be judged to influence an outcome. The scenarios under which 'planning' or the 'planner' might be demonstrated to have produced the targeted outcome (*green*) are limited. Can practitioners lay claim to a 'professional' service, in the strictest sense, when they have no means to evidence insight greater than that held by 'non-professional' actors (e.g. the scenarios coded in *yellow* or *pink*)? This distinction presents a significant ethical challenge that practitioners may reconcile to some extent by seeking to know their own limits and appropriately declaring them.

Table 2.3: Planning Logic Sequence III

Assumed Startpoint	Possible Outcomes			
	B	B'	C (X)	∞
A	A → B	A → B'	A → C	A → ∞
A'	A' → B	A' → B'	A' → C	A' → ∞
X	X → B	X → B'	X → C	X → ∞
∞	∞ → B	∞ → B'	∞ → C	∞ → ∞

 Directed or predictable transformation

 Uncertain degrees of influence

 Unforeseen outcomes and/or lack of demonstrable influence

Planning practices otherwise can be seen to have the effect of denying the unknowable. Unknowns generate scenarios that cannot be resolved through the 'work' of planning, undercutting one of the major projects of modernity.

Conversely, logical discontinuity may be seen to be tolerated and even encouraged in circumstances where the outcome is or resembles that desired, even though there may be no means of fixing a startpoint. Instead, some degree of intentionality equated with planning may be associated with the outcome, regardless of there being no measure for it.

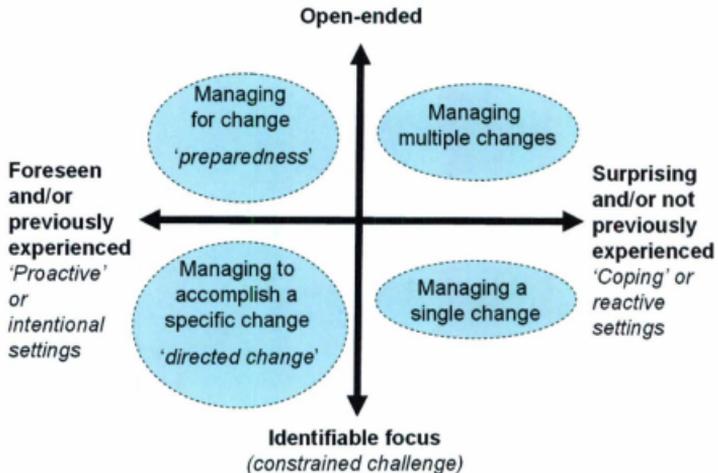


Figure 2.8: Planning as Change Management

A partial resolution proposed here is that planning be reconceived as a “change management practice” where circumstances are more explicitly acknowledged (Fig. 2.8) as more or less knowable and as arising from and/or engaging one or many vectors of change.

2.4.4 Planning as Public Process

Given the multiple value sets that may be at play in a given planning 'problem', axial heuristic tools (as above) seem to be of particular benefit in portraying both judgment scenarios and practitioner disposition ('positionality') relative to binary oppositions seen as present in a choice. The earlier presented foundational reconciliations (see Fig. 2.5) of Form/Function and Self/Other may be similarly constructed (Fig. 2.9) as startpoint for examining alternative stances for planners relative to 'the public'.

There is 'work' entailed in engaging the public. Arguably, the central skill set of the would-be planner is the ability to facilitate the processes leading to decisions in the public interest. As earlier identified, there are dominant, technocratic players in the

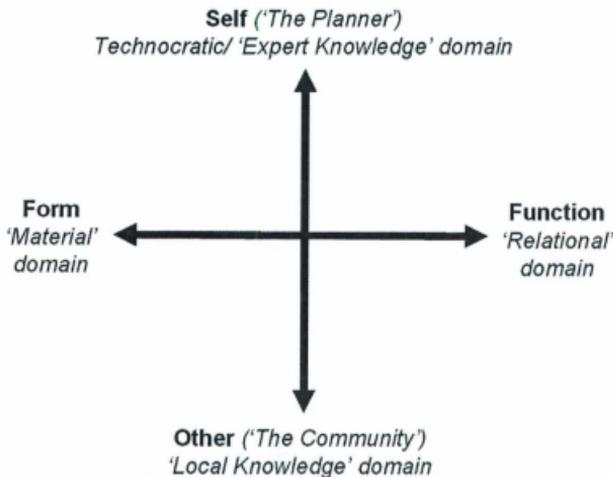


Figure 2.9: Scope of potential 'work' defined by foundational planning reconciliations

Citizen Control	<i>Degrees of Citizen Power-Sharing</i>
Delegated Power	
Partnership	
Placation	<i>Degrees of Token Power-Sharing</i>
Consultation	
Informing	
Therapy	<i>Contrived Participation (Non-participation)</i>
Manipulation	

Figure 2.10: The Ladder of Citizen Participation after Arnstein, 1969.

change management domain, and some are more open to sharing power than others. In 1969, Sherry Arnstein (Fig. 2.10) illustrated a conceptual range of potential public ‘engagements’ that could be present in ostensibly public processes. The bottom rung of her ladder refers to the potential for public manipulation; on the top rung, she places citizen control, with degrees of tokenism in the middle. Making the ‘choice’ of relationship between planner and public more explicit signaled a growing awareness of the embedded means by which marginalized populations could remain excluded from or silenced by a ‘democratic’ institution.

The evolution of land use planning practice in relation to the urban context suggests some of the nature of the translations in approach which might apply to a given rural community. Allowances for different types of users and uses, variations in spatial

relationships and densities, more pronounced seasonal considerations in relation to functions, relatively basic infrastructure and support services may all be found in 'simplified' plan and implementing regulations templates designed in many jurisdictions. Generally, such documentation relies on consolidated land use and zoning categories (e.g. a single 'mixed use' category to address residential, commercial and institutional uses which plans for larger communities typically treat using numerous sub-categories). In exchange for ease of interpretation, the prescriptive or aspirational content of the development control documentation is reduced, presumably to be replaced by greater discretion on the part of the planning authority. Even this circumstance can be seen by parties to a land use conflict as simultaneously too much and too little. In turn, it may be deemed an empty exercise and replaced by informal decision-making. Whether or not an alternative mechanism better serves to deliver an outcome meeting some defensible standard of foresight and care seems often to be secondary to what can appear to be an equally defensible logic, 'keeping things simple'.

Ideas about predictability and constancy are embedded in planning practices. Even where a change scenario is made explicit, a limited number of 'key' interacting factors are identified, by default assuming all others will remain constants in the model/equation. Once again, the simplest processes of zonation have adopted the convention of locationally precise boundaries. This mechanism assumes that a number of factors associated with a given 'zone' will be held constant over the timeframe being planned for: the already well-documented northward drift of climatic ecozones provides one dramatic example of the kind of challenge facing an earlier generation of protected areas policy (Scott and Lemieux 2005, Froese et al. 2008).

The relationship of planning and public politics is a notoriously close and conflicted one: it depends both on the constancy of the legislated framework and associated political institutions, all the while often tolerating a high degree of inconsistency in relation to specific applications, applicants or the limits of discretionary authority more generally. For some time the planner functioned as a modern expert capable of interpreting, navigating and even reconciling this give-and-take thanks to the influence of their presumably consistent values relative to those fluctuating (and thus suspect) in the politician. In a postmodern context, assumptions respecting a single 'correct' view have been set aside by an acknowledgement of multiple, valid perspectives. The latest additions to this array are environmental change scenarios suggesting a still greater variability and overall uncertainty. At some point, the all-seeing, all-knowing expert is reduced to such a small domain of 'knowledge' independent of what might be deemed common sense that they become one more object within their own frame of reference. The trajectory of public engagement and consultative practices since the 1960s underlines the emergence of the planner as facilitator and a retreat from expertise in relation to outcomes, to at least expertise in the *processes* which might discover them. But what does this imply in a larger context, particularly in relation to the growing attachment to professional claims that also characterize the period?

Multiple stakeholders, including planners, populate the global environmental change domain. Some of the knowledge systems employed there are informed primarily by the material changes seen in the world. Others are more concerned with the ways in which the changes propagate and accumulate in the system. Some seek empirical means and expertise to deduce the best way forward; others wish to capitalize on the knowledge

existing within their trusted circle. The various approaches examined in Section 2.3 may be plotted (Fig. 2.11) using a framework suggested by the earlier-proposed 'planning domain' construction (Fig. 2.9) to illustrate their relative breadth and association with the subjects of the change influence.

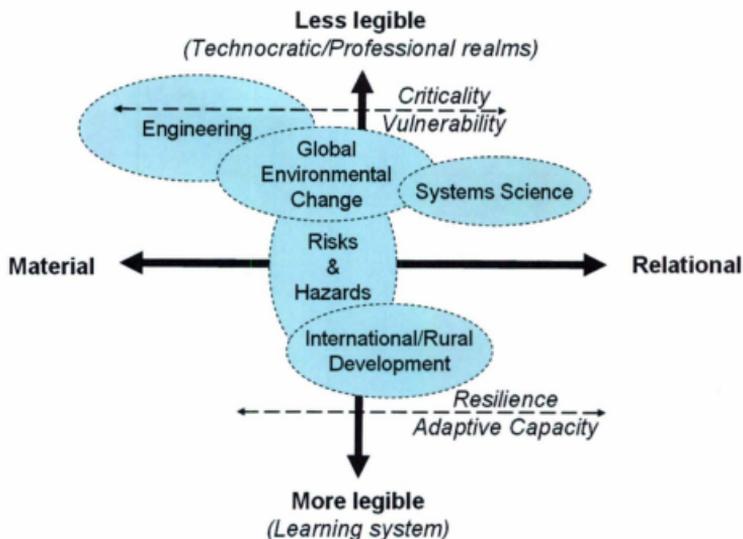


Figure 2.11: Conceptual Array of Sustainability Approaches by Cohort

To conclude, it is important to consider both what planning is and what it is not; how it is constituted conceptually and in practice; and to examine what it has and is producing. In respect of the circumstances of the coastal Arctic communities treated by this research, it was observed that conventional planning practice manifests several potential incompatibilities including a technocratic orientation and a consequent reliance

on non-resident 'expert' staff, who would be more likely to think 'for' the community than engage the knowledge residing there. In order to recover control over this function for Inuit communities, research methods employed would need to reframe and, in effect, reverse-engineer the planning process in relation to the previously stated objective of community resilience. Reasserting 'legibility' (cf. Scott 2005) in this context suggests that practitioners examining change management themes need to document inputs, process and outputs in fashions that are both more accessible to and open to [re]interpretation by the affected community.

Framework and Methods

3.1 Outline

As outlined in the introductory chapter, the purpose of this dissertation is three-fold:

- To analyze and compare the results of three community climate change adaptation planning case studies from Arctic Canada;
- To draw conclusions respecting local governance and climate change adaptation; and,
- To make general recommendations respecting the institutional and professional parameters of change management.

In order to analyze the community case studies, a common framework was developed to guide the process. This framework blends conventional municipal land use planning and management practice with methods suited to the more qualitative information sought by a 'resilience assessment'. Building on the general review of human adaptation, development and planning practice offered in Chapter 2, a discussion follows respecting the specific rationale for the framework and methodology selected. In that planning and governance more generally are described as applied knowledge domains, the practicalities of the methodology are considered in tandem with the logic that determines their applicability. Finally, as this project has engaged a decidedly cross-disciplinary and multicultural topic area, I attempt to make the trade-offs in the process explicit and to justify the choices made.

3.2 Towards Resilience-based Assessment

From the outset, community-scale case studies were the anticipated outcome for this body of research. The work, of a predominantly social science character, would be conducted in conjunction with that of other physical and life science researchers involved in ArcticNet projects along a defined High Arctic, east-west transect. This would entail substantial researcher-community interaction as a means of, in part, communicating relevant scientific findings. Almost everything else about the research approach, however, was to be determined by the researcher in consultation with the participating communities. Thus, the 'embedded' character (*sensu* Scholz and Tietje 2002, Fig. 3.1) of the case studies needed elaboration, as did the researcher's own perspective as a community development and planning practitioner.

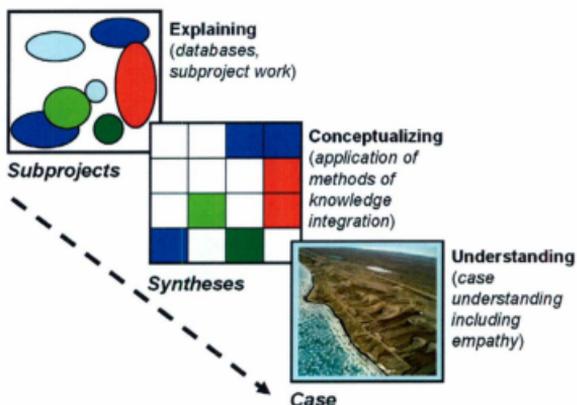


Figure 3.1: Architecture of knowledge integration in embedded case studies
Adapted from Scholz & Tietje (2002, p.30)

Of the five geographically-distributed potential case study communities initially identified by ArcticNet colleagues early in 2005, the researcher was to work with three. Due to the significant physical science project partner commitments already made to Sachs Harbour and Tuktoyaktuk, NWT, and their relative proximity within the Inuvialuit Settlement Region (ISR), adaptation planning research proceeded for these two communities in tandem starting in late 2005. Work in Gjoa Haven, NU (Central Arctic) began the following year.

3.2.1 Additional Factors Determining Research Design

The project context, the researcher's professional background and an emerging body of cross-disciplinary perspectives were primary determinants of the research approach and methods selected. Research ethics requirements and review processes also influenced the design and implementation of the project.

Thanks to a variety of Arctic region climate change observation projects already undertaken, both an awareness of related issues and some existing responses on the part of community residents had been documented by other researchers (Nickels et al. 2002, Jolly et al. 2002). Besides flagging the need for care to be exercised in the design of further community-based research to avoid consultation fatigue, it was apparent that any new project would need to contend with the fact that a host of change influences in Arctic coastal communities were already in motion and likely acting upon any apparent local adaptation processes. A research framework was required that could respond to both the incremental and longer-term perspectives of subject populations 'in transition'.

As a mid-career professional community planner, the author was pre-disposed to approach this research as a participant-observer, devising an adaptation planning approach, facilitating a series of local adaptation planning exercises and then preparing, also in consultation with the community, climate change adaptation plans. This was a role that was expected to function logically within the larger project team construct and one which would serve to accomplish the overarching goal of integrating science with local decision-making. It was anticipated that multiple methods and heuristic tools would need to be considered as potential means of integrating necessary climate change information in order to support communities seeking to make prudent and potentially difficult decisions.

The theoretical and philosophical orientation guiding the effort also needed to be made explicit. The researcher's professional experience and the literature she reviewed in the period leading up to the project launch had suggested several variations on the theme of 'resilience', not simply as an objective in relation to community adaptation but as a formal descriptor used in reference to complex systems behaviour. To serve as a guiding concept for this project, however, 'resilience' required further elaboration as a community-based value.

These factors led in turn to the community-based process and resilience assessment framework outlined below.

3.2.2 Adapting a Local Resilience Assessment Framework

Based on the literature review and prior consultation experience, an existing community resilience-focused planning model was selected to serve as a startpoint for the

design of the local adaptation-oriented exercises. As noted in Section 2.2.1.4, the *Community Resilience Manual for Rural Recovery and Renewal* (CCE 2000) provided an accessible community-based approach that, in comparison with conventional municipal plan characteristics (Table 3.1 after Hodge 1998 and CCE 2000), appeared to deemphasize technocratic interventions in favour of a broader assessment by community members that addressed both material and relational system functions. The Community Resilience Manual framework, although more targeted at economic development ends, was structured around an array of twenty-three 'resilience' traits or capacities which the CCE had distilled from case studies and practitioner observations respecting factors that appeared to correlate best with communities able to sustain themselves through times of difficulty. It also offered a working definition of the 'resilient community' that resonated with the orientation of this research project, as follows:

"A resilient community is one that takes intentional action to enhance the personal and collective capacity of its citizens and institutions to respond to and influence the course of social and economic change.

...resilience is not a fixed quality within communities. Rather, it is a quality that can be developed and strengthened over time."

CCE 2000, p. 1-5

Resilience is conceived as a mutable, community-scale, and composite attribute that is shown to a great extent by self-organization. It follows that as parts of this larger system, individual community members may have greater or lesser insights into the community workings but that they are all to be regarded as valued contributors to change processes. The ascribing of intention to a collectivity implies some means of translation

Comparison of Community Planning and Resilience Approaches

Conventional Municipal Plan Characteristics <i>(after Hodge, 1998)</i>	Resilience Assessment Characteristics <i>(after The Community Resilience Manual, 2000)</i>
<p>Core features:</p> <ul style="list-style-type: none"> ⇒ Focused on physical environment and infrastructure ⇒ Long-range and forward-looking (10-20 years) ⇒ Takes a comprehensive view of community circumstances ⇒ Establishes general, broad-based development policy and guidance <p>Generally also includes:</p> <ul style="list-style-type: none"> ⇒ Ties to social and economic objectives ⇒ Detailed planning analyses ⇒ Staged implementation ⇒ Capital improvements guide ⇒ Community design guidelines <p>Standard contents: statistical profile and projections; descriptions of existing conditions and anticipated development; development goals and objectives; binding policy statements regarding various classes of development (i.e. residential, commercial, transportation, public institutions...). Detailed implementation usually administered through companion development regulations or by-laws.</p>	<p>Core Features:</p> <ul style="list-style-type: none"> ⇒ Focused on people, organizations and capacity-building ⇒ Forward-looking but reflecting on past experience ⇒ Takes a multi-function, sustainable system approach ⇒ Offers broad-based perspective on community processes <p>Outcomes emphasizing:</p> <ul style="list-style-type: none"> ⇒ Strategic allocation of internal resources ⇒ Leveraging of outside resource ⇒ Strengthened local ownership ⇒ Citizen involvement in decision-making and implementation ⇒ Integrated social and economic goals ⇒ Community mobilization and collaboration as a means to progress <p>Standard contents: community “portrait” incorporating qualitative information concerning local attitudes, organization and communication and an inventory of keystone resilience factors; statements of community issues, goals and resilience-building priorities; best practice summaries; and consensus-based local action plan.</p>

Table 3.1: The climate change adaptation process needs to engage the entire community. Existing municipal plans may be amended to reflect certain physical and economic adaptations, but a more comprehensive, assets-oriented approach is required to examine the community’s resilience to change (Parewick 2005)

between what is known to the individual and what can be 'known' to the community as a whole. One possible interpretation of the 'means' employed could be to restate the above as simply, 'resilient communities plan', i.e. to act intentionally being the consequence of having planned to do so.

A less self-serving reading, however, might suggest a restatement more along the lines of 'resilient communities learn'. An intentional act that expressly provides for future iterations of intentional actions by individuals and groups suggests attributes of both teacher and learner are present in the resilient community as defined. System knowledge is in a constant state of reconstruction and subject to a multiplicity of interacting variables: this informs collective processes that may be equated with priority-setting, which in turn replenish the learning cycle with new intention(s).

There are limits on the amount of time or attention the individual citizen can be expected to grant any public exercise, particularly when that effort is not expected to yield direct and/or immediate benefits. At any given time, competing interests may arise. From a planning perspective, whatever time an individual or group have to invest in such an exercise, through the consultative approach taken, will be distributed between scope and depth. Trade-offs are often made at the expense of scope, limiting the subject matter to afford greater depth in its treatment. This approach, however, tends to favour 'expert' informants and consequently limits participant numbers. As suggested in Chapter 2, a more legible, 'learning' system would, in contrast, presumably provide for a much more diverse array of stepping-off points (i.e. greater scope and lesser depth) to suit a wider range of participants.

No record or translation can be expected to fully capture the 'real' as a consulted individual might seek to convey it. In this research setting, multiple knowledges (e.g. scientific, experiential, traditional), disciplines (i.e. spanning physical and social science domains), and cultures (i.e. Inuit/Inuvialuit, EuroCanadian) were present. Under such circumstances, the planning practitioner must acknowledge that incommensurability will survive even their most determined of efforts to overcome it. Given the significant amount of physical science and government content already being introduced to the community by this project, the researcher actively sought to employ qualitative research methods so as to counterbalance material and official knowledge with input of a more relational or experienced character.

Similarly, material/relational and form/function balances needed to be reflected elsewhere in the project framework. The understanding of resilience embedded in the CCE approach relies on "Four Dimensions of Community Resilience" as follows:

"People	Residents' beliefs, attitudes, and behaviour in matters of leadership, initiative, education, pride, co-operation, self-reliance, and participation.
Organizations	The scope, nature, and level of collaboration within local organizations, institutions, and groups.
Resources	The extent to which the community builds on local resources to achieve its goals, while drawing on external resources strategically.
Community Process	The nature and extent of community economic development planning, participation, and action."

CCE 2000, p. 1-11

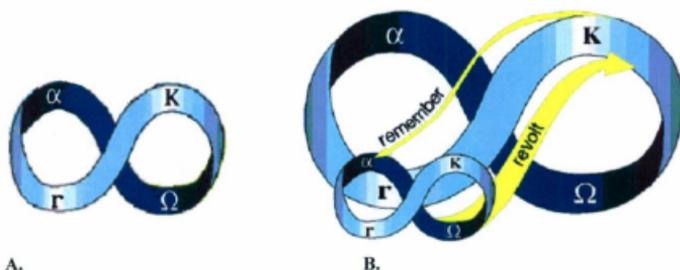


Figure 3.3: (A) **The Adaptive Cycle.** A foundational model employed by Resilience Alliance researchers, the stylized Möbius strip traces four characteristic ecosystem phases of exploitation or growth (the Γ phase); conservation (the K phase); release, “creative destruction” or collapse (the Ω phase); and reorganization (the α phase). Resilience is described as a third dimension missing from this 2-D portrayal: it expands and contracts through the system phases to alternatively emphasize conservative and creative adaptive strategies.

Source: Adapted from www.resalliance.org/index.php/panarchy after Holling 1986.

(B) **Panarchy.** As postulated by Gunderson and Holling, two key connections existing between nested systems are those of ‘revert’, where changes in one system may destabilize a larger, slower one; and ‘remembering’ which may aid renewal by drawing on the accumulated knowledge of a larger, slower system.

Source: www.resalliance.org/index.php/panarchy after Gunderson and Holling 2002.

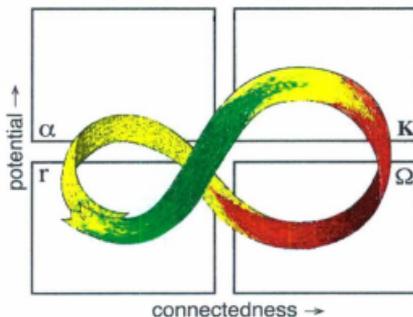


Figure 3.4: The **Coloured Adaptive Cycle** (Parewick, 2006 after Gunderson and Holling, 2002). In an experimental attempt to effect a ‘translation’ between resilience theory and community-scale change observations, the commonly employed traffic-signal colours were loosely equated with the experiences of participants transiting various stages of an adapting system state. The Growth phase was reconceived as a period where ‘things are going well’ (green), whereas Release/Collapse would be evidenced by grave difficulties (red), and intermediate phases of Conservation and Reorganization (yellow) characterized by periods of uncertainty and adjustment that presage decline and the opportunity for creative renewal, respectively.

development settings. At the core of a series of social-ecological systems applications that Alliance researchers have elaborated, multiple adaptive cycles are conceived of as operating at varying scales and rates with characteristic cross-scale interactions (Fig. 3.3 B). This nested behaviour, a feature referred to as 'panarchy' also equates well with social science observations respecting culture, human settlement patterns, and government.

As noted in the AHDR (2004, p.50):

"...Research so far has focused too little on local perceptions of changes. One may strongly suspect that the most damaging aspect of change is the feeling of not being able to control it locally, neither individually, nor collectively as a society. This means that attempts at "planned social change" from the outside are doomed to create as many problems as they solve, even if the planning rests on pertinent scientific knowledge."

The graphic sensibility of the adaptive cycle was considered suitable to use as an explanatory aid in relation to adaptation concepts. The possibility that it might be adapted further as a potential tool for translating the various community-informed qualitative inputs into some characterization that would continue to assert the community's experience within the overall assessment framework was also considered. One key outcome in this regard was the generation of a colour-coded version of the cycle (Fig. 3.4), suggestive of an experiential dimension that might be read into the process of adaptation. This tool was experimented with during the consultations and since as a project reporting method.

3.3 Research Licensing

3.3.1 Preliminary Visits

In advance of the initial licensing of her own project, the researcher was fortunate enough to make scoping visits under the auspices of other principal researchers' previously licensed projects. She was first included as a supporting team member for an annual round of Beaufort region community consultations undertaken by Natural Resources Canada and the Department of Fisheries and Oceans (DFO) in the spring of 2005. Her first visit to Gjoa Haven was timed to coincide with the end of the 2006 summer fieldwork of other Memorial University researchers.

3.3.2 Ethics and Regional Licensing Submissions

In the summer of 2005, shortly before the author's first official site visits for purposes of initiating her own research project, an application for ethics review (Appendix A) was submitted to Memorial University's Interdisciplinary Committee on Ethics in Human Research (ICEHR) pursuant to the institution's Policy on Ethics of Research Involving Human Participants (2003) (elaborated by the "Information for Researchers" page on the ICEHR website), and in compliance with the Tri-Council Ethics Statement.

Two regional bodies were subsequently applied to for project-specific licenses: the Aurora Research Institute (ARI) administered the research licences for each of Tuktoyaktuk and Sachs Harbour; and the Nunavut Research Institute (NRI) issued the license required for work conducted in Gjoa Haven. In each instance, the research

institutes distributed the completed application materials to local reviewing bodies for input and approval. The Nunavut application also required that the researcher obtain Inuktitut translations of the research summary. The permit processes also prompted the researcher to consult with other parties as appropriate. The researcher made contact with the territorial government departments responsible for local government and land use planning in each of the Northwest Territories (Municipal and Community Affairs) and Nunavut (Community and Government Services).

3.3.3 Primary Project Partnerships

Project financial support was obtained from a wide range of agencies: ArcticNet; Northern Science Training Program (NSTP), Climate Change Impacts and Adaptations Program (CCIAP), Knowledge Outreach and Awareness Program (Infrastructure Canada), and the Stuart Nesbitt White Fellowship for Emergency Preparedness. In-kind contributions on the part of the communities and the numerous agency staff consulted at various stages of this project were extensive.

3.4 Community-Based Process

The case study development was to be approached with the same general sequence of preparation, fieldwork and writing up as follows and as presented in the project fieldwork chronology (Table 3.2):

- preliminary familiarization visits and local pre-planning;
- climate change and community data compilation;
- adaptation planning consultations; and,
- adaptation plan preparation with stakeholder review and editing.

3.4.1 Preliminary Familiarization Visits and Local Pre-Planning

The objectives of the preliminary visits were to obtain general project approval of community leaders, Hamlet staff and other interested parties; to discuss and obtain direction vis-a-vis research/consultation approach; to assess local climate-change awareness and topics of greatest local concern; and, to begin handling consultation logistics matters (i.e. session timing and location, desired participants, access to local records, potential youth involvement, etc...). Meetings were typically requested in advance with representatives of key local organizations such as the local Hunters and Trappers groups (a key research licensing organization in all the communities) and Hamlet senior staff (usually the Senior Administrative Officer). Time was allowed to organize others as opportunity permitted and as directed by the initial community contacts.

Establishing an effective working partnership with subject communities is essential to the effective pursuit of any planning project, but particularly so for one aiming to bridge evident cultural and knowledge system differences. In order to do so, each community approached for this undertaking was from the outset asked to enter into a comprehensively participatory planning process; one over which they would exercise substantial control of the design, direction, delivery and outcomes. Developing this working relationship was an ongoing process throughout the project and, though typically falling short of meeting originally-desired high levels of engagement for reasons which will be discussed in later chapters, was both a well-received and successful approach in the eyes of participants.

Early lines of questioning (Fig. 3.5) sought direction from community leaders that was important for the planning of subsequent data gathering, consultation planning, additional contacts, and other 'homework' required prior to returning to the community for a longer period. It was also used to determine what was known or understood regarding the work of associated researchers. As the preliminary visits generally took place in conjunction with the fieldwork of ArcticNet or NRCan physical scientists, their climate-change findings arising from nearshore and/or terrestrial surveys and geophysical analysis were referred to as examples of some of the background information that could be included in forthcoming community planning exercises.

Preliminary Community Visit - Lines of questioning

- What changes are occurring locally? What are some of the most significant changes you've observed to date?
- Have you been doing things differently in order to adjust to the physical/climate changes experienced? Are you anticipating further changes?
- Have there been any physical changes made to date? Buildings or other infrastructure moved, redesigned or replaced?
- Are there community projects that (have been/may be/will be) affected by the changes you're experiencing?
- How aware of local climate changes and related effects is the community at-large? Are there things that more people need to be aware of?
- How familiar is the population with ongoing scientific activities in the area? How would you like to see the findings of local climate change research put to use in your community?
- Who would you like to see involved?

Figure 3.5: In order to illustrate the scope of inquiry, ethics submissions demanded a variety of scripts suggestive of the lines of questioning the researcher anticipated using at various stages of the community consultations.

Table 3.2: Case Study Community Visits - Project Chronology

Stage and Dates	Location(s)	Notes
Regional familiarization visits (prior to project case study selection) <i>April 2005</i>	Inuvik, Sachs Harbour , Uluhuktuk, Paulatuk, Aklavik	Annual meetings with Inuvialuit community Hunters and Trappers Committees (HTCs) to present community research updates and outcomes conducted as part of ongoing NRCan and DFO science projects. Tuktoyaktuk not visited - weather conditions prevented fly-in initially and too few committee members were able to reschedule at the time.
Introductory Site Visits <i>July - August 2005</i>	Sachs Harbour	In conjunction with ongoing MUN/NRCan physical science fieldwork activity in community
	Tuktoyaktuk	In conjunction with ongoing NRCan/Parks Canada physical science fieldwork activity in vicinity of community
Community Consultations <i>January - March 2006</i>	Sachs Harbour	Extended field visits to both ISR communities. As coincided with NRCan/DFO community consultations, also participated in those gatherings in each locale.
	Tuktoyaktuk	
Community Consultations <i>August 2006</i>	Tuktoyaktuk	In conjunction with Coastal Zone Canada Conference and with benefit of additional resources provided under Knowledge, Outreach and Awareness Program of Infrastructure Canada.
Introductory Site Visit <i>August 2006</i>	Gjoa Haven	Shortly after completion of MUN physical science summer fieldwork activity in community
Community Consultations <i>February - March 2007</i>	Gjoa Haven	Extended field visit to community.
Final review consultations and presentations <i>August - September 2008</i>	Sachs Harbour	Short visits to each community to present the latest versions of the information and observations collected and to discuss planning outcomes. Consultations with regional MACA staff were also conducted.
	Tuktoyaktuk	
Final review (pending)	Gjoa Haven	Originally planned as a follow-up project visit to be conducted as part of the regional consultations for the Nunavut Climate Strategy Planning process. That initiative experienced numerous delays and eventually proceeded in a different community and at a time the researcher was unable to attend.

3.4.2 Climate Change and Community Data Compilation

With the preliminary framework for each planning process in place, information was compiled respecting predicted local climate changes and likely impacts on the community critical infrastructure. Previously documented traditional knowledge was used as available, along with other historical records and research findings, and preliminary community input to produce a comprehensive physical, socio-economic, climatic, and governance profile for each locale. Where available, predicted and/or modeled local and/or regional climate changes from other researchers, documented and/or observed adaptations made by the community to date, and preliminary information respecting "critical" community infrastructure were included. The profiles served as key background documents that were referred to throughout the local planning processes and amended as required.

3.4.3 Adaptation Planning Consultations

The planning consultations were initially envisioned as the longer field period needed to encompass a community-based planning process. A minimum of three weeks in each community was thereby set aside to first identify 'significant' local climate change impacts (both observed to date and predicted); then, carefully consider their implications (physical, social, economic...) for the community on short, medium and long terms; and, finally, identify and achieve consensus on what constituted appropriate responses or adaptations. The researcher was prepared to (and did) adapt this proposed process (Fig. 3.6) to conditions encountered in the field: none of the planning consultations proceeded along the originally imagined trajectory.

Adaptation Planning Consultations – Potential Subject Matter

The exact line of questioning will be developed in consultation with community members engaged in preliminary community visits. General subject areas will however include:

- Physical changes already observed in the land and sea in the area;
- Animal life, vegetation and harvesting pattern changes;
- Predicted extent of changes to come (and the limits of those predictions);
- Impacts on local infrastructure;
- Impacts on local livelihoods/economy;
- Impacts on health, welfare and community fabric;
- Individual versus collective responses/adjustments;
- Governance mechanisms and other means that may be used to address issues; and,
- Gaps in local information and awareness.

Figure 3.6: The generalized scope of questioning as originally presented in the project ethics submissions.

The planning consultations were undertaken during the darkest winter months when the greatest number of local people were expected to be present in the communities and available to participate. As the details of the approach were in each instance to be defined in consultation with participants, the planning process was launched with an open community meeting that aimed to both inform and invite participation. The objectives of the exercises were to be defined in consultation with the community but were expected to generally result in the identification of the variety of potential climate change adaptation options that the community had along with those that the community wished to pursue (i.e. relocation of existing infrastructure, amendments to existing Hamlet plans and regulations, changes to capital works and infrastructure plans, review of community economic development and/or cultural development goals, requests for additional research, etc...). It was anticipated that preliminary recommendations would be recorded for further research, evaluation and discussion with prospective partners (i.e. Territorial

and Federal Governments, service providers, other external stakeholders), the results of which would be returned to the community and incorporated where deemed necessary or appropriate in their climate change adaptation plan.

A computer-based visualization tool was discussed at the outset of the project. A more elaborate time-series projection method was discarded, however, early in the project in favour of much simpler aids generated using readily available software (Microsoft© PowerPoint) that concentrated on capturing participant input and presenting it back to the community. This process, which entailed the creation of slide files and/or map-like images recording inventoried observations, was dubbed 'serial editing' as the iterations of screening and recording participant inputs provided for a variety of perspectives and numerous opportunities to confirm (or deny in some instances), refine and add to information already gathered

3.4.4 Adaptation Plan Preparation and Stakeholder Review

The final stage of each community planning exercise was to be the preparation of a local climate change adaptation "plan". The exact form that these documents would take was to be determined in consultation with each community and this process did result in different outcomes in each case. One anticipated application of these final reports, however, was the identification of possible amendments to local land use planning instruments (e.g. Hamlet Plans and planning by-laws), but this was not an outcome in any of the communities. Early discussion of this scenario with the GNWT Department of Municipal and Community Affairs had been encouraging since there had not been a planner assigned to either of Tuktoyaktuk or Sachs Harbour. Tuktoyaktuk's Hamlet Plan

was nearing its five-year review period at the time, and MACA staff had been discussing the possibility of preparing a Hamlet Plan with the Sachs Harbour Council. A regional planner had been engaged by the time those consultation processes got underway, so the researcher adjusted accordingly and sought to work in partnership with the new staff member.

Early in the planning process, attempts were made to establish a group of individuals in each community to act as "community editors". Besides providing ongoing guidance with respect to sensitive local matters that might require special treatment to preserve confidentiality or anonymity, it was hoped that these people would collectively assist the planning process by reviewing all the print materials produced during the project for accuracy and completeness of interpretation. This was another feature of the original research plan that did not work in practice. By in large, efforts to obtain community-based editing failed outside of those serially-edited sessions facilitated while the researcher was present in the community.

Consultations with other resource people from outside of the communities (GNWT staff, other researchers) did occur throughout the project. The outcomes of these discussions were reported back to the communities.

3.4.5 Contingencies

It was recognized that the outcomes of the community engagements could not be pre-judged and that, similarly, predetermining the form and format of the proposed participatory planning consultations would be counterproductive. General lines of questioning were instead outlined for the ethics review and licensing processes to suggest

the scope and character of the information being sought (see Figs. 3.5, 3.6). Similarly, opportunities arising from other local or regional activities (i.e. the Coastal Zone Conference hosted by Tuktoyaktuk in 2006, project calls concluded in 2007 for the one-time GNWT Community Capacity-building Grant; Nunavut Climate Change Strategy planning initiatives in 2008) were incorporated into the research process as they arose. Every effort was made to realize an adaptive planning process in the course of preparing the adaptation 'plans' as originally conceived.

3.5 Analysis

The focal level of governance addressed in this research is the 'local' with emphasis placed on the Hamlet government bodies in each community. The analysis employed in each of the three local case studies presented has been organized as follows.

3.5.1 Physical Geographies and Human Dimensions

Building on the regional profiles for the Northwest Territories, the ISR, and Nunavut presented in chapters 4 and 7, each chapter devoted to a case study community begins with a conventional inventory of local physical and human conditions. In the context of the resilience and institutional analysis frameworks employed, this section serves to construct baseline categorizations of each community's current material and organizational conditions. Engaging in an 'archaeological' approach (*sensu* Foucault 1969), however, numerous less-commonly engaged sources were consulted in order to provide supplementary information throughout succeeding sections to elaborate the unique narrative of each community's conditions and development. Records used include

geoscientific material, documented history, oral accounts, news media, and reports, minutes and notes reflecting the activities of community organizations and other government agents which were available to the researcher, in addition to the participant observations collected in situ.

3.5.2 Local Planning Process Review

The general planning process and approach defined for all the communities allowed for local circumstances to determine much of the path of the research effort and consequent form of outputs. For each exercise, this emerging 'texture' was important to capture as a basis for comparison with the more conventional and circumscribed experience conditioning plans and planning conducted by contracted or in-house planning staff. Accountability and liability-related provisions at play in formal organizational settings have led to numerous standard operating practices (SOP): institutional technologies which facilitate control, comparison, priority-setting and decision-making with particular emphasis on capital works and budgetary applications. Although SOP may be seen an institutional convention with the potential to embed and reinforce 'best practices', they more often define the minimum acceptable standards required to satisfy 'due diligence' expectations and consequently to reduce surprises (especially financial or legal ones) of a disadvantageous nature to the organization.

While project permissions were obtained from the territorial government departments responsible for municipal planning, no further commitment was made at that level from Nunavut or the Northwest Territories to the outcomes of the initiative. Care was exercised by the researcher throughout the project to identify her relationship as

being primarily with the Hamlet and greater community rather than with other regional governance agents.

Similarly, throughout the project period, this researcher's working affiliations and linkages were explained in relation to the larger groups of researchers in ArcticNet – a university-based scientific network examining multiple issues across the Canadian Arctic. The researcher's role within the larger team was introduced both as exploring ways of communicating some of the information that other researchers were collecting, and working with community members to establish stronger connections between ongoing scientific activities and day-to-day community decision-making and planning. Work completed by researchers from Natural Resources Canada, Memorial University, and elsewhere was incorporated in community presentations and consultation materials where appropriate. In so doing, it was hoped that duplication would be avoided in data collection and that prior results would be acknowledged, incorporated, disseminated and validated at the outset of the current process as a point of departure for identifying key community planning issues.

Consequently, while municipal and land use planning SOP were somewhat sidestepped, they were replaced to a great extent by academic and research SOP. Tri-Council university ethics protocols and the research permitting processes administered by the Nunavut and Aurora Research Institutes on behalf of the territorial governments reflected accountability and liability-related provisions but emphasized the protection of the interests of identified research subjects. 'Due diligence' in this case translated into the researcher's forethought needed to construct and appropriately implement a series of

contingency research plans which sought to reconcile individual, group and scientific values.

3.5.3 Local Development and Change Narratives

This section in each case study chapter introduces baseline physical and human geographies and contemporary change themes in a fashion that seeks to elaborate some of the dynamics between the material and the relational or less tangible features of the assessment framework. While clearly intertwined with the broader development narrative in each case, a more detailed examination of local change observations was pursued in each community. Where prior examination of climate change themes had been undertaken by other researchers or community-based organizations, it was felt that the most appropriate research approach would entail acknowledging, reviewing and confirming these earlier observations as a stepping off point for identifying the experience of change during the project period.

More contemporary change experiences may be interpreted or experienced as echoes of past events. If the 'memory' of the community is to be considered in relation to ongoing changes, it is important to consider accounts given by community members of what has occurred at other times. What has been tried, what has seemed resistant to being changed, and what is seen to have helped the community are all significant. To this end, where information was available or could be deduced about prior planning efforts, these materials are presented to illustrate that aspect of the local experience with formalized governance and/or institutional practices.

This section addresses most directly those accounts provided by community members, both individually in directed interviews or in group or public consultation settings. As per the agreed ethics protocols, waivers were prepared for possible use where recommended by local officials, or when handling sensitive information. The researcher had not thought it would be appropriate or constructive to expect every participant in the process to complete a consent form and that opinion turned out to be shared by all community representatives consulted. It was agreed that, for purposes of the dissertation submission, participant names would be expunged from the observation references for consistency's sake. A caveat to these arrangements was that special provisions were made for a few parties whose input is recorded at greater length herein and who expressed an interest in exploring having some or all of their contributions directly attributed in future publications and once they had the benefit of seeing how it would be treated.

As the overarching case study examination employed in this project is another exercise of formalized institutional practice, this portion of the analysis reflects on the researcher's own planning process as one in a series of instrumental engagements which the community may or may not respond to or be especially conversant with. Public consultation is an increasingly prevalent means by which organizations seek to fill internal voids of information or credibility. It establishes proto-relationships deemed necessary in order to manage a given resource or transaction. Further to Arnstein's (1969) ladder of public participation with its implied susceptibility to manipulation, the researcher explored the possibility that the growth in acceptance of this governance technology parallels the knowledge 'silos' and specialization (Latour, 1993) thus raising questions respecting its relative 'legibility' (*sensu* Scott) to the parties they are used with.

3.5.4 Local Consultation Outcomes and Discussion

The identification of local issues was explicitly stated as a primary objective of this activity so a rather open-ended inventory was solicited from each community. In this section, the outcomes of the various consultation gatherings have been consolidated and reorganized using a tabular analysis process into the following seven topic areas:

- Community Lands and Physical Hazards
- Core Community Services and Utilities
- Transportation and Communications
- Residential Infrastructure and Services
- Economic Infrastructure and Services
- Public Services
- Community Wellness

A descriptive section provides details for the highlighted themes in each of the topic areas. Implications are explored with reference to the scientific content of the resilience assessment framework but also with an eye to their interrelations and what they contribute to the overall experience of conditions in the community. Themes are characterized generally by both the dimensions they occupy (e.g. Resources, People, Organizations, Relationships) and the 'direction' they are seen as taking in relation to potential cycles of adaptation or transformation. These in turn are used to conceptually position each dimensional cluster in terms of the adaptive experience.

This last element is not to be taken as an evaluative 'measure' of resilience but rather as a composite of snapshots suggesting a prevailing influence or resident experience in the midst of the ebb, flow and interaction of clusters of indicators. The Resilience

Assessment Framework was developed as more of a heuristic rather than a prescriptive tool so each of the subthemes identified is assumed to have its own constellation of material and relational qualifiers (Table 3.3). Therein the following breakdown was used:

- **'Resources'** was applied to tangible assets that the community relies on to meet most of its material needs, including critical community infrastructure and economic commodities in conventional 'resource' sense. It also includes references to physical aspects of change/hazards (the "what" in relation to much of the anticipated adaptation subject matter).
- **'People'** was addressed to the conventional demographic descriptors of the community but also to the "Who?", "How?" and "Why?" (e.g. beliefs, attitudes, behaviour) exhibited in connection with the identified theme as might be seen to inform individual choices in the community.
- **'Organizations'** captured the "Who?", "How?" and "Why?" of the identified theme in relation to recognized organizations/institutions in the community as well as their activities within their respective jurisdictions. To some extent, the potential scope, nature, and level of collaboration between local organizations, institutions, and groups is suggested where multiple organizations are recorded as addressing a given theme.
- **'Relationships'** spoke to the nature and extent of community self-organization more generally. Statements reflecting the dynamics falling outside the other three categories (i.e. panarchic relations with actors outside the community, observations of dilemmas or other considerations arising from the current state of affair) are recorded in this column.

The simple tabular break-out commentaries are in turn condensed into a single generalized characterization based on the experiential dimension colour key (Fig. 3.7). While the content supporting the break-out statements originates in the consultations and

Table 3.3: Example of Theme Break-out Table format

Theme	<i>Material</i>		<i>Relational</i>	
	Resources	People	Organizations	Relationships
Eroding shoreline 	Infrastructure at risk	Occupants of premises in immediate vicinity at risk	Local government, housing authority...	Consulting geoscientists, regional government staff...
Hamlet staff turn-over 	Reflected in material conditions in community	Few qualified residents	Loss of institutional memory and consequently diminished local capacity	More decisions ultimately taken by regional authorities or contracted parties; loss of local autonomy



-  **Significant stresses, pervasive impacts or insecurity**
-  **Some stress, uncertainty and/or conflict**
-  **Low stress, relatively predictable conditions**

Figure 3.7: Experiential Colour Key for the Adaptive Cycle

community records more generally, the actual characterization coding is in this experimental instance the researcher's. By making the basis of the practitioner interpretation clear however, it is believed that this analysis may be more legible to others and thus more useful and open to correction/adjustment by the community. These characterizations may also be aggregated then in a variety of ways to address key arising topics.

3.5.5 Plan and Adaptation Scenarios

As initially presented in each community, the planning consultations were expected to lead to the identification of possible plan and adaptation outcomes. The

process however yielded different endpoints in respect of this aspect of the conventional planning exercise. An inventory is nonetheless presented for each community with an analysis of both the local appetite and the ‘professional’ response to the possible futures or options stemming from the resilience framework.

3.5.6 Synthesis

The concluding section of each case study chapter reflects on the composite local conditions and assessed resilience to identify determining characteristics and possible pathways for ongoing local adaptation processes. These adaptation dynamics are revisited in a comparative fashion in Chapter 9.

Table 3.4: Concluding ‘Ten Key Observations’ framework (after ACIA 2005)

Generalized Category of Observation	Associated ACIA Key Observations
Climate change awareness	<i>“Arctic climate is now warming rapidly and much larger changes are projected”</i>
Scope/scale of consequences	<i>“Arctic warming and its consequences have worldwide implications”</i>
Vegetation	<i>“Arctic vegetation zones are very likely to shift, causing wide-ranging impacts.”</i>
Wildlife	<i>“Animal species’ diversity ranges, and distribution will change.”</i>
Storm impacts	<i>“Many coastal communities and facilities face increasing exposure to storms”</i>
Ice impacts (sea or river ice and freeze-up periods more generally)	<i>“Reduced sea-ice is very likely to increase marine transport and access to resources.”</i>
Permafrost thaw impacts	<i>“Thawing ground will disrupt transportation, buildings, and other infrastructure”</i>
Economic and cultural impacts	<i>“Indigenous communities are facing major economic and cultural impacts.”</i>
UV impacts	<i>“Elevated ultraviolet radiation levels will affect people, plants, and animals.”</i>
Combined impacts on people and ecosystems	<i>“Multiple influences interact to cause impacts to people and ecosystems.”</i>

In addition to the construction of the dimensions planning framework employing more *emic* content , the “Ten Key Observations” recorded in the 2005 ACIA report are used as a final structuring device for an outsider or more consciously *etic* summation of the community conditions (Table 3.4). Comparing local outcomes to the generalized conclusions of the major Arctic climate change science compendium so commonly referenced throughout the period of this research also suggests the larger scales at which the relationships of these communities’ needs are being assessed.

The West of the Northwest: The Inuvialuit Settlement Region

4.1 The Evolving Northwest Territories

The compilation of a regional chronology to lend context to community-based research such as this is never a straightforward process. There is no single storyline to follow, as so much of the space now occupied has been explored, used, settled, otherwise claimed, even fought over, and the timescales over which these relationships have been played out also vary greatly. The details become fewer and more widely dispersed as available narratives reach back to their respective vanishing points. Increasingly, however, we recognize in these multiple histories and their telling intersections, another kind of account of how what is came to be. This is certainly true of the Northwest Territories of Canada (Fig. 4.1).

4.2 Narrative One – Creating communities in the North

4.2.1 Mapping

The formal geographic and political entity that was the Northwest Territories (NWT) in the 1970s serves as a kind of mid-ground entry point for introducing my study area. A full century had passed then since the Government of Canada had purchased the vast North-Western Territories and Rupert's Land from the Hudson's Bay Company (*Rupert's Land Act, 1868*). The Canadian ecumene was still, evidently, an idea in flux.

Notwithstanding the precedent-setting acknowledgement of occupation and usage of northern lands in a 1960 map by Roman Gajda, the Arctic would be regarded as part of the nation's 'vacant' real estate for many years thereafter. A case in point is a map

included in a 1976 report by the Canadian Habitat Secretariat, where sparse 'settled regions' hug the Canadian-U.S. border in two familiar clusters, running from the Maritimes down the St. Lawrence River Valley to Windsor, and across the southern extent of the three Prairie provinces. The Arctic Archipelago may have been altogether cropped from this depiction of the country, but the propagation of permanent, southern Canadian settlement forms was well-underway there.

4.2.2 Devolution Begins

At just over 1.3 million square miles in area, the NWT of the 1970s dwarfed the province of Quebec, the next largest jurisdiction in the country. Based on the 1971 population count of 34,807 however, it was also the least densely populated. Then, as now, density-based assessments had political ramifications.

The Cold War period that brought the DEW line, also made settling the North a strategic interest for the Canadian government, albeit one approached at arms-length. Through the 1960s, the Yukon and the Northwest Territories were still governed directly by Canadian authorities: territorial Commissioners liaised between constituents and their legislative authorities in Ottawa while services and resources were administered by federal departments, chiefly Indian and Northern Affairs, also based in the nation's capital. The Advisory Commission on the Development of Government in the Northwest Territories, later known as the Carrother's Commission, was struck in 1963. The 1966 Commission report recommended that the Legislative Council and staff complement for the NWT be moved from Ottawa to Yellowknife. This was acted upon the very next year along with the recommended transfer of powers over education, public works, local

government, small business, and social assistance. The Commission foresaw a need to eventually subdivide the Territories into eastern and western political units as well, but a second federal electoral district for the North took another decade, and was first exercised by voters in 1979.

Early governance efforts on the part of a decentralizing civil service were complicated by the great linguistic diversity of the North. Within the Western Arctic alone, there were four Inuvialuktun/Inukturn dialect groups within which further sub-dialects were distinguishable. The *Inuvialuktun* dialects associated with the present-day Inuvialuit Settlement Region (ISR) are *Siglit*, spoken in Sachs, Tuk and Paulatuk; *Kangiryuarmit*, predominant in Holman; and *Uummarmiut*, spoken mainly in Aklavik and Inuvik.

Notwithstanding the enforcement of colonial languages in residential schooling of the day, Inuit dialects and existing writing systems in use in communities varied from East to West, reinforcing the lines along which they were ordered administratively. In the Q-Book's "Preface to the Standard Roman Orthography Section" (1964), Raymond C. Gagné argued for a new writing system as a means "...for every Canadian Eskimo to write his own idiolect/dialect regardless of interdialectal differences, e.g. *nunasiutik/nunakkuujuuq* both mean "car" and *nattiq/nassiq* both mean "seal"." (p.14) He notes, however:

"...Since the degree of mutual intelligibility with the Eastern dialects decreases progressively as one moves into the Western Arctic, the problems of comprehension may increase in some measure for the Eskimos west of Hudson Bay but in most cases the context should help solve these difficulties. Rather, it is

the Eskimos of the Mackenzie River region (Allarvik, Inuvik, Tutuujartuuq, etc.) who will have the greatest hardship in understanding the texts because their dialect is the most radically different from the rest of the Canadian Eskimo dialects. Since these Eskimos form but a very small minority they will have to adapt themselves to the linguistic norms of the great majority of Eskimos if they want to enjoy the greater part of the literature yet to be born of this new orthography."

As new administrative and regional government infrastructure were put in place, devolution continued at intervals to move the 'territories' towards more provincial-like government circumstances. Additional authorities were subsequently transferred from Canada to the GNWT in health care, social services, education, airport administration and forestry. Devolution didn't simply transfer the powers and staff however; it also transferred a host of Southern Canadian norms embodied in institutions, technologies, codes and aesthetics. The rapid development of Arctic townsites through this period demonstrated as much.

A decade after its move to Yellowknife, the GNWT launched its own efforts to further devolve regional governance. The Task Force on Decentralization sought to move responsibilities from headquarters in Yellowknife to "government in the field" (GNWT 1977, p. 26). This entailed the establishment of four sub-regional offices governing divisions of the then-Territories (Fig. 4.2), the structure of which live on in many respects today.

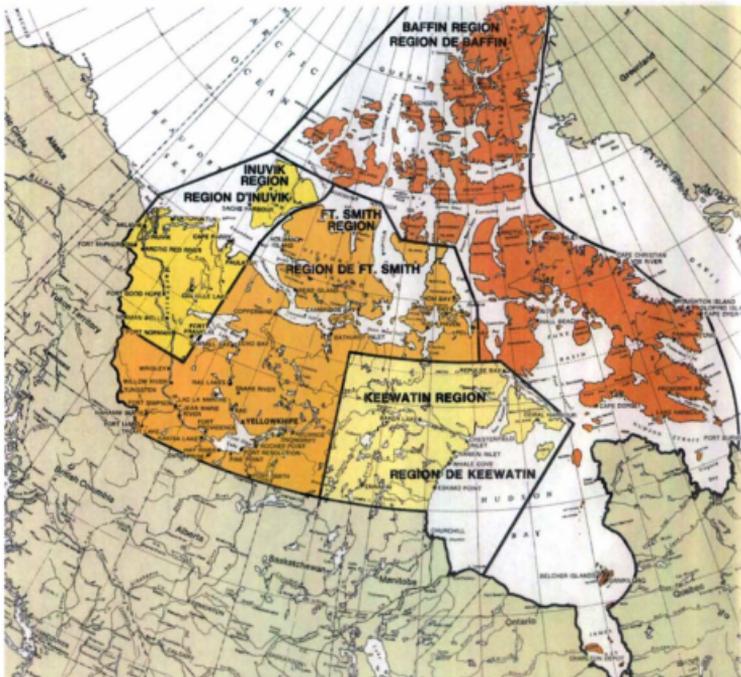


Figure 4.2: The Northwest Territories Regional Structure c. 1977
 Source: GNWT 1977, p. 112

All three of the communities profiled in this study – Tuktoyaktuk, Sachs Harbour and Gjoa Haven (Fig. 4.3), incorporated in 1970, 1986, and 1981 respectively – were operated under abutting regional administrations of the same territorial government system then. The bifurcation of Inuit claims organizations in the 1970s presaged the line that would be drawn between them to define the new domain of Inuit self-government in the east wherein Gjoa Haven now lies. For all intents and purposes though, they were

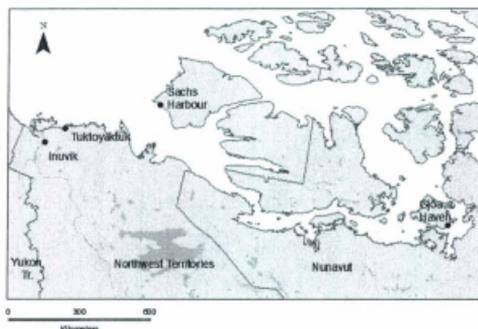


Figure 4.3: Case Study Communities - Tuktoyaktuk, Sachs Harbour and Gjoa Haven
 Source: Catto and Parewick 2009

born into a single institutional family; three among many new municipal entities that came into being within a single generation across the Canadian Arctic.

4.3 Narrative Two – Recovering the peoples' land

Notwithstanding the bulk of the nation's politics being transacted well to the South, the 1970s was to be a decade in Canada that examined the diversity within, signaled by the adoption of a national policy of multiculturalism (1971). The appointment of Canada's first Commissioner of Native Claims in late 1969 to formulate recommendations respecting a national system for handling claims had set the stage for a decade of high-profile Northern news stories. In 1971, the Alaska Native Claims Settlement was concluded with a grant of 180,000 km² of land and US\$962M to the communities there. As the first settlement of its kind, it certainly had been monitored by nearby Canadian aboriginal organizers.

4.3.1 Land Claims in Canada

That same year, the Inuit Tapirisat of Canada (ITC) was incorporated as the land claims negotiating entity acting on behalf of the Inuit of the NWT. The following year, the Northern Quebec Inuit Association was similarly launched to represent the interests of the James Bay peoples: together with the Grand Council of the Cree, they concluded Canada's first comprehensive land claims agreement in 1975. A series of Canadian legal precedents were set respecting aboriginal land rights over that three-year negotiating period. In 1973 alone, these included the blocking of the James Bay hydroelectric project by the Cree and Inuit and a Supreme Court ruling in favour of the Dene Nation respecting the inapplicability of Treaties 8 and 11 to their claims. The following year, the federal Office of Native Claims was established within the Department of Indian and Northern Affairs Canada (INAC) to address outstanding claims and treaty grievances. Four years later, the Berger Commission recommended a ten-year hiatus in the proposed Mackenzie Valley oil pipeline to provide for the negotiation of aboriginal entitlements in the Yukon and Western NWT.

4.3.2 Inuit Organizations

Twinned loci of political activity and Inuit organizing had emerged in the Eastern and Western Arctic led by a younger, residentially schooled generation of Inuit. Connections forged at high schools in Yellowknife, NWT and Churchill, Manitoba were built upon through the 1970s as community development efforts, outreach publications (i.e. Nunatsiaq News, c. 1973–present) and expanding broadcast media services provided vehicles for regional communications.

An early trajectory of Inuit representative organizations is found in the records of the Indian-Eskimo Association of Canada (IEA). Originally a committee of the Canadian Association for Adult Education (CAAE) struck to examine off-reserve education, the National Commission on the Indian Canadian (as it came to be known), was independently incorporated as the IEA in 1960. The Ontario-based IEA however was "a national citizen's organization with membership open to all people interested in promoting the well-being of Native Americans" (IEA, 1957-70). A Northwest Territories regional division of the IEA was actively representing the interests of a number of northern aboriginal groups by the later 1960s, giving rise in turn to wholly indigenous representative bodies such Committee for the Original Peoples Entitlement (COPE) in the Mackenzie Delta region, and the Inuit Tapirisat of Canada, established in 1971 (with founding members including IEA member Tagak Curley) to negotiate on behalf of all Canadian Inuit. As development pressures mounted in the Delta region however, further organizational subdivision occurred. In 1974, it was COPE that became the voice of the Inuvialuit in their land claims negotiations. Other regionally representative Inuit bodies soon followed in Labrador (Labrador Inuit Association, 1975, succeeded by the first Canadian regional Inuit government of Nunatsiavut in 2005), Quebec (Makivik Corporation, 1978), and the non-Inuvialuit NWT (first the Tunngavik Federation of Nunavut, succeeded by the Nunavut Tunngaik Incorporated as of 1993 as the implementing authority for the Nunavut land claim).

Extensive land use and occupancy research was conducted throughout the Northwest Territories in 1974-75 (Freeman 1976 a,b,c). This was initially seen as a best-practice methodology exemplified by the Inuit Land Use and Occupancy Study, and also

popularized through the work of Hugh Brody (*Maps and Dreams*, 1981). However, mapping the complex mesh of occupancy that is associated with peoples whose engagement with the land includes subsistence or harvesting uses and seasonal visitation of terrain far removed from a permanent homestead, is critiqued today from a number of angles. The flattening of embedded and sustaining social and cultural values onto a planar representation of their spatial extent is a translation through which much inevitably is lost. Such mapping has the potential to disclose information that is susceptible to misuse by outsiders. The argument is also made that mapped territories often suit the purposes of the State more so than the populace (Scott, 2005). As aboriginal organizations have developed throughout North America, the capacity to interpret, create and maintain their own maps nonetheless has become an important means of protecting cultural and intellectual 'property', as well as claims to land. Acquiring the vocabulary and methods of colonial institutions, including the conventions of land administration, have been integral to negotiating new, more autonomous relationships for the Inuvialuit and Inuit

4.4 Contemporary Governance and Development Context

The Inuvialuit Settlement Region (ISR) is the product of the first comprehensive land claim agreement settled in the NWT, and only the second one in Canada. Its implementing measure, the Inuvialuit Final Agreement (IFA) came into effect on July 25, 1984. The ISR comprises roughly a 225,460 square kilometer area of the Mackenzie Delta, Beaufort Sea, and Amundsen Gulf region and encompasses six municipalities (Table 4.1).

Table 4.1: ISR Communities by Incorporation Year

Community	Incorporated	Status	Census 2006	Population Est.* 2004
Tuktoyaktuk	1970	Hamlet	870	1,010
Aklavik	1974	Hamlet	594	631
Inuvik	1979	Town	3,484	3,586
Ulukhaktok (a.k.a. <i>Holman</i>)	1984	Hamlet	398	421
Sachs Harbour	1986	Hamlet	122	120
Paulatuk	1987	Hamlet	294	312

*Gas Tax Allocation Table (available on-line at <http://www.maca.gov.nt.ca/operations/gastax/AllocationTableGasTax.pdf>)

The IFA provides for Inuvialuit participation on various co-management boards within the Inuvialuit Settlement Region, including the Wildlife Management Advisory Councils (WMAC) for each of the NWT and North Slope; the Fisheries Joint Management Committee (FJMC); the Environmental Impact Screening Committee (EISC); and Environmental Impact Review Board (EIRB). The IFA also provides for the Inuvialuit Game Council which oversees Inuvialuit wildlife interests.

The IFA also provided for a total capital transfer of \$152M from the Government of Canada to the Inuvialuit, through the Inuvialuit Regional Corporation (IRC) over 14 years (1984-1998) and roughly 90,600 square kilometres of land, including 12,980 square kilometres of subsurface mineral rights. The IFA refers to two categories of land (Fig. 4.4):

- 7 (1) (a) – generally immediately surrounding Hamlet areas and providing Inuvialuit both surface and subsurface rights, and
- 7 (1) (b) (Fig. 4.6) – other regional lands for which Inuvialuit hold only surface rights.

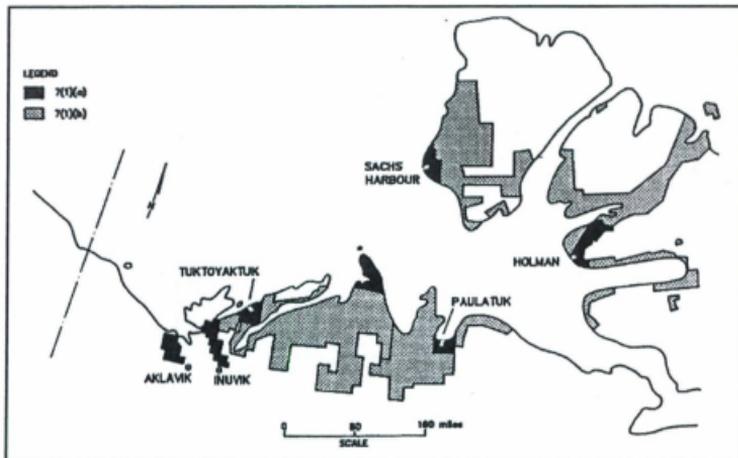


Figure 4.4: Inuvialuit Settlement Region Land Distribution

Source: Nesbitt and Howell, 1988

Notwithstanding ongoing processes of devolution, many of the circumstances of the Inuvialuit are still governed by the GNWT. The territorial Department of Municipal and Community Affairs (MACA) is headquartered in Yellowknife but has a regional office in Inuvik that liaises with all the ISR municipalities on everything from core infrastructure development through Hamlet staff training. The Northern Strategy Framework announced by the federal government in 2004 contributed to a major infusion of funding across the Arctic. In addition to \$4M allocated to addressing immediate housing issues, and \$1M targeting youth and wellness, the GNWT chose to distribute \$35M of their share to communities through the Community Capacity Building Fund between 2005 and 2008. The programme was managed by the MACA and offered all communities a one-time allocation proportionate to their resident population to invest in

an identified local need. The priority-setting processes were thus well-timed relative to the field periods of this research project.

Also of immediate interest to this research, land use and development control functions under the territorial *Planning Act, R.S.N.W.T 1988, c.P-7* (as amended) were to be administered by a planner through the Inuvik regional MACA office. Difficulties with staff retention were exhibited over the research period with a new planner engaged at the outset of the project in 2005 departing again in less than a year. The call on the office for local planning support services by the ISR communities appeared to be limited given their generally declining populations. While their existing plan documents (all communities excepting Sachs Harbour) might not have been among those in the Inuvik region most in need of amendment in consideration of their typical development control function (i.e. regulating new development), there were certainly other emerging community issues requiring attention. With the exception of Aklavik and Inuvik, all the ISR communities are sited on the coasts of the Beaufort Sea and Amundsen Gulf, zones on the margins of the formerly glaciated portion of the continent (Fig. 4.5). Consequently, much the ISR landmass is subsiding, which for most of their coastal settlements means that the sea is gradually advancing on shoreline infrastructure; combined with increased wave action and longer ice-free periods, most will be observing accelerating coastal erosion (Fig. 4.6).

The climate change implications for the greater population of the Northwest Territories have not gone unnoticed. Widely understood to be one of the most rapidly warming areas of North America (Zhang et al. 2000), regional climate change initiatives were garnering significant public profile over the project period. In January 2007,

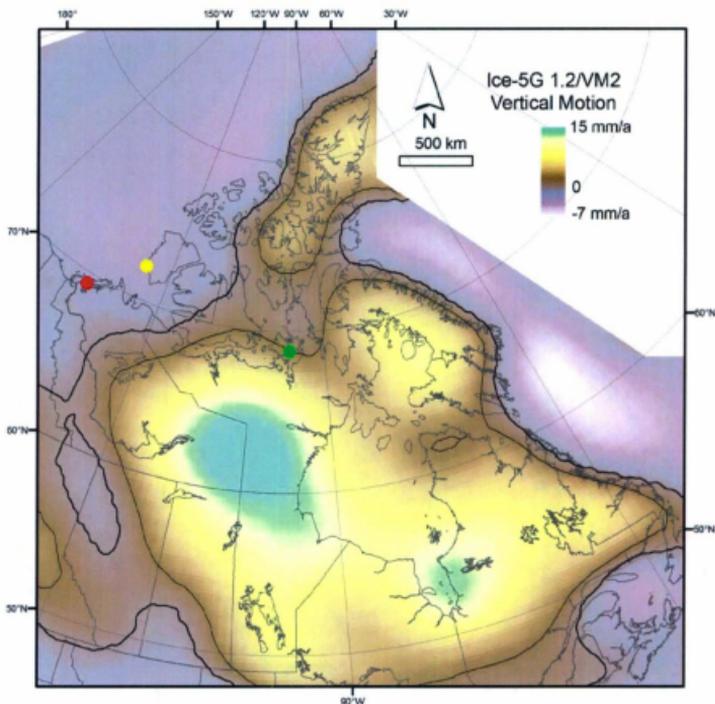


Figure 4.5: Current rates of land uplift or subsidence resulting from postglacial adjustment to former glacial loading. Of the three study communities, Tuktoyaktuk (red dot) and Sachs Harbour (yellow) lie within the zone of subsidence, which contributes to gradual submergence with rising sea level. Gjoa Haven (green dot) is located in a region of continuing rebound which counteracts the effects of sea-level rise. The line that Gjoa Haven sits astride denotes 2 mm/year rate of uplift, approximately equivalent to the rate of sea-level rise in recent decades, suggesting that sites such as Gjoa Haven inside the line are emergent.

Source: Natural Resources Canada, courtesy of G.K. Manson. Data derived from Ice-5G model by W.R. Peltier, University of Toronto. Figure © Her Majesty the Queen in right of Canada, 2012, with permission.

Ecology North hosted a Climate Change Summit in Yellowknife that was attended by community leaders from across the NWT, including a couple of Tuktoyaktuk Hamlet representatives. The organization published an excellent northern climate change primer

(Bastedo, 2006) in time for the event based on input from several regional climate change workshops and including illustrations of successful adaptations in the NWT.

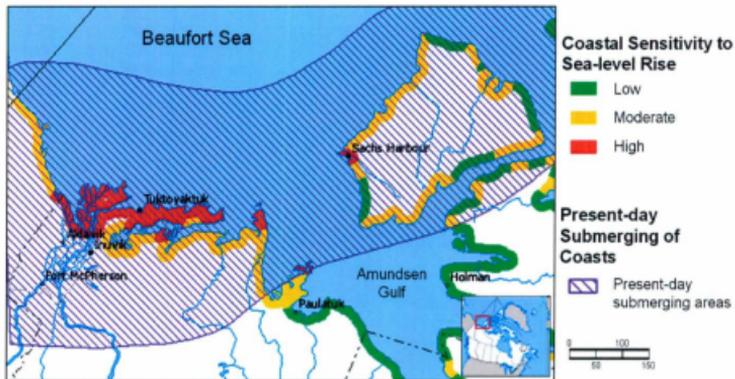


Figure 4.6: Parts of the Beaufort Sea coast have been assessed as one of Canada’s two major regions of high coastal sensitivity to sea-level rise and, among the ISR communities there, Tuktoyaktuk and Sachs Harbour fall within the most sensitive zones.

Sources: Adapted from *Coastal Sensitivity to Sea-Level Rise*, Natural Resources Canada, The Atlas of Canada with original data from Shaw et al. 1998. Contains material © Her Majesty the Queen in right of Canada, 2012.

In March of the same year, the Department of Environment and Natural Resources released their updated NWT Greenhouse Gas Strategy 2007-2011 (the precursor policy dated from 2001) committing “...the GNWT to reduce GHG emissions from its own operations to 10% below 2001 levels by the year 2011.” The strategy laid out sectoral action plans (Community and Residential, Commercial and Industrial, and Government sectors) as well as a series of cross-cutting initiatives. It also announced the intent of the government to commence stakeholder consultations in 2007 to develop a companion climate change impacts and adaptations plan. At the time of writing, the GNWT Planning Act was also under review (http://www.maca.gov.nt.ca/lands/community_planning).

Ongoing de-centralization of a variety of services are expected to provide new employment opportunities in the NWT but likely will also continue to highlight the flow-through nature of certain roles for which regional training avenues are presently inadequate. Self-government remains a work in progress across the ISR, much as the population awaits some kind of economic development arising from offshore oil and gas reserves.

At the same time, however, concern has grown across the North for the loss of indigenous languages. With the passing of their Elders, every community is conscious of the declining number of native Inuktitut or Inuvialuktun speakers available to hand on the languages and the rich knowledge embedded there. A couple of generations of predominantly English schooling have also introduced a pronounced language 'gap' between Elders and grandchildren (Fig. 4.7)

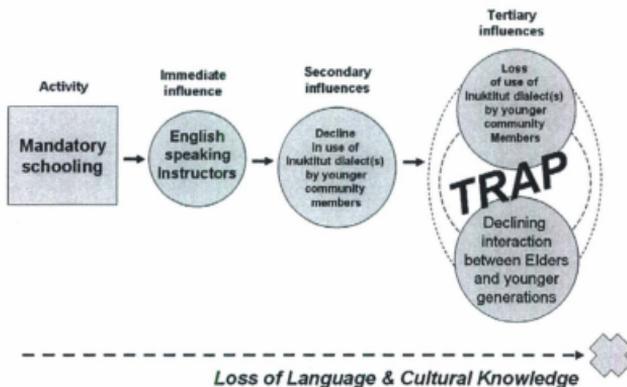


Figure 4.7: The language loss lifecycle

The recovery of regional autonomy across the Arctic, however, suggests its own cycle of interdependent activity for the Inuvialuit (Fig. 4.8). In the early summer of 2011, a truth and reconciliation gathering in Inuvik addressing residential school abuses attracted national media attention (CBC, 2011) and several as-yet unacknowledged Inuit victims from Labrador schools. The diverging narratives of the Inuvialuit and Inuit elsewhere in the North at an earlier phase of the Northwest Territories may be coalescing once more as they share investments (e.g. Norterra) and other economic and cultural interests in an increasingly accessible Arctic.

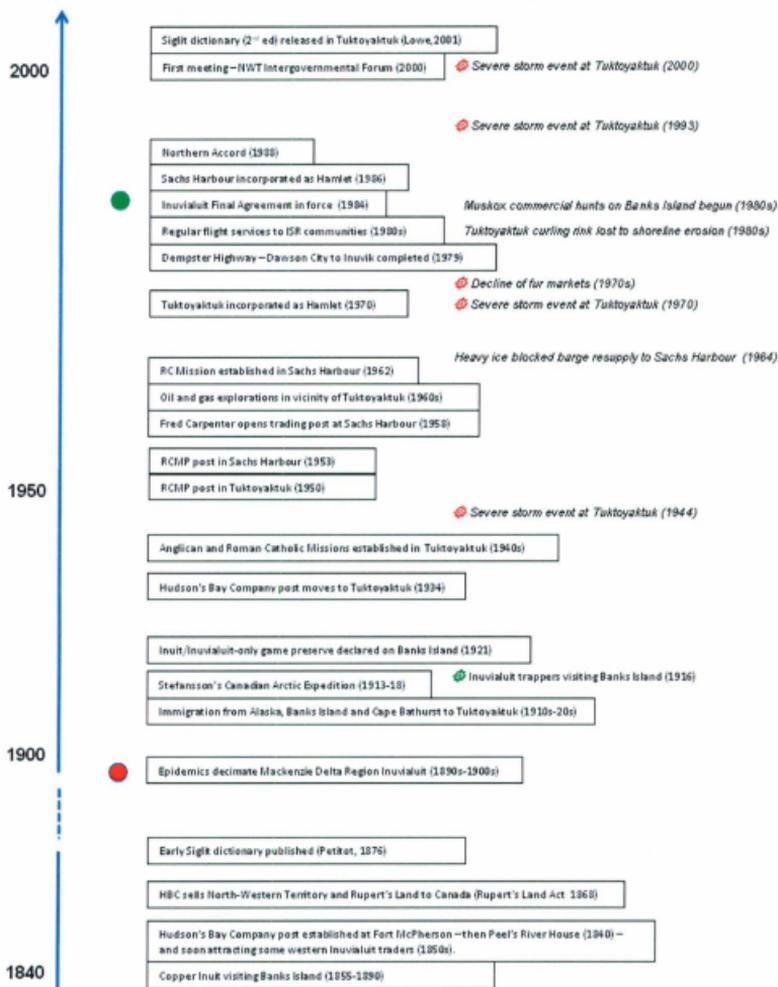


Figure 4.8: Inuvialuit Settlement Region generalized development chronology
Tuktoyaktuk storm data: Natural Resources Canada, 2001

Tuktoyaktuk

5.1 Tuktoyaktuk, N.W.T.

Of the three case study communities, Tuktoyaktuk (*Tuktujaartuq*, Inuvialuktun for “looks like a caribou”) is the most easterly and the one that has the longest association with the ‘imported’ modern phase of permanent community infrastructure development and governance practices in the Canadian Arctic (Fig. 5.1). It is located on the eastern side of Kugmallit Bay on the western shore of the Tuktoyaktuk Peninsula (Fig. 5.2). The Peninsula has been occupied for generations by the Inuvialuit, and Tuktoyaktuk Harbour counted as one of their best fishing spots. In 1934, the Hudson’s Bay Company moved their post from the larger Inuvialuit community of Kitigaaryuit to Tuktoyaktuk in order to capitalize on the deeper harbour there which could accommodate larger, sea-going vessels. The churches followed and Tuktoyaktuk soon grew from being a traditional home to a few families to a permanent settlement for



Figure 5.1: Tuktoyaktuk, view looking south down peninsula (26 June 2001)
Photo courtesy of Municipal and Community Affairs, GNWT



Figure 5.2: The Tuktoyaktuk Peninsula

Source: Adapted from Natural Resources Canada, The Atlas of Canada (www.atlas.gc.ca)

Contains material © Her Majesty the Queen in right of Canada, 2012

over 300 people by the 1950s. In the years that followed, its function as a regional port continued to expand. It was well-positioned to serve as a base for exploration operations as interest in oil and gas reserves in the Tuktoyaktuk Peninsula/Mackenzie Delta region grew in the 1960s.

5.2 Physical Geographies and Human Dimensions

Today, Tuktoyaktuk is accessible year-round by air, and by an ice road from December or early January to April. The Hamlet (Fig. 5.3) occupies 1,497 hectares between roughly 132°57'W and 133°03'W, and 69°24'N and 69°27'N making it the most northerly point in the Canadian Arctic accessible by road and the largest coastal settlement in the western Canadian Arctic. The community falls within the Inuvialuit Settlement Region (ISR) wherein it is second in size only to Inuvik (pop. 3,484), the regional government hub located 90 miles to the south.

The 2006 Census record pegged the population of Tuktoyaktuk at 870, down from a high of 943 in 1996. The community is predominantly Inuvialuit but includes a few Dene and Métis. Non-aboriginal residents account for 17% of the population.

Tuktoyaktuk lies to the east side of the Mackenzie Delta plain, a region characterized by extensive channels, wetlands and low-lying plateaus. In terms of landscape analysis, especially of permafrost features and the impact of sea level changes, the Tuktoyaktuk area is the most comprehensively studied low arctic region in the world. The archive of research by federal earth sciences staff alone dates back well into the 1940s and includes early research by J. Ross McKay on pingos (1971, 1972) – work cited today in relation to interpreting frozen terrain features on Mars.

Tuktoyaktuk is located at the far north of the Southern Arctic ecozone: long cold winters and short cool summers there contribute to dwarfed vegetation. Regional wildlife includes wolf, arctic fox, grizzly and polar bears, caribou and the occasional muskoxen.

5.2.1 Climate

The Tuktoyaktuk Peninsula is generally characterized as a low Arctic, tundra climate (modified Köppen-Geiger Et). Daily mean temperatures in January and July are -27°C and 11°C, respectively. The wide range indicates a strong continental influence, which is abnormal in arctic regions. The area benefits from 20 high summer days per year (at least 1 hour per day above 18°C), and receives 1900 hours of sunshine, primarily during the summer months. The region lies north of the Arctic Circle, and thus is dark throughout the day from November to late January.

The Mackenzie River is usually frozen from mid-November to mid-May. The ice road it supports could once be relied upon for travel prior to Christmas but has been opening later in recent years. Formerly, the freeze-up was of greater economic significance, as virtually all supplies were brought to Tuktoyaktuk by river barge in summer from Fort Simpson, along the Mackenzie River. The completion of the



Figure 5.3: Tuktoyaktuk area with Hamlet Boundary highlighted. Kudluk Lake, the community's drinking water supply, falls outside the municipal boundary and across the Tuktoyaktuk Harbour at the southeastern extent of this view.

Source: Municipal and Community Affairs, GNWT (ATLAS GIS). Contains material © Space Imaging

Dempster Highway from Dawson City to Inuvik in 1979 and the ice road extension provide for winter freight movement. Air freight has also grown greatly in importance since 1980.

Mean annual precipitation is 168 mm, 56 % of which falls as snow. Snow cover typically persists for 210-230 days with a modal snow pack depth of 40 cm. (Environment Canada 2007). The area is considered to have a dry sub-humid moisture regime, although measurable precipitation occurs on an average of 109 days each year. The effects of aspect and vegetation cover are more important than the absolute amount of precipitation. The prevailing winds are westerly and southwesterly.

Steve Solomon, an NRCan geologist with extensive knowledge of the Mackenzie Delta region, has compiled a wide array of available weather records for the community in order to document the progression of storm surge related damage. His work demonstrates that Tuktoyaktuk has become particularly susceptible to flooding during the late summer and fall when the fetch of open water on the Beaufort is great enough for major storm surges and waves to be produced during storm events.

5.2.2 Geomorphology

The Tuktoyaktuk Peninsula lies within the borderland region known as the Arctic Coastal Plain, a gently-sloping terrain with little relief (i.e. generally less than 20 m) (Atlas of Canada, 6th ed). To its west, the Mackenzie Delta is a river-dominated system discharging 9700 m³/s of water at peak flow into the frequently ice-covered Beaufort Sea. Microtidal conditions exist throughout the Tuktoyaktuk region.

The boundary between the zones of discontinuous and continuous permafrost is located in the southernmost part of the Mackenzie Delta, south of Inuvik (Kettle et al. 1997). The Tuktoyaktuk Peninsula is underlain by continuous permafrost (Fig. 5.4) of depths ranging between 200m inland and over 600m along the shoreline of Kugmallit Bay (Smith and Burgess, 2002). Mean annual near-surface ground temperatures recorded in the vicinity of Tuktoyaktuk are below -8°C (Smith and Burgess, 2000, <http://gsc.nrcan.gc.ca/permafrost/images/whatis1b.jpg>). Active layers develop in the deltaic sediments there in the spring or in summer. In these localities, frost heaving and earth hummocks are prevalent. Patterned ground is also developed in many low-lying areas underlain by silt.



Figure 5.4 (left): Permafrost section, wall of Tuktoyaktuk Ice House (August 2005)

Figure 5.5 (right): Looking south across floodplain on west side of community, pingos visible on horizon (August 2005)

The Tuktoyaktuk Peninsula contains numerous lakes, most of which are extremely shallow. The lakes have formed due to mass movement events generated by the collapse of melting banks of ice-laden sediment, and ablation of permafrost areas. Local degradation of the permafrost, due to warm periods or removal of the insulating

vegetation, results in the development of shallow lakes as the formerly frozen soil melts and subsides or compacts. These thermokarst lakes are most commonly formed in silty sediments and, in combination with submergent influences, appear to coalesce into wetland terrain in coastal zones (Fig. 5.5). Thermokarst lakes may be circular or oval in areas where the permafrost degrades uniformly around a central depression, or may have straight edges meeting at right angles in areas where melting is controlled by the position of ice wedges. The water system associated with the community's designated water supply, Kudluk Lake, has been exhibiting thermokarst degradation.

The greatest amount of relief is provided by the conical ice-cored pingos in the Tuktoyaktuk region, reaching elevations of 45 m above sea level (Fig. 5.6). More than 2,000 pingos are developed in silty lacustrine sediments in the area, but most are less than 5 m high. The largest pingos require several hundred years for growth and have diameters in excess of 500 metres (McKay 1979). They have been used by the Inuvialuit as lookouts and aids to navigation. A federally-designated protected area, the Pingo Canadian Landmark encompasses two pingos directly adjacent to Tuktoyaktuk in the vicinity of the community's dump and sewage disposal area.

A pingo develops in an enclosed lake basin which has recently drained (Mackay 1972, 1979). The insulating effect of the lake water causes an inverted cone of thawed sediment (talik) to form below the basin. As the lake sediment freezes, a lens of pure segregated ice develops. The lens is confined above by a thin layer of frozen sediment. As the permafrost encroaches on the talik cone from the sides, the talik shrinks and the water within the unfrozen sediment is compressed. The consequent increase in



Figure 5.6: Ibayuk, Pingo Canadian Landmark, (a) in February (left) and (b) August (right) of 2006. Note recent slide features visible in (b).

groundwater pressure forces the segregated ice lens upwards. The ice lens in turn forces the thin sediment layer upwards, forming the pingo. The ice lens will continue to grow upwards until either a) the capping sediment layer is unable to bow sufficiently and ruptures, or b) springs open at the base of the pingo, as the groundwater reaches the surface, causing the internal water pressure to drop. The pingos cannot grow indefinitely or to indefinite heights. When the surface sediment layer fractures (Fig. 5.6), the intrusive ice lens core is exposed to the atmosphere, and ablates rapidly. New pingos are constantly forming in the Tuktoyaktuk region, as older ones cease growing. Changes have however recently been observed in the local pingos that are thought to suggest this process may be experiencing climate-induced declines (see Fig. 5.6b).

5.2.3 The Beaufort Sea

The Beaufort Sea is also underlain by subsea permafrost, developed during the past 30,000 years, when sea levels were lower and the southern parts of the sea floor were exposed (Manson et al. 2005). As sea level has risen, the flooded permafrost has

become unstable, as the insulating effect of the water keeps temperatures above 0°C on the sea floor. The subsea permafrost is thus degrading at present.

The Beaufort Sea has been steadily rising for at least the past 30,000 years, and possibly since more than 110,000 years ago. There are no raised marine sediments younger than at least 110,000 years old along the southeastern Beaufort Sea coast. The coastline was approximately 70 m below its present position 30,000 years ago. Sea level is currently rising in this region at approximately 3.5 mm/a, the combined result of crustal response to deglaciation (glacio-isostatic changes) and changes in global sea level.



Figure 5.7: Sensitivity of Northern Canadian coasts to global sea-level rise

Source: Adapted from *Coastal Sensitivity to Sea-Level Rise*, Natural Resources Canada, The Atlas of Canada (www.atlas.gc.ca) with original data derived from Shaw et al. 1998. Contains material © Her Majesty the Queen in right of Canada, 2012.

5.2.4 The Coastal Zone

Coastlines throughout Canada have been examined to determine their sensitivity to sea level rise. The Tuktoyaktuk Peninsula is one of the most sensitive areas

in Canada to changing sea level (Fig.5.7, Shaw *et al.* 1998). The peninsula has low-lying barrier beaches and spits, breached thermokarst lake embayments, and areas of tundra polygons along the shore, composed of un lithified ice-rich sediments. Previous studies have calculated average rates of recession of 1 m/a, with maximum rates of up to 10 m/a. Predicted changes for the Tuktoyaktuk area include flooding, increased thermal and mechanical erosion rates, beach migration, increased rates of freshwater lake breaching, and destabilization of sediments in the coastal zone (Manson *et al.* 2005). The western shoreline of the community has been intensively studied since the 1970s due to concern for ongoing loss of infrastructure resulting from coastal erosion, including damage to a former school and curling rink in the vicinity of the community cemetery (Kolberg and Shah 1976; Henry 1984; Aveco Infrastructure Consultants 1986; Solomon 2002; Johnson *et al.* 2003). Notwithstanding the circumstances leading to the removal of these earlier structures, an Elders' residence – Kiglavak House - was constructed on the same land in 2001 (Fig. 5.8).

Coastal protection measures have been employed, including concrete slabs (Fig. 5.9), rock (Fig. 5.10), sandbags, and beach nourishment, but have proved ineffective under current storm conditions (Shah *et al.* 1982; Trillium Engineering and

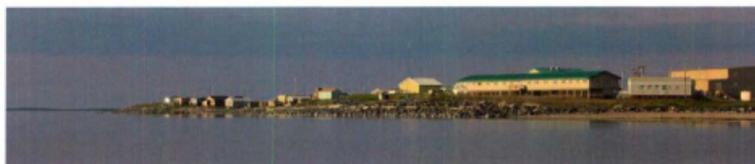


Figure 5.8: North Spit (west side) seen from water. The Kiglavak Elders' residence is the long, low structure seen to right in vicinity of the Aurora College and Health Centre buildings. Note shoreline armouring (riprap and armourstone). *Kiglavak* is the other name for Kidluit Bay located roughly 30 km west of the community near Hendrickson Island.



Figure 5.9 (left): Rip-rap shore protection installed in 1998, North Spit (west side). Note armourstone ‘mobility’.

Figure 5.10 (right): Armourstone at the Point

Hydrographics Inc. 1997). Continued shoreline retreat as predicted by the Geological Survey of Canada (Johnson *et al.* 2003; Manson *et al.* 2005) would impact more than 10 currently existing buildings within the next 20 years, and some areas of Tuktoyaktuk are expected to suffer complete inundation during future storm events. This research has sparked comparisons with Alaskan and Eastern Siberian community impacts and relocations (i.e. Associated Press 2009) and ongoing debate among government and community members regarding whether to erect more coastal protection along the upper peninsula (Figs. 5.8, 5.11), or relocate Tuktoyaktuk altogether. The working consensus that has since emerged instead advocates an incremental abandoning of low-lying areas of the peninsula in favour of new development in nearby areas of higher ground. As quoted in a 2005 Canadian Geographic article, then-Mayor (subsequently MLA for the region) Jackie Jacobson summed up the Hamlet’s position, saying, “The [shoreline protection] seems to be holding up so far, but in the long term, I don’t know what will happen....I



Figure 5.11: Inner Harbour from launch area. Tuktoyaktuk Island (seen to horizon on right) currently protects the harbour.

was born in Tuktoyaktuk and as long as I'm mayor, I'm going to do my best to stay in the community" (Efron 2005).

Acknowledging the attachment of the community to their existing location and the need to address projected erosion risks, Ken Johnson, consulting planner to the Hamlet and the GNWT Department of Municipal and Community Affairs described his community planning approach to the review of the local General Plan and Zoning Bylaws in 2000 as two-fold: first, "...develop a framework for reconfiguring the community", then, "...provide an administrative means to implement [it]" (Johnson 2001). This would entail:

- "Community consultation, in order to gain a sense of the spatial limits in which people will agree to live;
- Engineering, in order to determine where it remains feasible to build and at what cost;
- Stakeholder consultation, for the purpose of exploring opportunities to redevelop other land uses, particularly industry-related use, for residential use; and,

- Land-use policy development, to convey recognition and need for the community to reconfigure itself in the future.” (*ibid*)

5.3 Local Research Process

Together with similar adaptation planning initiatives mounted in Sachs Harbour, NWT and Gjoa Haven, Nunavut, the Tuktoyaktuk case study research was supported by Natural Resources Canada (NRCan) and ArcticNet. The work there thus shared with the others a generalized sequence of adaptation planning tasks as outlined in Table 5.1.

Table 5.1: Tuktoyaktuk Field Work

Phase & Timing	Activities	Stakeholders approached
Preliminary familiarization visit/ local pre-planning August 2005	Community tour with NRCan researcher Preliminary inventory	Hamlet (Staff and Mayor) RCMP Hunters and Trappers Association Community Corporation Local business people
Environmental change and community data compilation February-March 2006	Icebreaker activities (lantern-building) Local consultations (meetings, open house events) employing serial editing Key informant interviews	As above General public Housing Office
Local planning consultations July-August 2006	Local consultations (in conjunction with Coastal Zone Canada conference)	Elders (special session) Youth workshop

The researcher’s first visit to Tuktoyaktuk occurred over a 4-day period in August of 2005 in the company of Gavin Manson, an associated earth scientist from Natural Resources Canada (NRCan) whose fieldwork was examining coastal change in

the region. An earlier visit attempted in conjunction with a regional programme consultation (Fig. 5.12) by Natural Resources Canada and the Department of Fisheries and Oceans in April 2005 was not completed due to poor weather conditions that prevented flights into the community at the time.

The second visit by the researcher early in 2006 was for an extended period of fieldwork timed, as recommended by the community, during the 'dark period'. Over roughly three weeks, the researcher commenced the community consultation process with a series of meetings with key Hamlet staff, small-group meetings with representatives from other community organizations, and three open house events. A summary of the outcomes from this first series of consultations was returned to the Hamlet for feedback.



Figure 5.12: Annual Programme Consultation by Departments of Natural Resources Canada and Fisheries and Oceans with Tuktoyaktuk Hunters' and Trappers' Committee members, Tuktoyaktuk Council Chambers, February 2006.

Lantern-building workshops were also offered in partnership with the Elders' residence (Kiglavak House) as a way for the researcher to meet and get to know other community members on an informal basis.

Unlike the other two case study communities treated by this project, the research completed in Tuktoyaktuk was additionally funded by the Knowledge, Outreach and Awareness Program (KOA) of Infrastructure Canada in 2006. This assistance reflected the well-recognized nature of the infrastructure challenges facing the community. The KOA proposal provided the resources for additional community engagement and led to the development of two working documents: a local adaptation planning background compendium and an adaptation plan discussion paper.

The adaptation planning background compendium was envisaged as a binder of quick reference materials that could be added to as this project and other planning for the locale were undertaken. It was begun during the first extended research visit made to the community in February-March 2006, drawing on grey literature available in Tuktoyaktuk and earlier identified public and scientific records. The contents were periodically revisited and added to throughout the project with the intent that the assembled record might augment the 'memory' of the Hamlet: a great variety of relevant documentation existed for Tuktoyaktuk, but it was apparent that it needed some consolidation to allow useful records to be more readily recalled. These materials also served as the cache of information the researcher drew upon to construct local trend analyses.

The adaptation plan discussion document reflected the outcomes of the local consultations respecting community change, development priorities and opportunities. While returned to local stakeholders for feedback and to foster ongoing dialogue regarding adaptation scenarios and next steps, staff turnover in both the Hamlet Council, other local organizations, and at the regional Municipal and Community Affairs

(MACA) office over the study period frustrated efforts to fruitfully continue the process beyond the period of community visitation by the researcher.

As this was not the first consultative initiative concerning local climate changes, efforts were made to avoid duplication and instead bridge the current research effort with prior efforts. In January-February 2002, a team of researchers had conducted a series of workshops under the project banner *Arctic Climate Change: Observations from the Inuvialuit Settlement Region* with community members in each of Aklavik, Inuvik and Tuktoyaktuk in order to document local environmental change observations. Their results (Nickels et al. 2002) demonstrated both many observations shared across the region, as well as those that were locally unique. Observations attributed to Tuktoyaktuk (Fig. 5.13) were used in consultation materials to serve as both a stepping off point for the latest consultation and as a basis to reconfirm and validate the previously documented conditions.

5.4 Contemporary Development and Change Narratives

Before the impact of contemporary change influences can be fruitfully examined, it is necessary to scan for others which preexist and may condition circumstances today. There are numerous overlapping narratives to be read in the development trajectory of Tuktoyaktuk as a community, each suggesting ongoing adaptive cycles that may in turn be seen to interact with emerging environmental challenges.

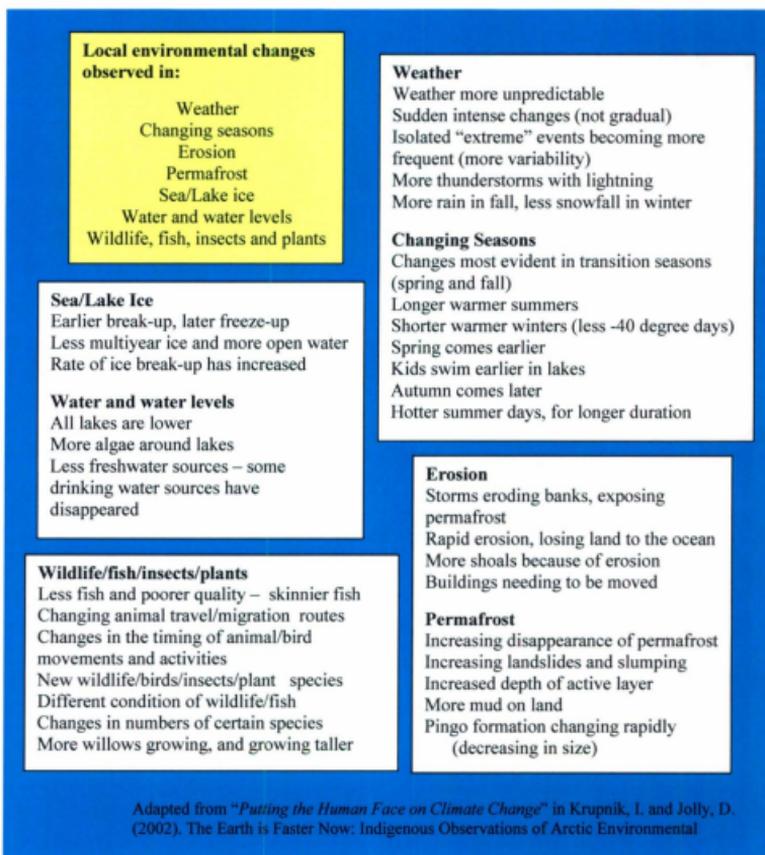


Figure 5.13: Tuktoyaktuk Observations of Environmental Change (c. 2000)

5.4.1 Early Community Development

As earlier noted, Tuktoyaktuk has been home to the Inuvialuit for generations. To their south below the Mackenzie Delta, Peel's River House (a Hudson's Bay

Company post established 1840 and later known as Fort McPherson) was attracting western Inuvialuit traders by the early 1850s. Exploration further north in this period initially encountered hostile reactions but eventually other posts were established in Inuvialuit territory.

Tragically, increasing contact with traders and whalers exposed the Inuvialuit to a variety of new diseases. A series of epidemics decimated the early Mackenzie-region indigenous populations in the 1890s-1910s. Their numbers had rebounded by the 1930s thanks to families moving in from Alaska, Banks Island and Cape Bathurst and Herschel Island. The Hudson's Bay Company post relocation to Tuktoyaktuk, then known as Port Brabant, in 1934 capitalized on the strategic port location. The Anglican and Roman Catholic missions soon followed, as did the RCMP in 1950. That same year, the community was renamed, making Tuktoyaktuk the first native community name reversion in Canada.

Meanwhile, Tuktoyaktuk's port facilities were also being upgraded as marine traffic in the Beaufort region increased. The Hudson's Bay Company's control over Arctic region cargo movement wasn't challenged until the Northern Transportation Company Limited (NTCL) formed in 1934. Tuktoyaktuk has been the major transshipment stop for NTCL's barge runs up and down the Mackenzie River and coastal boats on Western Arctic community resupply routes ever since.

The combination of the construction of the local Distant Early Warning station (1955), the introduction of government services, and the growing interest in oil and gas prospects in the Mackenzie Delta through the 1960s spurred dramatic new community growth. Imperial Oil discovered oil nearby in 1970 and subsequently ramped

up their offshore exploration program, making Tuktoyaktuk their base of operations. By 1976, Gulf Oil and Dome Petroleum exploration crews were also working out of Tuktoyaktuk. Regular air services and the seasonal ice road developed over this period to support industrial activities.

From a rather familiar trajectory of colonial incursion in the North American Arctic, much can be inferred about the dramatic transformation visited on this part of the Inuvialuit Settlement Region in just a single century. The challenges presented to traditional pursuits and values occasioned by the arrival of so many outsiders to the community in conjunction with succeeding waves of development activity were many and varied. The erosion of the language and the traditional roles of Elders within the community, the increasingly sedentary life and changing eating habits associated with the shift to a wage economy, and the readier access to alcohol and drugs are regularly described as consequences of this difficult period in the community's development. The years since correspond with the living memories of many older members of the community engaged by this research project and the emergence of the numerous contemporary narratives of dispossession and recovery on the part of the Inuvialuit.

Through to the early 1980s, offshore oil and gas exploration made Tuktoyaktuk a boom-town. Things died down significantly though in the period following the Berger Inquiry when a moratorium was placed on the fuel pipeline development proposed for the Mackenzie Valley corridor. At least ten years were expected to be needed in order to address aboriginal land claims in the region and so ensure that the peoples who stood to be most affected by the industrial development would be in a position to benefit from it too. It has taken quite a bit longer. In the Inuvialuit Settlement

Region (ISR), self-government has been “in the works” since 1978 when the Inuvialuit Land Claim Agreement in Principle was signed and the transitional process can still be seen in numerous aspects of overlapping or abutting jurisdictions existing between territorial and Inuvialuit governance bodies.

5.4.2 Development Planning in Tuktoyaktuk

In 2006, Elders in Tuktoyaktuk described to this researcher the many ways that the community has changed in their lifetimes. They also recounted numerous stories of development done without regard to Inuvialuit historic occupation and patterns of land use. One family returned from the land in 1954 to find their home dismantled to make way for the DEW Line station. Another family was displaced by the RCMP in the 1970s. Alongside the bureaucratic influences of the state and commercial organizations of the period, the movement towards self-determination throughout the region has brought with it a series of planning and community development efforts at all levels of Inuvialuit affairs.

The dynamics of regional change and the increasingly formalized processes seeking to manage it are particularly apparent in Tuktoyaktuk where it is possible to draw on both a substantial ‘official’ development record and the direct experience of so many residents. As a politically prominent community in the region, there have been many things planned there over the years. Some of these efforts are better recorded than others but every plan that was made is suggestive in some way of not just what people were experiencing at the time, but of the methods that were being employed by various consulting parties. Summaries of a selection of them follow, in chronological order,

beginning with a comprehensive early land use plan for the Hamlet and ending with a recent social impact exercise.

5.4.2.1 Tuktoyaktuk Community Plan (1984)

The 1984 Community Plan is a comprehensive document with background material treating community history, culture, current demographics, economy and recent industrial circumstances. It stated the community development policy – namely the direction and nature of Tuktoyaktuk expansion – and provided a series of detailed project sheets that lay out proposed infill housing and subdivision sites, new roads, commercial and light industrial areas, as well as industrial camp areas on the east side of the Harbour. The relocation and/or upgrading of some municipal facilities was proposed along with the consolidation of more hazardous uses. Key land use area themes are outlined, including the ‘historic’ area around the Lady of Lourdes monument and old community churches (Figs. 5.14-5.15), and the establishment of a commercial-institutional town centre in the vicinity of the Hamlet offices. Extensive landfilling and drainage proposals were also made. The establishment of a Harbour Management Committee to oversee a balancing of community and industrial objectives in the development and operation of the facilities there is noted.

Six residential development areas were described, of which two were in-fill projects and the remainder were proposed as new subdivision areas. In the two decades since, those identified areas have either been filled or have otherwise become or been deemed unsuitable for development. The document treats a number of planning themes



Figure 5.14 (left): Our Lady of Lourdes schooner, on display since 1982 and recently restored, it operated in the 1930s-1950s period as the supply vessel for Catholic missions around the Beaufort region and also carried Inuvialuit children to the Catholic residential schools of the day. Our Lady of Grace Catholic Church seen to right.

Figure 5.15 (right): Anglican Church

that the community was revisiting during the current research project, including shoreline erosion, water supply, and development of the east side of the Harbour.

In 1988, a follow-up study prepared by MACA, the *Tuktoyaktuk Community Growth Options Report*, revisited the theme of new development areas. It identified seven: Reindeer Point, the DEW Line site, the airport, Beaufort Meadows, Area Filling Lakes, the Reservoir, and the East Harbour Community Relocation. The same year, flood risk mapping for the community was published: the “Flood Risk” and “Floodway” areas described were “...designated on an interim basis by the Commissioner for the Northwest Territories and by the Ministers of Environment and Indian and Northern Affairs for Canada...”, presumably with the intent that future development avoid these at-risk areas.

5.4.2.2 The Health Planning Project - Tuktoyaktuk Community Profile of Needs

This 1995 regional health services planning study was one in a series of community profiles prepared based on a variety of existing studies, current statistics and

input from community residents. The report highlights the young population but notes that the high birth rates were being offset by people moving out of the community. A need for childcare services and more recreational activities generally; high turn-over rates in professional staff; overcrowded housing; the high cost of living; and unemployment were all identified as factors affecting health locally. The community was described as struggling with high rates of alcohol use and smoking, and an addiction to gambling.

5.4.2.3 Tuktoyaktuk Future Search: Together we fly into the Future (1998)

A "Follow-up Report" published to document a three-day conference held at Kitti Hall to address the question of how the citizens could make their community healthier. It was structured by a series of participatory exercises geared to "understanding the past" (identifying trends and issues affecting the community) (Fig. 5.16), "finding common ground" (a drama depicting the community as they imagine it will be in 2018), and identifying actions and commitments (both individually and as groups). There were four sub-groups, each with its own action plan. The Health Group committed to support one another, communicate better and coordinate efforts to serve the community at large better. The Inuvialuit/Concerned Citizens Group was youth-focused and committed to organizing a variety of services and activities to better support young people in the community. Similarly, the Business/Elected Group wished to facilitate a variety of youth leadership activities culminating in a regional youth conference. Finally, the Education/Justice Group also planned to pursue new youth-oriented programs based on input to be obtained from young people in the community. The coordinator for the event went on to work with Norterra in Yellowknife.

The Tuktoyaktuk Time Line

1970s	1980s	1990s
Radio came TV came to Tuk A few phones in town Canmar opened Importance of school, education Tuk became a Hamlet Tuk to Inuvik ice road built Running water Household appliances Inuvialuit Land Claim Agreement in Principle, 1978	Jobs that southerners had, northerners now have People from our community furthering education Oil boom and bust Signing of Inuvialuit Final Agreement Fur prices dropped Kitti Hall, hockey arena, new school built Grade 12 in Tuk People started owning homes New health centre Children left alone while parents worked for oil companies Reindeer Point road completed Water reservoir built Tuk becomes a tourist attraction EDO administered by the Hamlet	Inuit Circumpolar Conference 1992 First graduates from Mangilauk school Youth centre built Income Support Program – not Social Services – administered by the Hamlet Oil and gas companies leaving Movement towards maintaining and reviving our cultural heritage Self government negotiations All weather road discussion Hard to get jobs Dewline shut down Aurora College built

Excerpt from *Tuktoyaktuk Future Search* (1998)

Figure 5.16: A community development chronology compiled by residents in a 1998 planning workshop.

5.4.2.4 Tuktoyaktuk General Plan and Zoning By-Laws (2001)

As noted in Section 5.1.4, the municipal plan for the Hamlet in effect at the time this research project took place was reviewed in 2000. The updated documents reiterate most of the themes contained in the 1984 Plan. The principal consultant, Ken Johnson of EBA Engineering Consultants Ltd., worked closely with NRCan geologist Steve Solomon with respect to local coastal dynamics. A concise review of some studies completed in the intervening period, along with inventories and analyses of existing land use, development constraints and concerns, and development opportunities are presented.

An important additional aspect of this planning effort was the survey administered to residents of this part of the community in order to ascertain what they valued about their existing homes and neighbourhood. A strong attachment was observed to the northern half of the community. Other questions were included respecting the existing graveyard, filling ponds, and satisfaction with existing water and sewer services. In a scholarly article published in 2003, Johnson et al. detailed their evaluation of the erosion risks and a cost-benefit analysis of further protecting or relocating infrastructure at risk. This analysis would be expected to underestimate the risks however as it did not account for either existing rates of sea level rise (roughly 3.5 mm/year), increases due to environmental warming, or the projected lengthening of the open water periods.

5.4.2.5 Let's Begin...Social Impact Planning 2006 – Tuktoyaktuk March 14-16, 2006

Undertaken by the Inuvialuit Regional Corporation in partnership with the Gwich'in Tribal Council and the Inuvik Interagency Committee, this was a community training workshop regarding fetal alcohol system disorder (FASD) and addiction that was delivered in a number of communities. The record of the Tuktoyaktuk gathering includes the results of the asset-mapping (people, infrastructure, organizations and programs), community issues identification, goal-setting and planning for capacity-building that were conducted as part of the event. The priorities identified were: (1) Education, followed by (2) Alcohol, and (3) Gambling. Goals and actions are included for the Education priority – all seeking to improve school attendance - with the plan for the short-term being that a delegation of participants would meet with the Tuktoyaktuk District Education Authority (DEA) to discuss the workshop outcomes.

5.4.3 Contemporary Change Observations

From the outset of this project, it was well-recognized that Tuktoyaktuk residents have observed changes in their environment for many years. Shoreline erosion had been noted for decades with some Elders being able to recall the northern extent of the Spit as having once been a substantial beach with a small pond. The changes in this shoreline through time had been reconstructed by aforementioned NRCan researchers using aerial photographs and current satellite imagery (Figure 5.17) and consultation period feedback accorded well with this record.

Residents have definitely gauged change in relation to their observations of the North Spit and the Point more generally, where most agree the rates of retreat have accelerated in recent years, despite the shoreline protection measures that have been installed. Most also recall that in 2004 the local RCMP detachment was forced to remove several buildings. Among older residents, as well, reference is made to the loss of the former curling rink located on the southwest side of the peninsula in the 1970s, and the series of shoreline armouring and supplementation experiments that have since been conducted by consulting engineers. Several critical assessments of the engineered methods employed were offered during the consultation period. Elders commented too on the slower change trajectory of Tuktoyaktuk Island and the Harbour mouth (Fig. 5.18)

5.4.3.1 Public Works Staff Observations

The couple of decades spanned by the sampling of planning efforts documented above correspond with the period over which many residents describe becoming increasingly aware of local environmental changes more generally associated

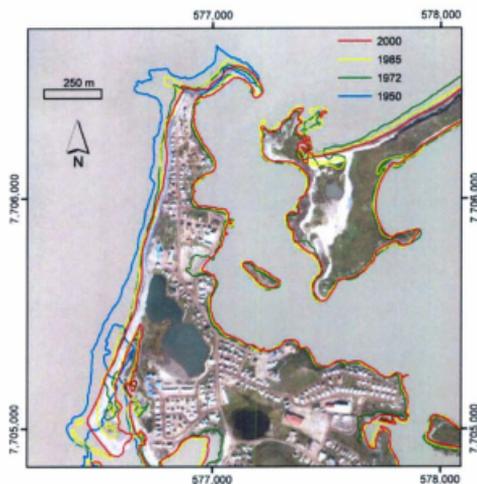


Figure 5.17 (left):
50-year reconstruction of shoreline retreat on north edge of Tuktoyaktuk.
Sources: Natural Resources Canada courtesy of S.M. Solomon (data). Contains material © DigitalGlobe.
Figure © Her Majesty the Queen in right of Canada, 2005, with permission.

Figure 5.18 (below):
Residents' observations of changes in barrier islands
Sources: ATLAS GIS (Satellite image 09/2010) © GNWT.
Contains material © Space Imaging.



North Tuktoyaktuk Conditions

Public Works Staff Observations – August 2005

Legend

Potential Breach Corridor ⋯

Pingo P

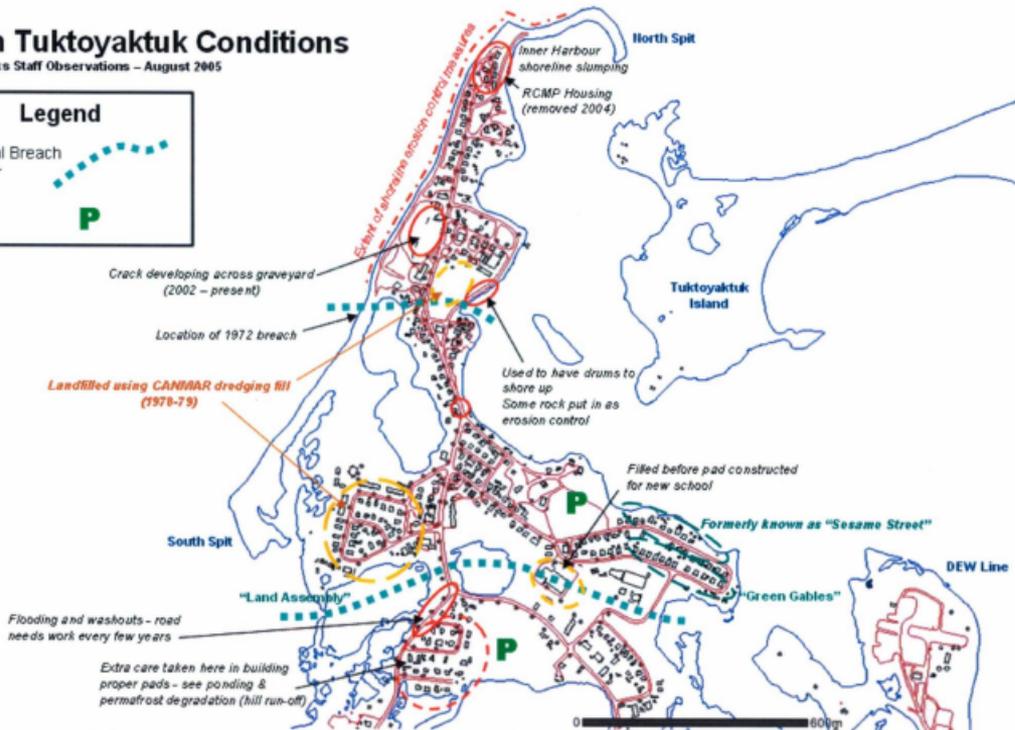


Figure 5.19: Public Works Staff observations – August 2005

Base Map courtesy of GNWT (ATLAS GIS)

with recognized regional warming trends. As might be expected, the key informant interviews conducted by the researcher with Hamlet Public Works staff were replete with accounts of physical changes around the community in this period (Fig. 5.19).

Storm events have more frequently resulted in flooding and erosion of some roadbeds: in particular, the raised bed constructed below the Northern Store (a landfilled area) and the road accessing the subdivision area to the south of the Land Assembly in the vicinity of the Baptist church. The latter area seems to also be experiencing more pronounced permafrost degradation and ponding, thought to be in part due to the adjacent pingo. These two "weak points" correspond with east-west corridors (ibid. – note blue dashed lines) across the peninsula that already flood and which staff believe may completely breach in a serious fall storm in years to come.

These in turn suggest emergency planning considerations not yet addressed by the Hamlet or Fire Department first responders: were either or both of these corridors to flood and their roads be washed out, critical infrastructure and services would be seriously compromised for some or all of the residents. Health services located in the Nursing Station, and the fuel and other supplies at the Northern Store on the Point could be cut off from the rest of the community. The second breach corridor crosses through the institutional area where Tuktoyaktuk's school, community hall, youth centre and recreational infrastructure are clustered. Further to the south lie the community fire hall, airport, water reservoir, and power plant, all of which could then be cut off from the majority of the local population.

It must be noted that Tuktoyaktuk was uniquely fortunate in having in their Public Works Superintendent, Peter Nagosak, someone who had held that position for

many years and was thereby in a position to speak from a very deep knowledge of the townsite, its infrastructure, and emerging issues that would require attention. This individual was the most experienced staff member in that domain that was encountered in the three case study communities during the research period. He was also the only Hamlet staff member observed to have an established working relationship with an external scientific resource person: a failure in the water line running across the Harbour delayed the refilling of the community reservoir in the fall of 2006 and was investigated with help of Steve Solomon (NRCan) and some of the bathymetric mapping that had been conducted there.

5.4.3.2 Elders' Observations

A second consultation avenue that yielded particularly valuable insights into local changes was a gathering of nineteen community Elders convened with the assistance of the Community Corporation, a couple of Inuvialuktun speakers, and several supportive community members on 14 August 2006. It was by far the most animated of Tuktoyaktuk group consultations. Notably, the assembled group was of a mind that some negative changes had occurred as a consequence of development decisions taken without the benefit of Elders' advice, particularly since the Hamlet government was established. As their observations were far-reaching, varied and spoke so clearly to the experience of the continuum of change in the community, the following account reflects the full scope of their commentary that day.

The impacts of erosion and flooding were described throughout the community. At its most northerly extent, the rapidly receding shore had caused people to

move former camps from Tuktoyaktuk Island and the Point. It is expected that Tuktoyaktuk Island will "break open in the middle" in years to come.

Thinking back to the 1940s, some participants recalled a small former island in the Harbour off Tuktoyaktuk Island.

In reference to ongoing erosion control on the northwest flank of the Point, the Elders' wondered if the evident shifting of the armourstone that had been installed might be making things worse: contributing to further erosion and preventing the accumulation of sand needed for the former beach to rebuild itself. It was suggested that these very costly boulders might be more effective if they were put out further in nearshore waters to create barrier or crib that would catch gravel and sand.

The old Graveyard was known to be experiencing problems. The prominent pingo at the edge of the Harbour (and north of the new school area) was said to have started eroding in the 1950s. Serious problems were pointed out with the community dump, located at water's edge and regularly flooded. Concern was expressed about the impact it was having on fish as the flesh in those caught in the area is unnaturally red.

The biggest storms occur in the fall and are creating evermore serious episodes of overwash in the northern part of the community, with Elders giving the government building near the Lady of Lourdes mission boat monument as an example. That same area was later described as experiencing severe ice pile-ups that were getting dangerously close to houses in the worst of West winds. The Elders said they could see that different places would be needed for these houses very soon.

An Elder commented that the ocean water had been very high all that July and that it had been a very wet month. He described the East wind as being particularly strong.

Others described development that had gone wrong. One Elder explained that when she was young, she'd been taught not to dig into the ground as it harms the land. Besides pointing to problems with buildings in the vicinity of sensitive features like the pingoes, the example was given of the accelerated erosion seen following the removal of material from former sandbars near what's now Kiglavik House (the Seniors' Residence) which was seen to have removed the shore's natural protection. It was emphasized that great care needed to be taken in selecting fill supplies anywhere in the area but especially from shore sources. Examples were given of the changes in the barrier sand spits off the Parks Canada Pingo site that had once been used for fill, and of serious erosion at pipeline gravel sites seen along the Mackenzie River near Reindeer Station

Other health-related concerns were raised. Dust from the local roads was seen as an ongoing problem as many in the community suffer from asthma. The Tuktoyaktuk sewage lagoon was also referred to as overflowing and needing to be relocated to a safer site. People were said to be getting sick from eating locally harvested animals and from drinking the water here. There are believed to be numerous instances of cancer and other illnesses in the community that have a connection to either PCB-contamination (associated with the DEW Line) and the former DDT flight spray program practices in the region (the operators were described as never notifying people when spraying would be happening so residents would often come home to find black spots left on their laundry or their drying fish or meat). These impacts are particularly worrisome as they describe

their local health system as poor, chronically short-staffed, and troubled by too much turn-over.

The Elders noted sightings of new and different bugs and birds in the area, and indicated that they believed the numbers of bugs had also increased. It was speculated that many of the newcomers were coming up on the barges from Hay River.

A number of economic concerns were raised. Climate changes already affect hunting activities and may present a number of business development issues for outfitters in the region. Harbour activity is expected to increase but workshop participants indicated that they didn't want to see dredging there as they feared it would destroy important herring habitat. The Elders also thought that companies involved in forthcoming oil and gas development might play a greater role in addressing some local issues, particularly where funding currently is lacking. It was suggested that since oil companies use incinerators in their camps, they might be asked to provide the community with a large incinerator [or better, environmentally-friendly technology] to address the local garbage problems.

With regards to 'new' technologies, it was noted that there was a currently operating [wind] charger out at Saunatok (Husky Lakes) in addition to a pole past the Tuktoyaktuk sewage lagoon that was being used to sample wind strength. The Inuvialuit have in fact been making a number of early experiments with wind power/wind mills including one in Stanton and "wind chargers" operated by Fred Carpenter and Paul Adam in 1940s.

There was discussion around other 'experiments' in the community. Unlike so many other Arctic communities, there was no local Co-op: it had been tried but hadn't

worked out. Similarly, opportunities for development involving *muktuk* and other traditional foods encountered difficulties due to meat inspection regulations, a lack of a reliable freezer facility, and a lack of a packing plant.

The Elders described numerous housing-related issues, pointing out that the community never used to have homeless people. There are many sub-standard houses now in Tuktoyaktuk: many experience serious ventilation problems, worsening shifting (less so for those dwellings on pilings), and it was noted that one Elder's roof had been seriously damaged by high winds during a recent storm. The Elders hoped to hear more about how local changes in permafrost might be measured and monitored.

Returning to the difficulties they observed in the community, the topic of food and the continuing importance of locally harvested goods was raised. It was stated that freezers had been provided on a subsidized basis to households in Paulatuk to better accommodate provisioning as both major hunts became more sporadic and former ice houses were lost. A relatively new Food Bank partnership was also noted.

The need for the upgrade to the Reindeer Point road was also discussed with reference to recent difficulties that were experienced with the bus runs there.

In closing, it was reinforced by the Elders that future planning efforts needed more of their input. This was explained in part by the manner in which some people only think about changes that may happen in own lifetime – not in their grandchildren's lives, a perspective that the Elders' experience is likely to correct. The Elders however also indicated that they needed transportation put in place to allow them to get to other public meetings.

The observations of the Elders highlighted the numerous features of the human development history of the area that are easily missed in more narrowly focused reviews of events. The textured narratives of changes seen, things done and what happened next are key to discerning not only the cycles of adaptation that have been played out in the community, but their legacies too as they may inform current experiences.

5.5 Consultation Outcomes and Discussion

A powerpoint slide deck was assembled as a facilitation tool for use in the local consultations during February-March 2006. The presentation introduced the research plan and provided an overview of earlier and ongoing climate change work conducted by other scientists, in particular the ongoing NRCan research of Gavin Manson, Steve Solomon and Steve Blasco. Participants were then invited to describe how the community had developed, what issues were arising, and what sorts of development were desired in years to come. Material for this final portion of the slide deck was initially based on recent community documentation and preliminary feedback from Hamlet Councilors and staff. The presentation was modified following each consultation event based on feedback.

A summary of the consultation outcomes, including the special gathering of Elders, was compiled for distribution to the Hamlet and regional Municipal and Community Affairs staff. The serially-edited list of local development concerns and needs was reproduced there slide-by-slide as they appeared in the last publicly-discussed version of the presentation.

The thematic outcomes of the various consultation gatherings were then consolidated with other community information and reorganized using the tabular analysis process into the following seven topic areas:

- Community Lands and Physical Hazards
- Core Community Services and Utilities
- Transportation and Communications
- Residential Infrastructure and Services
- Economic Infrastructure and Services
- Public Services
- Community Wellness

A discussion of each follows, accompanied by their respective theme tables. Therein, the ‘temperature’ of the specific issues or topics raised is suggested, and the overall condition of that category of community circumstances similarly portrayed using the colour key provided.



Figure 5.20: The Point and North Spit viewed from west, August 2005

Storm Surge Flooding at Tuktoyaktuk Map 3: Flood Depth in 2050

Garvin Manson, Steve Solomon & Dustin Whalen
Geological Survey of Canada

For more information or additional copies contact Garvin Manson
gman@gsr.gc.ca
3525-425-3146

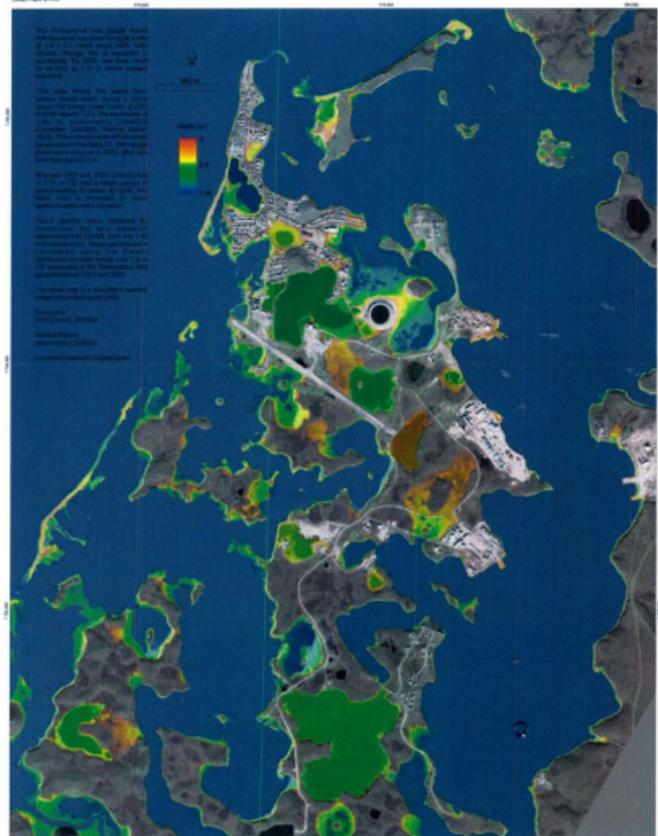
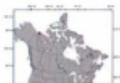


Figure 5.21: Storm surge flood simulation for Tuktoyaktuk under a plausible scenario of sea-level rise in 2050. This poster-format document was on display in the community during the research period. Source: Natural Resources Canada, courtesy G.K. Manson, S.M. Solomon and D. Whalen. Contains material © DigitalGlobe. Figure © Her Majesty the Queen in right of Canada, 2005, with permission.

5.5.1 Community Lands and Physical Hazards (See Table 5.2)

Tuktoyaktuk residents have observed many environmental changes in the last few decades that are consistent with the warming conditions documented throughout the Beaufort region. Receding shorelines and flooding, deeper permafrost layers in summer, and changes in local pingos have been reported in the community. While the ocean-facing sides of the Point and North Spit have been the subject of a series of erosion control experiments (see Figs. 5.17, 5.20), they have continued to retreat on the west bank prompting the designation of restricted development 'Erosion Risk Area' there with the last review of zoning by-laws (UMA 2001). RCMP housing at the top of the Spit was removed in 2004 and there are other properties in the vicinity that will soon also need to be relocated. Numerous accounts were given in the course of local consultations respecting shifting foundations, washouts, and erosion of banks elsewhere in the community. As infrastructure elements are replaced, or relocated in the instance of those beside an eroding shore, their design and siting need to take account of the fact that the entire community sits on ice-rich ground that will continue to change in years to come.

Improving drainage and adding fill to address wet ground conditions in some prospective in-fill areas will address their immediate shortcomings, but longer-range planning must also take into account the flood risk projections for the entire community area (Fig. 5.21). In addition to the measures taken by the Hamlet, some residents have armoured their own shoreline properties using emptied oil drums (Fig. 5.22).

Theme	<i>Material</i>		<i>Relational</i>	
	Resources	People	Organizations	Relationships
Little suitable land for new development ●	Most identified potential building sites within the existing planning area have been claimed. This cross-cutting resource scarcity theme repeatedly points to the need for determining the will of community vis-à-vis relocation	Pop'n relatively constant due to variety of factors including transience. Certainly not encouraged to stay , however, by difficulties in obtaining suitable housing, and limited services and local work opportunities.	Land Use Plan administered by Hamlet Housing Association is another key local organizational stakeholder All community organizations have an interest in this matter.	Failure to address prevents short and longer-term options identification in a number of areas, Catch-22 in relation to off-shore development opportunities, compromised infrastructure lifecycles will have pervasive community impacts/costs
Coastal erosion/flooding ●	Affecting the Point/North Spit in most pronounced fashion but also affecting airstrip and suggesting access 'choke points' in case of emergency	Individual properties and households affected, few means to address property risks Public works staff with long experience.	Longstanding and deepening Hamlet issue (resident safety, relocation options limited), RCMP infrastructure already moved	Chronic experience involving consulting engineers, geoscientists, civil servants, politicians.
Permafrost degradation ●	Cross-cutting influence that both destabilizes existing infrastructure and diminishes options for replacement Building cracking and settling occurring throughout community	Individual properties and households affected, some conventions in infrastructure design available to address property risks Public works staff with long experience.	Presents potential issues to all with property/capital assets in community.	Information needs suggest ongoing geoscience and engineering support required.
Former dumpsite issues ●	Former dumpsite in at least one landfilled area of community - exhibiting terrain movement	Residents expressed concerns regarding deterioration of potentially contaminated ground	Hamlet, CC, GNWT; other organizations with connection to wastes (i.e. Gov't of Canada re: DEW Line)	Legacy of landfilling suggests other factors requiring further research (i.e. variable terrain change response, contaminants)
Gravel sources ●	Limited supplies and needed for new development, terrain/infrastructure maintenance Access road to Gravel Source #177 (approx 22 km. SE of town) proposed	Well understood challenge - knowledgeable community members and corporate parties are available.	Significant cost implications for Hamlet road maintenance and other groups with significant property holdings and/or construction plans Tuk-Inuvik Hwy planning (GNWT, ILA, AANDC) also has bearing on this matter.	Quarrying and land use approvals required (GNWT, ILA) 20-year forecast and evaluation of potential supplies done as part of IFA implementation (Nesbitt & Howell 1988)

Less stress
More predictable

uncertainty

Significant stress
Pervasive impacts



Figure 5.22: Property armoring on Inner Harbour-side of community, August 2006

The Hamlet has been fortunate to have well-experienced senior staff in their Public Works department. As evidenced by the detailed ground condition and infrastructure condition accounts that the department manager offered the researcher, ongoing informal monitoring of local terrain has informed operations for some time. As more experienced staff near retirement, the Hamlet will need to be mindful of the tremendous benefit that their accumulated knowledge of the particularly challenging local conditions represents. The potential exists for a significant loss in capacity should there not be both succession planning and time dedicated for replacement staff to learn from their predecessors.

There are few suitable sites for new development left within the existing town planning area. Higher density developed areas in the oldest parts of the community tend to be the areas exhibiting the most problems. This prompts several questions:

- (a) Is repair or replacement of property there advisable?

(b) Is there currently suitable or potentially recoverable terrain nearby that allows for relocation?

(c) Might development densities in existing lower-density developed areas (i.e. Reindeer Point) be increased to offer in-fill options for relocation?

Although these considerations have been examined to some extent in the latest community land use planning cycles, there is little evidence that any of them are in practice being addressed on more than a case-by-case basis as the need arises. Under foreseeable circumstances of continual terrain change, detailed ground surveys should be conducted by any developer prior to proceeding with constructing new infrastructure in the Hamlet area. In order to manage remaining community lands appropriately, the Hamlet Council also must monitor and anticipate the general condition and constraints affecting the local land base.

There are several townsite areas requiring special attention. Pingos are not unique to the Parks Canada protected area southwest of the Hamlet: two other smaller ones exist within the existing built-up area of the community, necessitating extra care in construction and property maintenance in their vicinity. In addition to generalized permafrost-related changes, development on landfilled areas may face some additional challenges. There is already marked terrain change identified in one such area that was formerly a community dump. As little is known about the materials buried there, the possibility of an eventual remobilization of long-frozen contaminants cannot be discounted. During the consultations, it was proposed that an inventory be made of all former garbage/waste disposal sites, acknowledging the presence of several of potential

concern. In effect, this would be the domestic equivalent of the monitoring that has begun recently of the several decades worth of drill waste sumps (shallow containment trenches dug into the permafrost) throughout the Mackenzie Delta region (Jenkins *et al.* 2008, Kanigan and Kokelj 2010).

A 1980s period subdivision commonly referred to as the “Land Assembly” (south of the current RCMP compound) and the ballfield area south of the Northern Store were each extensively filled using harbour dredged materials provided by Canadian Marine Drilling Ltd. (CANMAR) in 1978-79 (See Fig. 5.19) in the wake of Dome’s early exploration work based in the community. Similarly, the existing school site was landfilled prior to the building pad being constructed (Fig. 5.23).



Figure 5.23: Panorama view from flood-prone neighbourhood to central east side of community, looking from north through southeast. Jason Jacobsen Youth Centre, Kitti Hall, arena and pool (domed structure) to left; NWS Station on horizon to right. This general area falls within one of two projected breach corridors in the northern portion of the community.

The DEW Line site in Tuktoyaktuk was operated from 1957 through to 1993 (Fig. 5.24). The existing radar tower, communications and storage buildings are part of the North Warning System infrastructure operated on the same site since 1990. The footprint of the former station remains although site remediation was completed in 2005. Notwithstanding this most recent clean-up, concerns remain over contaminants that may remain buried elsewhere in the community from earlier operations.



Figure 5.24: Panorama shot from former DEW Line (now NWS) access road looking north. Water reservoir on horizon to left. August 2005. Note driftwood – evidence of prior storm action and flooding extent.

Given the small remaining land base within the existing community area, exploration of long-range development options for the community must begin with the current planning cycle. The time has clearly come for adjacent areas to be reevaluated with an eye to the option of expanding the existing community boundary. ILA land transfer processes would need to be anticipated for any potential development areas falling outside the existing municipal area, an exercise known to take a very long time. This avenue would entail significant infrastructure and service costs, particularly in respect of the extending of the local road network, so time will also be required to rally budgetary resources to proceed with any implementation. As any properties replaced currently would be expected to survive into the high risk timeframe suggested by NRCan's flood risk projections, it is already appropriate to consider the prospect of their later relocation in their design. A phased retreat of the community infrastructure and services from highest-risk areas could be conceptualized and implemented in the interim to discourage community investments in areas slated for relocation. A similar phasing would presumably follow for any community expansion area.

The question of where the Hamlet can expand to will need further research. Just as remaining vacant lands within the existing Hamlet boundaries will need to be

monitored for future flooding and permafrost instability, areas outside the existing boundaries require much the same attention since ground conditions are similar throughout much of the area. Building on the southeast side of the Harbour – an area that would require the construction of a bridge to access – has been discussed in the past and is now clearly back on the table for discussion.

5.5.2 Core Community Services and Utilities (*See Table 5.3*)

Tuktoyaktuk has a trucked system for water and sewerage. Currently, the Hamlet has three water delivery trucks to serve the community and allow for back-up in the event of a breakdown. The town's seasonally-filled reservoir (an engineered, earthen lagoon structure with a storage capacity of roughly 90,300 m³), pumphouse and truckfill station (where chlorine is added to the supply immediately prior to delivery) are located on infilled land to the southeast side of the older community area. They were built in 1984. Dredged material from the Tuktoyaktuk Harbour was used to fill this area.

The Town's existing water supply, Kudluk Lake, is located on the east side of the Harbour (Fig. 5.25). A semi-permanent water line has been run across the harbour and is used to refill the reservoir late in the summer each year. At the time the community was consulted, there had been several recent problems with the water system. A fuel spill on the edge of the lake contaminated the supply in 2005 and its recertification delayed the refilling of the reservoir. Residents complained that the spill was never appropriately announced to the public, thereby raising even more concerns.

Changing ground conditions associated with permafrost melting in the land around the water lake have already resulted in breaching and a decline in the volume of

Table 5.3: Core Community Services and Utilities - Local Themes Break-out Summary

Tuktoyaktuk Consultation Outcomes - Theme Break-out II

Core Community Services/Utilities



Theme	Material		Relational	
	Resources	People	Organizations	Relationships
Water supply sustainability 	Water quality issues (lower water levels and watershed fuel spill episodes), as well as thermokarst degradation affecting source (breaches, recharge rates).	Many in community and Elders in particular prefer ice sourced from a few area streams for tea and drinking water	Hamlet maintains reservoir and fill pipeline (across harbour). MACA provides water quality oversight. ILA would be involved in establishment of new/back-up supply identification.	Source located outside community planning area boundary
New dumpsite required 	Current shoreside dumpsite is in flood zone. Burning occurs to reduce volume of garbage as there isn't sufficient fill to otherwise cover		Hamlet/MACA (municipal infrastructure), ILA (new site identification/review)	Site separation requirements not possible to meet within current planning area boundary
Sewage Lagoon discharges into nearshore 	Create second nearshore lagoon? Extend drainage infrastructure to beyond sand spits?	Concern raised by Elders in relation to marine species taken locally.	Hamlet/MACA (municipal infrastructure), DFO (discharges/fish health)	Adjacent Pingo National Landmark (Parks Canada)
Alternative energy (wind power?) 	Experiments with wind turbines in area suggest opportunity to diversify/augment existing power supply	Generator noise from Power Corp. plant is disturbing to some residents of Reindeer Pt	Hamlet, NTPC	Aurora Research Institute GNWT (Wind-turbine Power Pilot) - Dept. of Environment and Natural Resources (ENR)

Less stress
More predictable



uncertainty

Significant stress
Pervasive impacts



Figure 5.25: On approach to Tuktoyaktuk over lands on east side of Harbour and looking southwest. Note progression of ablating thermokarst basins towards coastal zone.

the supply. In 1998, a failure at Freshwater Lake sent a deluge downstream to Kudluk Lake, creating two more breaches there. The water supply lake levels dropped quickly and, despite repairs made since, holds less water and will remain at risk of further breaches. In 2006, the fill line was damaged and had to be replaced before the reservoir could be refilled. Notwithstanding these supply issues, community water quality has been documented as improving over the research period: the supply has generally met current water quality requirements, water testing has been undertaken more frequently, and plans are underway to further improve the existing system (GNWT 2010).

Sewage is dumped untreated into a 5.9 ha natural coastal retention lagoon four kilometres southwest of the airport (Fig. 5.27). The system capacity is described as sufficient to serve a community of 1,900 (EarthTech 2005). Residents comment that they



Figure 5.26: Ice blocks outside Kiglavak House

worry about the potential for fish to be contaminated by the annual sewage discharges each fall into the nearshore below the community. It was believed that an extended outfall might serve to ensure the wastes are better diluted and remain offshore. The siting of the sewage lagoon in the immediate vicinity of the Pingo National Landmark was also criticized as constraining the potential for touring and interpretation in the area.



Figure 5.27: Sewage Lagoon (a) panorama and (b) dump station, August 2005

Concerns were expressed on numerous occasions by Elders respecting the anticipated consequences of further industrialization in and around Tuktoyaktuk. One Elder raised questions regarding future industrial grey water disposal, noting that the current sewage lagoon was in no way suited to the needs arising from a growth in offshore oil and gas development. Giving as an example the dying willows and grass above the sewage outfall and overflow above Inuvik, he recalled the waters of the

Mackenzie River once being a source of drinking water but that this was out of the question now.



Figure 5.28: Dumpyard panorama, August 2005

The current dump (Fig. 5.28) is already regularly flooded and should be replaced and closed as soon as possible. As there is so little fill available locally, refuse is regularly burned to reduce its volume before covering.

The community's electrical service provider is the Northwest Territories Power Corporation (NTPC): their three diesel generators have a total installed capacity of 2,205 kW (NTPC website). Experimentation with alternative energy, however, is not new to the Inuvialuit. During the consultations, reference was made to recent wind turbine investigations undertaken in partnership with the Aurora Research Institute and, in 2009, the Hamlet agreed to participate in a GNWT wind-power pilot initiative (Associated Press 2009) expected to be in full operation in 2011.

5.5.3 Transportation and Communications (*See Table 5.4*)

Increased freeze-thaw and storm damage have been affecting Hamlet roads. The Hamlet's Public Works staff noted several areas in town that have repeatedly required road repairs in recent years. As discussed in Section 5.4.1, in conjunction with the NRCan flood risk scenario, these observations suggest likely weak points or areas of

breach which may accompany future episodes of more serious storm surge flooding. This is an element that the NRCan projection does not capture, but that should be incorporated in future serious storm event scenarios for emergency planning purposes. Lost road connections would exacerbate conditions in a flood event by physically dividing the community, cutting off access to critical services (i.e. airstrip, fire-fighting response, water and sewerage) for some or all residents.

At the time of the consultations, the Hamlet had acquired a bus for offering regular transit between Reindeer Point and the older community area. It was experiencing mechanical problems though, believed to be related to the rough condition of the road it traveled over.

It was noted that dust from local roads was an ongoing problem and that many people in the community suffered from asthma. Formerly, waste oil was used for dust control on town roads but this practice was phased out in the 1980s.

The generalized warming trend observed in the Western Arctic has contributed to marked variability in the freeze-up and break-up dates that define the operating period for the ice road to Inuvik (Fig. 5.29). In 2006, however, the ice road opened late but stayed open longer than it had in a couple of decades according to consultation participants. After several decades of discussion, the prospect of a permanent road link to Inuvik was moved one step closer to being realized with the announcement of an Environmental Impact Assessment in 2010, followed by a \$150M commitment to developing the highway in the March 2011 Federal Budget (CBC 2011).

Table 5.4: Transportation and Communications - Local Themes Break-out Summary

Tuktoyaktuk Consultation Outcomes - Theme Break-out III

Transportation and Communications



Theme	Material		Relational	
	Resources	People	Organizations	Relationships
Community road development and maintenance 	Critical infrastructure susceptible to increased freeze-thaw, ground condition changes, flood events and storm damage Current lack of suitable fill contributes to high maintenance costs	Ongoing maintenance by Hamlet staff – significant knowledge base and monitors of change	Used by all, Hamlet maintains. Currently lacking plan for emergency access in event of major flood event /road breach risks.	Bellweather of terrain changes, enabler of so much of activity in relatively large and spread-out community.
Ice road travel disruptions 	Not open as long	Well-used by residents, government, businesses – major economic link	Hamlet/GNWT (DOT), Community Corporation/ILA	Permanent road link a development target since 1980s Latest study done in 2009-10, referred to EIRB in 2010; permissions will be needed from NWT Water Board, DFO, Transport Canada and AANDC
All-season Access road needed 	Access road to Gravel Source #177 (approx. 22 km. SE of town) as possible first leg?		Hamlet, GNWT	
Reindeer Pt. transit system 	New community bus but road in such poor condition that Hamlet fears vehicle may require extraordinary maintenance	Serving as school bussing for youth and general transportation for others.	Hamlet, Community Corporation.	Means of 'bridging gap' between available development area and existing community services.
Airstrip erosion 	Deteriorating conditions prompting question of whether consolidation or relocation more appropriate	Well-used by residents, visitors, government, businesses – major economic link for community	Aklak Air (passenger and freight service) CED/Industry interests	Community has sought longer runway to handle larger planes (industry/tourism opportunities)
Expanded public internet access 	Significant service improvements in period since consultations	Remains an issue for households unable to afford service although public access terminals available	Private service provider (Community Access Program public access site host?)	
Harbour operations 	Major marine port facilities for region. Concern expressed about ongoing erosion of barrier island (Tuktoyaktuk Island)	Significant number of small boat operators locally in addition to major industrial interests	Hamlet, Community Corp. Harbour Committee Corporate entities GNWT (Transportation)	Key facility relative to regional industrial development prospects. Deep-water port development likely to entail dredging.

Less stress
More predictable



uncertainty

Significant stress
Pervasive impacts



Figure 5.29: Panorama of west-central neighbourhood area, Part 1 – looking North towards entrance to ice road, March 2008

Figure 5.30: Panorama, Part 2 – Looking South towards airport and Polar Continental Shelf premises

The James Gruben Airport (CYUB) is located on the southwest flank of the community (Fig. 5.30-5.31) and has been experiencing ongoing issues with erosion on northwest edge of its 5000' gravel runway. A shortened runway could prevent larger planes from landing, thus potentially compromising local tourism and economic development opportunities. Tuktoyaktuk has counted among the numerous northern communities that have been seeking runway extensions for some time. Most recently, a GNWT-commissioned 'Airport Runway Issues and Optimal Lengths Study' determined that Tuktoyaktuk had experienced a 15.8% decline in overall flight movement since 1996, the largest in the NWT (LPS 2007, p. 2-4). It was also, however, one of a handful of mid-sized NWT airports experiencing growth in commuter-sized (up to 19 seats) aircraft traffic. At the time, scheduled air services offered by Aklak Air provided 18 round trips per week to Inuvik with the lowest average one-way fare for the 127 km flight being \$126.00. The study estimated the cost of upgrading Tuktoyaktuk to a 6,000 foot runway was in the order of \$2.4M not including land costs. Notwithstanding the spike in flight

activity that might be expected to accompany oil and gas development in the region, no need was seen to extend Mackenzie Valley community runways. Although no extension was recommended, it was noted that runway paving might be sought by oil industry users but that such upgrades should be at their cost.

Interestingly, the same study characterized the Tuktoyaktuk airport as being at medium risk of climate change impacts. Their assessment rubric (*ibid.*, p.5) was described in relation to three major impacts of changing weather patterns that would need to be monitored, as follows:

- Reduced strength and durability of runways
- Structural impacts (e.g. footing deterioration) to buildings
- Operational changes stemming from poor flight weather conditions to be addressed in part by improved navigation aids.



Figure 5.31: View from road south of airport looking from southwest through south, August 2006
Visible from left to right are pingo – embayed driftwood – airstrip - DEW – NTCL – Boss Camp – EGT-
Beaudril Camp – Power Plant

Tuktoyaktuk Harbour was addressed primarily in relation to regional transshipment and exploration operations. The extent to which the Inuvialuit residents personally rely on marine transportation has greatly diminished in the last couple of generations (Fig. 5.32). At the time of the consultations, little detail was forthcoming about local development plans on the part of oil and gas interests, or the Inuit-controlled NTCL. The expansion and/or relocation of some shoreline facilities was expected though.



Figure 5.32 (above): Retired schooner in backyard

Figure 5.33 (below): Wharf on Inner Harbour – used by vessels and float planes.

The inner Harbour (Fig. 5.33) is currently screened from the worst of the area's storm wave action by Tuktoyaktuk Island; the island, however, is currently eroding at the rate of 2 m/a which means that by 2050, it will no longer provide a significant barrier (S. Solomon, *pers comm.*) Operationally, questions were being asked about what could be done to extend the life of the Island. In anticipation of increased ship movements and the likelihood of deeper-draught vessels operating in the region, dredging of the Harbour was once again under discussion, as was the removal of the iconic caisson that has sat there for so many years.

A local radio station, CFCT-AM was established in 1971 thanks to a financial, technical and administrative partnership between a local priest, Father Robert LeMeur (C.M., o.m.i.) and CHUM Ltd. (Toronto). The Canadian Radio-Television Commission is recorded as having seen the effort as "...a useful experiment in its determination to developing broadcasting service in isolated areas of Canada" (Billboard 1971, p. 50). The station provided a few hours of daily local programming in English and Inuvialuktun in addition to CBC Northern Service broadcasts. It proved difficult to maintain, however, so, after many years of financial problems, its license lapsed in 2005. Regional CBC broadcasts originating in Inuvik are instead rebroadcast now under the call sign CBAC. The Hamlet maintains an intermittent television broadcasting service which is most regularly used for bingo games.

Local internet services have been improving but during the consultation period, residents had expressed a need for expanded public internet access.

5.5.4 Residential Infrastructure and Services *(See Table 5.5)*

As earlier noted, land suited to new development is a dwindling commodity within the existing Tuktoyaktuk community area (Fig. 5.34). Identifying suitable land for new housing is a significant issue.

The supply and condition of housing in the community has been a longstanding concern. There are a few undeveloped housing lots remaining in the community's most recent (c. 1990s) subdivision, Reindeer Point, a higher area of land at the southern end of the Hamlet, nearly five kilometres from the older part of the



Figure 5.34: On approach to southern extent of Tuktoyaktuk, looking northeast, August 2006. Note ablating terrain throughout.

community. Remaining subdivision development sites at Reindeer Point were seen as either too difficult to develop or simply too far away from community amenities.

Although identified outside of the public gatherings, concern was expressed that the generator noise from the NTPC plant was disturbing to some residents of Reindeer Point.

A road had yet to be developed to access a new subdivision area designated in the current Plan.

Few of the infill development opportunities otherwise identified by the Hamlet land use plan in force at the time of the consultations appeared to be viable in the eyes of residents at the time of the researcher's visits (Figs. 5.35-5.36).

Table 5.5: Residential Infrastructure and Services - Local Themes Break-out Summary

Tuktoyaktuk Consultation Outcomes - Theme Break-outs IV

Residential Infrastructure and Services



Theme	Material		Relational	
	Resources	People	Organizations	Relationships
Existing lots in Reindeer Pt.	Far from town centre	Small proportion of community lives there	Hamlet/MACA (land-use plan)	Generator noise from NTPC plant affects area
Housing shortage and condition	Too few single/ starter units, several larger vacant properties that Housing is not in a position to renovate; high rates of damage to subsidized housing units	Substantial waiting list for available units Maintenance/construction staff have not been able to keep up with demand for upgrades/repairs/redesign.	Housing Association Hamlet/MACA (land-use planning)	Overcrowding recognized to affect student performance (i.e. unable to study)
Subsidized housing	Extensive property damages	Declared income issues (OKO)	Consultation and communications	Support from other agencies
Need for market housing	Required for transient and professional workers and for those ineligible for Housing Association units	Contributing factor in difficulties experienced in specialists and general employees	Housing Association Public sector employers	Complicates hiring of staff from outside community.
Need for detox/rehab facility	Already constrained supply of regular housing	Serious rates of substance abuse, domestic violence	Community Corporation GNWT Health & Social Services	Addictions, health and social service support systems are lacking locally
Need for men's shelter				

Less stress
More predictable



uncertainty

Significant stress
Pervasive impacts

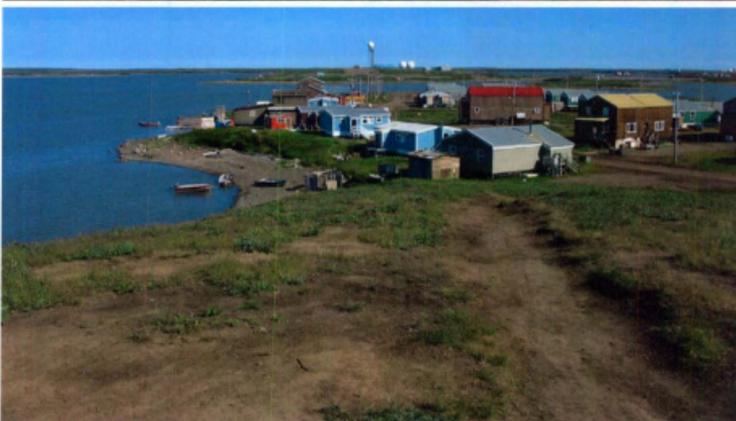


Figure 5.35 (above): North Spit and upper harbour mouth viewed from pingo

Figure 5.36 (below): Looking southeast towards 'Green Gables' from same pingo. Former DEW Line site in background.

Poor drainage affected a number of spots in the community (P. Nogasak, *pers. comm.*) including the Land Assembly area (Figs. 5.37-5.38) north of the airport, where a great deal of the community's subsidized housing was located. To its southeast, another subdivision area was highlighted by Public Works staff as having required extra care in the building of pads due to increased ponding and run-off from the adjacent pingo. According to Housing Association staff, there was a significant wait list for available properties. In particular, the community lacked smaller 'starter' homes; consequently,



Figure 5.37: Housing Association units east of RCMP Compound, Land Assembly (West), August 2005
Figure 5.38: Land Assembly housing panorama taken south of the RCMP Compound, Land Assembly (West), August 2005

numerous vacant larger family units were awaiting renovations. Public housing in the community also regularly suffers from tenant damages, delaying their use until backlogged housing maintenance and repairs are completed.

Tuktoyaktuk boasts a new Elders' residence (Fig. 5.39). Co-located with the Rosie Owayouk Health Centre (the community clinic administered by Beaufort-Delta Health and Social Services Authority) (Fig. 5.40), the Aurora College building and the community graveyard, Kiglavak House is also located in the immediate vicinity of the former school and curling rink, both condemned and removed decades before due to the rapid erosion observed there. The project was a legacy, however, of the final term served by the venerable Vincent Steen (1941-2007) as the M.L.A. for the region. In the 14th

sitting of the Assembly, Mr. Steen was a member of NWT Executive Council and oversaw the departments of Public Works and Services, Municipal and Community Affairs, and Transportation. He was also the Minister Responsible for seniors. Unfortunately, while the complex can house over thirty Elders, very few have chosen to live there, and it lacks the support services to qualify as a care home.



Figure 5.39 (above): Kiglavak Elders' Residence with Nursing Station and Aurora College office building visible to rear and right respectively. August 2005



Figure 5.40 (left): Rosie Ovayouk Health Centre
Photo:<http://polardoc.typepad.com/photos/tuktoyaktuk/tuk-health-centre.html>

5.5.5 Economic Infrastructure and Services (See Table 5.6)

Located in the older, northern part of the community, the Northern Store (Fig. 5.41) – successor to the historic Hudson's Bay Company operations in the community - sells groceries, a variety of household and hardware items, gas and houses the local post office. Stanton's opened a competitive grocery store in 2006, between the Land Assembly and the older neighbourhoods surrounding the school and recreation facilities.

At the time of this study, there was no banking institution operating in the community. Debit card readers and a commercial ATM at the Northern Store, however, were facilitating cash transactions, and many households were taking advantage of on-line banking services.



Figure 5.41: Northern Store and Gas Station (then recently relocated) with Sod House to right, March 2008

At the time of consultations, the Economic Development Officer for Tuktoyaktuk had been in the community for several years and worked closely with the Executive Director of the Tuktoyaktuk Community Corporation in identifying development projects for purposes of submissions to major granting programs. Other priorities had overshadowed the preparation of a comprehensive economic development plan but it was well-recognized that one is required.

Tourism development in the community has been significant. Visitors to the Point are regularly seen dipping a toe (or more) in the Arctic Ocean and standing for photographs by the Trans-Canada Trailhead marker there. Historic structures in the older part of the community include the two early church buildings, the “Our Lady of Lourdes” schooner installation (See Fig. 5.14) and the sod structures (Fig. 5.42) adjacent to the Northern Store. At least one tour operator was active in the community during the consultation period, interpreting Inuvialuit culture and community history. Their tour also featured a visit to the community icehouse, excavated ten metres down into the permafrost (Fig. 5.43).

Table 5.6: Economic Infrastructure and Services - Local Themes Break-out Summary

Theme	Material		Relational	
	Resources	People	Organizations	Relationships
Oil and Gas development/enterprise	Need for support services	Questions remain about skills development in relation to potential sector employment	Hamlet, Community Corporation, ILA, GNWT, Government of Canada (NRCan)	Numerous 'contingent' developments described in relation to oil & gas prospects
Tourism	Coordinated services and attractions	Some local service providers	Hamlet, Community Corporation, local entrepreneurs/craftspeople	Substantial traffic for 'authentic' Inuvialut experiences as well as Arctic Ocean 'toe dip'
Need Community Economic Development Plan	To provide direction respecting future infrastructure and land requirements to support future enterprise. Need to also identify/inventory underutilized extant equipment, resources, buildings (i.e. former fur garment sewing facility slated for auction)	Inventory of existing entrepreneurs/enterprise and other resident skills - former members of fur garment production program, local carvers, interpreters, translators...	Hamlet/Community Corporation, other stakeholders Begin process of identifying needed training and opportunities/subsidies for interested members of community	Identification of <u>all</u> enterprise opportunities (i.e. small enterprise, crafts, tourism...) and compile list of needed trades/skills
NTCL plans	Will need to monitor existing infrastructure	Management of corporate facilities located outside of Tuktoyaktuk	HQ outside community	Part of Norterra Group
Expansion/relocation of shoreline facilities			Entre community but requiring Hamlet/Community Corporation leadership, ILA assistance	Numerous unknowns in relation to oil & gas prospects
Fencing/screening of industrial properties	Symptomatic of constrained development areas	<i>Commentary from Reindeer Point residents at time of consultations</i>		
Harbour improvement and operations	Removal of obstacles (i.e. old caisson), dredging and breakwater maintenance (Tuk Island)		Hamlet Harbour Committee Industry interests	Longer-term development potential (with or without community?)
Little job training/upgrading	Local Aurora satellite facility	Many will leave for training in Inuvik and beyond	Aurora College satellite	

Less stress
More predictable

uncertainty

Significant stress
Pervasive impacts



Figure 5.42: Sod structures, August 2005

Figure 5.43: In Tuktoyaktuk Ice House: *Left (a) corridor, and right (b) tour participants at base of ladder access.* August 2005

During the research period, Tuktoyaktuk played host to a major national conference. Coastal Zone Canada, an annual gathering coordinated by the Department of Fisheries and Oceans, brought nearly two hundred delegates to the community over the course of a week in early August 2006 for meetings and workshops. Organizers relied on exploration camp facilities (Fig. 5.44) located south of town to house and feed most visitors since commercial accommodations in Tuktoyaktuk were extremely limited. A



Figure 5.44: Boss Camp (left) and other exploration-related industrial infrastructure on east side of Harbour (right) visible on approach to Tuktoyaktuk, August 2005

shuttle was operated in order to facilitate movement around the community throughout the event.

The connections with the marine/offshore sector and Arctic region resupply more generally are extensive in Tuktoyaktuk. Besides the exploration-related infrastructure at the EGT/Beaudril and Boss Camps to the southeast side of the community, and the NTCL property just south of the DEW/NWS site, there is a Polar Continental Shelf shed located in a compound near the Hamlet Public Works Garage and just beside the western end of the community airstrip (Fig. 5.45). Natural Resources Canada Polar Continental Shelf Program (PCSP) has been providing transportation, equipment and logistical support to thousands of Arctic researchers since 1958.



Figure 5.45: Looking southwest from second pingo in developed community area. Polar Continental Shelf premises in background.

Photo: <http://polardoc.typepad.com/photos/tuktoyaktuk/tuk3.html>

As is the case elsewhere in the Arctic, earlier periods of Tuktoyaktuk economic development programming had been structured around crafts skills training and commercialization. A fur garment making program was run in the community that trained many local residents. Unfortunately, the program was discontinued in the late 1990s and the facility mothballed. During the consultations, reference was made to the likelihood that the premises and equipment would be sold but the property was still on the NWT Business Development and Investment Corporation books at the time.

Other creative producers in the community include some very talented sculptors and numerous small crafts producers. An updated general inventory of resident skills, including those of local tradespeople, was identified as a good first step that should be taken in order to begin the process of identifying current training opportunities and subsidies for interested local people.

A general-purpose community workshop and some new storage facilities were proposed. This was a theme that recurred throughout this project as few community residents have access to suitable indoor spaces to pursue vehicle repairs, carpentry, carving or similarly messy undertakings on a year-round basis.

5.5.6 Public Services *(See Table 5.7)*

The Mangiluk School replaced the former Tuktoyaktuk school lost to erosion on the west side of the Spit in the 1970s. It offers primary and secondary level instruction (kindergarten through Grade 12) to roughly 200 students. Instructional staff numbered about twenty; nearly one-third of these were Inuvialuit, most of whom supported the Inuvialuktun language curriculum. At the time of the consultations, the

school was about to embark on some renovations. Overall school staff turnover had been a worry and was seen to rely often on contracted, retired instructors. Extracurricular activities were said to have suffered on occasion from a lack of willing staff and community involvement. Greater cultural orientation was felt to be needed for new, non-indigenous teachers. In that the Tuktoyaktuk high school offered fewer courses than the high school in Inuvik, some families opted to have older children schooled there where they could also often stay with relatives.

Aurora College maintains an adult education centre in the community. Alongside distance learning resources there, general and administrative instruction is offered on-site as available resources and assessed priorities allow. Most older learners, however, must leave the community in order to access career-oriented education.

Tuktoyaktuk has a variety of recreational facilities including an indoor rink/arena and an outdoor ballfield and basketball court. Kitti Hall (Fig. 5.46), the community's main gathering place, is co-located with the school and the Youth Centre. The Youth Centre, developed with the help of a major donation from the rock band Metallica in the mid-1990s, was successfully operating a beverage bottle collection



Figure 5.46: Kitti Hall, Tuktoyaktuk's primary public gathering facility



Theme	Material		Relational	
	Resources	People	Organizations	Relationships
Upgraded and expanded school needed	Existing school in reasonable condition but additional programming/activities sought	Residents want more engaged and culturally oriented school system	Local Education Committee	Regional School Board
Education Program delivery				
Retaining qualified teachers	Improved language instruction programming	Recruitment and professional development Elders' engagement		
Early Childhood Centre needed	Co-locate with school?		Local Education Committee Health & Social Services	Regional School Board
Recreation Centre expansion needed	Proposed that could include curling rink, hockey rink w/artificial ice, and Healing Centre	Recreation Coordinator	Hamlet/Community Corporation/GNWT	Good existing facilities
Fitness Centre/year-round pool	Existing pool operated seasonally and often shut due to lack of qualified life-guarding staff			
Organized outdoor activities	Regional cross-country skiing trail system?		Hamlet, Community Corporation, Church youth group	* <i>Note: Suggestion originated outside consultations</i>
Heritage Centre	Could include interpretation centre, museum, archive, public library, gathering space		Community Corporation, Hamlet	Siting challenging – a major project idea that should be developed
New Cemetery required	Cracking/erosion evident in existing cemetery. It will need to be relocated in time	Concerns all in community, especially Elders	Hamlet/Community Corporation, local congregations	Old cemetery relocation will require

Less stress
More predictable

uncertainty

Significant stress
Pervasive impacts

Table 5.7: Public Services - Issue Themes Break-out Summary

system. The Pentecostal congregation in the community also maintained a youth program in the community during the research period.

The Tuktoyaktuk pool (summer use, above-ground with enclosure) is located behind the Arena. Sachs Harbour residents claim that it had been approved for their community in the mid-1990s but wound up being given to Tuktoyaktuk instead. Difficulties have been experienced in obtaining qualified local staff, and the facility has often been closed as a consequence.

The need for a Heritage Centre was repeatedly stated by residents as there are few suitable places for smaller gatherings, particularly for Elders, in the community. The historic community cemetery beside the new Elders' residence is displaying cracking and slumping characteristic of permafrost decay (Fig. 5.47).

During the consultation period, some interest was expressed in establishing a regional ski trail system that could eventually link Tuktoyaktuk with Inuvik and Aklavik. The effort was being lead by the club in Inuvik.



Figure 5.47: Cemetery from front steps of Kiglavak House (Elders' Residence). Government Building (brown building) and Hamlet Offices (green building) to rear of view.

5.5.7 Community Wellness *(See Table 5.8)*

There were a number of recurring themes that were raised in discussions of the future of the community. Social and cultural changes, overextended public services, and a limited number of people prepared to serve in volunteer capacities certainly constrain the capacity of the community in a number of ways.

The Hamlet has a current emergency plan, however it lacked a flood-risk response plan. In 2006, the Inuvik-based regional RCMP office was working towards an updating of the regional emergency plan. Reviewing and completing all community emergency plans was to be an objective following on this effort but outside of the responsibility of the RCMP. Instead, it was expected that MACA would offer assistance to communities seeking to prepare or review local emergency plans. The Tuktoyaktuk RCMP were provided with the NRCan future flood risk scenario however and have committed to ensuring it is addressed in upcoming planning.

5.6 Plan and Adaptation Scenarios

Along the lines of the ACIA “10 Key Findings” (2004), some general conclusions arising from the Tuktoyaktuk consultations may be drawn (Table 5.9). Generally, however, despite very challenging land constraints, physical hazards and critical infrastructure implications associated with accelerating erosion, ablating frozen terrain, and increasingly serious flood risks, Tuktoyaktuk appears to enjoy a number of compensating factors. These include strategic infrastructure - a harbour and other

Theme	Material		Relational	
	Resources	People	Organizations	Relationships
Community health services 	Local taxi/ambulance service Air-ambulance services	Limited local access to physicians/specialists.	Improvements sought	Regular traffic from the community in to Inuvik and beyond (Edmonton, Yellowknife) for diagnostic and specialist services.
Smoking, drug and alcohol dependency 	Limited by staff available at Health Centre	Prevalent issues in community	Few local support services	Gambling also cited as contributor to difficulties
Cultural sensitivity training 		All incoming staff	Greater new staff involvement in community and extracurricular activities	Substantial 'flow-through' of support staff
Increasingly young population 		Many will be spending time away from community (education, employment)	Hamlet - Youth Centre a major resource	Language loss noted - some Elders not able to communicate as readily with grandchildren
Elders and cultural legacy 		Few members left of a last generation with memory of year-round life on land, few remaining fluent Inuvialuktun speakers	Community Corporation actively supporting elders' programs/initiatives	Intergenerational legacy of residential schools
Fewer community volunteers 			Affecting most organizations (i.e. firefighting, youth centre, school)	[Wage employment frequently cited as contributing factor]
Emergency planning 	Have plan but flood risk scenario had not been anticipated (i.e. relocation of emergency equipment and supplies needed)	Affects all residents but first responders and individuals in designated at-risk areas or cohorts particularly engaged	Hamlet as implementing organization but in partnership with all in community	RCMP involvement, Municipal and Community Affairs jurisdiction NRCan geoscientific input

Less stress
More predictable

uncertainty

Significant stress
Pervasive impacts

Table 5.8: Community Wellness - Local Themes Break-out Summary

facilities suited to transshipment and exploration uses – needed to realize long-anticipated economic opportunities in the offshore, and an influential Inuvialuit population which has set its collective sights on making the most of what their community has for at least another couple of decades. These influences in turn may be seen as acting in various ways on other features of the evolving community, either fueling or resolving political tensions, substandard living conditions, and other circumstances in flux (Fig. 5.48).

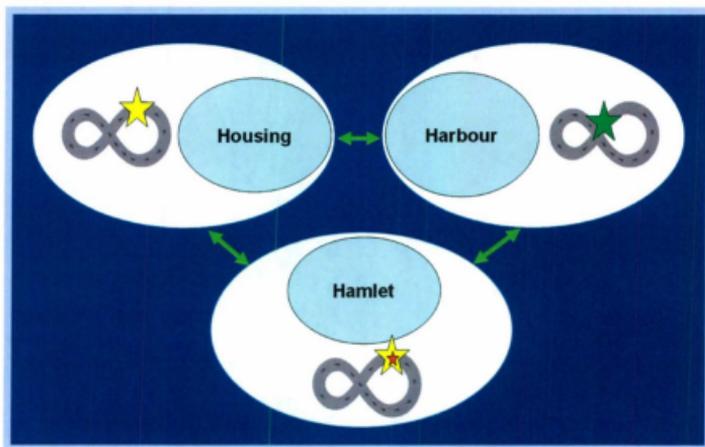


Figure 5.48: Notional adaptive phase interactions. In keeping with the composite nature attributed to community resilience, Tuktoyaktuk's circumstances may be read as innumerable adaptive cycles which themselves interact both offsetting and exacerbating one another's influences.

In light of these findings, an adaptation plan for Tuktoyaktuk must address a number of challenges, of which climate change is just the latest. As the institution with the most extensive array of services and infrastructure to maintain in the community, the Hamlet has already been making many small adaptations to the changing climate in the

course of its day-to-day operations. Adapting by increments, however, will soon need to be matched by a more deliberate process that takes the longer-term development needs of the community into account.

For instance, as relative sea levels continue to rise, municipal staff may expect repair costs associated with road wash-outs and other infrastructure maintenance to rise substantially. Council's longer-term adaptation plan should evaluate to what extent these costs may be offset by investing in a staged relocation of critical infrastructure, community services, and other development. Besides material adaptations, the community will need to persist in, and likely expand, its existing social supports. Relational adaptations will likely be needed to compensate for material capacities which may be expected to experience significant disruptions. It follows then that some investments in Tuktoyaktuk's "social infrastructure" may deserve more immediate consideration than certain of the identified physical risks.

There is a recurring narrative of dispossession that appears in Tuktoyaktuk development accounts. The most recent incarnation of this reads something like, "the oil companies are interested in what might be under Tuktoyaktuk – they'll be pleased if we move." The cohesion that may be born of this kind of suspicion of a common foe, however, is very susceptible to being turned into something quite divisive as Inuvialuit autonomy proceeds and the already apparent diversity of views respecting resource development opportunities become more apparent within the community. The potential for a mirroring of conflicts between actors in and outside of the community by actors of different views located within the community will need to be anticipated. If the compensating capacities of the relational sphere may be diminished in this way, it could

Table 5.9: Ten Key Observations – Tuktoyaktuk

1. The community recognizes their climate is rapidly warming, is inclined to believe that much larger changes are projected, and is conscious that their local observations of changes accord in numerous instances with those of scientists active in the area.
2. The NRCan flood risk projections had not received much attention outside of the few organizations they had been provided to prior to this round of community consultations. General awareness of multiple and cumulative effects of terrain and infrastructure instability was most readily expressed by residents when referring to the North Spit area.
3. Regular travel back and forth from Inuvik by plane, boat or automobile (along the ice road) have provided most residents with evidence of the northward movement of the tree line in their region.
4. Infrastructure relocation was in practice being approached on a case-by-case basis.
5. Storm impacts and flooding occurring outside of the North Spit area has received little attention to date.
6. Where acknowledged, climate change implications are viewed negatively (e.g. reduced river and sea-ice is currently seen less in terms of its potential to increase marine transport, access to resources, and Tuktoyaktuk's importance as a marine service centre and more as a loss of ice road reliability).
7. Thawing ground already disrupts transportation, buildings, and other infrastructure.
8. The community acknowledges numerous economic and cultural concerns but did not appear to consider climate change a major contributor to any of them at this time. Some difficulty in advancing the consideration of infrastructure relocation, however, may be attributable to the fear that this might negatively affect the community's existing competitive advantages (i.e. regional transportation hub, proximity to offshore oil and gas prospects, political influence).
9. The community's mounting physical hazards and related critical infrastructure problems remain off-set for now by the current capacity of local people, institutions, and economic infrastructure.
10. In lieu of a pre-emptive plan and implementation process, the failure of the community's current water supply system could precede the predicted flood event scenario as a critical infrastructure system failure.

Neither wildlife nor UV impacts were addressed by Tuktoyaktuk participants during this project, presumably due to its clear association with the Hamlet area and the infrastructure and services there.

be argued that the organization of some intra-community dialogues on the theme could be a constructive pre-emptive measure.

The preliminary recommendations returned by the Tuktoyaktuk Community Climate Change Adaptation Plan draft responded to the *Four Dimensions of Community Resilience*. These recommendations are consolidated in Table 5.10, reflecting some of the conventions of contemporary planning documentation: statements of goals and objectives along with an accounting of the parties needed or expected to be involved in actively promoting the desired ends. The Adaptation Plan also provides a summary statement of the rationale for each objective along the lines of the information provided in Section 5.4. Rather than itemizing the recommendations again, the discussion that follows addresses the implications of the outcomes and observations respecting this exercise of format and practice.

As discussed in Chapters 2 and 3, the resilience assessment approach taken to this planning effort sought to address the imbalance seen to emerge in municipal planning where future physical infrastructure are the dominant outcomes, notwithstanding what is conventionally termed a 'comprehensive' exercise. In making explicit the planning interests in the less tangible features of the community system (i.e. capacity, relationships, informing experiences), the researcher was, in effect, advancing the project of comprehensiveness. The initial hypothesis was that better outcomes would emerge if 'balance' was reasserted in the research design and, thereby, better conveyed and sustained throughout the process. What was initially approached as an experiment in planning practice was thereby less of an 'experiment' (in the sense of a significant

Table 5.10: Tuktoyaktuk Adaptation Plan - Consolidated Recommendations

Resources		
Resources Goal 1: Secure Tuktoyaktuk's critical community infrastructure		
Objective 1	Review and update the Hamlet of Tuktoyaktuk Land Use Plan	Hamlet in consultation with GNWT Department of Municipal and Community Affairs (MACA), Inuvialuit Lands Administration (ILA), Housing Association, Community Corporation and other community organizations, residents.
Objective 2	Prepare a water supply contingency plan	Hamlet in consultation with MACA, ILA, and other community organizations, residents.
Objective 3	Identify and develop new community dumpsite	Hamlet in consultation with MACA, ILA, Housing Association, Community Corporation and other community organizations, residents.
Objective 4	Identify and develop new gravel/aggregate sources	Hamlet in consultation with MACA, ILA, local industrial operators, other community organizations, others TBD.
Objective 5	Investigate long-term sewage disposal plans	Hamlet in consultation with MACA, ILA, local industrial operators, other community organizations, others TBD.
Resources Goal 2: To identify sustainable economic opportunities		
Objective 1	Undertake a Community Economic Development Plan	Hamlet in consultation with MACA, Inuvialuit Regional Corporation (IRC), ILA, Community Corporation, local business interests, other community organizations, residents, others TBD.
People		
People Goal 1: Improve local emergency preparedness		
Objective 1	Update the Tuktoyaktuk Emergency Plan	Hamlet in consultation with RCMP, MACA, Fire Department, Health Services, Rangers, and other community residents.
People Goal 2: Support and encourage community associations		
Objective 1	Identify and/or develop additional community meeting and gathering spaces	Hamlet, Community Corporation, MACA, other community organizations, other interested parties and residents TBD.
Organizations		
Organizations Goal: To improve local organizations' access to information needed to support decision-making		
Objective 1	Establish a monitoring mechanism for lands within community boundaries	Hamlet (Public Works) in partnership with MACA, Housing Association, NRCan, Infrastructure Canada, DFO/Coast Guard, Transport Canada, DND/Rangers, Arctic Coastal Dynamics Working Group, ACCO-Net initiative, others TBD
Objective 2	Establish a monitoring program for lands outside community boundaries	Hunters and Trappers Committee (HTC), Hamlet, NRCan, Inuvialuit Lands Administration (ILA), and others as above.
Relationships		
Relationships Goal: To build a local community-science network node		
Objective 1	Establish and maintain a locally-accessible database and archive of researcher contact information, publications, and other project documentation concerning Tuktoyaktuk and area.	Hamlet/Community Corporation/HTC (primary local research licence referees), school (library), Arctic Coastal Dynamics Working Group (NRCan members), ACCO-Net initiative (Figure 10), Parks Canada, others TBD
Objective 2	Establish a local Scientific Research Committee	Hamlet, /Community Corporation/HTC (primary local research licence referees), school, others TBD

departure) than originally imagined. In retrospect, it was better regarded as an experiment in facilitation.

In practice, the pursuit of comprehensiveness is inevitably frustrated by any number of variables, from the availability of information to the potential bias of the parties providing or receiving it. The municipal context is one that imposes its own emphases given the institutional roles and responsibilities at play there. Finally, planning is a process that anticipates iterations and variants of itself: one process tends to lead to more of the same.

All of the above are present in the outcomes recommended in the Tuktoyaktuk Adaptation Plan. The critical infrastructure-oriented considerations attributed to the Resources dimension each address core municipal functions (i.e. water and waste-related services, quarry materials needed to maintain infrastructure, and local land use oversight). More planning is particularly required to address Resource and People targets in relation to the jurisdictions and institutional partners they need to engage (i.e. economic development and emergency preparedness plans, contingency planning for the problematic water supply, and the updating of the existing municipal plan), and it is implied in the remaining two categories of recommendations. Filling information gaps (e.g., by devising monitoring programs) and completing inventories (e.g. of local research, available gathering spaces, suitable development areas) figure among the actions. The fact that any consideration of potential development sites outside of the existing municipal boundary will trigger an extensive review and release process by the ILA pursuant to land claims requirements is also flagged.

The relational characteristics of the outcomes are not confined to the Organizations and Relationships dimensions as, in effect, the lists of identified actors associated with each item suggest the scope of interchange needed to augment desired ends. In practice, identifying objectives to allocate to the Resources category was much easier than distinguishing between those that belonged more to one or another of the other three. Resolving confusion between People, Organizations and Relationships categories eventually required additional framing of questions - in particular distinguishing "Organizations" as primarily treating relations 'within' the community and among existing, relatively formalized entities - whereas "Relationships" was attributed a larger context, a greater association with 'outside' actors and 'emerging' entities. Interestingly, the confusion engendered was a source of engagement as participants and researcher alike sought to 'fill' the categories offered. This underlined to the researcher that planning outcomes may be recast in manners that allow them to be read as more or less "comprehensive". This need not, however, be an empty exercise in that it was apparent that the work to reframe the objective accordingly engages participants in a different way of thinking about conclusions earlier drawn.

The Tuktoyaktuk recommendations speak to future capacity being sought through the development of one new organization (e.g., a Scientific Research Committee) but otherwise suggest that extant organizations explore new relationships, e.g., the potential leveraging of the extensive scientific alumni with connections to the area that could follow on cataloging and assembly of a local reference collection of Tuktoyaktuk-specific research. Where summary community planning outcomes might otherwise 'flatten' or make relational dynamics implicit relative to the material preoccupations with

built infrastructure, the explicit inclusion of these categories did prompt the consideration of capacity-building themes in a broader fashion.

5.7 Synthesis

The Tuktoyaktuk Climate Change Adaptation Plan was returned to the community as a non-binding information and discussion document. It in no way committed any participating individual or organization to a particular course of action. Implementation of any and all measures it described would be subject to a number of factors such as future industrial developments, available public funding, and other emerging priorities facing local organizations. Instead, it was hoped that it would offer a framework to guide collaboration in months and years to come.

Going into this project, Tuktoyaktuk was the community most readily seen to be facing significant, climate change influenced physical hazards. As the larger of the two Inuvialuit Settlement Region communities studied, it was the exemplar of an ISR Hamlet governed by a land use plan, a local policy tool with recognized potential for addressing a number of the physical development themes identified in the resilience-oriented planning exercise. Given the number of physical challenges identified in Tuktoyaktuk, the regular updating of the existing land use plan and associated zoning by-law should be able to support and incremental retreat of the community from at-risk areas. The other existing municipal measure of note, the Tuktoyaktuk Emergency Plan, can similarly be used to address the increasing possibility of a serious flood event in the community. Neither of these tools however can immediately address the prospect of where the community should be moving its resources and investments in coming years. The options of either or

both of extending the community south along a new road towards the gravel supply, or the move east to lands on the other side of the Harbour will engage the Inuvialuit settlement lands review processes. Given the implications for industrial operations in the region and the high development costs that must be anticipated, any forthcoming feasibility study processes for Tuktoyaktuk will also command the attention of other ISR communities and the GNWT more generally.

Addressing locational or material endpoints thereby characterizes the emphasis of the Tuktoyaktuk adaptation plan for the time being. In that this strategy entails numerous investments in infrastructure, it may also present decision makers with difficult budgetary choices. The resilience planning model however serves to remind the reader that there are relational dimensions to every material choice. Tuktoyaktuk will need to move consciously and proactively to ensure it is able to keep a robust balance in the community over the next couple of decades of continued change.

Sachs Harbour

6.1 Sachs Harbour, N.W.T.

Sachs Harbour (71°59'N, 125°14'W) is the lone permanent settlement on Banks Island (Fig. 6.1). The “Sachs” in the name refers to the Mary Sachs, a vessel that visited the island with the Canadian Arctic Expedition (1913-18) led by Vilhjalmur Stefansson and was run aground. The traditional name for the area is *Ikaahuk* which translates as ‘where you go across to’ – as many Inuvialuit from the mainland and Victoria Island in fact did in earlier times. At the southwestern edge of both the Island and the Arctic Archipelago it forms a part of, the community is the smallest of the three examined in this study. Its predominantly Inuvialuit residents numbered 122 in 2006 (Statistics Canada 2009).

The fifth-largest island in Canada, archaeological evidence shows that at least four major cultural groups have occupied various parts of Banks Island (Fig. 6.2): Pre-Dorset



Figure 6.1: Sachs Harbour seen from west, July 2005

peoples arrived roughly 3500 years ago; followed by Thule occupation between roughly 1200 and 1450 A.D. (Friesen and Arnold 2008); and, more recently by Mackenzie Inuit or Inuvialuit (1650 – 1820s) (ibid.) and the Copper Inuit (1855-1890). Remains of a Thule village containing 30 or more whale-bone framed dwellings were found at Cape Kellett just twenty kilometres west of Sachs Harbour (Manning 1956).

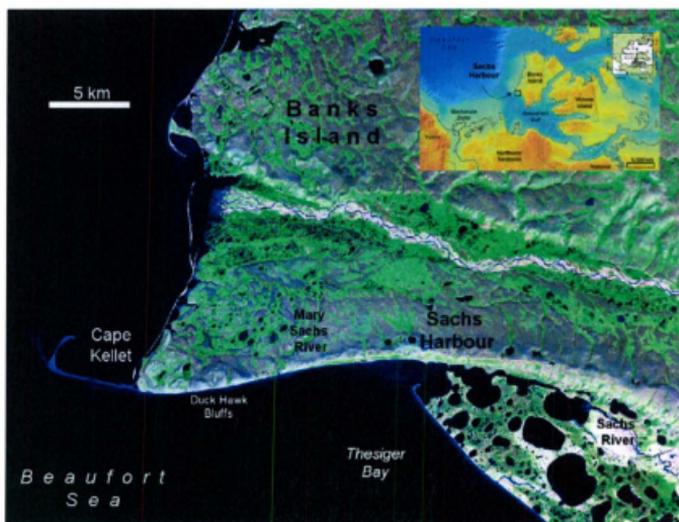


Figure 6.2: Banks Island, N.W.T.

Source: Natural Resources Canada courtesy of G. K. Manson (data). Contains Landsat imagery © NASA. Figure © Her Majesty the Queen in right of Canada, 2006, with permission.

Banks Island was infrequently visited by neighbouring Inuit and Inuvialuit in the early 1900s but in 1921, an Inuit-only game preserve was declared there by the Canadian government (Alunik et al. 2003). Local accounts assert that Inuvialuit trappers were visiting the Island by 1916 (Community of Sachs Harbour et al. 2008) and in 1928, three

Mackenzie Delta families crossed with their schooners to overwinter in the vicinity of the present-day community (Alunik et al. 2003). Stefansson's Alaskan-born, Inuvialuit guide Natkusiak is said to have become familiar with its untapped animal resources and chose to stay on there after the expedition trapping white fox through 1921 (Alunik et al. 2003). "Billy Banksland" as he was known, retired then to Baillie Island.

The 1920s marked the beginning of a boom period for the Western Arctic fur trade which saw numerous Inuvialuit families traveling back and forth by schooner between mainland trading posts and winter camps around Banks Island. One of the most successful trappers, Fred Carpenter, had built a cabin in the present Sachs Harbour in the 1930s (Figs. 6.3-6.4). The RCMP established an outpost there in 1953, the Department of Transportation (DOT) and the meteorological station following in 1954, and in 1958 Fred opened his own trading post (Fig. 6.5). Others trapping elsewhere on the Island soon joined him and the community's permanent infrastructure began to grow during the early 1960s (Alunik et al. 2003).

6.2 Physical Geographies and Human Dimensions

Sachs Harbour is accessible year-round by air today and receives major freight deliveries by NTCL barge over the summer months. It was granted official hamlet status by the Government of the Northwest Territories in 1986. Sachs Harbour's claim to being the 'white fox capital of the world' lives on, but market conditions have contributed to the decline of trapping as a local livelihood since the 1970s.

Sachs Harbour is located at the southwest edge of Canada's Arctic Lowlands physiographic region which is characterized by lowland plains and glacial moraines



Figure 6.3 (left): Fred Carpenter's original cabin, c. 1930s, still standing today behind the Parks Canada House

Figure 6.4 (right): Fred Carpenter, 2 October 1958 (Source: R. Knights/NWT Archives/N-1993-002-0301)



Figure 6.5: Sachs Harbour as of 6 March 1958. Frank and Fred Carpenter's house on the left and the RCMP detachment is on the right. (Source: R. Knights/NWT Archives/N-1993-002-0138)

(Vincent 1982). Low-lying coastal bluffs and large depositional features characterize the community and nearby shoreline.

It also lies at the southwestern extent of the Northern Arctic ecozone where very dry, cold conditions lead to herb and lichen-dominated vegetation. Island wildlife include

the world's largest herd of muskoxen; the Western Arctic's biggest nesting population of snow geese; caribou; wolf; arctic fox and hare; polar bears; and of late, the 'grolar' or 'pizzly' bear, the rare offspring demonstrating the northward movement being observed in the range of grizzly bears (Fig. 6.6) (CBC 2006). Although ice conditions have not been conducive to hunting them in the waters close to Sachs Harbour for many years, two beluga whales were harvested in the fall of 2008 (Fig. 6.7) (B.Wolki, pers. comm.. 2008)



Figure 6.6 (left): Grizzly shot at Nelson Head by a local hunter in May 2006, a month after the much-publicized take of a polar-grizzly hybrid in the region by a sports hunter.

Figure 6.7 (right): Belugas taken off Sachs Harbour beach in early September 2008.
(Both photos courtesy B. Wolki)

6.2.1 Climate

Sachs Harbour has a Mid-Arctic climate. Mean temperatures vary between -29°C in January and 7°C in July. Total precipitation is currently 128 mm/a of which 60% falls as snow (Environment Canada 2005). Precipitation has, however, been increasing since 1956 (Belliveau 2007) and mean temperatures throughout the western Arctic also have been increasing.



Figure 6.8 (above): Gully feature to west side of community. Note recent slumps in foreground caused by action of run-off and progressively deepening active layer, August 2008.

Figure 6.9 (below and detail): Sediments at base of eroding shoreline bluff below Parks Canada House on east side of community, August 2008.

6.2.2 Geomorphology

The sediments underlying Sachs Harbour are predominately sands and gravels. Permafrost is continuous but characterized by substantial ice lenses that contribute to more dramatic melt-related ground slumping. The terrain in and around the community displays thermokarst features and patterned ground in silt-dominated sediments, while coastal bluffs reveal unconsolidated, ice-rich and silt-dominated glacial deposits, and extensive segregated ice lenses (Belliveau 2007) (Figs. 6.8 – 6.9). Following earlier research by Vincent (1982), geoscientific monitoring has been ongoing in the area since 2000 (Forbes et al. 2003). During the study period, thermal retreat, or shoreline erosion attributable to warming conditions melting ice-rich terrain, combined with wave action, especially during storm events, were being studied by scientists from Natural Resources Canada (Don Forbes, Gavin Manson and Dave Frobels based in Dartmouth, Nova Scotia) and Memorial University (Norm Catto, Karissa Belliveau, Evan Edinger, Tanya Brown, Dominique St-Hilaire and Trevor Bell) using a combination of terrestrial and marine coastal surveys, aerial photo and satellite image analyses. Sachs has been determined to lie in a region experiencing subsidence with sea level rising in the order of 3 mm/y.

6.2.3 The Coastal Zone

Low-energy microtidal conditions prevail at Sachs Harbour. A reconstruction of community shoreline change over the period 1961-2003 (Fig. 6.11) by NRCan researchers using aerial photographs and current satellite imagery demonstrate progradation at the barge landing beach with retreat at bluffs to the east and west



Figure 6.10: Satellite imagery of community area provides evidence of drowned thermokarst features in nearshore waters, August 2005.
 Source: Natural Resources Canada courtesy of G.K. Manson (data). Contains material © Space Imaging. Figure © Her Majesty the Queen in right of Canada, 2005, with permission.

(Manson et al 2005). Rates of change vary along the coast in the vicinity, with the maximum shoreline erosion rate of 3.9 m/a recorded on the eastern side of the hamlet (Manson *et al.* 2005; Belliveau 2007).

Erosion of the community's south-facing shoreline is primarily attributed to thermal degradation of segregated ice lenses rather than wave impacts (Belliveau 2007). Persistent off-shore ice and a restricted marine fetch in the Sachs River estuary have tended to protect the community area from higher energy Beaufort waves. Rising sea level, combined with a predicted decrease in sea ice and increasingly effective storm

events, may be expected to accelerate existing thermal and mechanical erosion of shoreline bluffs in Sachs Harbour. An upwards trend in precipitation is also expected to add to thermal and run-off-related erosion throughout the townsite.



Figure 6.11: Sachs Harbour shoreline change 1961-2003. While the community beach has grown, retreating bluffs to the east and west are encroaching on residential infrastructure. Source: Natural Resources Canada courtesy G.K. Manson (data). Contains material © DigitalGlobe. Figure © Her Majesty the Queen in right of Canada, 2005, with permission.

6.3 Local Research Process

The Sachs Harbour, NWT case study research was supported by Natural Resources Canada (NRCan) and ArcticNet. The work in Sachs Harbour proceeded through the generalized sequence of adaptation planning tasks as outlined in Table 6.1.

The researcher's first visit to Sachs Harbour was only a few hours in duration in conjunction with an annual regional programme consultation (Fig. 6.12) by NRCan and

the Department of Fisheries and Oceans (DFO) in April 2005. A brief overview of this project and the upcoming work of other Memorial University researchers was presented to the Hunters and Trappers Committee (HTC) and input received. The second community visit, also introductory in nature, coincided with the end of the summer 2005 field season of her Memorial University colleagues and allowed more time for meetings with other organizations including a special presentation to members of the Hamlet Council.

The third extended period of fieldwork occurred, as recommended by the community, during the 'dark period' early in 2006. This three-week stay afforded a series



Figure 6.12: Annual NRCan/DFO consultations in 2006, Hamlet Council Chamber. A 'fly through' animation of seafloor data collected using multibeam scanning systems was being screened, hence the distribution of 3-D glasses.

Table 6.1: Sachs Harbour Field Work

Phase & Timing	Activities	Stakeholders approached
Introductory visit 25 April 2005	NRCan/DFO Programme review consultation	Hunters and Trappers Committee
Familiarization visit/ local pre-planning July 2005	Community tour with NRCan and MUN researchers Preliminary inventory	Hamlet (Staff and Mayor) RCMP Hunters and Trappers Committee Community Corporation Local business people
Environmental change and community data compilation January-February 2006	Icebreaker activities (lantern-building) Local consultations (meetings, open house events) employing serial editing Key informant interviews	As above General public Hamlet staff Housing Office Meetings with regional MACA and RCMP staff (Inuvik)
January & February 2007 (en route to/from Gjoa Haven)	Consultation with GNWT staff	MACA staff (Yellowknife)
Local planning review with follow-up August 2008	Local consultations, review of draft Development Needs Summary, documentation of fuel leak	All of above Meetings with regional MACA staff (Inuvik)

of small-group meetings and a couple of open house events in addition to numerous repeat visits with key local stakeholders. Special activities (lantern-building and movie night) were also offered in partnership with the Recreation Coordinator (Fig. 6.13). A summary of the outcomes from this first series of consultations was returned to the Hamlet later that year for feedback.

Materials gathered during visits to Sachs Harbour and in subsequent research were assembled in an adaptation planning background binder that was returned to the community for future reference. Sachs Harbour lacked a community plan, so some of the

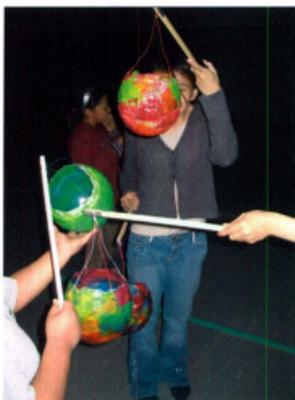


Figure 6.13: Completed lanterns on parade, August 2008.

development chronology, that in the case of Tuktoyaktuk was possible to reconstruct from their plan documents, was not readily compiled. This enhanced the value of the intended ‘memory’ that the compendium could provide the researcher and the community alike.

In early winter 2007, travel through Yellowknife en route to Nunavut community fieldwork afforded the researcher a couple of opportunities to meet with GNWT headquarters staff. A programme then available, the Community Capacity-building Fund, was identified as matching an identified community need (the ‘family centre’). As the application deadline was fast approaching, a slightly revised draft of the consultation outcomes summary was provided to the GNWT programme officer and sent again to the Hamlet to facilitate follow-up.

Notwithstanding the apparent difficulties in communication later determined to be attributable to staff issues in the Hamlet Council, other local organizations, and the regional MACA staff turnover during the study period, fruitful connections did get made beyond the period of community visitation by the researcher. The latest version of the consultation outcomes (a ‘Development Needs Summary’) was presented at two open house events during a reporting-back field visit in 2008. As no feedback had been returned in response to the earlier consultation reporting, this provided for both formal endorsement of the earlier content, and discussion of implications related to adaptation

planning and recent developments. The visit coincided with the final barge visit of the season and the delivery of the construction materials for the aforementioned family centre.

As this was not the first consultative initiative concerning local climate changes (IISD 1999; Jolly et al. 2002), efforts were made to avoid duplication and instead pick up as appropriate where prior research efforts left off. In the summer of 1999, a team of researchers assembled by the International Institute for Sustainable Development (IISD) conducted an initial local workshop with residents under the project title *Inuit Observations on Climate Change* and later returned to shoot video footage based on the outcomes of the first visit. Sachs Harbour community members had recorded changes in the weather (Table 6.2); marine and land animals; birds and insects; harvesting and health problems. Subsequent visits in the winter and spring of 2000 augmented the video footage and continued the process of consulting with community members on remaining aspects of that production and other follow-up publications. The well-documented local environmental change observations from this earlier project were recognized as the logical stepping-off point for the latest one, so the researcher regularly acknowledged them in her consultation materials. This also provided a basis to reconfirm and build on the previously documented conditions.

6.4 Contemporary Development and Change Narratives

Sachs Harbour residents had observed changes in their environment for some time. Despite its small size, the community received international attention as an early exemplar of Arctic climate change impacts thanks to the aforementioned video project.

Table 6.2: Sachs Harbour Environmental Change Observations as per IISD, 1999-2001

Recent Trends	
Spring/Summer	Fall/Winter
<ul style="list-style-type: none">• Quicker melting (mid-June now)• Hotter - too warm sometimes• Don't see ice floes in summer any more• More rain with lightning and thunder• More bugs, flies• Warmer ocean water	<ul style="list-style-type: none">• Shorter fall and slow freeze-up• Warmer, milder winters• Too much open water – harder to hunt• Ice pack moving farther away• Less multi-year ice• Thinner ice, no more pressure ridges• Thinner ice in lakes too

Sila Alangotok: Inuit Observations of Climate Change (IISD 2000) documented local observations, highlighting the contributions that indigenous and traditional knowledge could make to understanding ongoing global environmental changes, and otherwise setting a high standard of community-researcher collaboration for others to follow in the period leading up to International Polar Year (2007-2008). The video featured vivid local accounts of changing sea-ice, sightings of new wildlife, lake breaches and other evidence of permafrost melting.

6.4.1 Early Community Development

The relatively recent permanent infrastructure at Sachs Harbour is typical of many Canadian Arctic communities. Elders in Sachs Harbour provided accounts of the community's development since the late 1950s-early 1960s when Inuvialuit from all over Banks Island and elsewhere in the Beaufort chose to live there. One consultation participant described coming from Holman originally and living for several years at De

Salis Bay (eastern Banks Island), a place where at least four other families lived, all of whom eventually moved to Sachs Harbour. The same Elder recalled that they had been asked by government field workers to consider an upland location for the Sachs community originally but that the people did not want to be too far from the water. Prior to the advent of snowmobiles, it would have been too hard to get back and forth and to look after their dogs.

In 1966, the Advisory Commission on the Development of Government in the Northwest Territories (ACDGNWT) published a series of Arctic community profiles. The account provided for Sachs Harbour was based on a visit conducted on 20 August 1965, supplemented by an Island economic survey undertaken by Peter Usher the same year. The profile traced the growth of the local population: from a total of nine families distributed around the Island in 1952-53 (when the number of individuals was not recorded), the residents at Sachs Harbour had grown to number 77 in 1965. At that time, three organizations were described as being active: a local association of trappers (formed in 1963), an Anglican Women's Association (said to meet weekly), and the first chartered local governance body, formed in 1965 and described on the last page of the Sachs Harbour profile as follows,

"Its officers are Eskimos and some members of the white community are in consulting or advisory positions. Although this group intends to act first of all on community projects, including operation of the community hall, the association provides for the first time a vehicle for settlement-wide action on any matter."

Prior to the local community association, the two RCMP constables posted there had handled local governance matters, including the sale of heating oil, the distribution of relief and the administering of emergency first aid.

Sachs Harbour was the only regularly-occupied Island camp by 1961, but other western Banks Island winter camps were recorded at Storkerson Bay and Sea Otter Harbour (ACDGNWT 1966, Community of Sachs Harbour 2008) and Siksik Bay, Siksik Point, Lennie Harbour and Blue Fox Harbour (Community of Sachs Harbour 2008). On the east coast, in addition to De Salis Bay, there was a camp at Jesse Bay (*ibid.*).

The Roman Catholic mission was established there in 1962 (Alunik et al. 2003). They built a chapel and community hall in 1965. Prior to that, however, the community gathering-place was the Department of Transportation (DOT) station where movies were regularly screened and parties hosted.

Until the community school was built, the children of families trapping on Banks Island attended the residential schools in Aklavik or Inuvik. During the 2006 consultations, Elders recalled that back in the 1940s, particularly heavy ice conditions one year prevented parents from collecting their children for their two-month summer break. In 1964, they said the annual resupply visit of the NTCL barge M.V. Banksland was not completed due to heavy ice conditions and the community's provisions had to be airlifted.

Residents recall that local dogsled races used to occur in July but that the last time this had happened was in 1967.

Sport hunting of muskoxen on the Island began in 1980 (Gunn et al. 1991). Visiting hunters were required to engage an outfitter and local guide, providing a new local opportunity for waged employment. In the 1989-90 season, 19 muskoxen were

taken on sport hunts representing an estimated infusion of \$57,000 into the local economy (*ibid.*)

Just a year after the first sports hunt of muskoxen, the Sachs Harbour Hunters and Trappers Committee and the Inuvialuit Development Corporation held their first commercial harvest. Agriculture Canada inspection and licensing presented early challenges to the initiative but the 470 muskoxen commercially harvested in the 1985-87 period were said to be worth \$117,600 (T.Beaudoin,1989 cited in Gunn et al. 1991, p. 191).

6.4.2 Contemporary Change Observations

It was noted that there was once a substantial island (much more than a shoal) off Martha's Point. It has disappeared fairly recently (c.1990-91). Erosion along the south-facing shoreline the community is built on has been noted for decades, but residents say it has been accelerating since the late 1990s (see Fig. 6.10).

As recently as the 1990s, residents could recall a hockey tournament being held in Sachs on July 1st when everyone else in the ISR at the time would have been hosting ball games. They still had ice (albeit soft) as this had been the first year that their rink was open and the community had not understood that the doors were meant to be opened over the summer so that the ice would melt away. The rink site becomes a big mud puddle when this is done, however, raising concerns for the structure of the building.

More recently, small sink-holes have been observed by community members in the vicinity of the Housing Association office (Housing Association staff member, pers. comm., 2008).

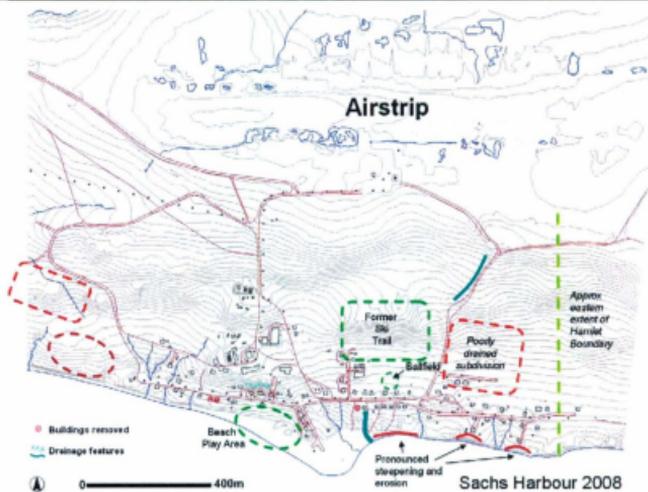


Figure 6.14 (top): Aerial view of community looking south with infrastructure notes. (August 2008)
 Figure 6.15 (bottom): Surveyed terrain conditions and development notes consolidated over project visits.
 Source: Base map courtesy of GNWT (ATLAS GIS)

Big troughs were described as often being left along the beach by large grounded chunks of ice. Residents had to steer around them regularly on the ATV trail running out toward Cape Kellett and beyond. These ice holes eventually fill with sediment, typically disappearing within a year.

Participants noted numerous lighter-toned areas seen on the aerial images of the Sachs community as ground disturbed by earth-moving equipment: the surface layer was described as often being scraped off rather indiscriminately in search of construction fill or in order to level the ground. The road to Mary Sachs River was constructed to access a special grade of deposit in a gravel supply there which residents recalled was required for construction of their airstrip.

Consultation period feedback accorded well with the shoreline change record assembled by NRCan researchers (see Figs. 6.11 and 6.15). The Parks Canada residence located on the east side of the community (Fig 6.16) was frequently named as a property facing a significant erosion risk. The diminishing space between the building and the eroding bank behind the property has become the gauge for locally observed rates of retreat. No shoreline protection measures have been attempted anywhere in Sachs Harbour. However, several buildings directly along the edge of the coastal bluff in the western part of the community were not rebuilt there when they required replacement (Fig. 6.17).

6.5 Consultation Outcomes and Discussion

A powerpoint presentation was used as a facilitation tool in local consultations during the winter of 2006. The presentation introduced the research plan and provided an



Figure 6.16: Parks Canada House and eroding bank (*inset*), July 2005

Figure 6.17: Condemned shoreline housing slated for removal, west side of community, July 2005. (Also noted in Figure 6.15)

overview of earlier and ongoing climate change work conducted by other scientists, in particular the ongoing NRCan research of Gavin Manson, as well as that of two other Memorial University graduate researchers, Tanya Brown and Karissa Belliveau.

Participants were then invited to describe how the community had developed; what issues were arising and whether or how they were being addressed to date; and, what sorts of development were desired in years to come. Material for this section was initially based on recent community documentation and preliminary feedback from Hamlet staff, Councilors and other residents. The presentation was modified following each consultation event based on feedback.

A summary of the consultation outcomes was compiled for distribution to the Hamlet and regional Municipal and Community Affairs staff. The serially-edited list of local development concerns and needs was reproduced there as they appeared in the last publicly-discussed version of the presentation

The thematic outcomes of the various consultation gatherings have been consolidated and reorganized once again using the tabular analysis process into the following seven topic areas:

- Community Lands and Physical Hazards
- Core Community Services and Utilities
- Transportation and Communications
- Residential Infrastructure and Services
- Economic Infrastructure and Services
- Public Services
- Community Wellness

A discussion of each, along with its local theme summary table, follows.

6.5.1 Community Lands and Physical Hazards (See Table 6.3)

Sachs Harbour residents have observed many environmental changes in the last few decades that are consistent with the warming conditions documented throughout the Beaufort region. Slope failures, permafrost melting, and growth in thermokarst ponds have been reported in the community. While the beach below the RCMP post has been growing, the shoreline to the east and west has been retreating for some time. Numerous accounts were given in the course of local consultations of shifting foundations, washouts, and erosion of banks near structures. As infrastructure is replaced or relocated, design and siting needs to recognize that the entire community sits on ice-rich ground that will continue to change in years to come.

Identifying suitable land for development is a significant issue in Sachs Harbour. While there is no official Hamlet land use plan in force, concept plan materials dating from the early 1970s (Fig. 6.18) on file at the regional MACA office document a longstanding intent to develop a small subdivision on the east side of the community just north of the main road (*see arrow*). A raised roadbed had subsequently been developed. Only two dwellings had been erected there by the time consultations commenced in 2006, however, and they both were experiencing cracking due to seasonal frost heaving (Fig. 6.19). Not only was the road itself impeding natural drainage, culverts and pipes in the vicinity were found to be damaged or otherwise insufficient to prevent water from regularly ponding in the area. Consequently, the land there (the equivalent of several remaining building lots) was no longer suitable for development.

Table 6.3: Community Lands & Physical Hazards - Local Themes Break-out Summary

Sachs Harbour Consultation Outcomes - Theme Break-out I

Community Lands & Physical Hazards 

Theme	Material		Relational	
	Resources	People	Organizations	Relationships
Coastal erosion 	Affecting shoreline properties, the most prominent of these being the Parks Canada house to the east side of the community	Properties and households most affected are subsidized housing; limited means to address property risks.	Longstanding and deepening Hanlet issue (resident safety, relocation options limited) but slow-moving enough to manage; Housing Association units slated for replacement will not be rebuilt on a few deteriorating shoreline sites.	Chronic experience that has relatively recently engaged geoscientists
Drainage problems & permafrost degradation 	Cross-cutting influence that both destabilizes existing infrastructure and diminishes options for replacement Poor condition of drainage infrastructure (i.e. related to design, execution and/or positioned and/or maintenance) contributing to ponding, in turn accelerating permafrost degradation (e.g. designated subdivision area) Building heaving and cracking occurring throughout community; increasing numbers of 'sinkholes' (muddy pits attributable to near-surface ice lens melting)	Properties and households most affected are public housing. Public works staff turnover had reduced capacity to address problems.	Presents potential issues to all with property/capital assets but Housing Association and Hanlet are especially affected.	Information needs suggest ongoing geoscience and engineering support would be of assistance, particularly in relation to evaluating emerging concerns (i.e. 'sinkholes', slope stability questions)
Former dumpsite(s) 	Former dumpsite (landfilled) to west side of community - exhibiting terrain movement	Residents expressed concerns regarding deterioration of potentially contaminated ground.	Former Hanlet foreman had buried vehicles in small gully on west end of community.	Legacy of landfilling suggests other factors requiring further research (i.e. variable change response, contaminants)

Less stress
More predictable



uncertainty

Significant stress
Pervasive impacts



Figure 6.18 (top): Sachs Harbour Concept Plan Map (c. 1970s), MACA Regional Office, Inuvik. (Photo dated August 2005). Proposed housing area to east side of community highlighted.

Figure 6.19 (bottom): Sachs Harbour Panorama – East side of Hamlet, July 2005. Two Elders' residences indicated (arrow) – the only units constructed to date in originally designated subdivision area. Latest roadway there has created unintended dam and consequent ponding has accelerated permafrost degradation, making the land unsuitable for development. Remedial drainage measures are required.

Siting options for new development are increasingly constrained by both terrain conditions and remaining vacant lands. The existing Hamlet boundary defines a relatively small area flanked to the North by the airstrip and otherwise by Inuvialuit Settlement Lands managed by the Inuvialuit Lands Administration (Fig. 6.20). Community members said permission to develop outside of the existing community area had been sought but not granted. Residents have also avoided areas to the west side of the community where the former community dump was located and where a former Hamlet works foreman was also known to have attempted to consolidate terrain with landfill that included surplus vehicles. A 'multitude of sins' such as these are believed to be hidden in what, until recently, has been reliably frozen ground; warming conditions, however, were said to have noticeably softened filled areas and accelerated the development and deepening of drainage features throughout the community (Fig. 6.21).

It was agreed that an inventory should be made of all former garbage/waste disposal sites, acknowledging the presence of several of potential concern. In addition to the buried vehicles in the west side of town; there was a former sewage lagoon described as having existed in the same general vicinity; and, that other buried refuse existed including materials cleared from near the old weather station (locally known as 'Iceicle Inn') and elsewhere in the areas formerly occupied by the Department/Ministry of Transportation (DOT/MOT). The east side of town was characterized as "cleaner".

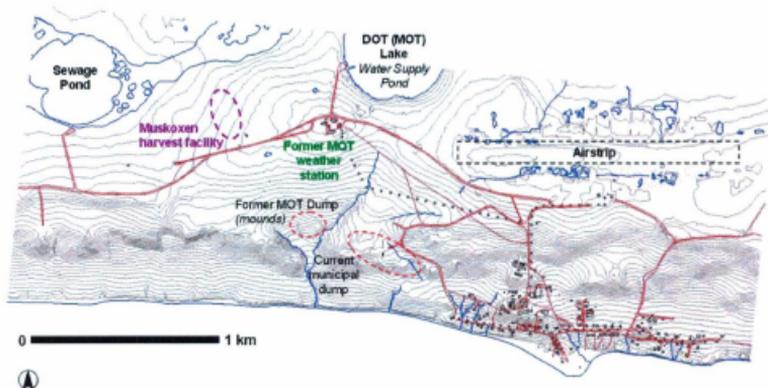


Figure 6.20: Contemporary Sachs Harbour community area and infrastructure
Base map courtesy of Municipal and Community Affairs, GNWT (ATLAS GIS).



Figure 6.21: Recently resurfacing landfilled vehicle (c. 1980s) in west end gully, July 2005.

6.5.2 Core Community Services and Utilities (See Table 6.4)



Figure 6.22: Panorama shot from Hamlet garage looking north. Power plant to left; tank farm up hill; and shared Hamlet/Parks Canada Interpretation Centre building to right (arena visible to rear). A buried fuel line follows the road from the tank farm down the hill to the beach. August 2008.

The Hamlet of Sachs Harbour has most of its facilities clustered at the centre of the community (Fig. 6.22). The Council Chamber and general offices are located in a building shared with Parks Canada. The community arena is located immediately beside the Hamlet offices and the Hamlet Public Works garages, Fire Hall and vehicle yard are located across the road.



Figures 6.23: Sachs Harbour Water plant (left) and intake (right), July 2005

Hamlet water services have been a chronic source of serious concern. Residents expressed numerous reservations about both the quality of the water in the designated supply pond and the services in place to treat and deliver it. The community's drinking

Table 6-4: Core Community Services and Utilities - Local Themes Break-out Summary

Sachs Harbour Consultation Outcomes - Theme Break-out II

Core Community Services/Utilities

Theme	Material		Relational	
	Resources	People	Organizations	Relationships
Water supply sustainability	Water supply and quality issues (system freeze-ups), as well as permafrost degradation believed to be affecting source retention (pond leaching/infiltration via gullying/patterned ground?). Boil water orders (2008-09 & 2011)	Many in community and Elders in particular prefer ice sourced from a few area streams for tea and drinking water	Hamlet maintains system and water truck(s) for delivery of water.	Source located in immediate vicinity of airstrip, sewage pond, and seasonal musk-oxen harvest facility. Frequent system freeze-ups and other technical problems requiring services of supplier (U.S.) and MACA/GNWT engineering over several years to address.
Design issues	Existing infrastructure either poorly executed or ill-suited to local conditions Ex: water supply pump noted above, rink	Few residents in a position to address arising issues, infrastructure design decisions have tended to reinforce external and technical solutions	Hamlet saddled with malfunctioning infrastructure	The GNWT has exercised primary oversight of capital works and contractors.
Siting issues	Conflicting uses difficult to address Ex: Musk-oxen harvest facility in relation to water supply	Residents had earlier identified abattoir concerns but siting outside Hamlet area hadn't been allowed.	Hamlet/MACA (land-use planning within community boundary), ILA (Inuvialuit lands)	Site separation requirements not possible to meet within small community boundary New development on ILA-managed lands (surrounding community) prevented by stringent and slow permitting processes
Sewage Pond leaking?	Sewage pond and water supply separated by just over 1 km	Concern expressed that changing hydrology in patterned ground between sewage and drinking water ponds may allow contaminated water to reach water supply.	Hamlet/MACA responsible for both water and sewage services	GNWT water quality testing does not offer evidence of this contamination but latest boil order based on turbidity is consistent with permafrost degradation and drainage changes.
Alternative energy (wind energy pilot)	Experiment with wind turbine in area suggest opportunity to diversify/augment existing power supply	Historic use of small-scale, wind-generated power.	Hamlet, Community Corporation	ARI GNWT
Fuel Line leaks	N-S line running from tanks to shore - leaking suspected and later confirmed on lower road above RCMP Clean-up further destabilizing shore	Resident observations and complaints led to discovery of problem	Petroleum Products Division, GNWT Public Works and Services (Tank Farm)	Inadequate oversight of contracted clean-up, ineffective removal, protracted work period with numerous delays contributing to additional permafrost degradation

Less stress
More predictable



uncertainty

Significant stress
Pervasive impacts

water is sourced from the DOT (or 'MOT') Lake, a reference to the association of most all the extant infrastructure developed on the upper elevations of the community (e.g. the airport and the remnants of 'Icicle Inn') with the Department of Transportation. While residents had identified a back-up water supply – Picnic Lake – they were frustrated by the difficulties they had encountered in getting it formally recognized as an alternative supply (see also 6.4.3 below). They named the Mary Sachs River as a former water source in the area, but pointed out that the community dump now drains into it.

The on-line GNWT Municipal and Community Affairs Drinking Water Quality Database (DWQD) records Sachs Harbour as being under a Boil Water Advisory from July 2008 through March 2009 and, at the time of writing, it was under another that had commenced on 14 June 2011(MACA 2011a). The explanation for the earlier advisory was not elaborated but the latest one was stated as follows:

"High Turbidity – due to cloudy water (high turbidity) a result of problems with the treatment plant's water intake which prevents water from being filtered in the treatment plant. The high turbidity could interfere with the ability of chlorine to act as an effective disinfectant to ensure water safety." (ibid.)

Assuming that a higher than usual amount of organic content would be present under the circumstances, not only would chlorination be a less effective disinfectant, it would be more likely to generate by-products of public health concern such as trihalomethanes (THMs). The current water pumping plant (Figs. 6.23 – 6.25), classed by MACA as a 'small system', relies on cartridge filtration and disinfection with liquid chlorine (MACA 2011b). Regarding this simplest class of GNWT water treatment plants, however, the DWQD website notes:

“Most small systems in the NWT where the source water is classified as pristine (filtration is not required as per GCDWQ) typically include a reusable filter to screen out suspended solids that may interfere with the disinfection process, UV disinfection followed by chlorine addition prior to storage and distribution. Other small systems where source water is not classified as pristine may include a series of cartridge filters followed by UV and/or chlorine disinfection prior to storage and distribution.” (MACA 2011c)

While the chief environmental health officer interviewed at the time wished to reassure residents that this was a precautionary measure only, he also indicated that the cloudy lake water actually followed on a plugged intake pipe over a month earlier (Heiberg-Harrison 2011). While the nature of the latest blockage wasn't specified either, this circumstance was certainly familiar to residents. Since its upgrade in 2005, the water system intake had experienced regular winter freeze-ups, one of which occurred during the researcher's winter field visit in 2006. Blocked water intakes are regularly addressed by bypassing the truck fill station and instead pumping water directly from the supply pond into the delivery truck. In 2006, the researcher was told that in-truck water treatment was accomplished by adding disinfection tablets. She also noted, however, that the quality of the water delivered was significantly altered by this practice. A review of commercially-available water treatment tablets revealed that there are numerous varieties, each with different chemical properties (i.e. common active ingredients are chlorine, sodium dichloroisocyanurate, halazone, or compounds containing iodine). Further research regarding their suitability for extended community-scale usage relative to other methods remains of interest to the community.



Figure 6.24: Truck fill station at water treatment plant, Sachs Harbour. (Photo: MACA)

Residents clearly do not believe their designated water supply pond is 'pristine'. A plane crashed and sank into the water supply lake in the fall of 1989 killing all five occupants (Transportation Safety Board of Canada, 1991). Concerns remain that the water supply contamination from this incident has persisted in some way. More recently, residents described the depression seen in aerial views of the community as running between the sewage lagoon and the water supply area and indicated that it might permit flows between the two under higher water conditions (Figure 6.26). Similarly, the growth seen in the fissures of patterned ground there were seen as potentially adding to the mobility of contaminants. Elders have also commented that the sewage lagoon appears to be getting larger. The two ponds are located just over a kilometer apart, with a third small pond between them. All three are thermokarst features that will be expected to continue to

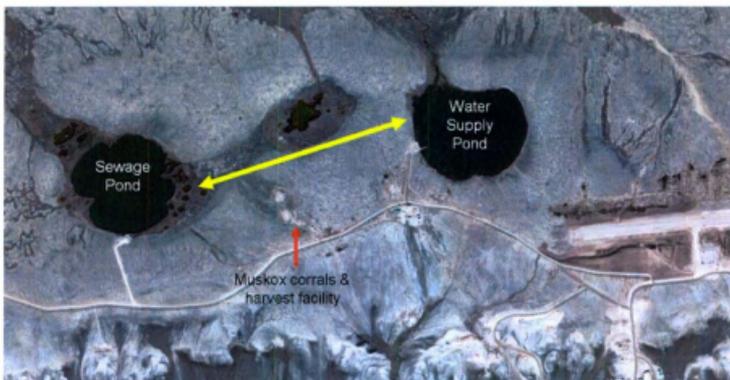


Figure 6.25 (above): Sachs Harbour sewage and water supply ponds (yellow arrow = 1 km)

Note proximity of muskoxen abattoir and airstrip.
Satellite image source: GoogleMaps (maps.google.ca)



Figure 6.26 (left): Sachs Harbour sewage lake dump station, July 2006

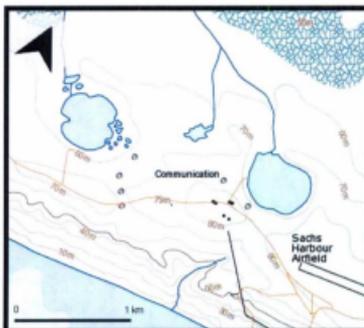


Figure 6.27 (a) & (b): Elevations Details – Water Supply and Sewage Ponds

Source: Natural Resources Canada, The Atlas of Canada (www.atlas.gc.ca) © Her Majesty the Queen in right of Canada, 2011.

expand through ablation processes as area temperatures trend higher. The turbidity present in the water supply pond is also generally consistent with a changing periglacial drainage system (Fortier et al. 2007, GNWT 2009).

In addition, the proximity of the water supply to potential contaminants from the muskoxen harvest facility and airport were noted. Offal and blood, runway dust, leaking oil from planes, and prop wash were all described as possible contaminants. The seasonally operated muskoxen corrals and temporary abattoir structure are located 1.5 km northwest of the built-up portion of the hamlet and within 750 m of the DOT Lake. The consensus of Sachs Harbour residents has been that the operation is too close to their water supply. Their efforts to have the current facility relocated were said to have failed, however, due to the stringent development permitting process associated with ILA-managed lands outside of the designated Hamlet area (see 6.4.5 below).

Conventional land use planning strategies call for separating these sorts of conflicting uses, often by defining buffer zones around the sensitive area (i.e., watersheds). Contemporary rural abattoir development control approaches (e.g. Government of Western Australia 2007; see also Back 1995) recommend a variety of special run-off and waste management criteria to facilities with smaller separation distances from water resources than are currently available at Sachs Harbour. However, further study of environmental differences (i.e. permafrost terrain; vegetative cover; climate; water body characteristics) and not-so-obvious new considerations (i.e. warming-induced changes in local hydrology) are needed to inform comparable buffer designations in Arctic settings. For now, suffice it to say that standards of industrial facility containment, support services and other design and practice safeguards typically bear an

inverse relationship to available separation distances: in other words, the less elaborated the abattoir infrastructure, the greater the recommended separation between it and a protected water body should be.

Sachs Harbour has a trucked system for water and sewerage. The Hamlet has two trucks dedicated to each service in order that there be a back-up in the event of a breakdown. There were occasions during the project period, however, when both trucks were in need of repairs.



Figure 6.28: Children playing in vicinity of fuel contaminated culvert, August 2008. Contaminant clean-up equipment visible to left. The fumes were noticeable at the time.

A significant concern was raised respecting the fuel line that runs down the hill from the local tank farm (Petroleum Products Division, GNWT Public Works and Services) to the beach. Residents described periodic episodes of discharge into a creek on the main road and some more serious leaks that had necessitated clean-ups. Between the third and final community visits, complaints regarding the chronic and accumulating

nature of the problem finally received some attention and a contractor was engaged to undertake a clean-up. According to residents, however, the process engaged was not an impounding, removal and disposal of the contaminated soils but rather a simple turning and aeration, seemingly operating on the assumption that evaporation of the contaminants would accomplish the ends desired. Residents – adults and children alike (Fig. 6.29) – in



Figure 6.29 (top): Area condition prior to fuel line leak clean-up, July 2005. (Photo: K. Belliveau)
Inset map showing clean-up area. Source: Adapted from ATLAS GIS content courtesy of GNWT.
Figure 6.30 (bottom): Area after fuel leak clean-up commenced, August 2008. (Photo: K. Parewick)

any proximity to the site complained of the smell and consequent headaches and nausea. Occupants of the adjacent RCMP detachment and Housing Association Office were particularly affected. Furthermore, the remediation approach had not taken into account the local permafrost conditions (Figs. 6.30-6.31). A cut of this nature into the active layer at this time of the year would be expected to rapidly accelerate the melting of ground ice in the vicinity. As this site was also located at the base of a slope, this attempted remediation had the potential to destabilize terrain above. The researcher record of this episode was provided to MACA staff in the Inuvik Regional Office immediately following her fourth visit to Sachs Harbour.

Notably, the theme of staff turn-over at the Hamlet was raised in relation to a number of the community infrastructure-related problems that were identified. A Hamlet foreman with fifteen years of experience with the community's equipment and infrastructure had left the position for one in another community not long before the 2006 consultations. Significant difficulties with other resident and visiting support staff were also described during the project period. The subject of staffing was acknowledged to be a complex one – the Hamlet positions said to be requiring a balance of firm management and sensitivity to local politics in order to maintain operations effectively.

The Hamlet relies on a diesel-electric power plant (three generators, total installed capacity of 795 kW) and distribution system operated by the Northwest Territories Power Corporation (NTPC). Wind power development has been of great interest to the community, both as a means of augmenting the costly existing power supply, and to provide a back-up in the event of a plant shutdown. At the time of the consultations, such a system was thought to still be a number of years away: the Aurora Research Institute

had been experimenting with the technology but was experiencing difficulties with a couple of local wind monitoring stations installed in July 2005. Residents described the systems being tested as generally unsuited to operating in extreme cold and high wind conditions, citing instances they were aware of elsewhere in the region (Kugluktuk) where turbines had snapped off entirely in some pilot installations.

At the time of writing, consulting engineers had compiled and analyzed community wind data in order to evaluate possible wind farm locations in the community (Pinard and Maissan 2011). They noted several uncertainties bearing on the potential performance of wind turbines locally, in particular, local rime icing related losses, and the fact that no turbines with a northern track record had been identified that fell under the NTPC's stated turbine size cap of 40kW (*ibid.*, p. 18). Upgrading of sub-standard local roads (priced at \$40,000/km) and the installation of costly new power lines were factored into three site-specific capital cost projections for one-turbine installations yielding an initial development cost of between \$382K - \$787K. Turbine sites adjacent to existing community power lines were the more cost-effective options.

6.5.3 Transportation and Communications (*See Table 6.5*)

Natural flows must be considered in northern infrastructure design (Fig. 6.31). When permafrost ground conditions are present, construction crews preparing roadbeds and foundations for smaller structures will employ a thick, insulating subfloor of fill to protect the underlying active layer from thermal disturbance. While these materials do allow for some degree of percolation, the raised beds they create will become barriers to



Figure 6.31 (top): Aerial view of northeast corner of Hamlet area. Note distinctive 'striping' of slopes suggestive of predominant flows and mass movements. Drainage problems exist throughout the community and are related to periglacial ground conditions.

Figure 6.32 (bottom): Examples of drainage system infrastructure demonstrating problems with system maintenance. Karissa Belliveau is shown recording elevation and position data for future analysis.

Table 6.5: Transportation and Communications - Local Themes Break-out Summary

Sachs Harbour Consultation Outcomes - Theme Break-outs III

Transportation and Communications



Theme	Material		Relational	
	Resources	People	Organizations	Relationships
Community road maintenance and upgrading	Increased freeze-thaw and rain damage	Small pool of qualified equipment operators	Hamlet maintains	Indirect costs to community associated with other development which depends on reliable road access (e.g. wind power sites)
Travel disruptions	Storm delays	Residents described numerous episodes of dangerous and unseasonal weather encountered on land trips in last decade.	Hamlet Search and Rescue/Rangers	GPS and satellite-mediated communications becoming part of regular gear for travel outside of community.
Slope failures	Affecting trails throughout region (e.g. Angus Lake)	Most of community engaged in travel on the land at various times throughout the year	Hunters and Trappers Association, Rangers and other potential responders to search and rescue calls	
Upgraded internet service	Anticipated since 2006		Private service provider	

Less stress
More predictable



uncertainty

Significant stress
Pervasive impacts

larger flows. If drainage is inadequately addressed in these designs, a vicious cycle ensues: a poorly designed road begets poor drainage, which begets an even worse road condition as the water finds a way through, likely necessitating recurring repairs. Washouts were apparent after one heavy rain event during the Summer 2005 field season (Fig. 6.33). Poor drainage certainly contributes to problems in several areas of the community and needs to be addressed before any upgrading can be successfully completed (Fig. 6.34).



Figure 6.33: Road wash-out on east side of community, July 2005.

Figure 6.34: Poorly draining children's playground below arena, July 2005.

Efforts to develop an access road to the Hamlet's desired back-up water supply lake were said to have been hampered by a \$10,000/year cap on road upgrading funding and the need to do much other local road work. The community nonetheless had been building the access by increments as resources allowed.

Community members report that they are seeing significant changes to the land along the routes they travel elsewhere on Banks Island. A field visit made to Angus Lake in July 2005 (Figs. 6.35) provided one example of the kinds of obstacles being encountered. The trip was made by boat up the Sachs River but with some difficulty as

the riverbed became very shallow towards the destination. One Elder consulted recalled that the Sachs River had once been deep enough to allow access a much longer way inland. As was typical of other thermokarst features in the vicinity, the sides of Angus Lake were rapidly ablating, in turn requiring that a well-used all-terrain vehicle trail running alongside it be moved. Lower lake water levels suggested that the already reduced strip of ground between Angus Lake and the adjacent Sachs River basin was allowing some drainage to occur well in advance of a complete breach occurring.



Figure 6.35 (left) Angus Lake, west of Sachs Harbour in July 2005. Note the recently realigned ATV trail and the proximity of Sachs River (to right in background). Lakeside slumping seen in detail (right).

Also attributable to the erosion seen there, a fine, reddish silt matching the sediments in the vicinity of the lake and riverbed was noted by Sachs Harbour residents as increasingly blown into the community, depositing on windows and, as seen by the researcher during the consultations, evident in layers in sectioned snow banks.

Airport deficiencies identified at Sachs Harbour by the NWT Runway Issues Study (VISS Ltd. 1998) included the need for improved terminal facilities, airport lighting and heavy equipment to maintain the runway. The community's 4000' gravel runway was not recommended for extension then or in 2007 (LPS Aviation Inc.); the latter study, however, ranked it as tied with Paulatuk at fourth in the regional priority rankings for this type of upgrade. Scheduled air services offered by Aklak Air provide three return flights per week with Inuvik (24 seats) with the lowest average one-way fare of \$482.00 for the 515 km flight. The estimated cost (2007) of upgrading to a 5,000 foot runway was \$2.2M and a 6,000 foot runway was \$5.65M, neither of which included land costs.

At the time of the community consultations, recent airstrip improvements undertaken had included grading of the sides of the strip which was said to have 'created a dustbowl' in even light winds. Local support staff had noted then that an instrument landing system would be a desirable improvement. In 2011, the terminal building was upgraded.



Figure 6.36: The well-used community beach - August 2008

Residents felt that development of a permanent docking facility should be explored. Elders noted, however, that there had been one years ago for float planes that a

big storm wave had destroyed. The beach remains the landing area for the NTCL barge and any other small local vessels in use locally (Figs. 6.36-6.38).

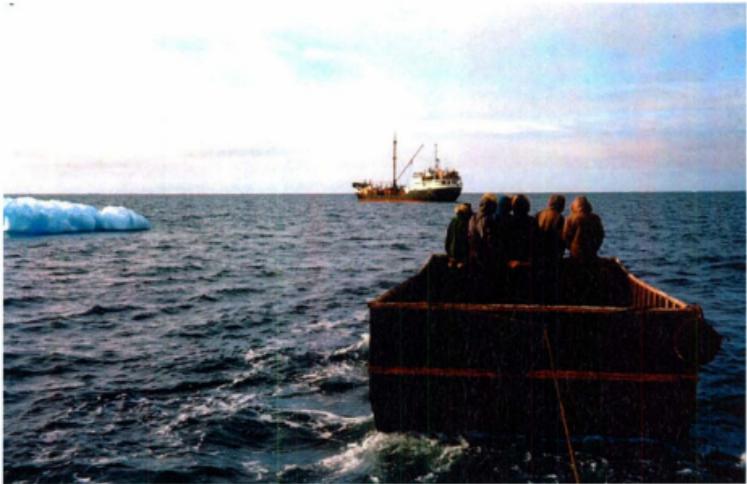


Figure 6.37 (above): Two barges being towed from Sachs Harbour back to the HBC ship "Banksland" after unloading the annual supplies on Sachs Harbour, 19 September 1957. (Source: R. Knights/NWT Archives/N-1993-002-0074)

Figure 6.38 (below): Arrival of NTCL barge, 20 August 2008

At the time of the consultations, a need for local internet service upgrading was identified. The existing service seemed to work better for some than others: some residents have few service interruptions while others noted storm-period difficulties. Households without internet services relied on the community access terminal in one or other of the school or Hamlet offices.

6.5.4 Residential Infrastructure and Services *(See Table 6.6)*

Most of the residences in Sachs Harbour are subsidized units maintained by the Housing Association. A number of their older units have required replacement in recent years. As noted above, available sites for new development are in short supply and this constrains the supply of shelter of all sorts. Transient workers are either accommodated in employer-provided units (e.g. RCMP compound; apartments in health clinic building and Parks Canada interpretation centre); or in a small number of market units available in the Ikaahuk Co-op or held by residents. A well-equipped lodge is also maintained by an outfitter based in the community, but is not economical for most visitor stays of more than a few days duration.



Figure 6.39: Panorama of shoreside housing on east side of community, August 2008

Table 6.6: Residential Infrastructure and Services - Local Themes Break-out Summary

Sachs Harbour Consultation Outcomes - Theme Break-out IV

Residential Infrastructure and Services



Theme	Material			Relational	
	Resources	People	Organizations	Relationships	
Subdivision land with drainage problems	Primary new housing area (as per Concept Plan) has been rendered unuseable by poorly drained land there.	Few qualified equipment operators in community. Need to augment local expertise in fashion that would allow better ongoing troubleshooting	Hamlet responsible for area drainage but has had numerous public works staff difficulties (retention, few workers with needed skills)	Concept plan had not anticipated issues stemming from road construction and subsequent drainage/accelerated permafrost degradation issues.	
Need for new subsidized housing to replace older units	Aging building stock – most of housing constructed in 1970s now in need of replacement; higher rates of damage to subsidized housing units	Small population has meant small allocations for new units	Housing Association	Legacy of former trapping-period success seen in many family-owned properties, somewhat offsetting existing issues with public housing	
Need for market housing	Required for transient and professional workers	While lodging options were limited, needs appeared to be met during the study period.		Existing employer-maintained units provided in Health Centre, Parks Canada Interpretation Centre, RCMP compound.	
Need for shelter	Special needs shelter options lacking	To serve women, youth and otherwise homeless persons	Regional health/social services	Special social service supports have entailed leaving community.	

Less stress
More predictable

uncertainty

Significant stress
Pervasive impacts



The existing lot lay-out of the community was criticized. Some residents believe that houses in the hamlet are being built too close together, causing snow to pile up which, in turn, can make walking difficult. The community is very muddy in the spring.

Snow drifting is a well-recognized design consideration in northern settlements so areas of regular accumulation in Sachs Harbour should be mapped. During the consultations, residents noted that while it was not as apparent so far that year, the area west of the existing "subdivision" was an area where a great deal of snow tended to collect each year.

Efforts to maintain daycare operations in the community have failed due to the difficulty experienced in retaining reliable staff. There is a library in the school but it is neither staffed nor operated as a public facility. There is significant concern regarding the future of the local school: student numbers have been declining and the staff allocation consequently reduced. Community members believe that having a high school in the community could help to reverse the declines.

6.5.5 Economic Infrastructure and Services *(See Table 6.7)*

Tourism is of growing importance to community residents. Established in 1992, Aulavik National Park occupies over 12,000 km² on the northern side of Banks Island. Cooperatively run by Parks Canada and the Inuvialuit pursuant to terms set out in the ISR land claims agreement, it is a wilderness attraction with no developed tourism infrastructure. The arctic lowlands environment and the muskoxen and endangered Peary caribou there; the last 3,500 years of aboriginal occupation in the region; as well as the history of Western Arctic exploration are among the rich themes that could be further

Table 6.7: Economic Infrastructure and Services - Local Themes Break-out Summary

Sachs Harbour Consultation Outcomes - Theme Break-out V

Economic Infrastructure and Services



Theme	<i>Material</i>		<i>Relational</i>	
	Resources	People	Organizations	Relationships
Co-op in serious need of renovation	Aging building stock - need for upgraded office space Complaints of 'sick building' syndrome	Local skills and professional development supports needed	Several organizations including current Co-op tenants	
Need for other spaces for rental, storage, and enterprise development purposes	Envisaged for various uses: Crafts retail? Bakery? Muskox processing? Outfitting?	Proposed for use by visiting officials, researchers, meetings, workshops	Community Corporation	Inventories of enterprise opportunities (i.e. small enterprise, crafts, tourism...) and compile list of needed trades/skills
Little job skills training/upgrading available locally	School, existing employers, internet-based learning supports	Catch-22 of ongoing need for individuals to do local work but needed skills entail leaving community for extended periods of training (e.g. education at Aurora College, Inuvik, equipment operator certification even further away)	Limited pool of local employers with relatively few full-time positions.	Identification of enterprise opportunities (i.e. small enterprise, crafts, tourism...) and compile list of needed trades/skills
Musk-oxen harvest expansion	Temporary structure with siting issues (too close to Hamlet water supply) Increased volume and secondary processing desired but would require new infrastructure	Provides some seasonal work but not as much as hoped. Seen as a major, unfulfilled local development opportunity	Hunters and Trappers Committee Community Corporation	Constrained by ILA development permitting process; meat inspection/certification standards, seemingly a lower priority for regional Inuvialuit government
Fishery	Some local species believed to have potential for commercial harvest	Mainly subsistence fishing by residents	Community Corporation HTC	Studies sought that address locally-identified research questions
Tank Farm expansion/relocation	Existing fuel reservoirs in need of replacement and associated fuel line evidencing serious problems	Fuel line leak response evidenced difficulties in management of infrastructure	By association and as a possible intervenor, MACA Inuvik office staff	Poorly sited and in need of greater monitoring <i>Tank Farm improvements made after consultation period</i>

Less stress
More predictable



uncertainty

Significant stress
Pervasive impacts

developed for visitors to the Park's interpretation centre in Sachs Harbour. In addition to a couple of full-time Park employees based in the community, at the time of the consultations and since, seasonal employment opportunities have included guiding and assisting with Park-based research activities.

Visitation to the Park is low, totaling 450 over the 1999-2009 period (Parks Canada 2011). Many visitors fly there on charters straight from Inuvik to the Park where most will paddle the Thomsen River independently or as part of outfitter-guided trips. Some tourists deplane in Sachs Harbour enroute. Aulavik has also developed a youth camp for ISR-region students to cement Inuvialuit bonds to 'their' Park. The Park's draft



Figure 6.40: The *Fox*, August 2008

management plan was under review in the summer of 2011 and specifically refers to initiatives that will enhance community visitation in order to support the development of other attractions in and near Sachs Harbour. A variety of (pre)historic and cultural themes certainly could be pursued (e.g. interpreting "The Fox", now positioned above the beach head, as the last extant schooner from the 1920s-40s white fox fur trade

boom period) (Fig. 6.40). At the time of writing, Parks Canada was also promoting significant discoveries at Aulavik National Park arising from a side trip to an earlier noted Thule site at Mercy Bay in July 2010, during an archaeological expedition focused otherwise on locating the HMS Investigator wreck and other remains of Robert McClure's expedition (1850-54) that discovered what was then the last segment of the Northwest Passage

To support longer-term visitation, residents said that a hotel was needed. At the time of the consultations, one resident was known to be exploring the possibility and had proceeded with some preliminary sitework on a prime area above the beach. Most of the co-ops in the region (Kugluktuk, Holman) are the operators of their local hotel, but the Ikaahuk Co-op is not. It has been suggested that the upstairs of the existing co-op building could be renovated to serve as a hotel.



Figure 6.41: Ikaahuk Co-operative Building, August 2008.

The Ikaahuk Co-operative (Fig. 6.41) has struggled through numerous cycles of reorganization and staff turnover. Their existing building is in serious need of repair and upgrading and there have been complaints about its air quality too. It houses the one

major retail operation in the community (food, clothing, hardware, agent services for local flights and mail), offices for the Hunters and Trappers Committee and Community Corporation, as well as upstairs apartments generally reserved for Hamlet support staff (e.g. visiting equipment mechanic) and the Co-op Manager.

The Sachs Harbour Community Corporation had been seriously discussing the development of a new office building for some time. Several organizations in the community wished to relocate to upgraded premises that, amongst other things, would meet current accessibility standards. The viability of the existing Co-op would, however, be called into question should it be faced with a loss of its existing office tenants.

A lack of suitable office and workspace was flagged as a very significant obstacle to new local enterprise. During the consultations, the example was given of a bakery: while there was both a sizeable local demand for baked goods and community members interested in and capable of producing them, the initiative was said to have been stymied by existing territorial food production regulations that forbid the locating of a commercial bakery in a residence. It was suggested that the dysfunctional arena might be productively renovated to accommodate this and other new ventures.

Residents referred to prospects for a local fishery, noting that a recent study had determined a commercial harvest would not be sustainable. It was believed, however, that the consultants had examined the immediate Sachs River mouth and Thesinger Bay only. The community hopes that opportunities to the west in the deep water off Cape Kellett will be examined. Arctic char has been caught at the mouths of the De Salis and Sachs Rivers, and salmon are among the new species sighted in the region since 1999.

At the time of the consultations, one resident was exploring the start-up of a recycling depot. They hoped that such an operation might in time expand to handle metal recovery and thus address the numerous abandoned and buried vehicles in the community.

Residents said that Sachs Harbour was lacking in general storage facilities. Numerous institutional storage needs were cited (i.e. school, recreation program, municipal operations) that were resulting in cluttered, "doubled up" circumstances in many buildings. Similarly, a community workshop was proposed in order to address the need for a larger, heated workspace suitable for vehicle repairing or other larger projects that community members need to complete from time to time. A facility of this kind in Kugluktuk was proposed as a model to investigate. At the time, the Sachs Harbour Hamlet's garage was not available for general public use due to concerns raised about inventory control and the secure storage for mechanic's personal tools.

The question of whether or not the community needed an ice house was raised during the consultations. Only a few years earlier, a former cold storage trailer maintained by the Hamlet had been discontinued following a community survey: at the time, a majority of respondents indicated that they wished to have an ice house instead so a committee was struck to pursue the initiative. As of the researcher's early 2006 visit to the community, however, little progress had been made. Consultation participants described an old ice house a short distance east of the community that was no longer in regular use but that had been a storage facility for seal carcasses used for dog food. They also said that a number of recent freezer purchases had been made that were providing some households with alternative cold storage space.

As noted in Section 6.5.1 above, due to constraints on development outside the designated Hamlet area, the musk-oxen harvest facility (Figure 6.42) is awkwardly sited relative to the community's water supply. A temporary slaughter facility of this nature should have a larger buffer between it and a drinking water supply, especially in a community already experiencing water system challenges. The harvest undertaken in the winter of 2005 was not viewed as commercially successful. Although 1,000 animals were captured and processed, and several weeks of employment were provided for local hunters, the enterprise did not realize a significant return on the investment. Another commercial hunt was not undertaken until early 2008 (CBC 2008).

Consultation participants noted that skilled tradespeople were in very short supply locally. All agreed that it was very difficult to get renovations done in the community as too few carpenters/builders were available to handle the workload. Several accounts were given of cracking houses, one being referred to by the owner as their "haunted house"



Figure 6.42: Muskoxen harvest and primary processing facility, July 2005. Community sewage lagoon visible to left.

because of all the noise it made. It was also agreed that this issue was not unique to the building trades and that it would be a good idea to compile a list of needed local

tradespeople in order to begin the process of identifying training opportunities and subsidies for interested local people.

6.5.6 Public Services (See Table 6.8)

The recurring theme of outdated, dysfunctional and/or otherwise inadequate infrastructure extended to a variety of institutional services in Sachs Harbour. The existing school was built in the 1960s and renovated in the 1990s. The renovation entailed the ripping out of asbestos, reportedly done without the appropriate gear and precautions to ensure worker safety. In that it was expected that sufficient territorial funding might take some time to obtain, consultation participants wished to record the obtaining a new school as a current planning objective.



Figure 6.43: View of west side of Sachs Harbour from beach in July 2005. Note terraced character of development on this side of community. Concerns are being expressed about ground conditions in the vicinity of the steep bank below the school (see arrow).

Significant school staff turn-over has been experienced in the community. A principal with several years in the community retired during the study period. Given the small local student numbers, the possibility of losing teaching units has been a chronic source of concern and student assistants have also not been available. Consequently, students were described by some residents as often having to work unsupervised. The

Table 6.8: Public Services - Local Themes Break-out Summary

Sachs Harbour Consultation Outcomes - Theme Break-outs VI

Public Services 

Theme	Material			Relational	
	Resources	People	Organizations	Relationships	
New school needed 	Existing school considered aging building stock	School staff turn-over of concern	Local Education Committee	District Education Authority	
Library needed 	Current library irregularly maintained in school		Local Education Committee Hamlet/Community Corporation	District Education Authority	
Daycare needed 	Had been tried unsuccessfully in past Co-locate with new school?	Retaining reliable staff had been difficult	Local Education Committee Hamlet/Community Corporation		
Rink repairs 	Rink not functioning	Recreation Coordinator	Hamlet	Protracted difficulties in obtaining effective evaluation and solution for facility issues.	
Pool and Gym desired 	Only functioning indoor recreation and gathering place is the school gym	Recreation Coordinator coordinates a number of after-hours activities in consultation with School Principal, some lunchtime use by residents during the week.	Hamlet-School Board partnership produced School gym but in practice difficult to balance school and community recreation uses	Residents recount loss of earlier promised pool to Tuktoyaktuk	District Education Authority
Organized outdoor activities 	Cross-country skiing and sledding suggested	Recreation Coordinator	Hamlet	In prior generation, skis and other outdoor gear had been available at the Roman Catholic Mission and were said to be well-used	
Family Centre 	Could include community gathering place, Elders program, coffee shop, audio-visual room...	Site owned by local family on shoreline above beach and (formerly slated for hotel development) made available in 2008.	Community Corporation and Hamlet objectives realized in combined design. Area above beach the only readily available development site	<i>Funding opportunity arose during project period</i>	
Fire Hall 	Need for additional space as former one taken over for hamlet vehicle storage.	First response capacity augmented by Rangers	Hamlet/Volunteer Fire Brigade		

More predictable

uncertainty

Significant stress
Pervasive impacts



potential for a less well-managed school to cause other problems was apparent given the extent to which the community use of the gym there depends on the capacity of the educational staff. The problems locally however were said to be mirrored at the level of the District Education Authority which was described as having suffered big cuts in its operating funds and was often struggling to pay bills (i.e. the phone having even been cut in recent memory).

One Elder noted that the community, prior to having a Hamlet Council, had one governing group that was responsible for recreation and that they had much more activity then, including more traditional games, and student exchanges (coordinated with the school). The limited existing community recreation program was thought to be overly constrained by safety and insurance concerns: the example being given of a recent failure of efforts made to set up a running program in the gym. It was also acknowledged that people in the community used to volunteer more and would engage in organizing community events and other projects without being paid.



Figure 6.44: Boarded-upChurch, August 2008

In the days prior to the establishment of the Hamlet, its predecessor - the old Settlement Office - used to house the Recreation Committee and Department. Clarification was sought respecting the ownership of the school gym: it was understood that the Beaufort-Delta Education Commission (EDEC) owned the school but that the gym belonged to the Hamlet. Concerns were expressed for liability/safety/insurance concerns that seemed to be standing in the way of some desired activities (e.g. a running club using school gym). Elders recalled a time when community recreation "really involved the whole community", in effect allowing it to function "like a big family". It was also felt that the major annual community celebration, the White Fox Jamboree should be reinstated as a Recreation Department responsibility; it had become a volunteer-driven event in the early 2000s but had suffered from more generalized declines in community volunteerism.

The ongoing difficulties with resurrecting regular operations in the rink were in evidence during the 2006 consultation period when contracted technicians visited the community to undertake some work but left without completing the repairs. The problems with the facility were thought to stem from both bad management and design problems. The history of the recreation facilities in the community were discussed on a number of occasions during this consultation. The significant role that the former Roman Catholic Mission played as a much-needed gathering place for the community was emphasized by many people. The building now occupied by the Hamlet offices and the Parks Canada Interpretation Centre was also a former community recreation facility. The gym attached to the school was developed for joint school-community use: the public use that it

actually gets however is constrained by the school-day schedule and the discretion exercised by the school principal in managing the off-hours access to the building.

Consultation participants recalled that a seasonal use, above-ground pool with enclosure had been approved for the community in 1996 but was not built. It is said that the facility went to Tuktoyaktuk instead.

Community residents also emphasized the need in the community for a gathering place suited to a variety of functions, including potentially a daycare, sewing/crafts room, AV/movie room and coffee shop, and designed to meet current accessibility standards.

6.5.7 Community Wellness *(See Table 6.9)*

The limited service capacity of the community extends to those provided by regional health and safety agencies. The Health Centre (Fig. 6.42) was characterized by one resident as recently becoming “another local renovation-gone-wrong story”. The



Figure 6.45: Sachs Harbour Clinic, August 2008.

Sachs Harbour Consultation Outcomes - Theme Break-outs VII

Community Wellness 

Theme	Material		Relational	
	Resources	People	Organizations	Relationships
Community Policing vs. RCMP presence 	Loss of resident constables for local detachment seem to lead to loss of other local services (e.g. money order service)	Sense of insecurity	RCMP had instituted a policy that required no fewer than two constables per detachment and consequently provided no resident RCMP services for much of the project period	Lengthy response times as flying in from Inuvik to handle emergencies
Community health services 	Well-maintained local clinic with established staff	Little access to specialists		Regional Health Authority
Smoking, drug and alcohol dependency 		Prevalent issues in community	Few local support services – must often refer to Inuvik or Edmonton	
Decreasing population, growing proportion of youth 	Negatively affecting local labour pool, market for local services/enterprise	Small resident population frequently needing to leave community to obtain services	Constrained capacity throughout - burn-out and turn-over	
Elders and cultural legacy 	Two elders' housing units located on poorly-drained subdivision and experiencing serious freeze-thaw damage	Few members left of a last generation with memory of year-round life on land, few remaining fluent Inuvialuktun speakers	Community Corporation actively supporting elders' programs/initiatives	
Fewer community volunteers 	Substantial volunteer commitment entailed in oversight of local services (Boards and Council members)	Staff and volunteer burn-out/turn-over	Affecting most all community activities, especially as several individuals participate in multiple organizations.	Wage employment cited as changing former relationships (i.e. formerly volunteered efforts became 'jobs')
Emergency planning 	Little progress on local emergency planning	Affects all residents but first responders and individuals in designated at-risk cohorts	Hamlet as implementing organization little capacity to attend to process Local Rangers, Fire Brigade	RCMP involvement, Municipal and Community Affairs jurisdiction(?)

Less stress
More predictable



uncertainty

Significant stress
Pervasive impacts

upgrade process had introduced boiler issues and caused a loss of medical staff accommodations. It was unclear whether the problems being experienced might eventually necessitate a new facility. It was noted however that the Centre was also the only building in town at the time with a back-up generator. It was thought that the harvest facility had some portable generators as well (items to include in emergency planning inventory).

It was noted that the Sachs Harbour Fire Hall had been partially taken over for sheltering Hamlet trucks which, if left outside, developed mechanical problems. A new fire hall was proposed in order to free up more general garage space. In addition, the fire hall could be designed to include a reservoir tank to ensure the fire truck would have ready access to additional water. Accounts were given of two recent fires that demonstrated the potential for significant losses stemming from a truck running out of water.

At the time of the consultations, the volunteer firefighting force in the community did not appear to be meeting regularly, raising concerns about general first responder capacity. The Sachs Rangers, however, were engaged in regular training (Fig. 6.46), periodically supported by a visiting member of the Canadian Forces.

At the time of the winter field visit, the community was coping with a scaled-back RCMP presence. Based on the prior population-based staffing criterion, the community had been eligible for one resident police officer but that changed in 2005 when a new policy was implemented calling for no fewer than two officers per detachment so that no



Figure 6.46: Sachs Rangers on parade in school gymnasium following completion of field training (February 2006)

member was left without back-up in case of emergency. To the dismay of the community, the outcome was that they were being served on a rotating basis by two-person police teams flown in from Inuvik. The community was very anxious to reverse the loss of their local detachment and it was felt that they required a sheriff at least. An increase in break-ins at the Co-op had already been attributed to the loss of the full-time RCMP presence, and had in turn resulted in the loss of the revenue stream from a money order service they were forced to discontinue.

In 2006, the Hamlet was the only one in the Inuvik region that lacked an emergency response plan (J. Picek, pers. comm.). Longer-serving Hamlet staff recall that a planning process had been begun but was unable to locate the materials that had been produced at the time (e.g. inventories of local equipment for call to use in the event of an emergency). A search was made by the researcher in February 2006 and a few materials

were found in the archived Hamlet file boxes. Unfortunately, no electronic files surfaced at that time.

In 2006, the Inuvik-based regional RCMP office was working towards an updating of the regional emergency plan. Reviewing and completing all the community emergency plans was to be an objective following on this effort but outside of the responsibility of the RCMP. Instead, it was expected that MACA would offer assistance to communities seeking to prepare or review local emergency plans.

6.6 Plan and Adaptation Scenarios

Sachs Harbour had a track record of self-sufficiency that was impossible to ignore, notwithstanding the difficulties it faced at the time of the consultations. Even the moderate and relatively predictable grade of physical hazards being evidenced, however, were accumulating across the full spectrum of community resources and were taxing limited local human resources. Where and when the Hamlet sought assistance from external agents, it was not always forthcoming.

In keeping with the 'ten key observations' convention, while several of the observations made in Tuktoyaktuk might have been expected to carry over to Sachs Harbour given their regional climatic and isostatic similarities, there were instead significant differences (Table 6.3). Offsetting their shared physical hazards associated with permafrost degradation and coastal erosion, the topography of the Sachs Harbour townsite released its

Table 6.3: Ten Key Observations – Sachs Harbour

1. Community members recognized that their climate is rapidly warming and anticipated that the types of changes they are currently experiencing will continue to evolve for years to come. As so many residents had been involved in local research activities (i.e. IISD project participation; providing research support services), there was a general awareness that their local observations of changes accorded with and informed those of scientists active in the region.
2. Environmental changes were pervasive and acknowledged as affecting individuals, groups and the community as a whole. Shoreline erosion monitoring and analyses by associated researchers were not complete early consultations so the community's own change observations, both in the townsite and elsewhere on Banks Island, were the primary reference used for planning.
3. While residents recognized small changes in area vegetation (e.g. larger blooms), their observations of changes in wildlife were extensive and detailed.
4. Storm and ice impacts were among the climate change implications most readily acknowledged in relation to ground transportation and land-based activities but, thanks to the elevation of the townsite, were not posing coastal flooding hazards to infrastructure.
5. There was growing awareness of the multiple and cumulative effects of terrain and infrastructure instability throughout the Hamlet where thawing ground already affects critical community infrastructure.
6. Infrastructure relocation, in practice, was being approached on a case-by-case basis by the local Housing Authority office where staff had begun to evaluate their local properties in relation to factors such as shoreline and permafrost terrain stability.
7. The community acknowledges numerous economic and cultural concerns and climate change is being increasingly seen as a contributor to some of them (e.g. impact on land-based activities, including outfitter operations).
8. The community's emerging physical hazards and related critical infrastructure problems have been exacerbated by limited capacity of the small population, constrained economic circumstances and services.
9. Chronic and recurrent community infrastructure issues appear to correlate with matters adjudicated outside of the community.
10. In lieu of a recovery of Public Works capacity, the deterioration of local ground conditions and service infrastructure will continue with the likelihood that the loss of options rather than a catastrophic failure may contribute to residents opting to leave the community.

While not revisited in any depth during these consultations, community residents had recorded UV-related health concerns (IISD 1999).

infrastructure from the heightened coastal flooding risks experienced in Tuktoyaktuk. There is a trade-off, however, in that gravity will be an equally persistent contributor to local terrain changes. Sachs Harbour must instead be mindful of the potential for precipitation to gather momentum and sediment as it drains across the townsite to the shore. The potential for mass movements or slides of unconsolidated surface materials loosened by a deepened active layer exists in a few parts of the community as well. In particular, the area below the community school should be monitored.

Another major contributing difference, of course, is population. Numbers matter in many respects and, as the smallest of the ISR communities, there have been numerous occasions when the inevitable question of 'how small is too small?' gets asked. Many important Inuvialuit leaders have come from the community, however, and it is strategically important in relation to both Inuvialuit and Canadian claims and control over the western reaches of the Archipelago, so the community has consistently managed to 'fight above its weight class' in the regional political arena. The ground-breaking IISD initiative showcased this capacity once again, highlighting the circumstances of Sachs Harbour at an international scale and consequently rallying new opportunities and relationships.

Those relationships potentially include a network of scientific partners. As noted, however, there are a number of challenges faced by researchers coming to work in Sachs Harbour, not least of which are the high costs and limited availability of work space and accommodations. There are longer-term benefits, both in terms of supplementing local human resources and developing new capacities in residents through experiential training, that could be derived from investments in these areas.

Table 6.4: Recommendations arising from 2005 Geophysical Assessment

Recommendations

“Although no retreat is evident in coastal bluffs within the community of Sachs Harbour, except at one location, coastal erosion is an issue within the community. Housing and other community infrastructure should not be placed in coastal sites that show gullying or near the edge of coastal cliffs. The eastern side of the community specifically appears more susceptible to erosion with transport of material towards the east removing material from the coastal zone. Infrastructure which is currently near a cliff edge, such as the Parks Canada house (Sachs Harbour Line 2) should be relocated to avoid loss in future years. Coastal cliffs within the community are often sparsely vegetated, and use of these slopes by the community should be minimized to avoid accelerating retreat. Dredging of the community harbour should be avoided as this would introduce sediment into transport and increase the rate of progradation of the Sachs Landing Beach.

Specific recommendations for the community of Sachs Harbour are:

1. No community expansion along the coastal cliffs in the community boundaries, especially in the eastern slopes,
2. Removal or relocation of infrastructure in proximity to cliff edges, particularly the Parks Canada House,
3. Resurveying of coastal cliffs that have shown retreat in the past, such as the cliffs to the west of Martha Point, southeast of the Sachs Spit, and the eastern slopes of the community,
4. No dredging of the community harbour, as sediment transport is complex and dredging will likely re-suspend sediment in the transport cell,
5. No armouring structures to be placed along the coastline as these will disrupt sediment transport, and
6. No community infrastructure to be placed on or in proximity to the Sachs Landing Beach.”

Karissa Belliveau (2007)

Excerpt from *Conclusions*, “The Impacts of Climate Change on the Coastal Geomorphology of Southwestern Banks Island, NWT “ (unpublished thesis)
Department of Geography, Memorial University.

During the study period, recommendations were returned by an associated researcher, Karissa Belliveau, based on her 2005 geophysical assessment of the community (Table 6.4). Although she justifiably suggests that further development along

the coastal bluffs be avoided, this will be difficult for the community to do given the poor ground conditions elsewhere in what is, already, a very constrained community area. In 2008, the area above the Town Beach had already been prepared for construction of the new community centre (Fig. 6.47)

The ‘planning’ outcome discussion document reflected the outcomes of the local consultations respecting community change, development priorities and opportunities. Notwithstanding its small population, Sachs Harbour lives up to its history as settlement comprised of enterprising and resourceful people. The community did evidence some significant capacity problems that, while not necessarily precipitated by climate changes, were certainly exacerbated by them. There were, however, numerous knowledgeable and engaged residents who ‘wore many hats’ and worked patiently towards better outcomes for their community.



Figure 6.47: Site overlooking hamlet beach as prepared for development, August 2008. The development of a new community gathering place was documented in the Executive Summary of the consultation outcomes and later used to facilitate a late-breaking application to the Capacity-Building Grant Fund in 2007.

6.7 Synthesis

Sachs Harbour is a small community that is contending with a number of challenges, of which climate change is just the latest. There were a number of recurring themes that were raised in discussions of the future of the community. The small resident population commonly is less than 100 people, due to travel required to access services not available in the hamlet. This limited human capacity produces a cascade of effects throughout the community: there are fewer people available to participate in its organizations; fewer to operate its machines; and fewer that remember how things have been done before. In this context, small problems continue to multiply and grow.

As the institution with the most extensive array of services and infrastructure to maintain in the community, the Hamlet has presumably accommodated small adaptations to the changing climate through ongoing maintenance operations. This has not been a conscious process, however, but it will need to become so if the most significant emerging issues are to be addressed. In her last community visit, the researcher conducted an exercise with Council along these lines (Table 6.5): reporting back on the content of their meeting using the experiential colour-coding and breaking out the attributes of each agenda item in relation to the Resilience framework. This process underlined the human resource and relational challenges attending every agenda item.

Revisiting the community's drainage issues with this in mind, it becomes apparent that Council's longer-term adaptation plan will need to move beyond having staff repair road wash-outs on a case-by-case basis. They will need to budget for drainage infrastructure improvements, an expanded maintenance program, and staff training regarding drainage systems.

Table 6.5: Council Meeting content explored using Resilience framework

Item Discussed	Physical Hazard	Phys Infr. Economy	Org'n	People	Rel'nships	
					Internal	External
Victim Services program opportunity <i>(capacity building)</i>			X+	X+	X+	X+
Fuel leak –seriously contaminated site	X	X	X	X	(X)	X
Lack of staff report(s)			X	X	X	
Lack of response to postings for new workers	(X)	(X)	X	X	(X)	(X)
Lack of adequately qualified local labour pool		X	X	X	X	X
Urgent requirement for by-law passage (New Deal provisions)		(X)	X	X	(X)	X
Difficulty in addressing removal of Boil Order	(X)	X	X	X	X	X
Appointment of new Hamlet Councilor <i>(capacity-building)</i>			X+	X+	X+	
Appointment of new Swamper <i>(capacity-building)</i>		(X)	X+	X+	X+	
Contract issue (serious breach of Council directive)			X	X	X	

Accelerating coastal erosion and wet ground in a number of undeveloped locations of the Hamlet have made the locating of new development in Sachs Harbour very challenging. When community members addressed significant potential developments (i.e. new Elders' housing; an office building; a new gathering place), their discussions frequently 'bogged down' when attention turned to site identification. A townsite review needs to be undertaken and an inventory of potential development sites compiled, ranked with reference to the additional measures required to address any deficiencies they may have. Detailed ground surveys also should be conducted prior to proceeding with constructing any new building in the Hamlet. In order to appropriately

manage the community lands, the Hamlet administration would benefit greatly from more systematic and regular documentation of the conditions and constraints affecting the local land base. Improving drainage to address wet ground conditions will resolve many of the shortcomings of existing vacant land, including those of the existing "subdivision", but effective drainage will, in turn, require careful planning, design, construction and regular maintenance.

In a more general sense, the question of where the Hamlet could expand is open for further research. In relation to potential ground contamination (generally a concern associated with former dump locations), the east side of the community is believed to be "cleaner". The idea of building to the north on higher ground is also under discussion. It appears that there are ILA land transfer processes that would be required by either of these scenarios, an exercise that can take a very long time to complete.

The limited local government capacity of this small organization has been further constrained by the small pool of workers available. Many skills lacking in the community (e.g. heavy equipment operation) require protracted training and/or certification elsewhere. It can be very difficult to leave family behind, for the individual seeking the training opportunity and, if they must leave a position to do so, the disruption may be readily propagated if there is no one else suited to filling that role. Over the long run, the many small frustrations and readjustments entailed in filling unforeseen gaps, as well as those that can be anticipated, can erode individual and collective confidence. Stop gap measures readily adopted under these circumstances further delay the development of indigenous capacity.

Keeping pace with longer-term capacity targets could be easier, however, in a case such as this where the community is relatively small. There is much about Sachs Harbour that can be grasped within a relatively short period, although much more can be discovered over time. The lack of flexibility inherent in the relatively constrained services and infrastructure must be compensated for using relational means. The attrition suggested over the last two decades in the places that residents gather is one particularly telling sign of the ways in which the 'work' of community has been made more difficult. The informal social functions that the former DOT and mission premises provided at one time, need to be reinstated.

As Justice Berger noted in Northern Frontier, Northern Homeland:

"The idea of modernizing the native economy is not new. It has been adumbrated in many reports bearing the imprimatur of the Department of Indian Affairs and Northern Development. But nothing has been done about it. Why? Because it was not important to us, whereas large-scale industrial development was. Indeed, such large-scale projects hold great attraction for policy-makers and planners in Ottawa and Yellowknife. Small-scale projects, amenable to local control, do not."

(Vol 1, Ch. 11, p. 191)

<http://caid.ca/BergerV1ch11b.pdf>

A community is much more than the sum of its people, physical infrastructure and resources. Besides physical adaptations, responding to significant change is a social process. Building a community's capacity to adapt will entail investments in its "social infrastructure" – the relationships and ways of doing things that allow it to be much more than the sum of its parts. This would be an argument in support of the development of a dedicated community gathering place along the lines of the "Family Centre" that Sachs

Harbour consultation participants earlier described, but there certainly could be other means identified to meet similar ends. The key, however, would appear to lie in identifying that material and relational gaps may be opened in a community operating under chronically constrained or stressed circumstances and it is important to take their measure and attempt to fill both sorts of needs with what resources may be available.

Nunavut

7.1 The Emerging Nunavut

As was the case for the peoples throughout the former Northwest Territories (NWT), the 1960s-70s was a dramatic period of sedentarization and change in the Central and Eastern Arctic (Figs. 7.1-7.2). The forces of social reorganization set in motion by the collective experience of the Inuit in this timeframe have since resulted in what many would see as a complete transformation of their circumstances in relation to the nation-state of Canada.

7.2 A Diverging Narrative

Although Eastern Arctic and Subarctic peoples circa 1000-1300 AD are believed to have had the earliest encounters with the Norse, sustained colonial contacts between Inuit and Europeans in the Canadian Arctic Archipelago several hundred years later tended to progress from west to east. In the East, the Inuit of Pond Inlet are regularly cited as not having met Europeans until the early 1900s, even though they traded for European goods with other aboriginal populations for some time beforehand. In general, peoples traversing areas where seasonally ice-free waters provided readier access met Europeans first.

Certainly in comparison to the Western Arctic, however, and notwithstanding the pervasive impact of the DEW Line and national policies directed towards a generalized concept of 'the North', other industrial influences were a later feature of Central and Eastern Arctic development histories. This salient difference was clearly manifested in

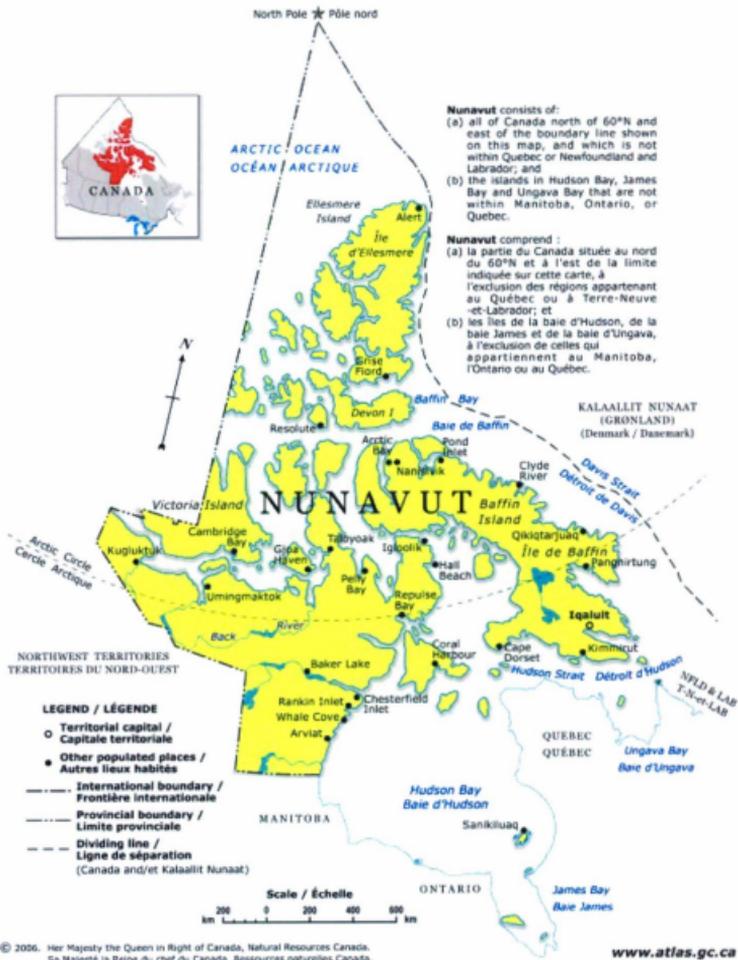


Figure 7.1: Map of Nunavut

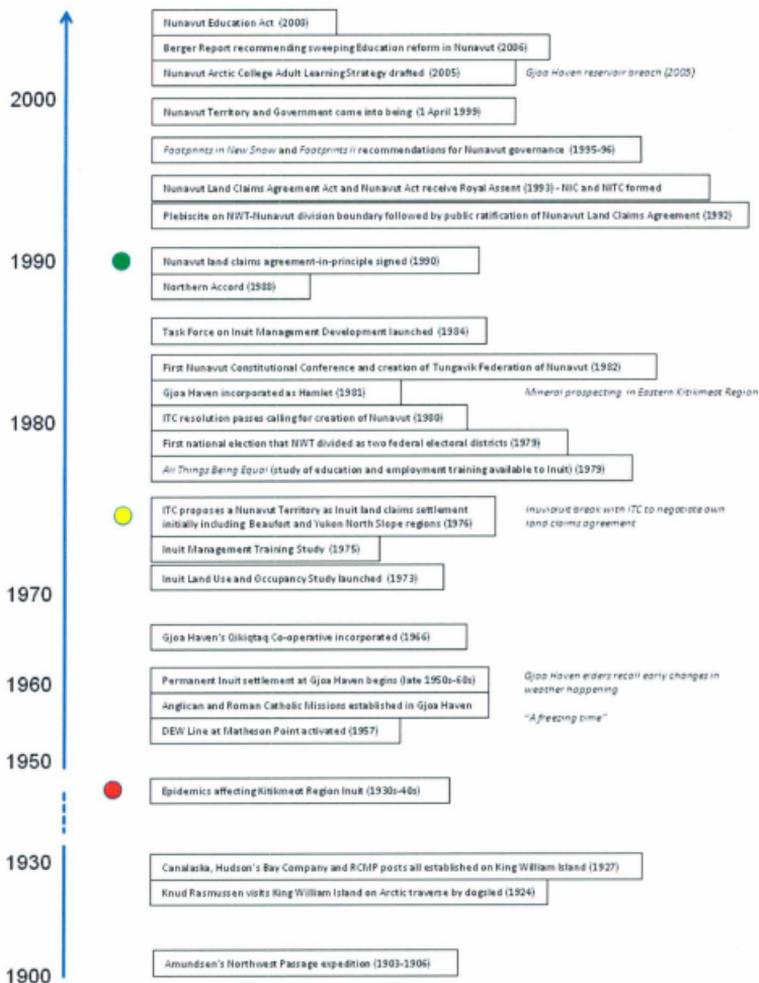


Figure 7.2: Eastern Kitikmeot Timeline

1976 when the Inuvialuit chose to pursue a land claims process specific to the interests of the people of the greater Beaufort region in order to address the immediate oil and gas development pressures they faced there. The ITC, however, was well underway with the data collection needed to support Inuit claims elsewhere and carried on with the process for the remaining lands to the east.

The definition of the final boundary between eastern and western Arctic territories was to require several more years of negotiation and a plebiscite (1992) but by 1980, the ITC had formally resolved to create *Nunavut*, "the peoples land". A decade later, the tripartite agreement-in-principle for the new territory – and the largest aboriginal land claim agreement in Canadian history - was signed between the Government of Canada, the Government of the Northwest Territories, and the Tunngavik Federation of Nunavut (succeeded today Nunavut Tunngavik Incorporated as the representative organization for the Inuit of Nunavut) . The Nunavut Implementation Commission was struck in 1993 to determine a way forward. The nine Commissioners appointed included community leaders from across the NWT: Meeka Kilabuk (born in Pangnirtung, later of Iqaluit), David Alagalak (originally of Southampton Island, later of Arviat); John Amagoalik (born near Inukjuuaq, relocated to Resolute Bay); Clara O'Gorman (Cambridge Bay); Mary Simon (from Kangiqsualujjuaq, Quebec), Vice-Chair Bill Lyall (formerly of Talyoyoak, later of Cambridge Bay) and Peter Taqtu Irniq (formerly of Repulse Bay or *Naujaat*). Notably, they all were still making important contributions to the new territorial governance framework in 2011.

On 01 April 1999, the Government of Nunavut was launched, albeit with a full complement of legislation, policies and bureaucratic experience that were carried over from the former government. There was no overnight restructuring; rather, there were a series of transformative processes implemented from within. Central to these were the enshrining of *Inuit Qaujimagatuqangit* (IQ) – Inuit values and beliefs – and their incorporation into the everyday ways and means of the new government. A visioning process was undertaken in 1999 that looked ahead to the Nunavut desired in 2020, from which the following four core goals were distilled: “Healthy Communities”; “Simplicity and Unity”; “Continued Learning” and “Self-Reliance”. Alternatively referred to as the ‘Bathurst Mandate’ or *Pinasuaqtavut* (Table 7.1), the Government later published a five-year plan outlining the strategy to advance these ends on behalf of *Nunavumiut* (GNU 2004). The Bathurst Mandate also was further translated into an implementation creed that was promoted within the civil service of the new territory and in the school system (Table 7.2).

Implementing support structures were also put in place. Key among these was the *Inuit Qaujimagatuqangit Katimajit*, a group of fourteen Elders convened to provide advice to the Nunavut government and its departments on how to incorporate IQ in the delivery of programs, services, day-to-day operations, and otherwise meeting the Bathurst Mandate goals. They were encouraged to feel free to offer advice on the issues they saw arising in the new government and territory at any time.

It was also expected that each government department would engage their own IQ Coordinator (*Tuttarviit*) to provide ongoing oversight and review services and policy for compliance. The collective of departmental coordinators were also expected to work

Table 7.1: The Bathurst Mandate as interpreted by *Pinasuaqtavut*: 2004-2009 and Awa (*undated*)

Nunavut Goal	Translation	Guiding Principles
<i>Inuuqatigiittiarniq</i>	Healthy Communities	<ul style="list-style-type: none"> • People come first; • People are responsible and accountable for their own well being; • We will provide for those who are not able to care for themselves; • We must provide options and opportunities which build the strengths of individuals, families and communities; • We will respond to the challenges of substance abuse, violence and loss as individuals, families and communities; • Building the capacity of communities will strengthen Nunavut; • All levels of government working together will strengthen Nunavut.
<p>“The health of Nunavut depends on the health of each of its physical, social, economic and cultural communities, and the ability of those communities to serve Nunavumiut in the spirit of <i>Inuuqatigiittiarniq</i>; the healthy inter-connection of mind, body, spirit and environment.”</p>		
<i>Pijarnirniqsat Katujjiqatigiittiarnirlu</i>	Simplicity and Unity	<ul style="list-style-type: none"> • <i>Inuit Qaujimaqatungit</i> will provide the context in which we develop an open, responsive and accountable government; • By developing programs and services which are fair, understandable and easy to access we will encourage public participation and create accountability; • Every activity and expense must have a productive purpose; • Simplicity does not mean uniformity – diversity in approach can build on unique strengths, resources and ways of doing things; • Cooperation will be the operating standard at every level. • <i>MLAs will be respected as important sources of community opinion</i> (only in Awa)
<p>“Simplicity in the processes of government encourages access by all; makes the tasks more focused and achievable; and invites participation.”</p>		

cont'd...

Table 7.1 cont'd: The Bathurst Mandate as interpreted by *Pinasuaqtavut* and Awa

Nunavut Goal	Translation	Guiding Principles
<i>Ilippallianginnarniq</i>	Continued Learning	<ul style="list-style-type: none"> • Learning is a lifelong process; • It is important to recognize the value of teaching and learning at all levels and from all sources: Elders, families, youth, schools, and community learning centres, and moving out to apprenticeships, college and university programs; • Equal opportunity and equal access across Nunavut is fundamental to our success; • Land and language skills and respectful pride in our cultures and languages are fundamental for adults and children; • Our education system will be built within the context of <i>Inuit Qaujimagatuqangit</i>; • Children should be able to receive instruction in their first language; • Respect for individuals is the basis of effective learning and a healthy workplace.
<p>“To achieve the dreams of Nunavut we all need to listen closely and learn well in order to acquire the skills we need to increase our independence and prosperity.”</p>		
<i>Namminiq Makitajunnarniq</i>	Self Reliance	<ul style="list-style-type: none"> • We will work within our means; • We will incorporate Inuit societal values into new strategies to participate actively in the sustainable development of our economic resources; • We will build on our strengths, respecting and highlighting the unique elements of our residents, communities, and the environment and economy in Nunavut; • Nunavut residents will receive every opportunity to benefit from public dollars spent in and by Nunavut; • We will work within the framework of the Nunavut Land Claims Agreement in planning and developing government programs and services; • Nunavut will contribute to our country as a committed and active participant in the life of Canada and to the circumpolar world as an active arctic neighbour.
<p>“As individuals we are each responsible for our own lives and responsible through our own efforts and activities to provide for the needs of our families and communities;</p> <p>As communities and as a government we are connected to and reliant on each other to care for those in need, to establish common goals, and to secure the resources required to achieve these goals;</p> <p>As Nunavummiut we look to support ourselves and contribute to Canada through the potential of our land, the responsible development of our resources and the contributions of our peoples and our cultures.”</p>		

Table 7.2: IQ Guiding Principles as per *Pinasuaqtavut*: 2004-2009 and Owljioot 2008

<i>IQ Guiding Principles & Translated Concept</i>	Rationale
<p><i>Inuuqatigiitsiarniq</i> “Respecting others, relationships and caring for people”</p>	<p>“The concept of respecting others, building positive relationships and caring for others <i>Inuuqatigiitsiarniq</i> is showing respect and a caring attitude for others. When each person considers their relationships to people and behaves in ways that build this relationship, they build strength both in themselves and in others and together as a community. This is foundational to Inuit ways of being.”</p>
<p><i>Tunnganarniq</i> “Fostering good spirit by being open, welcoming and inclusive”</p>	<p>“The concept of fostering good spirit by being open, welcoming and inclusive <i>Tunnganarniq</i> is being welcoming to others, being open in communications and inclusive in the ways people interact. Demonstrating this attitude is essential in building positive relationships with others.”</p>
<p><i>Pijitsirarniq</i> “Serving and providing for family and/or community”</p>	<p>“The concept of serving is central to the Inuit style of leadership and as such is the measure of the maturity and wisdom of the Inuk. Key here is the understanding that each person has a contribution to make and is a valued contributor to his/her community. Students will be expected to demonstrate this kind of leadership and commitment to serving the common good.”</p>
<p><i>Aajiiqatigiinniq</i> “Decision making through discussion and consensus”</p>	<p>“The concept of consensus decision-making relies on strong communication skills and a strong belief in shared goals. All students are expected to become contributing members of their community and to participate actively in building the strength of Inuit in Nunavut. Being able to think and act collaboratively, to assist with the development of shared understandings, to resolve conflict in consensus-building ways, and to consult respecting various perspectives and worldviews, are expectations that cross all curriculum areas.”</p>
<p><i>Pilimmaksarniq/ Pijariuqsarniq</i> “Development of skills through practice, effort and action”</p>	<p>“The concept of skills and knowledge acquisition and capacity building is central to the success of Inuit in a harsh environment. Building personal capacity in Inuit ways of knowing and doing are key expectations for students. Demonstrating empowerment to lead a successful and productive life, that is respectful of all, is a powerful end goal of our educational system.”</p>
<p><i>Quanuqtuurungnarniq</i> “Being innovative and resourceful (to solve problems)”</p>	<p>“The concept of being resourceful to solve problems, through innovative and creative use of resources and demonstrating adaptability and flexibility in response to a rapidly changing world, are strengths all our students should develop. Resourcefulness should be demonstrated in all learning and also thinking that seeks to improve the context in which Inuit live.”</p>
<p><i>Piliriqatigiingniq/ Ikajuqatigiinniq</i> “Working together for a common cause”</p>	<p>“The concept of developing collaborative relationships and working together for a common purpose...[the] essential Inuit belief that stresses the importance of the group over the individual [,] should pervade all our teaching. Expectations for students will reflect working for the common good, collaboration, shared leadership and volunteerism. <i>Piliriqatigiingniq</i> also sets expectations for supportive behaviour development, strong relationship-building and consensus-building.”</p>
<p><i>Avatittinnik kamatsiarniq</i> “Respect and care for the land, animals and the environment”</p>	<p>“The concept of environmental stewardship stresses the key relationship Inuit have with their environment and with the world in which they live. Students will be expected to articulate respect for this mutually interdependent relationship and to demonstrate responsible behaviors that seek to improve and protect the relationship in ways that meet global challenges to environmental wellness.”</p>

towards cross-departmental and government-wide consistency, in part through the development of an IQ strategic plan. They were also to serve as the primary and ongoing link between the *Katimajit* and their respective departments. In this way, the Nunavut government embarked on the process of reforming their institutional inheritance and transforming the circumstances of their populace. The groundwork had been laid for this pivotal moment through a series of studies examining education and human resource development needs.

The Nunavut Implementation Training Committee (NITC) was formed in 1993 pursuant to Article 37 of the Nunavut Land Claims Agreement (NLCA) to “ensure full participation of Inuit in the Implementation of the Nunavut Land Claims Agreement”. While primarily focused on training for Inuit in public governance and land claims-related roles, the NITC more generally sought “...to enhance Inuit participation in the Nunavut workforce” (www.nitc.ca). Their comprehensive review of implementation training needs (NITC 1994) was completed the following year and identified the following priorities:

- Training for Boards of Directors
- Training for staff to support the management of Inuit-Owned Lands
- Training to develop Senior Managers, including Chief Executive Officers, Executive Directors, and Heads of Departments
- Training for Administrative Staff
- Training for Support Staff
- Training for Community Liaison Workers to inform communities about the implementation process.

The flexibility shown in their consequent approach outlined in their Implementation Training Plan, clearly responded to the kinds of chronic concerns and staffing issues experienced throughout the Arctic (e.g. issues noted in Sachs Harbour). In addition to managing a scholarship program for Nunavut beneficiaries pursuing post-secondary education, the NITC strategy provided for funding to enable organizations to both obtain outside training for staff in priority areas, and develop in-house training capacities. Seen in combination with the attention being given adult learning (NAC 2005) and the major reform of regional education recommended by Justice Berger (Berger, 2006) and the emphasis that has been given to primary Inuktitut language instruction (Fig. 7.3), the commitment to IQ principles is in evidence at all levels of Nunavut's formal education systems.

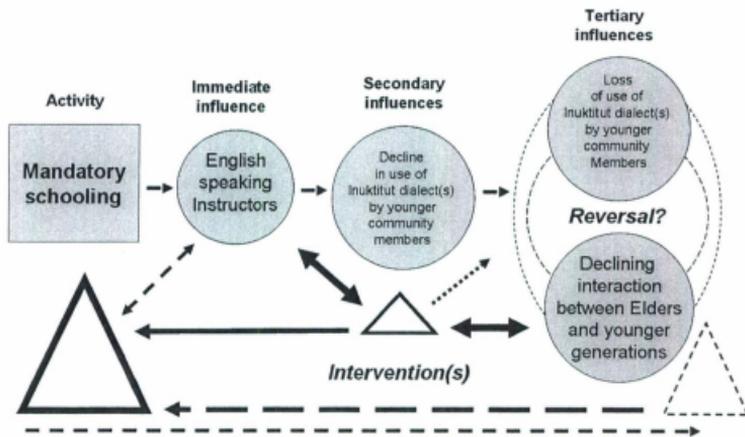


Figure 7.3: Recovery of Language as adaptation. Interventions being undertaken in Nunavut to reverse the declining use of Inuktitut include school-based initiatives to increase the numbers of Inuit teaching staff, increase Elders' presence as teachers and educational advisors, and curriculum redesign to ensure Inuktitut language instruction receives greater priority relative to other learning outcomes.

7.3 Contemporary Governance and Development Context

As noted in Chapter 4, the earliest influences on local governance in Inuit settlements were common across the Canadian North. Municipal-level structures persist under Nunavut administration with regional support staff stationed in offices across the territory, strategically redistributed to ensure their local employment and other spin-off benefits were evenly spread.

The Department of Community and Government Services (CGS) works in partnership with Nunavut local governments much as the GNWT's MACA did before it: programs and funding are provided to support core municipal operations, infrastructure development, and land management. Training for councils and municipal employees is available and, thanks to the NITC efforts, extends to a full array of staged career supports for beneficiaries.

Within government, CGS provides a variety of support services to other departments and agencies, including procurement and contracting services; properties management and maintenance; technical and project oversight, especially related to construction activities; and records management services.

Public services offered by CGS include fire safety programming, inspection and training; electrical and mechanical inspection services; emergency management support including search and rescue coordination and training; consumer affairs; and petroleum products distribution.

The relationships of local governments with Nunavut departments appeared to be a much more direct than those existing in the GNWT given the extent to which the regional governance mechanisms are reinforced by the prominent role played by regional

Inuit Development Corporations. While some growing pains were in evidence during the project period, there were also ample indications that inter-departmental coordinating facilitated through locally-driven interchange rather than from a territorial headquarters directive was succeeding in relation to the IQ principle of *Quanuqtuarungnarniq* - "being innovative and resourceful".

In the context of the adaptation-oriented nature of this research project, the other Nunavut departments and agencies most directly engaged were the departments of Transportation and Environment, and the Nunavut Water Board. The Water Board and Department of Transportation turned out to have a headquarters and a regional office, respectively, in Gjoa Haven and both could be seen to have strong working relationships with the Hamlet that were generously extended to the researcher during her time in the community. By contrast, the Nunavut Adaptation Strategy effort originated from the headquarters of the Department of Environment in Iqaluit. In becoming involved in early stages (2006-2007) of that initiative, the researcher had hoped to increase the department's presence in the Gjoa Haven: it was limited to start with and, unfortunately it remained so, particularly after the regional climate change workshop originally planned to take place there was moved to a larger community.

In its central location relative to the two Canadian Arctic government headquarters in Yellowknife and Iqaluit, the final case study community - Gjoa Haven - has been equally remote from both. With major air connections to the west and the NWT rather than east to Nunavut, the Kitikmeot more generally could be seen as the Nunavut region most removed from its new 'centre'. As a new core-periphery dynamic can be expected to evolve with time, for the purposes of this study, Gjoa Haven provides a basis

upon which a limited Nunavut-ISR comparison is possible. How do their respective institutional and governance circumstances condition their response to the changes they face?

At one and the same time as we might examine their differences, in 2001 the ITC became the 'ITK' or *Inuit Tapiriit Kanatami* ('Inuit united within Canada'). Their longstanding Nunavut 'project' completed, the organization was in a position to reassert a national mandate representing the entirety of the Inuit diaspora, including the Inuvialuit in the West and a growing southern Canadian population of urban Inuit. With new challenges presumably to embrace, are apparently bifurcating narratives of the last two generations of Canadian Inuit about to be reconciled? What, if anything, can be read in these two, distinctive self-governance trajectories?

Gjoa Haven

8.1 Gjoa Haven, NU

The community of Gjoa Haven, Nunavut (68°37'N, 95°53'W) is located on the southeast coast of King William Island (Figs. 8.1-8.2). The 'Gjøa' in the common name refers to the ship that Norwegian polar explorer Roald Amundsen used for the first successful European attempt to navigate the entirety of the Northwest Passage (Figs. 8.3-8.4). The expedition lasted from 1903 to 1906 and Amundsen and the Gjøa's crew famously spent two of those years iced into "the finest little harbour in the world" (Amundsen 1909).



Figure 8.1: Gjoa Haven, 1996

Source: Dept. of Municipal and Community Affairs, GNWT

In contrast, the Inuktitut place name *Ursuqtuuq*, (alternatively *Uqsuqtuuq* or *Uqsuqtuq*) or a "place of plentiful blubber", marks the site's former importance as a seal harvesting area for the *Netsilingmiut*. The "people of the place where there is seal" lived in the Boothia Peninsula region of the south-central Arctic, today a part of the (western) Kitikmeot district of Nunavut. This was one of the later 'contact' areas in the Arctic as it was equally remote from the western and eastern corridors of European entry. European articles and goods found their way to the Kitikmeot via Inuit trade networks well before there were sustained direct encounters between the Inuit and outsiders. Permanent occupation at Gjoa Haven only dates from 1927 when first a Canalaska trading post, a Hudson's Bay Company trading post, and finally an RCMP post were established in the vicinity. The Kitikmeot Heritage Society archives contain numerous accounts of Inuk of this period being frightened by their first glimpses of white men.



Figure 8.2: King William Island and region

Satellite imagery source: Google/TerraMetrics 2011

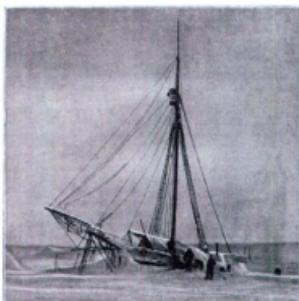


Figure 8.3 (Left): The *Gjøa* overwintering at “Port-Gjøa”

Figure 8.4 (Right): Roald Amundsen and crew members Helmer Hanssen and Peter Ristvedt.

Source (both): Amundsen 1909 (<http://www.gutenberg.org/files/21878/21878-h/21878-h.htm>)

In addition to Amundsen, the popular culture association of the region with polar exploration includes the demise of the Franklin Expedition. Following their third Arctic winter off the western shore of King William Island, the surviving officers and crew finally left their ice-locked ships in 1848. They never reached the Hudson's Bay post they struck out for, instead succumbing to starvation and scurvy along the way. The mystery surrounding their last days captured imaginations internationally, spurring an intermittent series of search expeditions to the region (Gibson 1932). Local Inuit accounts and residents contributed substantially to the discoveries that eventually told the tale (McMahon 1988). The Greenlandic explorer Knud Rasmussen also visited the region in 1924 on his trek by dogsled across the Arctic but to date he has not been as extensively exploited as a tourism theme.

Gjoa Haven is the largest of the three case study communities and the only one experiencing significant growth at the time of writing. The community population had grown by 104 people between 2001 and 2006 (Statistics Canada), an increase of 10.8%.

Ursuqtuq is the principal settlement on King William Island, and the third largest among Kitikmeot region communities (Table 8.1). Formally incorporated in 1981 as a Hamlet, then of the Northwest Territories, the local government has, since 1999, operated within the Nunavut governance framework.

Table 8.1: Kitikmeot Region Communities

Community	Incorp'd*	Status	Census 2006	Notes
Cambridge Bay <i>Iqaluktuuttiaq</i>	1984	Hamlet	1,477	Kitikmeot regional government centre, with services including <ul style="list-style-type: none"> • Nunavut Planning Commission headquarters • Nunavut Arctic College (Kitikmeot campus) • Kitikmeot Foods Ltd. (Nunavut Development Corporation subsidiary) • Nunavut Housing Corporation District Office
Kugluktuk (formerly Coppermine) <i>Qurluqtuq</i>	1981	Hamlet	1,302	
Gjoa Haven <i>Ursuqtuq</i>	1981	Hamlet	1,064	Regional services centre for <ul style="list-style-type: none"> • Dept. of Economic Development & Transportation • Nunavut Water Board headquarters
Taloyoak (formerly Spence Bay) <i>Talurjuaq</i>	1976	Hamlet	809	Headquarters for <ul style="list-style-type: none"> • Taluq Designs Ltd. (Nunavut Development Corporation subsidiary)
Kugaaruk (formerly Pelly Bay) <i>Arviligjuaq</i>	1972	Hamlet	688	
Note: Included in this region are the unincorporated twin settlements of Bathurst Inlet/Bay Chimo (<i>Kingoak/Umingmaktuq</i>). These communities are recorded as having a population of less than 5 since 2001.				

*Under NWT Hamlets Act prior to 1999

8.2 Physical Geography

8.2.1 Climate

Gjoa Haven has a Mid-Arctic climate, with temperatures dipping to a mean of -34°C in January and rising to a July mean of 8°C (Environment Canada, 2007). Temperatures have been trending higher throughout the year since the mid-1980s, lengthening the number of days each summer and early fall when permafrost could thaw. Annual precipitation means have also increased over the same period, currently standing at 200mm/a of which 60% falls as snow.

Vegetation is sparse and dominated by grasses and low-growing shrubs. Wildlife in the region include caribou, muskoxen, snowy owl and polar bear. Migratory bird species that traverse the Island include various ducks, Canada geese, plovers and terns.

8.2.2 Geomorphology

Gjoa Haven is located at the southern extent of the central portion of the Arctic Lowlands physiographic region, nestled between the Nunavut mainland and Boothia Peninsula of the Canadian Shield. The island is relatively flat, pocked by many small lakes and shallow rivers. The highest point of land is Mount Matheson (150 m elevation) 37 km to the northeast of Gjoa Haven on the southeastern tip of King William Island. Pleistocene glaciation has influenced the terrain: there are plentiful sources of gravel and sand derived from the limestone substrate. Although located in the continuous permafrost zone and experiencing a generalized warming trend like the other two study areas, ablation in the Gjoa Haven region has produced the least pronounced terrain change in the

three study communities due to the lower ice contents of the sediments (Papadimitriou 2007, Papadimitriou & Catto 2008).

In contrast with the other two study areas, King William Island lies in an emergent region of the Arctic Archipelago where uplift still exceeds the rate of sea level rise. Gjoa Haven and most of the rest of King William Island have been characterized as moderately sensitive to coastal erosion (Shaw et al. 1998).

8.2.3 Surrounding Waters

Marine traffic in the region includes industrial ship movement through the Northwest Passage and the Storö Passage as well as a significant amount of pleasure craft and cruise vessel visitation. While marine transportation in the region is expected to increase as sea ice coverage and duration decline, modeling suggests that pack ice will tend to accumulate in many of the straits, a pattern that may somewhat delay the growth in visitation to Gjoa Haven (Sou and Flato 2009).

With increased vessel traffic, the risk of petroleum spills and other marine vessel discharges into sensitive marine and coastal zone environments grows. Gjoa Haven has been assessed as increasingly vulnerable to spills: the beaches facing out into open waters are sand and gravel dominated but will not be especially self-cleaning as a result of the low-energy wave regimes that predominate there (Catto & Papadimitriou 2006, Papadimitriou & Catto 2008).

8.3 Local Research Process

Gjoa Haven was the last of the three communities to be visited. The researcher's familiarization visit followed a period of summer fieldwork completed by colleagues from Memorial University: Stephanie Papadimitriou, Tanya Brown and Drs. Norm Catto and Evan Edinger. A presentation to the Hamlet Council respecting the project was made and approval was given to proceed. The summer period visit coincided with that of a consulting engineer who was examining potential sites for a new bridge to facilitate an inland river crossing several kilometers to the northwest of the community. Construction activity on the new community waterline was also proceeding at the time.

Table 8.2: Gjoa Haven Field Work

Phase & Timing	Activities	Stakeholders approached
Preliminary familiarization visit/ local pre-planning August 2006	Community tour following on other MUN researchers' fieldwork (July-Aug) Preliminary inventory	Hamlet (SAO and Council) RCMP Transportation Department staff Hunters and Trappers Organization Local business people/artists Consulting engineer
Environmental change and community data compilation January-February 2007	Icebreaker activities (lantern-building) Local consultations Key informant interviews	As above General public Housing Office School Class/Youth consultation project Elders (although special session storm-canceled without time to reschedule)

The second extended period of fieldwork occurred, once again as recommended by the community, during the 'dark period' early in 2007. In hopes of fostering future community-research partnerships, project funding was offered to ArcticNet's regional Inuit Research Advisor (IRA) in order that she be able to visit the community while the

researcher was there conducting her consultations. Unfortunately, after initially agreeing, the advisor was later forced to withdraw due to family circumstances.

As in the other study communities, the longer field visit was structured around small-group meetings and key local stakeholder interviews. Lantern-building workshops were also offered in partnership with the school as a way to get to know residents. One open public presentation took place early in the visit to introduce the project. Although most community residents were functionally bilingual (English-Inuktitut), the operating language preference of this community was Inuktitut: public gatherings or consultations without the benefit of simultaneous interpretation were therefore of limited value, especially if participation by older members of the community was sought. Resources were rallied over the course of the field visit to mount a major open house at the community hall but a storm effectively scuttled that event and it was not possible to reschedule it within the remaining period of the visit.

Similarly, all project permits, posters and print materials required translation, ideally into both Inuktitut and Inuinaktun (presented in syllabics and roman orthography respectively). The researcher consequently had translations done for two posters during the second visit, one describing her own work and a second for her colleague Stephanie Papadimitriou who had recently completed a terrain assessment there (Parewick and Catto 2006, Papadimitriou *et al.* 2006). She was able to produce syllabics lay-outs for both posters, and the local Transportation Department office was able to print the new versions. They were displayed for the remainder of the project and then left on deposit with the school.

Unlike the other communities, a very productive partnership was struck with the local high school, *Qiqirtaq Ilihakvik*, where a number of project activities, including lantern-building and the aforementioned public presentation were mounted. A science teacher and a student there had participated in the ArcticNet *Schools on Board* cruise the previous fall, and were very supportive of the research effort. A school-based consultation project was organized that entailed the participating students discussing what they understood was changing and then taking a morning from school to interview an older family member. They reported their findings to the class and it was then planned that they would also present them at the open house. These results were consolidated and presented at the Council meeting the researcher attended prior to leaving the community.

Other consultation was pursued in partnership with the community radio station. The first attempt to do a call-in exchange regarding changes seen in the community turned out to be poorly timed relative to listener expectation of their usual community announcements and music in the timeslot offered. A second attempt with a later afternoon slot was better received and there were eight listeners who called in to offer their observations of changes in the weather and land. Some callers qualified their statements by asserting the limits of their knowledge relative to that of their Creator and in relation to greater forces that would determine local conditions.

Follow-up activities were pursued in partnership with the Nunavut Climate Change Coordinator. Special arrangements were made to bring the SAO from Gjoa to participate in the Nunavut Climate Change Workshop (Dec 6-8th 2006) but he was storm-bound and was unable to travel to the event. Subsequent plans for a Kitikmeot region Climate Change Workshop in Gjoa Haven were delayed: a session initially planned for

the summer of 2007 was initially postponed until November of that year, but then changed again to a larger venue in Cambridge Bay, the regional government hub for the Kitikmeot. The Climate Change Coordinator spearheading the process left her position later in 2007.

8.4 Contemporary Development and Change Narratives

8.4.1 Early Community Development

Notwithstanding the earlier and anchoring development of the trading post there, the beginning of the built community of Gjoa Haven dates from the 1960s. Accounts from elders describe the coalescing of the population occurring in stages as local services expanded but particularly from the later 1950s following the activation of area DEW line facilities. The seasonal occupation of the townsite by Inuit living still in tents or *iglus*



Figure 8.5: Inuit camp at Gjoa Haven, King William Island, ca. 1931.
Source: Rowan/NWT Archives/N-1991-068: 0135

(Fig. 8.5) was regularized in relation to church attendance and the school year, eventually giving way to the construction of permanent housing.

Few structures are visible in aerial photos taken in 1960 (Fig. 8.6) but by 1966 (Fig. 8.7) a line of the small government-supplied houses (referred to as 'matchboxes') is clearly visible just south of the major stream feature known locally as 'the Gully', and east of the Anglican Church. By 1965, about 155 Netsilik were living in the area. Less than a decade later (Fig. 8.8a), infilling had occurred to the south and east of the areas occupied by the HBC and RCMP. By 1983, another axis of development had emerged further south towards the harbour mouth. The first discontinuous residential area is visible as a newly developed cul-de-sac in the 1993 photos, north of original townsite off the road to the then-utilized water reservoir.

8.4.2 Transition and Tradition?

As the one Nunavut community examined in this study, Gjoa Haven offers a snapshot of a community that has sustained the transition from the former GNWT administration to that of the new self-governed Inuit territory. Local government elections still occur every two years and have been well-contested. As recently as the 2004 election, there had been a complete turnover in the Gjoa Haven Council: 23 people stood for the five available Council seats and a former MLA was elected as the Mayor (Minogue, 2004).

The major employers in the community are the local and Nunavut governments. The Nunavut Water Board is headquartered there and the Department of Economic Development and Transportation also maintains a regional office in the community.



Figure 8.6 (above): Aerial Photo Composite (detail) 1960

Figure 8.7 (below): Aerial Photo Composite (detail) 1966

Source for both photos: National Air Photo Library, Government of Canada

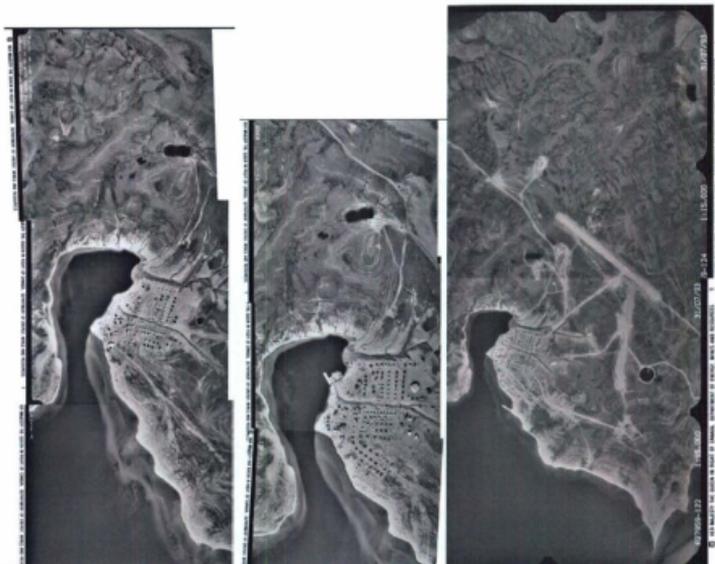


Figure 8.8: Aerial Photo Composites for (a) 1975, (b) 1983, and (c) 1993
 Photo source: National Air Photo Library, Government of Canada

Subsistence hunting and fishing remain significant contributors to the domestic economy with numerous households also deriving income from arts and crafts production. Tourism has exploited the aforementioned historic exploration themes, particularly since the centennial of Amundsen's sailing of the Northwest Passage. Interpretive plaques, a cairn on the former site of Amundsen's observatory, and an artifact display at the Hamlet offices support both guided and self-guided touring of the community. Boat tours are also available in the summer. Winter period offerings have included snowmobile and dogsled touring.

The community is one of seven 'dry' communities in Nunavut. The Gjoa Haven's formal liquor prohibition has been in place for three decades (R.R.N.W.T. 1980, Reg. 104). Enforcement is difficult, however, so alcohol-related problems stemming from supplies imported from Yellowknife or neighbouring 'wet' communities such as Taloyoak remain (Gagnon 2011). The RCMP detachment has seen significant increases in complaints, associated crime-related follow-up services, and local jail visits in recent years, prompting calls for the existing two-member unit to be expanded (Siku News 2010).

8.4.3 Contemporary Change Observations

"Jerry Arqviq, who is an Inuit hunter, has seen first hand the impacts of climate change in his community of Gjoa Haven in the North. "When I went out on the land in the past I never worried about being stranded by the weather, but now I have to think about that and prepare to stay longer with extra heating fuel, food and gas because the weather changes so suddenly. In the past the Elders used to go far out on the open ocean without motor driven boats. This was possible because they had long periods of calm, stable weather. These days you can't go a full day without changes in the wind and the weather."

"Inuit sound the alarm in Ottawa over escalating Arctic climate crisis"
(WWF 2006)

Much as in other communities, residents of Gjoa Haven were taking note of changes in their environs. Prior consultations respecting area climate changes had not been as extensive as those in either of Sachs Harbour or Tuktoyaktuk however, so this

became an element that was discussed at greater length as opportunity allowed. A record of key observations follows.

8.4.3.1 High School Class Consultation Project

Given the communications challenges associated with both the researcher's language 'gap' and the need to promote the better-resourced community gathering later in the visit, an outreach initiative was planned in partnership with the senior science class at the high school. The teacher and students engaged in the project discussed who in the community they felt should come to the larger event, identifying individuals connected with airport weather reporting; local Land Claim negotiations; the Hunters and Trappers Organization; Nunavut Renewable Resources Department staff; community Elders; and all their family members. Following a series of in-class activities, interviews with older family members were assigned as an individual or small group exercise. The class discussed and designed their interviews in consultation with the researcher. Students then made the necessary arrangements with the person they wished to interview and were given a block of school time one morning (a Tuesday) to all do their respective interviews. As poor weather prevented the larger gathering from proceeding a week later, the students' outcomes, recorded in Table 8.3, did not have the benefit of the anticipated feedback from the community. Notwithstanding some contradictory statements, however, most observations appear to align with those recorded in ACIA (2005) and contributed by other key informants in the community.

The students also worked with the researcher to map their community observations using the laminated satellite views that were being used otherwise in the project (Figs. 8.9-8.11). Their maps identify existing infrastructure of the community area (their homes, obvious features such as the sewage lagoon), and reflect some contemporary local activities they partake of or take an interest in (i.e. noting fishing spots, places dogs tied, and cabins in vicinity). They also referred to proposed new developments, including a new subdivision to the west of the main townsite and a suggested upgrading to a roadway of the well-used, basic footbridge and path across the Lower Gully.

The student work was presented to the Hamlet Council by the researcher as part of her report prior to departing the community, in turn spawning some additional input from a few councilors.

Table 8.3 (a): High School Class Consultation Project Outcomes

Classroom discussion: What changes in the climate and environment here are you aware of?		
Weather Changing	Effects on the Land	Effects for Humans & Animals
<ul style="list-style-type: none"> • Milder winter • Weather changing • Not as much blizzards • Weather changes from really warm to really cold • Not as strong wind • More low mist • Not as windy as it should be • More fog • Warmer summer • No blizzards • Lightning • Not as cold weather than last year • Very warm weather this winter • More Northern Lights 	<ul style="list-style-type: none"> • Sea level rising • Less snow (3) • Not enough snow fall • Ice melting (4) • More rocks during winter (2) • More Northern Lights • The water lake had a breach • More water • We had an early summer last year • Ground getting smaller or larger • The sun is out early then it should be • Ocean freezing up later than usual • Ice breaking up slowly • Ice not freezing fast enough 	<ul style="list-style-type: none"> • More water • Slower ice freeze-up • Less snow fall • Birds going home later • Smog in Gjoa Haven! • More carbon dioxide in the air every month • Late winter this year • More rain during the summer • Its latter to go out camping this year • Not using the ski-doo on the Bay before Hallowe'en <p>Air pollution (skidoo, power station, houses, cigarettes, trucks...)</p>
Commentary added based on community interviews:		
<ul style="list-style-type: none"> • Climate changes keeps getting warmer, and warmer will Nunavut in the future • The sun rises higher than 60 years ago • More rain • Less snow and ice • The weather never changes in the months of January and February always smoky and cold weather • Over the last 11 years like right now is warmer than few years ago • Since she was a little girl there has been a little bit of changes she thinks it's been warmer since the past • Shorter winter, and later • Today I see late winter and warmer month of winter this change, changed dramatically • The wind usually come directly from the North but now the bad winds come directly from the West • The winters got warmer and the summers got shorter • In the South, a lot of storms and rain • More snow other year less snow this year • It was warmer this year than other year • Late fall/early winter – Global change has cause delay because of thin ice, lack of snow, etc. 	<ul style="list-style-type: none"> • Soil is coming off shore – wearing away • More flowers • In the south a lot of storms and rains • She said that when you[re] out camping it's more colder because there isn't any houses and thing that doesn't block the wind • Permafrost melting • The land is not changing • Mainly to ocean is affected the greatest – it takes longer to freeze • 1960s – the Petersen Bay was much deeper • Maybe the ice will melt fa[s]ter 	<ul style="list-style-type: none"> • Doesn't bother him and his family but probably will pretty soon • Caribou tend to leave very early now – they go down south, it's harder for hunters to harvest caribou • It might affect my kids in the future because of climate change • The polar bears are being mistreated from researchers • All kinds of bugs are coming • It doesn't really effect our family because were use to the weather but some time when we run out of... • When it takes longer to freeze up, we can't hunt or provide country food for our family • It's getting tougher hunting wise and financially they are cutting quotas for animal tags

Table 8.3 (b): High School Class Consultation Project Outcomes

Additional questions asked in interviews:	
How will it affect the future?	What should the Nunavut Government do?
<ul style="list-style-type: none"> • Some good years and some bad years • It's going to have an affect on wildlife and the people who depend on wildlife to live • It will affect the animals and sea animals • The world is changing – "it's a cycle" we're not helping. Countries are producing lots of pollution • It could affect most of the Arctic because of pollution 	<ul style="list-style-type: none"> • More studies on climate change so that they can be prepared for climate change • I think the government and manufact[ur]ers should use less pollution and reduce weather change • The government should leave the Inuit alone and let them hunt what they want • Nunavut government have to work together towards climate change • They should become heavily involved and find better programs to help us become modern. They need to help with our social problems. And they need to clean up the mines.

Table 8.4: Kitikmeot Region Observations as per Arctic Climate Impact Assessment (2005)

Weather Changing	Effects on the Land	Effects for Humans and Animals
<ul style="list-style-type: none"> • Warmer temperatures • Unpredictable weather • late autumn • early spring; • more extreme hot days • sporadic extreme heat days • spring melt came earlier than in the past in the 1990s • earlier snow melt <p>(All attributed to Thorpe, 2000).</p>	<p>Sea ice: Unusually high number of cracks in sea ice in early spring around Hope Bay (Thorpe, 2000)." p. 69</p> <p>"Indigenous and scientific observations do not always agree, however. For example, in the Kitikmeot region of Nunavut, Inuit have observed more abundant and new types of shrubs and lichens (Thorpe et al., 2001). While the increased abundance of shrubs corresponds with aerial photography of vegetation change, experimental evidence suggests that lichens should decrease under the changing environmental conditions seen in the Kitikmeot (see section 7.3.3.1)."p.67</p>	<p>Caribou: Caribou changing migration routes due to early cracks in sea ice. Changes in vegetation types and abundance affecting caribou foraging strategies. Massive caribou drownings increasing due to thinner ice, e.g., massive drowning observed in 1996. Lower water levels may mean caribou can save energy by not having to swim as far, however, changing shorelines due to dropping water levels are affecting caribou forage (though unclear how). Caribou deaths due to exhaustion from extreme heat and attempts to escape more mosquitoes (Thorpe, 2000).</p> <p>Seals: Seals come up through the unusually high number of cracks in sea ice in early spring around Hope Bay, which attracts polar bears (Thorpe, 2000).</p> <p>Bears: Grizzly bears seen for the first time crossing from the mainland northward to Victoria Island in 1999. Spring 2000, unusually high numbers of grizzly bears and grizzly tracks (Thorpe, 2000).</p> <p>Birds: New birds seen for the first time such as the robin and unidentified yellow songbird (Thorpe, 2000).</p> <p>Insects: Number of mosquitoes increasing with temperature, but this occurs only to a threshold then the mosquitoes cannot survive (Thorpe, 2000)." P. 71</p>



Figure 8.9: Class commentary – area composite
 Base image source: National Air Photo Library, Government of Canada

8.4.3.2 Community Radio Station Phone-in

As earlier noted, after one false start, the researcher was successful in convening a radio call-in the week prior to the then-planned community consultation event. The call-in however was conducted almost entirely in English with some informal translation provided by on-air station staff. Nonetheless, several community elders called in.



Figure 8.10: Class commentary – townsite composite (18 January 2007)
 Base image source: National Air Photo Library, Government of Canada



Figure 8.11: Class commentary – area composite (18 January 2007)
 Base image source: National Air Photo Library, Government of Canada

A condensed account based on the researcher's notes regarding callers' observations follows.

The first caller had moved to the vicinity in 1953, a period they remembered as a "freezing time". March was when a seasonal shift in the weather started and things started to melt in April. Rocky areas (dark spots) melted first. This caller described 1956-57 and

the 1960s as being when they started seeing changes in weather patterns. It started snowing earlier than usual and the snow took longer to melt. They said this pattern persisted until 1995. In reference to the 1960s, they recalled conditions becoming cloudier all the time making it hard to identify where the sun was.

The caller said it was hard to be aware of everything that was happening in the Arctic climate. They had observed changes in annual cycles, noting that their daylight gets longer each year: the sun never actually disappeared now in the dark time so it seemed a lot lighter than it used to be. They described the sun as not showing at the horizon until February for the last two years (2005-2006), but noting that it had appeared first right after the Christmas holidays that year.

In reference to 2005 breach of the former water reservoir above the community, the caller suggested that it had been filled from Swan Lake that year before freezing so the structure had not been sufficiently well-frozen.

They also noted more generalized changes in area water bodies from 1966-67 when they actually ran out of water. In particular, smaller lakes were more often drying up before freeze-up.

The second caller also recounted several changes. They had noticed that it was taking longer now before freeze-up and this was especially apparent that year. As a Northerner and country food eater this was very worrying. That year and the one prior, they described darker conditions on clear days when the sun was up: the ground would appear as though the sun was down even when it was up in their light period and even then, as it was just returning. They recalled the sun as being way brighter when it was up.

The third caller referred to not having been prepared for a visit by the high school students and offered some feedback on some of their questions which were thought a bit awkward. They had moved to the community as a young adult with a child on the way. While they did not think there had been any extreme changes locally, the annual daylight cycle was described as coming earlier. They also remembered the positions of certain stars and believed they had changed: there were some they didn't see as often and others that seem higher than usual.

The fourth caller indicated that they wanted to talk about the land, not climate change. They would regularly travel to and from Back River. Their trail would be smooth there and back with the exception of a few ice ridges. There were no people and plenty of animals including wolverine. They also referred to changes in the daylight and in certain stars, noting that some stars had shifted positions. They referred to the North Star as being in a darker area of the sky now, and to '*Agiacha*', the constellation of another star.

A fifth caller was critical of some for "going on radio without any knowledge". They pointed out that their changing frame of reference needed to be taken into account: "Global warming? I live in a warm house now so I still find it cold." They still spent time out on the land from June though August, noting they were finding it colder now, even in summer. They could recall the heat of the summer in places they went when they were younger, where they now need to take shelter to stay warm. They also recalled that they used to find so many more mosquitoes out, they would need to seek shelter but that now there were hardly any.

They described the position of the sun as being much higher now than it used to be. The stars they usually take note of seem to be in a different position now when they first appear. Even during daylight, they noted they could see the moon high up in the sky.

As a child, they had spent a lot of time outside as that was their recreation. While the summers today seemed much colder, they said the ice still melted away when it was expected to though.

The Northern Lights seemed to be much brighter in the old days since they spent much more time on the land. They seemed to respond to whistles then faster; slower now. The caller's adoptive mother warned them never to play outside when the lights were there – they seemed much closer then.

The sixth caller thought that most everyone was noticing the longer days coming sooner, noting that they personally recalled it taking much longer for daylight to come when they were younger. Self-identifying as an elder, "...but not as senior as some", the caller stated that as the Inuit were not Creators, they didn't know what was actually happening.

The position of the sun was said to be getting higher. The caller had traveled a lot with their father as a child. As the daylight lengthened, they recalled the sun used to take longer to rise after the daylight came. Now they said daylight and the sun seemed to appear together. They also believed the appearance of the Northern Lights had changed over the same time period.

They referred to global warming, noting it was not an issue there. In childhood, summers were remembered as warmer; now they were cold and required warmer dress. The caller said they lived on the coast and not the Mainland. They believed plants there

were growing much as they always had with flowers appearing in gravel areas. They did think that not as much was growing now as when they were younger and that the growing season was taking longer. There were also some plants that they didn't recognize that were growing in the area.

The caller said that the sea ice had changed. They liked to spend time traveling but it seemed much more dangerous to do now in the spring due to thinner ice. In earlier days, people would come to the Post to trade in the spring but now it was harder to travel at that time of year as there were some open water areas. This was particularly so for some nearby parts of the Island. People who know can recognize dangerous conditions. "Perhaps we're not as observant as elders but dangerous areas seem to be occurring in new areas." The caller felt that people with the greatest knowledge of the land could still identify the dangerous areas.

The seventh caller indicated that they were aware that the weather and the land were being talked about all over the world and that this was a big issue that was affecting animals and was a worry for Southerners as well. They acknowledged climate change and global warming but noted it was still very cold up there. The caller had come to Gjoa as a young person and could recall traveling to get supplies in July (around the 11th) by boat back then, which they wouldn't do now in that month. In those days, the summer came on much earlier. There may be break-up season changes over time. Regarding ice conditions, they noted that there were thin parts where the currents were strong. There are dangerous areas near Montreal Island (see Fig. 8.2) and in the midpoint of the strait towards Spence Bay. The immediate Taloyoak area also opens up earlier than usual and on the crossing

to the Mainland. These changes were said to have occurred slowly but that they were more noticeable in recent years.

Differences were also noted in the land. The caller referred to much later freeze-ups in the Baffin area and in Gjoa Haven too where it once was September but now was well into October. They said that Inuit may be well-informed and note changes but cannot themselves make changes as they were not the Creator (e.g. "We are like worms; this is our condition."). The caller proceeded then to ask whether it was even possible to connect the many changes to specific polluters noting the large numbers of jets and industrial emissions and ongoing controversy respecting predictions of future changes: those with great knowledge were still guessing because they didn't see the entirety of what they were researching. The caller said that they believed that animals were becoming endangered and that this and the difficult current human condition had been foreseen by Biblical prophecies.

The final caller introduced himself as an elder in the community, noting that they had observed many changes, many of which had been mentioned by prior callers. They said the Northern Lights might not be as bright as they were but that they did not believe they had changed very much. Viewed out on the land, they were described as being, "as bright as ever" but the caller suggested that in the community, they just seemed paler in competition with streetlights and lights from houses. The caller's childhood had been spent near Gjoa Haven and around the coast. They too recalled very warm weather, especially in the springtime as a teenager. That was contrasted with current conditions, noting that when the snow started melting now, it was much colder. Even with shelter, the caller said they still feel the cold.

The caller referred to heathers as growing and spreading to many new areas including their own settlement. They stood out because they used to be relatively rare. Heathers were especially hard to find on the northern part of King William Island but not anymore; now they were described as being easiest to spot on the narrow part closest to the Mainland. The top part of the ground was said to have changed too, especially inside the community. The caller noted that when people started to build houses, they brought in gravel for pads. Although the ground hardened and compacted with use, they still experienced a lot of erosion due to the large amount of sand in the area. They had observed that erosion was occurring much faster.

Another change noted in the weather was that it was much windier now. The caller said that clear calm weather used to last two days at a time. Local tides were described as being much higher now and shallow areas had become much more visible and surrounded by sand. In reference to the mouth to the harbour, the caller indicated the deepest part was becoming narrower. They also noted that surrounding lakes seemed to be exhibiting lower water levels.

The caller summarized their observations as:

- changes in the weather;
- changes in the climate (the summers are colder);
- changes in the position of the sun and moon (both higher and right above them now);
- changes in the ground (the permafrost is more noticeable now); and,

- the freeze-up is later (especially noticeable when fishing in lakes – the spawning season seems way earlier. When the freeze-ups were earlier, they would catch the fish when they were spawning).

The caller added that they had intended to travel by boat the prior fall to trap but it froze up. Other changes they'd heard talked about included the changes in the treeline and they believed what they'd heard. They described animals returning to the area that haven't been seen there for a long time noting that grizzly bears in particular were coming to the Island. The caller referred to the links between climate changes and southern emissions and forest fires, suggesting that animals were being driven out of more developed areas. They pointed out that industry (mining) was contributing to this too. The caller noted the return of caribou to the Island: it was before their time that the caribou were last there and it was predicted that more animals would be returning.

The radio phone-in provided the researcher with a rich array of observations, some of which were more challenging to reconcile than others. In particular, the accounts of changes observed in the positions or behaviour of celestial objects (e.g. the Sun, Moon, and stars) were difficult to explain with conventional reference to scientific knowledge and were first encountered in this community – the third of the three visited. The account of them provided above however does appear to accord significantly with others documented in the region (i.e. Kunuk and Mauro 2010). Environmental change workshop findings from communities across the Arctic were published in 2006 under the title, *Unikkaaqatigiit – Putting the Human Face on Climate Change: Perspectives from Inuit in Canada* (Nickels *et al.*). Kuugaaruk was the only Kitikmeot region community

represented in that study and it was one of only two communities – the other being Iqviq, Nunavik - recorded there as noting all of the following:

- “Stars have shifted in the sky.”
- “Moon seems higher in the sky.”
- “Sun seems higher in the sky.” (ibid., p. 67)

Only two other communities are recorded as raising some of these observations: Arctic Bay (stars and Sun) and Repulse Bay (Moon). Notably, all four of these communities fall within a relatively narrow longitudinal range east of Gjoa Haven and, as did one of the Gjoa Haven callers, they also described the sky being hazier. This might suggest that either or both of the relatively rapid isostatic uplift that prevails in this central Arctic region, and atmospherically-mediated refractive effects may play a part in the changes observed.

8.4.3.3 Other Community Elders' Observations

During the research period, three Gjoa Haven Elders, each of whom had extensive involvement with some aspect of community governance, contributed their own observations of what was changing. Two of the three were in their sixties and had both come to Gjoa Haven in the late 1950s. Their observations are consolidated by category in Table 8.5.

The first of these 'younger' Elders indicated that they had noted changes over the last 25-30 years. They noted an island roughly 20 km to the southwest of the community which used to be free of the land where the channel was no longer passable. Similarly,

Table 8.5: Elder's Change Observations by Category (Age: 60s)

<p>Wildlife</p> <p>Locally, the spring run of arctic char used to average 5-7 kg/char and now nearly twice that.</p> <p>Too many snow geese now. They never used to migrate north this way. It was noted that although their eggs had been harvested traditionally, this species was protected when he moved to the Island (1958). In recent years however, NTI has offered \$5/goose to try to cull the population.</p> <p>They have been seeing different kinds of insects. He described a personal experience with a recent bug bite that had gotten infected; as this was a very uncommon reaction, it was attributed to new kind of bug.</p> <p>More bugs generally although not so many relative to the Mainland where there were said to be more. He recalls that when he was first in Gjoa ('58) it used to be really pleasant. Now there are way more, although surprisingly hardly any in the last couple of years. He doesn't think their cold summers have affected them though; he suspects they weren't hatching for some other reason.</p>	<p>Land/Nearshore</p> <p>Over the last 5-7 years, has observed more vegetation in riverbeds than on their sides.</p> <p>Seeing a lot more seaweeds offshore as well as bubbling that adheres to and lifts plants, moving them.</p> <hr/> <p>Weather</p> <p>He recalled as a younger person hearing animals – dogs – about 5 miles out. Sounds carried more in the [formerly] colder conditions.</p> <p>They've had two cool summers in a row.</p>
--	---

they noted that the mouth of the bay had been narrowing and that they would likely need to dredge it soon for the first time. They'd observed that the rivers were becoming shallower and that this seemed to be affecting inland fishing. They indicated that they were also seeing changes in travel routes out on the land.

The second 'young' Elder prefaced their input by suggesting that Gjoa Haven needed a local research committee along the lines of one established in Clyde River, noting that not only was there a need to raise awareness respecting the significance of findings respecting local climate changes, the research activities themselves presented economic development opportunities. He was also interested in the opportunities that

technologies such as satellite-assisted observations might provide to better monitor local conditions (e.g. vegetation changes). He highlighted several snow geese and arctic char harvesting opportunities that he believed merited study for their potential as a basis for local enterprise.

The third Elder was in their early 80s at the time and generously made himself available for a lengthy interview, conducted with the assistance of an Inuktitut interpreter. A condensed account of his observations follows with reference to local information mapped during the visit (Map Sheet 1 – Appendix B, with excerpt provided in Fig. 8.12). The changes he had observed are consolidated by category in Table 8.6 and accord fairly well with those related by participants in the radio call-in.

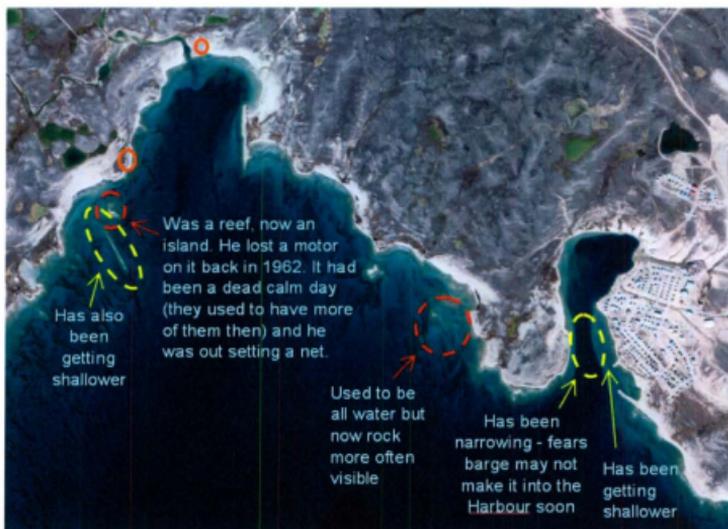


Figure 8.12: Map Sheet 1 detail with elder's observations suggestive of local uplift.

Base Photo Source: National Air Photo Library, Government of Canada

Table 8.6: Elder's Change Observations by Category (Age: 80s)

<p>Weather</p> <p>'Global warming' wasn't as noticeable in the Gjoa Haven area as it was in some other parts of the Arctic.</p> <p>Their winters were shorter and not as cold. The January-March 'cold period' had gotten warmer.</p> <p>Changes were not as noticeable in summer but it was believed that Gjoa Haven was on its way to experiencing more warmth in the summer.</p> <p>Their weather is changeable – cold spells followed by warm periods. There is nothing predictable about their warmer periods – the days are changeable. It used to be calm most everyday but now it can change within a day.</p> <p>They are seeing more mist and drizzle.</p> <p>More windy conditions. Although there is more wind throughout the year, during the windy season of September through November, it has been getting even windier and the waves have been getting bigger each year. It tended to become calm late November but now the windy season runs well into December - the calm is now the last week in January.</p> <p>Their windy season is switching from winter to summer. Their strongest winds in the Baffin are from the South; here [Gjoa Haven] from the West. Their north wind used to come from due North but has shifted (See Map Sheet 1) – it can be seen in the pattern of drifts. The snow drifts created by the north wind that could once be followed, now have to be crossed when traveling the same way.</p>	<p>Wildlife</p> <p>They don't see as many butterflies or mosquitoes, perhaps due to windier conditions. Back in the 1960s, the bugs there had often been bad enough that people would need to take shelter.</p> <p>In living memory, Gjoa Haven has tended to have fewer marine species than the Baffin Region where there is a deeper sea. The waters off Gjoa Haven see mostly fish, seals, bearded seals and occasionally a beluga (but not their common track as far shallower waters here); there haven't been any unusual marine species seen.</p> <p>In general, animals and fish were becoming more plentiful. They are seeing more grizzly and this is having an impact on caribou.</p> <p>He hasn't noticed any significant changes in the tastes of meats outside of the mating season taste changes that he avoids (i.e. male polar bear or caribou).</p> <p>He has seen a change in the size of fish – they are bigger but not edible, particularly this last summer. He's not been eating fish.</p> <p>Of late there had been polar bear sightings in the Taloyoak area where they didn't used to appear. He says this means there are more bears. He's not worried about polar bears since they are such a mobile species following the seals' patterns and they can catch seal any time of year regardless of ice conditions.</p>
<p>Celestial Features</p> <p>The sun is now way higher in the sky which causes warmer days. He remembers it being much lower when he first came.</p> <p>The direction of the sunrise has shifted too – they couldn't actually see the cresting before but they can now (See Map Sheet 1).</p>	<p>Land/Nearshore</p> <p>Less terrestrial plant growth.</p> <p>Within the community perhaps the biggest concern is with the access to the Harbour and keeping it open. He wonders if dredging may be an issue in relation to its potential impact on existing fishing areas.</p> <p>Reference made to numerous nearshore hazards created by areas becoming shallower (See Map Sheet 1 and detail in Figure 8.12)</p> <p>He noted changes to quality of water from inland creeks and ponds. (See Map Sheet 1)</p>

This Elder was originally from the Baffin region and had lived in a couple of other Kitikmeot region communities during the late 1950s before settling in Gjoa Haven. There were 30 people there counting him when he came, most of whom lived in *iglus* there in the winter and tents in the summer. He noted that people only started moving into the community once the school was built (c. 1968). Prior to that, children would have to go away from September through the end of May to the school in Taloyoak.

The Elder noted that Inuit didn't have the power to correct the climate changes being seen, nor could they be blamed for them. He did relate some changes in wildlife to the Inuit not hunting as much as they used to. Years ago, in addition to getting the skins they needed for clothing, the Inuit hunted mainly for dog food. A family would often keep 12-15 dogs: they would eat a seal a day plus plenty of fish, and would be supplemented by some of their caribou harvest. Now there weren't as many dogs to feed so the Inuit just need to hunt enough to feed a household. He thought fish populations had perhaps been increasing as a result. He recalled last hunting himself in the 1980s.

With less hunting, there seemed to also be more problems. They were hearing about endangered populations. He pointed out however that because of vast territories, animals can disappear from one area and reappear in another part of their region (i.e. lemming, fox, polar bear, caribou). The elder related traditional knowledge respecting migration routes for numerous species taken in the region. Their geese hunting season starts in September at the start of their migration. Caribou were described as still following an ancestral route through Taloyoak even now there are buildings there. He expressed concern about the fencing of the caribou migration trail attempted at Taloyoak as he believed it was very important to provide for the movement of migrating species.

Similarly, while he approved of no-hunting area designations, he disagreed with protected areas being penned or otherwise crafted in a manner that obstructed the movements of animal populations. He also expressed some frustration with other enforced wildlife protection practices noting that as a teenager, he'd been forbidden to kill waterfowl, and that now they were instructed to kill as many as possible to control populations.

Raised as a polar bear hunting Inuk in the Northern Baffin region, he was most interested in speaking about the polar bears. He expressed concern about what researchers might be doing to them. He doesn't believe reports or scientists suggesting the polar bears are becoming extinct due to his knowledge of their migratory behaviour. He said the ones seen in the Gjoa Haven area were in the process of migration between the Banks Island and Greenland regions. They used to catch them north of King William Island (along the migration route). He described them as being more plentiful on the Boothia Peninsula and most plentiful in the Northern Baffin region.

8.4.3.4 Public Works and Housing Staff Observations

Several staff members of the Hamlet Public Works Department and the local Kikitak Housing Association were interviewed over the course of the community visit. Their consolidated observations respecting Gjoa Haven infrastructure and related operational matters are reported below and on Map Sheet 2 (Appendix C). The staff also offered a variety of other change observations summarized in Table 8. 7.

A number of observations respecting the age and condition of housing were recorded (Fig. 8.13). The oldest units were described as needing renovations, not on account of deteriorating foundations or ground conditions changes, but because they

Table 8.7: Staff Change Observations by Category

Weather	Land/Nearshore
<p>The freeze-up is later. It was variously described as:</p> <ul style="list-style-type: none"> • currently occurring by the 1st or 2nd week of October with traveling to the Mainland starting in the 3rd week of October although they would need to take special routes then to avoid unfrozen patches. • being so late (beginning of November) in the last couple of years such that the speaker recalled being asked to go fishing in late October. • in particular reference to the river over which a crossing was being planned at the time: it once was frozen by early October but now is almost a month later (See Map Sheet 2) 	<p>References to the ice caps melting inland on King William Island.</p> <p>The creeks in the vicinity were recalled as having been full in 1957 (when the speaker had first come to Gjoa Haven) when conditions were cooler overall.</p> <p>One speaker referred to changes his father could see in Koka Lake: the river was shallower and a long point there had eroded away.</p>
<p>There have been instances of it taking longer: by one account, freeze-up had been two weeks later still 5-6 years prior. An elder was spoken of who described a year in the 1920s when the ocean in the vicinity didn't freeze at all.</p> <p>Their fall winds have been much stronger than usual. A lot more windy than calm days.</p> <p>The tide, especially in the fall, is higher than usual some days. The higher tides are usually associated with windier conditions to come.</p> <p>One speaker referred to his grandmother telling him that weather fluctuates from warmer to colder. She had told him that the ice caps in their region didn't used to melt in the summer and that their disappearance was a recent occurrence. She had been aware of warming for some time, but was observing that it seemed to be happening faster now.</p> <p>Less snow is being seen on the land each year. There had been less snow than usual so far that winter too that was causing a lot of wear and tear on skidoos.</p>	<p>Celestial Features</p> <p>The position of the sun and moon were both described as higher. The speaker recalled it as having sat at 2 o'clock to the horizon; now more often at 1 o'clock or midnight. At dawn now, the sky brightens faster. It used to rise more to the east and now rises to the south.</p> <p>The sky was alternately described as 'faded', "not being as [dark] blue as it used to be", or 'murkier', particularly in the summer and springtime. One speaker suspected it was smoke and fog that was producing this.</p> <p>Their sunsets would be brilliant orange and red but they don't see that as much now.</p>

tended to be smaller units and there was great demand for larger houses at this time. Most residents also wanted single detached units so as to avoid noise problems. There were said to be 60 people on the Kikitak waiting list at that time and they had no option but to

stay with relatives for the meantime. The worst case scenarios were described as a two-bedroom unit with 6 residents, and a couple of four bedroom units with between 10 and 16 residents each. Getting new units to solve the overcrowding was repeatedly mentioned as a major local issue. Two infill development areas were suggested for further investigation based on their easy walking distance from existing stores and other amenities.

It was noted that the conventional wooden block foundations with gravel pads are being eroded by the passage of water, generally on the highest, built-up side. "Crushed" gravels (a mix of sand and pebbles or small rocks were said to erode more than gravel without sand. Staff had identified some new gravel supplies in the vicinity of the water supply lake to replace older community quarry sites (including the former airstrip) said to be running out of suitable aggregate. Reference was made to the aggregate sourced in the later 1960s from the island to the south of the townsite. Accessed across an ice road at the time, it was the supply used for most of the landfilling done in the vicinity of the school complex.

A number of the older housing units have also had insect problems, often associated with leaky plumbing (seen in bathroom or kitchen). Housing of late 1980s construction were described as having poor ventilation and vapour barrier issues leading to more generalized moisture problems. The current bugs were characterized as small (1/16th ") whereas the ones observed back in the 1980s were bigger (1/8th ") and came through the walls.

Drifting problems were described with the Uptown area and along the road to the water supply, particularly in the area just past the turn-off to the DEW Line site and in the



Figure 8.13: Staff commentary respecting townsite
 Base photo source: National Air Photo Library, Government of Canada



Figure 8.14: Lower Gully near beach, August 2006



Figure 8.15: Upper Gully, July 2006. Site where house removed indicated.
Base photo courtesy of S. Papadimitriou

vicinity of the waterline heating sheds. So far that winter however, there had been virtually no drifting along the road. There was reference to freeze-up damage that had required the replacement of the culvert and road repairs at the crossing over the Upper Gully (See Map Sheet 2).

Thaw conditions had also produced operational and infrastructure problems. A grader had recently been abandoned beside the pond to the northeast of Swan Lake where it had become mired in unexpectedly thawed ground. The accelerating erosion of the Upper Gully was described in relation to the cracking of walls in much of the housing there: it was estimated that it had gone from being a steep-sided creek to its current slope-sided state over the last 10-15 years (Figs. 8.14-8.15). The sudden breach in the fall of 2005 of the former water reservoir above the Uptown area was noted.

8.5 Consultation Outcomes and Discussion

A powerpoint slide deck was assembled as a facilitation tool for use in the local consultations during January–February 2007; however the course of the local consultation process differed significantly in Gjoa Haven from the other two case study communities.

The introductory public presentation was delivered in English and provided an overview of the research plan and associated field work recently conducted by other Memorial researchers. The resources required for fully bilingual community gathering were rallied for a major event on January 29th and much of the time spent in the community was used to lay the groundwork for that event. A greater emphasis was thereby placed on interviews with key informants (e.g. Hamlet Councilors, staff from various organizations, Elders...) and youth. A presentation compiled based on these consultations and the documentation provided by various organizations was readied for the gathering on the 29th with the intent that it be available should circumstances allow for some serial editing, but it was agreed among the small number of participants who braved the storm that their time there would not be long enough to sufficiently engage that process.

A summary of the consultation outcomes was provided as a presentation to the Hamlet Council at the end of the researcher's extended fieldwork period.

For discussion purposes, the thematic outcomes of the various consultation gatherings have been consolidated and reorganized using the tabular analysis process and the same seven topic areas applied in the other two case studies:

- Community Lands and Physical Hazards
- Core Community Services and Utilities
- Transportation and Communications
- Residential Infrastructure and Services
- Economic Infrastructure and Services
- Public Services
- Community Wellness

8.5.1 Community Lands and Physical Hazards *(See Table 8.9)*

Relative to the other two case study communities, Gjoa Haven is fortunate in having few geographic or terrain constraints on its potential expansion. Due to the nature of local substrate materials, the relatively small annual changes seen in frozen ground to date suggest that there are relatively few sites in the vicinity where development needs be avoided for these reasons alone. Four potential development areas in the immediate townsite area were identified by Papadimitriou (2007, pp. 91-92) based on the non ice-rich nature of their coarse-grained sediments (i.e. sands and gravels) (Figs. 8.16-8.17).

Independent observations provided by Hamlet and Housing staff suggest other factors to be investigated in selecting new development areas in Arctic settings (i.e. former waste disposal sites, areas subject to drifting). As in the other case study communities, landfilling has occurred in many parts of the community and must be treated as a significant additional variable when evaluating the potential for terrain movement in prospective development sites. Both the characteristics of the fill used and the preexisting conditions of the filled area will influence the behaviour of the new ground over time (Fig. 8.18).

This is not to say that ground movement in Gjoa Haven is of little consequence. Several areas of older existing development have been affected by freeze-thaw movement and erosion. The community remains relatively compact but generally divided by 'the Gully' – a major local drainage feature - into the older townsite to its south, and the newer "Uptown" area to the northwest. Residents describe the Gully as having changed from a relatively steep-sided channel to one with sloped sides over the last couple of decades.

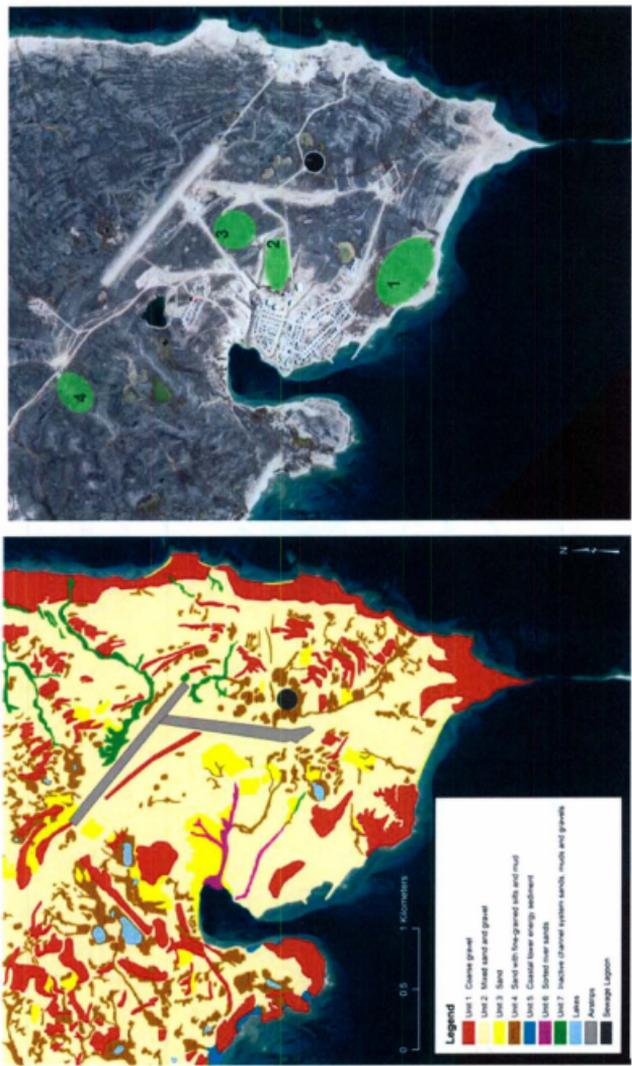


Figure 8.16 (left): Surficial geology map of Gjoa Haven and surrounding area (Papadimitriou 2007, p.92)
Figure 8.17 (right): Areas recommended based on preliminary terrain condition assessment (after Papadimitriou). See other considerations noted based on consultation feedback (Table 8.8). Base image source: National Air Photo Library, Government of Canada.

Table 8.8: Prospective Development Areas (See Figure 8.17)

Area	Recommended based on	Additional considerations
<i>As per Papadimitriou, 2007</i>		<i>Resident Accounts</i>
Area 1	Gravel substrate, relatively flat with no evidence of gullying Proximity to existing development Setback from shoreline	Area is adjacent to/overlapping area proposed by town staff who indicated it was a landfilled former dumpsite, likely needing clean-up
Area 2	Sand and gravel substrate, relatively flat, minor ablation in evidence Adjacent to existing development with existing access	Appears to encompass some earlier landfilled areas.
Area 3	Sand substrate, relatively flat with minor gullying in area Proximity to existing development (although located beside airport) Site is currently used as golf course	<i>No other reference made to this area during consultations.</i>
Area 4	Gravel and sand substrate, relatively flat and sheltered with no evidence of gullying Good access although remote from existing community	In area characterized as experiencing some of the worst drifting some winters.



Figure 8.18: Gully comparison 1960-1993 with landfilled area highlighted.
Base photo source: National Air Photo Library, Government of Canada

Erosion there has already led to the removal of one older house and the relocation of another.

There are former dump and fuel storage sites that have been identified as requiring clean-up. Similarly, there are several landfilled ponds and water features in the older area of the community that are recognized as potentially less stable locations for development (Fig. 8.18). Gravel is generally in good supply in the area. The current town quarry, however, is said to be nearing the end of cost-effective use.

8.5.2 Core Community Services and Utilities (*See Table 8.10*)

The community's water supply (Swan Lake) is considered to be a reliable source by community members. A new 3.5 km supply line and water treatment plant were completed in 2006. The Hamlet had some concerns that the line might freeze, but to date it has operated as promised.

Maintaining existing services alongside of responding to demands for new ones have presented numerous challenges. Problems with aging heavy equipment have brought municipal operations to a near standstill on occasion in recent years (Lippa 2003)

Earth berm containment structures have been in use in this and many other Northern communities. As the numbers of warm days increase and begin to deepen the active layer of frozen ground, it is reasonable to expect that engineered works that rely on the properties of frozen ground could be similarly affected. Gjoa Haven's former community water reservoir, however, experienced a sudden failure in 2005, suggesting that the assumptions supporting this permafrost-based engineering method had not been revisited recently.

Table 8.9: Community Lands and Physical Hazards - Local Themes Break-out Summary

Theme	<i>Material</i>		<i>Relational</i>	
	Resources	People	Organizations	Relationships
Suitable land for new development 	Based on a preliminary assessment of their relative susceptibility to permafrost degradation, several potential areas for new development have been identified (Papadimitriou) that require further investigation.	Rapidly growing population already in need of additional infrastructure.	Land Use Plan administered by Hamlet, with Housing Association as other key local organisational stakeholder	Addressing residential overcrowding is an identified priority but one that has been a longstanding issue.
Permafrost degradation 	Building cracking and settling noted in the Gully area. Erosion there has contributed to the relocation of one structure and a decision to not rebuild a house destroyed by fire. Sudden earthbeem reservoir failure highlights class of infrastructure requiring greater attention.	Individual properties and households affected, changes for the most part have been gradual and addressed in the course of ongoing maintenance and replacement activity. Monitoring capacity exists and could be readily enhanced.	Hamlet, Housing and the Department of Transportation have all experienced some degree of infrastructure issues to which permafrost degradation has contributed. Little formal ongoing evaluation or monitoring, however, of existing infrastructure and/or ground conditions.	Evidence and awareness of changes in local ground conditions are relatively recent and confined to a few sites, particularly in the vicinity of the Gully.
Drainage system improvements 	Existing erosion and gullying point to continued importance of development siting, local drainage system design and maintenance.	Accounts of "soft spots" around community, especially in relation to landfilled former water features.	CEDP 1998 referred to improving drainage as part of road system upgrading, and to a new snow removal strategy as a means of reducing local erosion. A seeding program was also proposed as a beautification initiative.	Dept. of Economic Development & Transportation services based in community, augmenting local system design and maintenance capacity.
Former dump site issues 	One prospective development area identified as former dumpsite – clean-up require?	Residents conscious of potential for contamination	Hamlet and Housing Association have immediate interests in identification of new development areas	Legacy of landfilling suggests other factors requiring further research (i.e. variable change response, contaminants)
Gravel sources 	Current community gravel supply in need of replacement. Supplies of finer grades of fill are available in region. Difficulties identified however in locating larger rock supplies suitable for breakwater construction.	References made to new gravel sources identified in vicinity of hamlet water supply. As development of these uses could affect source water quality, local awareness-raising around watershed management may be needed.	Cost implications for certain classes of infrastructure development and maintenance.	Formal quarry areas and informal fill supplies (e.g. the former airstrip) both exist in the community.

More predictable

uncertainty

Significant stress
Pervasive impacts



Community Lands & Physical Hazards





Less stress
More predictable

uncertainty

Significant stress
Pervasive impacts

Theme	Resources	Material	People	Organizations	Relationships
Water supply sustainability 	Current water quality is receding as good. A sewer pump house and buried 3.2 km line has allowed fill station to be located closer to town. Some cabins nearby in water shed and interest expressed in quarrying in immediate water shed for use for contamination events.	Many in community and Elders in particular prefer ice sourced from a few areas streams for tea and drinking water. Changes in water have been noted in some creeks and streams (e.g. turning tea from red to darker hues).	Hamlet personnel have reservations about new buried water line (i.e. have feared it may freeze). The 1998 Community Economic Development Plan (CEDP) had identified improving water quality as an objective.	Precautionary principles was-k-ya protected water supply may require reinforcement in years to come.	
Dump site 	Dump site in reasonable location allowing occur to reduce volume of garbage	Resident conscious of potential for contamination	Hamlet maintains.	Optimal site separation requirements will likely require another site be identified as community continues to grow.	
Sewage Lagoon 	Lagoon seepage - is it functioning as it should or not? Or is there evidence that this is another northern structure with the potential to breach more seriously?		Hamlet maintains. In 2011, the development of a local wastewater treatment plant was underway	Siting of lagoon will start of townsite; sudden earthquake failure wouldn't pose a significant downside risk to any community infrastructure.	
Wind power development 	A mid-range goal of developing local wind-generated power was identified in CEDP 1998.			Arctic community sustainability planning initiatives have emphasized development of renewable energy projects. • Also referred to in 2007 consultations.	
Import substitution strategies 	CEDP 1998 identified the development of local greenhouses to assist in lowering local living costs.			Applied in but not referred to directly in 2007 consultations.	

Table 8.10: Core Community Services and Utilities - Local Themes Break-out Summary

Examination of the community's sewage lagoon in the summer of 2006 appeared to reveal related leakage issues there (Papadimitriou, 2007), however, Hamlet staff later consulted indicated that the fissures in question were overflow features. At the time of writing, bids were being accepted for the development of a wastewater treatment facility at Gjoa Haven, likely addressing most remaining concerns for the local sewerage infrastructure.

8.5.3 Transportation and Communications *(See Table 8.11)*

While community roads appeared to be in good condition on the occasions of the visits made to the community, however neither of these occurred during the post-thaw period when deterioration of surfaces would be expected to be the most apparent.

Ground transportation by ATV along existing gravel access routes already extends well beyond the built-up area of the community. Some of the better used travel routes hug the more protected southern shores of the Island. Spread along them, from west to east, are a series of colonial development sites including a Terror Bay fur trade post operated by Patrick Klengenber from 1940-44 (Usher 1971), a former large DEW Line site(1957-1992) known as Gladman that remains a part of the NWS today; the early HBC trading post (c. 1923-27) at Peabody Point; and, on the easternmost part of the Island, a former DEW Line Intermediate Site (closed in 1963) at Matheson Point.

An access road to Taseyoak Lake roughly 35 kilometres north of the community had been proposed. It did not appear to be a high priority project but rather a target that a series of incremental initiatives might accomplish as opportunity permitted. A visit by an engineering consultant to evaluate the site options for a bridge to span the shallow river



Figure 8.19 (above): 1992 Air photo with reservoir highlighted (arrow)

Figure 8.20 (below) : Reservoir failure points to more generalized class of specifications failure arising from earthworks engineered under a former climatic regime.

Source (both base images): National Air Photo Library, Government of Canada



Figure 8.21: Proposed river crossing sites (August 2006)

just west of the community, evidently the first of what would be numerous potential obstacles for vehicles passing that way, happened to coincide with the researcher's introductory trip (Fig. 8.21). Funding was obtained under the federal Community Adjustment Fund (2009-11) for construction of the 26-metre bridge.

The Hamlet has recently developed a breakwater to protect small boats in the Harbour from wave action (Lippa 2003). Maintaining and upgrading this and other marine facilities will require a supply of armourstone be identified in the area. At the time of the researcher's initial visit, the consulting engineer for the river crossing project was also exploring potential sources of suitably large rock near the townsite. A couple of areas along the road between the proposed river crossing and the town were suggested for further examination at the time but it was also noted might correspond to sacred areas about which information and advice should be sought from community elders.

Building the economic bases in the various regions of Nunavut has been a strategic emphasis of the new territorial government. The Kitikmeot Corporation is the enterprise development arm of Kitikmeot Inuit Association. Regional business

Gjoa Haven Consultation Outcomes - Theme Break-outs III

Transportation and Communications

Theme	Material		Relational	
	Resources	People	Organizations	Relationships
Local road development/maintenance 	Susceptible to increased freeze-thaw and ground condition changes. Some roads in poor condition but relatively few serious issues to date. Dust problems also noted.	Ongoing maintenance by Hamlet staff – significant knowledge base and monitors of change	Used by all. Hamlet maintains CEDP 1998 also referred to dust being an issue.	<i>Bellwether of terrain changes</i> Dept. of Economic Development & Transportation services based in community, augmenting local system design and maintenance capacity.
Inland access road plans 	Access sought to Taseoyak Lake, approx. 35 km. inland and to the North of the community.		Used by many, Dept. of Transportation maintains	
New river crossing infrastructure planned 	Existing ATV trails cross river west of community but it is not readily forded during higher water periods (presumably lengthening with warming and increased precipitation trends). <i>(Note: Along route towards proposed inland access road.)</i>	The bridge will facilitate residents' movement to and from land-based activities and outcamps north and west of Petersen Bay and beyond.	Dept. of Transportation Hamlet (approved August 2007)	
Relative remoteness of community to rest of Nunavut 	Gjoa Haven and Kitikmeot air services more generally are routed through NWT. CEDP 1998 identified strategy targeting transportation costs as primary contributor to high local cost of living	Kitikmeot retains both more of a connection to former NWT associations and a greater degree of regional autonomy	First Air Canadian North (<i>effective 2007</i>) Ken Eorek Air (intra-regional service) <i>(multiple carriers have addressed earlier lack of competition)</i>	Kitikmeot Inuit Association (and other regional associations) provide support for inter-community event travel
Airport improvements 	A short runway limits air services to smaller craft		CEDP 1998 identifies new hangar and runway extension as short and mid-term objectives.	<i>New airport building completed at time of consultations</i>
Harbour improvement and operations 	The mouth of the Harbour has been narrowing and increasing sediment loads have further reduced the depth of run-up areas.	Residents note numerous areas of emerging marine obstacles/hazards.	Dredging of the mouth and inner Harbour and the improvement of the existing breakwater are concerns of both the Hamlet and the Dept. of Transportation.	Update marine surveys and aids to navigation may be required (Federal-level responsibilities) to address emerging nearshore features
Internet services 			CEDP 1998 identified community internet system improvements as immediate priority	<i>* Not referred to in 2007 consultations.</i>

Less stress
More predictable

uncertainty

Significant stress
Pervasive impacts

opportunities that the Corporation has invested in include the satellite phone and internet services (operated under the name PolarNet) available locally.

The original DEW Line station in the vicinity was operated from 1957-1963 at Matheson Point, roughly one mile northwest of the current NWS site. The succeeding unattended Northern Warning System (NWS) Short Range Radar site has been active since 1990 and consists of communications and storage buildings and a radar tower.

The original airport at Gjoa Haven was built to service the DEW Line site. It was oriented roughly north-south and is still clearly visible from the air. It was later replaced by the realigned current 1300 m runway gravel airstrip. Airport deficiencies identified by parties consulted in Gjoa Haven in 1998 included the need for improved terminal facilities, airport lighting and heavy equipment to maintain the runway. Surveyed responses respecting air service noted the need for faster aircraft, increased capacity, and scheduled services to Iqaluit and other eastern destinations in Nunavut. At the time, an infusion of 22 new regional government staff was predicted for the community as part of the transition to the Nunavut governance framework (VISS Ltd. 1998, p. 30). Gjoa Haven has recently received an upgraded air terminal building.

8.5.4 Residential Infrastructure and Services *(See Table 8.12)*

Overcrowding has been a chronic problem for the community, compounded by other issues with existing structure design and deterioration. Structures in the vicinity of the Gully have been evidencing the ground movement caused by erosion there for some time. To date, only one building has been removed expressly due to the erosion there

Less stress
More predictable

uncertainty

Significant stress
Pervasive impacts



Residential Infrastructure and Services



Gjoa Haven Consultation Outcomes - Theme Break-outs IV

Theme	<i>Material</i>		<i>Relational</i>	
	Resources	People	Organizations	Relationships
Significant overcrowding 	Considered one of the most serious issues in the community. In the order of 60 people awaiting subsidized units and currently residing with other family members.	Experienced Housing Association staff Strains on families are significant.	This has been a chronic concern for the Housing Association. Identified in CEDP 1998 as a key objective. The Housing Association is faced with challenge of balancing more desirable design features with the need to urgently provide additional units.	Resources lacking for amount of new housing required. Support from other agencies is required
Available housing types and condition 	Additional single, detached units preferred so as to avoid sound transmission issues.			
Market housing 	Required for transient and professional workers and for those ineligible for Housing Association units		Housing Association	<i>Relatively recent Uptown area units constructed.</i>

Table 8.12: Residential Infrastructure and Services - Local Themes Break-out Summary

(relocated to a site across the road as shown in Fig. 8.15); while a second structure damaged in a fire has not been replaced.

The Nunavut Housing Corporation in partnership with Nunavut Tunngavik Inc. submitted a Ten-Year Inuit Housing Action Plan to the Government of Canada in 2004. Nunavut was said to be in need of 3,000 units at the time which were then estimated to require a \$1.9B investment to meet in the 2006-2016 period. Relative to other Nunavut communities, Gjoa Haven is in the mid-range with just under 20% of their residents living in overcrowded households (ibid. citing Statistics Canada, 2001).

8.5.5 Economic Infrastructure and Services *(See Table 8.13)*

Existing community enterprise includes the longstanding Northern Store and a handful of declared small businesses (i.e. taxi, confectionary, bed and breakfast, logistics service provider). The Qikiqtaq Co-operative Association Limited was incorporated in 1966. In addition to a retail store (the current store premises opened in 2002), it operates the local hotel and provides local cable TV, fuel delivery, freight and property rental services. The community is home to numerous artists and carvers, several of who sell their work using on-line means (i.e. www.waddingtons.ca , an internet auction house featuring Canadian and Inuit art). A variety of other services are offered by residents on an occasional basis (i.e. translation/interpretation, catering).

Government services provide most of the employment opportunities in the community so economic diversification has been a recurring theme in local planning efforts. Of the numerous avenues suggested in the Community Economic Development Plan in 1998, tourism appeared to be the one area where some progress was apparent. The

latest round of economic development planning (Aarluk Consulting, 2007) appeared to be in the process of producing better-elaborated and targeted strategies identifying organizational, programmatic and land use requirements. A lack of space for new enterprise and limited local skills development and professional development opportunities still present challenges. A full-time administrative skills training program was available through the local Nunavut Arctic College Community Learning centre at the time of the consultations.

Issues related to 'flow-through' employment were not apparent in Gjoa Haven. Supportive employment settings that favoured on-the-job development of Inuk candidates were very much in evidence among the government services offices. At the time of the consultations, the Hamlet had just engaged a new Lands Administrator trainee whose work would complement that of the regional community planning staff who visited three or four times each year (R. Kamoookak, *pers.com*). Given the small staff of most local organizations, more experienced Inuit filling senior positions did have few options for career advancement other than moving to regional government services. One prominent example of this during the research period was the departure of the Hamlet's Senior Administrative Officer in late 2007 in order to take a position with the Nunavut Water Board following the controversial departure of a senior staff member there.

8.5.6 Public Services (*See Table 8.14*)

Given the high community birth rates, it was not surprising that the bulk of the public service themes identified during the consultations treated youth-oriented needs (e.g. school gym, other recreational infrastructure and programming, formalized child

Table 8.13: Economic Infrastructure and Services - Local Themes Break-out Summary

Theme	Material		Relational	
	Resources	People	Organizations	Relationships
Implement Community Economic Development Plan (CEDP) 	<p>Analysis and recommendations respecting future economic ends were available and a community (land use) plan review had been initiated in 2007. Local economic diversification was the central CEDP 1998 theme with opportunities identified in food processing, manufacturing, and enterprise support services.</p> <p>Note: Opportunities referenced during this researcher's visits:</p> <ul style="list-style-type: none"> Arctic Char fishery potential Snow geese harvest (meat, down, eggs) 	<p>Community Economic Development Officer was in place.</p> <p>Process of identifying needed training and opportunities/subsidies for interested members of community underway</p> <p>Inventory of existing entrepreneurs/enterprise and other resident skills underway</p>	<p>Hamlet Economic Development Committee worked with Nunavut-based Aarkuk Consulting (part of the Conium Consulting Group) on Plan from 2006-07.</p> <p>Identified strategies engage most all existing organizations and entail the creation of numerous new groups, programs and designation of a local commercial land use zone.</p>	<p>Identification of all enterprise opportunities (i.e. small enterprise, crafts, tourism ...) and compile list of needed trades/skills</p> <p>Government of Nunavut Department of Community and Government Services has commissioned territory-wide community infrastructure investment planning consultations (also done by Conium)</p>
Tourism 	<p>The community has already established several attractions with a focus on existing cruise ship traffic. Some coordinated services and attractions under development. Local accommodations limit scale of potential market for non-cruise visitation.</p>	<p>Skilled craftspeople, numerous certified guides, many with knowledge of land and Inuit culture.</p> <p>Limited training opportunities and high reliance on social assistance have impeded new enterprise development.</p>	<p>Hamlet (Economic Development Committee)</p> <p>Hotel</p> <p>CEDP 1998 called for creation of local tourism group and consolidated local promotions (i.e. print materials, website, tourist centre). A local mural painting initiative was also proposed.</p>	<p>Market recognized for goods and services built around local heritage and culture and eco-tourism.</p> <p>It was noted by some community members that scientific research activities also constituted a local visitation-based economic development activity.</p>
Need for office and work space 	<p>Not enough existing office and other building space noted to new enterprise or start-up operations.</p>	<p>Limited job/enterprise development skills training/upgrading locally</p>		<p>Identified initiatives in CEDP 1998 included local meat/fish processing, a cannery, a tannery, a water bottling operation, aquaculture operations, and a mini-mall - few of which were mentioned in 2007.</p>
Area mineral industry development/enterprise 	<p>CEDP 1998 identified mineral industry as focus for strategic research and human resources development</p>	<p>Questions remain about skills development in relation to potential sector employment in region. A few in community currently engaged as fly-in-fly-out staff or in prospecting.</p>	<p>Various corporate interests</p>	<p>Extensive staking activity on <i>Mavland (Boobus Peninsula)</i>.</p>

Less stress
More predictable



uncertainty

Significant stress
Pervasive impacts

Economic Infrastructure and Services 

Gjoa Haven Consultation Outcomes - Theme Break-outs V

Goja Haven Consultation Outcomes - Theme Break-outs VI

Public Services 

Theme	<i>Material</i>		<i>Relational</i>	
	Resources	People	Organizations	Relationships
Qiqshum Ilihakvik Elementary School gym needed  <i>(Note: Under construction in 2010)</i>	Colocated Qeqi Taqilihakvik High School gym also used by elementary school students now but increased student numbers have made it more difficult to effectively serve both.		Local Education Committee	Regional School Board
Need for more Inuit teachers 	Inuktitut language instruction and use a priority area	Elders still a relatively untapped resource as instructors		
Community pool and recreation complex sought 	Existing formal recreational facilities limited to indoor rink; CEDP 1998 had proposed new (off-season) uses for the arena and the development of a new recreation.	Youth are described as bored and overly engaged by internet- based pursuits	Good existing facilities (rink, school gym)	Evidence that outdoor recreational opportunities (i.e. fishing) still occupy some youth but may require reinforcement.
Need for child care services 	Growing numbers of young residents suggest opportunity		CEDP 1998 had identified as short-term objective.	<i>Implicit in but not expressly addressed in 2007 feedback.</i>
New Cemetery required 	Existing area in town at capacity		Hamlet/CGS	
Community sustainability initiatives 			CEDP 1998 had identified recycling and litter control programs as short-term objectives.	<i>Implicit in but not expressly addressed in 2007 feedback.</i>

Less stress
More predictable

uncertainty

Significant stress
Pervasive impacts

Table 8.14: Public Services - Local Themes Break-out Summary

care services). Of concern as well were the instructors needed to ensure the retention of Inuktitut language by the current generation.

8.5.7 Community Wellness *(See Table 8.15)*

Recurring themes in this and prior planning processes related to addictions (including the local dry community status); mental health services; policing and restorative justice practices; and programming and/or facilities sought for youth and Elders. Community feedback respecting this category of local circumstances, however, was limited by the nature of the consultation activities accomplished.

Relative to the other two case study communities, faith communities in Gjoa Haven were more prominent in their influence, and a much larger proportion of the population were speakers of one or another Inuktitut dialect. Social and cultural changes throughout the region and the services required to address them, however, were clearly encompassed in the larger and ongoing IQ-informed processes of governance change set in motion by the creation of the new territory.

8.6 Plan and Adaptation Scenarios

Extensive community planning efforts have been pursued throughout the Central and Eastern Arctic in recent years in conjunction with the transition from the GNWT to Nunavut governance frameworks. As such, not only was there a significant amount of documentation respecting recent community consultation outcomes in Gjoa Haven; there was also a limited local appetite for additional consultation. Notwithstanding the full approval for the project obtained from both the community and the Nunavut Research

Community Wellness

Gjoja Haven Consultation Outcomes - Theme Break-outs VII

Theme	Resources	Material	People	Organizations	Relationships
Community health services 	Need for a youth addiction treatment camp	In spite of dry community status, some addictions issues. Limited local access to doctors, specialists and nursing staff overextended.	CEEP 1998 identified strategy for improving medical care.	Back River identified as potential location for land-based education and recovery/treatment programs	
Community Wellness Centre * 	CEEP 1998-identified objective to forward traditions and culture. Need for parenting and dietary instruction - could provide venue for other programs. Elders Overextending existing youth- targeted services and infrastructure.	Traditional Inuit health educators lacking in the community according to CEEP 1998	Elders Association seen as a primary tenant of new facility	* Not referred to in 2007 consultations.	
Increasingly young population 	CEEP 1998 addressed with Wellness Centre (as noted above)	Sense of growing disconnection of youth from elders and traditional ways.	Active local youth group Hunter and School provides bulk of local youth-oriented activities		
Space needed for Elders' Association 					
Local language retention 		While a high proportion of the community are speakers, concern is expressed about current generation.			During the radio phone-in conducted during the community consultations, one elder made reference to how hard it was to tell any stories with so many in their house.
Not enough volunteers 		CEEP 1998 suggested that volunteerism be promoted and recognized.			
School breakfast and lunch programs 	Poor local data a source of concern. Successful school breakfast program to be expanded			School staff	Implement in next expressly addressed in 2007 feedback.
Young offenders 	CEEP 1998 referred to need to strengthen Community Justice Initiative in order to make young offenders accountable to the community.	CEEP 1998 also suggested vandalism was a problem in the community			* Not referred to in 2007 consultations.

Less stress
More predictable

uncertainty

Significant stress
Pervasive impacts



Table 8.15: Community Wellness - Local Themes Break-out Summary

Institute, the researcher later also was asked by the Manager of the Kitikmeot Regional Planning Office to exercise care in describing her dealings with the community so as not to confuse residents or lead them to understand she was engaged in any of their other recently contracted planning activities (R. Chapple, pers. comm., 2006).

The Gjoa Haven Strategic Community Economic Development Plan (henceforth CEDP 1998) provided a useful baseline document with which the researcher's site visit observations and resident commentary could be compared. An extensive inventory of community needs had been compiled at the time, and a variety of projects identified. The CEDP 1998 outlined the following rather generic community goals, most of which would appear to still hold true:

- (1) To strengthen and diversify the economic base of Gjoa Haven while creating employment opportunities for local residents;
- (2) To reduce the cost of living for residents of Gjoa Haven;
- (3) To maintain Inuit traditional knowledge and culture;
- (4) To improve the health of local residents;
- (5) To develop an infrastructure that meets the present and future requirements of the people of Gjoa Haven;
- (6) To promote a clean and healthy environment for the people of Gjoa Haven;
- (7) [To provide] Residents of Gjoa Haven...greater access to modern and traditional technologies;
- (8) [To] Keep Gjoa Haven safe;
- (9) [To] Have people become more involved in their community; and,
- (10) [To] Have sufficient recreation for residents, especially youth.

Excerpt from CEDP 1998, p.36

At the time of the research visit, a recently completed draft report on Strategic Options for Development was available. It referred to the ongoing process as building on the 1998 study but more specifically responding to the Nunavut Government principles and philosophy respecting Inuit community development. In particular, the consultants were asked to provide "...a detailed implementation plan that w[ould] enable the community to put the CED plan into action with minimal dependence on outside expertise." (Section 1: Introduction, first page). The hiring and training of local Community Economic Development Officers (CEDOs) was ongoing at the time in most Nunavut communities in keeping with the territorial emphasis on developing both local capacity and sustainable, independently achievable development.

The course of the adaptation planning process did not, in this instance, lead to a consolidated plan document so much as a snapshot of the community circumstances. As a larger community in the Kitikmeot, Gjoa Haven has numerous advantages stemming from the regional institutions based there. Its remoteness relative to either of the political centres of the eastern and western Arctic means that it has, by default as much as design, achieved an enviable balance even as development proceeds in and around it. The kind of urgent questions that lend themselves to engaging the community in the generation of adaptation scenarios did not exist in this instance. This however presented a different kind of challenge; one that is perhaps of greater concern because it pervades everything. How is the public interest best served when a threat is recognized that is neither perceived as immediately serious nor as pressing as some others on the horizon?

There remain significant climate change-related threats that Gjoa Haven should engage but that, for now, remain in the 'Important but not urgent' category. The failure of

the former reservoir's earthberm structure in 2005 suggests the kind of sudden event that tends to follow on a protracted subtle change. While nobody was hurt by the sudden deluge on the quiet morning it took place, that reservoir breach offers a greater cautionary tale for the many Arctic communities with landworks engineered using formerly reliable, professional rules-of-thumb respecting a permafrost about which little should be assumed now. In contrast, there are new assumptions that ought to be made now; for instance, that fuel spills will very likely accompany the opportunities provided by increased marine traffic in the region.

Each of these examples entails adaptation scenarios with a twist: they require adaptation at multiple scales. The immediate capacity of the local government to avoid or prevent them is limited. The conventional wisdom respecting a local response demands at least a well-practiced emergency plan in order to mitigate their impacts *when they happen*. Gjoa Haven has retired the former reservoir, and its only other earthworks of note, the already leaky sewage lagoon, would not spill into a developed area. The possibility of an offshore fuel spill is limited somewhat by the fact that the vessels moving in that region remain relatively small. The sensitivity, however, of the beaches and nearshore areas in the vicinity of the community has been assessed as relatively high given the low-energy wave regimes (Catto & Papadimitriou 2006). As they would not self-clean well, the community should probably try to acquire the means to both shield their shore and clean up spilled materials. They might also wish to support regional policy processes targeting marine pollution and spill response measures. There was at least one younger member of the community who raised this as a concern during the 2007 consultation period and the researcher did provide him with contact information for

environmental non-governmental organizations with marine protection interests and expertise.

8.7 Synthesis

From the perspective of managing climate-related changes, Gjoa Haven appeared to be a community well-equipped to handle coming changes (Table 8.16). The changes residents observed to date were not as dramatic as those being reported in other regions at the time, nor had they been creating circumstances that seemed beyond the means of existing local knowledge, services and equipment to tackle.

Of the three communities studied, Gjoa Haven appeared to have the best opportunity to benefit from others' experiences and to anticipate patterns of change. There was evidence that community members were both aware of and watching for some local evidence of the changes reported in other regions.

It was, however, also evident to the researcher that some features of the discourse respecting climate change in this community were very different from that of Tuktoyaktuk and Sachs Harbour. The care with which so many speakers sought to qualify both their observations and what might be done to respond to potentially worrisome changes in relation to the powers and insight of a Creator was unique to Gjoa Haven. This community appears to have most successfully preserved a traditional *inuit* relationship to place, in the midst of one of the most vigorously pursued and comprehensive planning efforts anywhere in Canada. Administrative challenges facing the new territorial government were being met by planning processes in every quarter and to such an extent

Table 8.16: Ten Key Observations - Gjoa Haven

1. Community members recognize that their climate is warming, seem inclined to believe further changes are coming, but many older residents are uncomfortable engaging in speculation about future conditions.
 2. Local observations of changes tend to emphasize altered seasonality, positioning of celestial features, and other aspects consistent with generalized warming and uplift in this region of the Arctic.
 3. It is recognized that vegetation in the region is changing (i.e. varieties once seen further south becoming more plentiful on Island).
 4. Changes in wildlife behavior have been noted.
 5. Storm influences are receiving greater attention and have been most notable in relation to their impact on boats moored in the harbour.
 6. The extent and duration of sea ice is seen as declining in the region, but the community tends to acknowledge this as a mixed blessing: they need to exercise greater care in their movement across the sea-ice but they also look forward to the economic opportunity associated with greater visitation and cruise vessel-based tourism.
 7. Accounts of permafrost thaw impacts are infrequent and more often implied than explicitly attributed as the cause of infrastructure issues. Individuals who work directly with some feature of the built community do acknowledge terrain thaw-related changes but they do not appear to consider them especially serious and address them on a case-by-case basis.
 8. Economic and cultural issues are not seen as consequences of climate change here.
 9. Foremost among local concerns are those related to infrastructure development that continues to lag behind the needs of a rapidly growing population.
 10. The community's emerging physical hazards and related critical infrastructure issues remain of low concern and appear well within the current capacity of local people and institutions to manage.
- UV impacts were not referred to by participants.

as to require that the researcher be warned off behaving in fashions that could be confused with the 'real' planning of the emerging state.

Notwithstanding the climate change orientation, conventional planning approaches were employed to explore the development-oriented research questions

previously approved by the research licensing processes. Reframed as resilience practice, they were adapted to suit the conditions met in the community, including those of prohibition respecting 'planning' themes.

Things Change, We Change

9.1 A Basis for Comparison

In the preceding sections treating three Arctic settlements and their respective contexts, I have cast my net in different pools of social and cultural narratives, political records and scientific observations in order to provide what I hope is a sufficiently representative account of what it is that I have seen and heard. It remains however, in the final analysis, my representation of others' experiences of complex and dynamic places, and, in that, inevitably both an act of simplification and translation. The chosen methods and a study design that provided for relatively more open-ended processes in respect of the circumstances of each community have each, in turn, exerted their own constraints and opportunities, producing quite different outcomes in each case. Before considering these differences, I will highlight three primary themes that permeate my analysis: scale; institutional change; and practice.

9.1.1 Scale

I have attempted to distinguish some of the multi-scale dynamics that have contributed to the conditions I observed in each community. In doing so, I was influenced by panarchy as a conceptual framework emphasizing inter-scalar relationships with both 'cascading' and 'trickle up' characteristics. My entry point and focus have been at the human level that I have referred to as 'local' and 'the community' in keeping with common parlance, but I have also explored individual, household, regional (i.e. the ISR), and those 'levels' equating with contemporary Canadian Arctic state jurisdictions and

ethnographic or cultural categorizations. I also refer to the appearance and impacts of environmental change that the people I have worked with have described across a range of geographic scales. With those environmental conditions as possible drivers of other changes, I have looked for evidence of other material and relational shifts as they may present themselves across the gamut of Arctic knowledges encountered.

9.1.2 Institutional Change

My focal institution was the formal local governance vehicle commonly referred to as a 'municipality'. In the smaller communities of the Canadian North, this is formally and informally termed 'the Hamlet' or simply 'Council'. This local authority is constituted as a 'creature of' the territorial state (e.g. the NWT or Nunavut), that is, the territorial and regional agencies with which it interacts most regularly. My local government focus follows from the functions of land use decision-making and development control. These responsibilities may, to greater or lesser degrees, be delegated to this level. My local government focus also follows from the fact that so many of the impacts of environmental changes are visited on the land and what is done and built there. As stressors act on the material and less tangible aspects of each locale, I have sought to examine to what extent each local government had identified ongoing changes that might require adjustments on their part, and what those adjustments entailed. Given the functional similarities in other local organizations found in each of the three communities (e.g. the Hunters and Trappers Committees/Organizations), the discussion of local institutional change has also drawn on examples from these bodies as opportunity permitted.

In keeping with the approach earlier framed, the identified dimensions of community resilience were used to organize the community case studies. The characterization of the change experience in each dimension employs the adaptive cycle (Holling et al, various), the basic unit of reference at each level of the hypothesized panarchic structure. I have attempted to characterize some of the timescales seen as operating at the local level and contributing to a composite cycling of adaptations. Specifying 'where' a given experience 'is' on a hypothetical cycle is a relative characterization better left to historical analysis. Instead, the stages of the adaptive cycle recognized were ascribed levels of stress, uncertainty and impacts. A proxy value could then be derived from the conditions assessed on a good-to-bad experiential range, qualitatively captured using the same traffic signal convention of a green-yellow-red spectrum.

9.1.3 Practice

I examine 'practice' from the contrasting perspectives of accessible 'practical knowledge' or 'mētis' (sensu Scott, 1998), and the more circumscribed and exclusive domain of epistemic knowledge as exercised by professional cadres. The ongoing work by Inuit towards self-government ends have reached the long-awaited stage where the first question being posed in most Arctic employment settings is whether a suitable Inuk candidate is available to fill a given job vacancy. Similarly, the perspectives and values of the Inuit – *Inuit Qaujimagatuqangit* (IQ) – have been enshrined in Nunavut to guide new governance practice. These are significant as protocols that challenge 'habits of mind' developed throughout the pre-existing governance relationships. I have looked for these

and other aspects of practice that may be embedded in those institutions and community governance roles to which contemporary Arctic residents have become habituated over the last couple of generations. I look too for indications of whether and how they may be changing in concert with all that is changing around them.

9.2 Arctic Community Challenges and Adaptations

The detailed thematic break-outs compiled for each of the case study communities are consolidated in Table 9.1. The summary topic areas, most of which recurred in all three consultations, are listed without further attribution. Referring to the community-specific assessments, a consolidated characterization of each community's overall circumstances is provided using the green-yellow-red colour system. The 'assessments' here should not be regarded as a grading or ranking of the communities; they are instead meant to capture the 'temperature' of the community conditions encountered, portrayed and interpreted at the time the research was conducted. This representation aims to facilitate comparison and discussion by a larger audience; allowing the 'big picture' to be retained even as the highlighting and unpacking of explanatory details occurs among various parties drawing on different knowledge systems.

9.2.1 Community Lands and Physical Hazards

These break-outs might be seen as having addressed what many would consider the most obvious applications of climate change-related impacts in relation to a given community. Changes to the terrain and more specifically the land base existing within each hamlet's boundaries represent a starting point for many development planning and

operational decisions. From a formal, local government perspective, these are descriptors that inform annual budget priorities, assessments of how best to deploy other available resources, and the identification of gaps to be filled by other means. Both Tuktoyaktuk and Gjoa Haven had municipal land use plans in force for some time and these required review during the study period. A concept document had been prepared in the 1970s for Sachs Harbour, but a land use plan was never brought into effect there.

Coastal erosion and flooding were characteristics of the serious challenges facing Tuktoyaktuk. Coastal erosion was also a prominent consideration in Sachs Harbour. In contrast, Gjoa Haven's coastal changes were attributable to emergence but still presented a hazard to vessel movements in the nearshore and harbour. Terrain erosion in Gjoa Haven was instead mainly experienced along major natural drainage features like the Gully and noted in relation to the exposure of once-buried infrastructure in sandier areas of the townsite. In all three communities, erosion was a significant consideration in relation to existing infrastructure maintenance and planning for new development.

Similarly, thawing ground and drainage systems were topics in all three communities. While the behaviour of the terrain movements varied with substrate characteristics (i.e. grain-size, proportions and distribution of ground ice), local drainage system design and maintenance was a clearly correlated factor. Sachs Harbour sustained the most serious damage to the land base due to poorly drained terrain, having lost the use of an area earlier designated for new housing. There were, however, indications that both Gjoa Haven and Tuktoyaktuk have been experiencing issues that would be alleviated by drainage improvements. Operationally, drainage must receive additional attention in the

public works plans for all three communities if they are to obtain the fullest possible benefit from the lands they hold.

A closely related consideration is the legacy of use and landfilling. In these Arctic community settings, contemporary development plans need to be informed by what has gone on before. In each of the three case studies, there was a distinctive history of local landfilling: damp or eroding areas supplemented, foundations bolstered, and waste buried with materials hauled or dredged from elsewhere. There was ample evidence that these areas settled, thawed and eroded in different ways based on the nature of the materials involved (those added and those covered). It was also clear that workable assumptions had been made in the past about permafrost as a condition supporting the longterm containment of contaminants, but that such assumptions were no longer reliable. In all three communities, former dumpsites with little further record were identified by residents. As much local knowledge as possible needs to be solicited from residents, and elders in particular, regarding the locations and nature of former wastes and waste disposal practices in order to ensure potential risks associated with buried contaminants are identified. Similarly, hamlets should compile their community's knowledge of the landfilling done in their area: useful conclusions may then be drawn about the longer term behaviour of various fill materials and methods.

Given the copious use of various kinds of fill for development in regions underlain by permafrost, the identification and excavation of suitable aggregate supplies to replace depleted 'first generation' inventories were considerations in all three communities. Tuktoyaktuk was experiencing the most serious shortages of fill: the armourstone and gravel brought in to consolidate the North Spit were very costly. Gjoa

Haven had little large rock available in the vicinity but good supplies of sand and gravel. Sachs Harbour also had ample fill supplies in the area.

9.2.2 Core Community Services and Utilities

The discussion regarding physical changes in the local land base needs to be kept in mind in relation to the following topic areas. The conventional suite of utilities and municipal services – power, fuel, water, sewage and waste disposal – all depend in one respect or another on the configuration and condition of the land in the community. Lessons learned about how the pieces of a typical community's infrastructure should all fit together are embedded in the conventions of contemporary civic design, engineering, and land use planning practices. A cautious practitioner, however, will recall that most of these conventions have only recently been informed by Arctic experience. As Arctic change proceeds, so then must we reexamine every rule of thumb and assumption employed there respecting community development.

Water supply sustainability was a focal point among the community service topics. Domestic running water is a service that few North Americans would happily forego today, but it is all too often taken for granted. This is not true of Arctic residents: community elders have lived through the period when household plumbing was a novelty, and most households still have to cope with periodic disruptions of some kind in their trucked water deliveries.

The relationship of people to their water supply inevitably becomes less direct in the implementation of these services. Municipal water systems introduce technologies and treatments that alter the water collected and reduce both the number of times the

Table 9.1: Consolidated Themes

Theme Break-outs	Topics	Tuk	Sachs	Gjoa
Community Lands & Physical Hazards	<ul style="list-style-type: none"> Coastal erosion Flooding Drainage system problems/improvements Permafrost degradation Slope failures/mass movements Former land uses/landfilling Scarcity/adequacy of suitable land for development Gravel/fill supplies 			
Core Community Services/Utilities	<ul style="list-style-type: none"> Water supply sustainability Design issues Siting issues New dumpsite required Sewage pond/lagoon as source of contamination Alternative energy (wind) Fuel line leaks Import substitution 			
Transportation and Communications	<ul style="list-style-type: none"> Community road maintenance/upgrading New road(s) and/or bridges required Ice road issues Transit systems Travel disruptions Airport maintenance and upgrading Air service improvements Relative remoteness from major centres Harbour improvements Upgraded internet service 			
Residential Infrastructure and Services	<ul style="list-style-type: none"> Overcrowding Designated subdivision land with drainage issues Need for replacement and new units (subsidized) Need for market housing Need for shelter(s) – women, men, youth... Identification of new housing areas 			



Table 9.1: Consolidated Themes (cont'd)

Theme Break-outs	Topics	Tuk	Sachs	Gjoa
Economic Infrastructure and Services	<ul style="list-style-type: none"> • Obtaining or implementing CEDP • Existing enterprise facilities needing renovation/replacement • Multi-purpose space available for rental/enterprise development • Lack of skills development and/or training available locally • Unrealized enterprise growth opportunities • Unrealized industry opportunities (tourism, mineral sector, fisheries...) • Major facility deterioration producing safety issues 			
Public/Institutional Services	<ul style="list-style-type: none"> • School upgrade/replacement • Need for more Inuit teachers • Library required • Childcare services required • Rink upgrade/repairs • Pool/Rec Complex required • Gym required • Organized outdoor activities required • Family Centre required • Fire Hall upgrade or expansion • Cemetery concerns • Recycling system required 			
Community Wellness	<ul style="list-style-type: none"> • Community policing (RCMP) requirements • Community health services • Wellness Centre and/or Heritage Centre (incorporating spaces for Elders and cultural transmission) • Smoking, drug and alcohol dependency • Younger population • Elders and cultural legacy • Local language retention • Not enough community volunteers • Emergency planning • Hunger (school breakfast and lunch programs) • Young offender programs 			



Less stress
More predictable

uncertainty

Significant stress
Pervasive impacts

source is visited and the individuals doing the visiting. Elders throughout the North routinely complain of the altered quality of the water from municipal supplies, preferring ice collected from designated 'clean' streams when they can get it for their tea-making. Once a community has a municipal water system, the local government is accountable for the safety of the potable water they provide. This in turn depends on:

- a) maintenance of water intake and disinfection equipment and practices;
- b) maintenance of reservoir (where used) and filling practices;
- c) maintenance and operation of the delivery vehicle(s);
- d) care taken in dispensing the water to receiving tanks (i.e. by delivery staff);
- e) maintenance of the receiving tanks; and
- f) securing the source itself from adverse conditions.

All of these requirements have presented challenges in the Arctic, examples of which were encountered in the communities consulted. Water system equipment supplied and serviced by parties outside the region showed issues with design and difficulties in establishing and preserving proper system function. In the case of Sachs Harbour, the Hamlet had to operate through several years of winter freeze-ups before their new water intake functioned properly. Community staff members seeking to cope with system breakdowns were not necessarily operating with full knowledge of what their contingency measures implied for water quality. Damages discovered in the Tuktoyaktuk fill line in the summer of 2006 seriously delayed the refilling of the community reservoir that year. Delivery trucks were susceptible to damage from winter freeze-ups, necessitating their storage in a heated space that the community might not have available or was designated for another vehicle (e.g. the fire truck). Operator certifications for trucks and larger

vehicles were not widely held as certification involved leaving the community for training and/or testing. Receiving water tanks might or might not be cleaned correctly or often enough.

The many things that could and did on occasion go wrong with the equipment and protocols for intake, treatment and delivery of water seemed to receive more attention overall, however, than the circumstances of the supply itself. The arms-length relationship of a population from its designated municipal water supply is conventionally governed today by a series of protective measures enacted through local and state development controls. Adverse developments are then expressly forbidden in the subject watershed. 'Grandfathering' of preexisting uses (e.g. the cabins in the direct vicinity of the Gjoa Haven water supply) may be accommodated in some instances with the proviso that they will be retired or removed over time. New or intensifying usage would be discouraged, however. Increased local awareness of watershed management principles along with adverse use monitoring seem to be required as there were existing or potentially adverse uses identified within all three of the community watersheds. Tuktoyaktuk's watershed is located on the opposite side of the Harbour outside the community's planning area, making it even more difficult to monitor and protect; fuel spill episodes and lowering levels in recent years suggest it may not be a suitable supply for much longer.

While not apparent in Gjoa Haven, the natural waterbodies selected as municipal supplies in each of Tuktoyaktuk and Sachs Harbour are undergoing predictable climate-related changes. Both are thermokarst features that will continue to ablate along their perimeters as temperatures continue to trend upwards. Their function as reservoirs will thus continue to deteriorate with time. Back-up supplies need to be officially designated

for each of these communities, and the existing supplies continually monitored for the progress of changes. In the case of Sachs Harbour, existing concerns respecting contamination of the supply by percolation of sewage lagoon contents across channels opening in patterned ground; operations of the adjacent airstrip; or in connection with the seasonal operations of the muskoxen abattoir suggest that serious consideration also should be given to bringing a new supply into operation as soon as is practicable. At times of the year when significant quantities of organic materials may be present, chlorination of surface water supplies may also result in trihalomethanes (THMs), a carcinogenic by-product.

Tuktoyaktuk's freshwater supply must be piped across the harbour annually to refill the large earthberm reservoir. Constructed on an extensively landfilled area, flooding projections suggest that access to it could be cut off during serious events. Gjoa Haven's former reservoir, created by impounding a natural water feature with an earthberm, breached suddenly in 2005. Subsequently, a new buried water line was constructed to a fill station much closer to town.

Fire services in all three communities are provided by community volunteers. The hamlets maintain equipment, a fire truck and a heated garage in each community. Training activities were infrequent in Sachs Harbour.

The managing of community wastes has presented some issues in all three communities but Tuktoyaktuk is the only community which requires urgent attention to this matter: a replacement needs to be identified for its currently flooding dumpsite. The day-to-day operations of the various community dumpsites were not investigated in detail but it was apparent that burning is still widely employed to reduce the volume of

materials prior to burial. There was insufficient access to suitable fill in Tuktoyaktuk, so materials there were often exposed. In Sachs Harbour, some reorganization and consolidation of materials was being undertaken in the current dump. No issues were raised respecting the Gjoa Haven dump, however it was noted that an alternate site may need to be identified if townsite expansion were to intrude on and reduce the existing buffer.

As with water supply reservoirs, ice-rich, earthbern structures have been used to construct numerous Arctic community sewage lagoons. These structures need to be checked for signs of thaw-related deterioration and phased out as budgets allow. The new sewage treatment facility planned for Gjoa Haven hopefully signals the direction of public infrastructure investment available to other communities in future years. Given the uncertainty respecting the sustainability of the present townsite, a new permanent sewage treatment plant in Tuktoyaktuk may not be entertained for some time. Should cost-effective technology become available however, a temporary treatment unit may be able to address concerns raised by the siting of the existing sewage lagoon relative to the Pingo National Landmark and the possible impact of discharges on nearshore food fish populations.

With changing ground conditions, increased monitoring and maintenance of existing infrastructure need to be undertaken in all of the communities. Priority clearly needs to be given to buried infrastructure such as fuel lines, given the seriousness of undetected leaks. The discovery of the leaks in Sachs Harbour and the apparent difficulties in conducting the subsequent clean-up serve as a warning in this regard.

Alternative energy and import substitution topics received increased attention during the study period due to regional climate change campaigns on the part of ENGOs and senior levels of government. Many recommended practices, however, actually harken back to domestic practices that were set aside relatively recently in most permanent coastal Arctic communities. In particular, wind power discussions evoked several stories of Elders' experiments with earlier models of wind-generators.

9.2.3 Transportation and Communications

In two generations, hydrocarbon-based transportation modes have surpassed all others in the North. Sled dogs have been overtaken by snowmobiles and ATVs; kayaks and sails by outboard motors, and longer distances increasingly accommodated by scheduled air services.

In terms of ground transportation, much of what has been stated in the sections above respecting terrain conditions, drainage and the development of other core services applies to community road development and maintenance. All three communities support relatively simple, unpaved, local road systems supplemented with well-used trails in the vicinity of the townsites. Only Tuktoyaktuk had the equivalent of a seasonal highway connecting it to other permanent regional road systems, contributing in turn to both higher numbers of automobiles in the community and a more consistent volume of freight movement throughout the year. The readier movement of goods and access to outside services the ice road provides have been affected by the increased variability in the onset, extent and duration of ice conditions now regularly described in Arctic climate change assessments. Tuktoyaktuk was implementing a local bus service at the time of the

consultations, and was the only community in the position to support a seasonal shuttle service to another community (Inuvik), due to the ice road.

Residents of all three communities noted changes in their snowmobile and ATV travel routes outside of their communities attributable to changes in formerly experienced freeze and thaw conditions over land and water. Trail deterioration was more pronounced in the two western communities.

NTCL barge services provide most of the non-perishable freight movement to Sachs Harbour and Gjoa Haven. Gjoa Haven and Tuktoyaktuk have significant harbour infrastructure and operations supporting small vessel movements. There were emerging marine operations issues noted in connection with environmental changes in both these communities. Little of Sachs Harbour's former reliance on marine modes remains: their beach serves as a landing area for the barge and a few motorboats used by residents mostly in the immediate area.

All three communities have terminal buildings and unpaved airstrips. They are also all served by regular flights with connections through the western Arctic corridor (e.g. Yellowknife and Inuvik). Only Tuktoyaktuk recorded significant erosion-related runway issues. Most concerns noted during the consultations addressed service levels.

While satellite services afford much better media and phone services now than in years past, Sachs Harbour was notable for its lack of a local radio station. Gjoa Haven's station was very active, with dedicated listeners for a variety of Inuktitut programming. Tuktoyaktuk also maintained a basic television broadcast system, viewed mostly for bingo calling and community announcements a few times each week.

9.2.4 Residential Infrastructure and Services

The housing profiles of the three communities were distinct, but they all recorded significant issues. All three needed additional units, either to address overcrowding (Tuktoyaktuk and Gjoa Haven); deteriorating or inadequate existing units (all three); to satisfy market housing demand (Tuktoyaktuk and Sachs Harbour); and various special shelter needs (all three). There were examples of houses being removed from eroding sites in all three communities, but conditions in Tuktoyaktuk were particularly hazardous given the additional storm surge flooding risks to numerous properties on the near sea-level terrain there. With reference to the discussion of community ground conditions, further community growth is severely limited in Sachs Harbour and Tuktoyaktuk by the lack of suitable new development areas. The land base is much better in Gjoa Haven, but the growth rate there was also the highest of the three communities, making calls for new housing particularly pressing.

Other constraints on housing development are the high costs of materials (brought in by barge to Sachs Harbour and Gjoa Haven), and the availability of local tradespeople. The local Housing Association Offices manage annual allocations from the territorial Housing Corporations.

9.2.5 Economic Infrastructure and Services

As discussed in Chapter 3, municipal plans are generally crafted with economic and social objectives in mind. Modern management practice has segmented community functions into sub-domains of bureaucratic expertise, each of which makes its own plans. However, economic development-oriented plans often seem to be present when others are

not, and appear to generally engage staff and committee energies in most Arctic communities. All three of the partnered communities were involved in some stage or degree of local economic development planning during the study period. In Tuktoyaktuk, the Hamlet's Economic Development Officer was collaborating with the Executive Director of the Community Development Corporation on development funding submissions; in Sachs Harbour, the Development Corporation was evaluating the development of a new business premises; and in Gjoa Haven, a recently hired Community Economic Development Officer was being oriented while territorial consultants prepared a new CEDP. All of these processes informed this research, both in terms of their assembled inventories of economic opportunities and as examples of local governance dynamics.

Unrealized opportunity was an overarching theme, to which the pursuit of the CEDP process was repeatedly pointed to as a step in the right direction. The opportunities described were at the levels of individual entrepreneurs, small and medium-scale local businesses, and sectoral domains requiring larger, long-term efforts coordinated among numerous players. Tourism and culture-related activities, local food harvesting (e.g. local fisheries, muskoxen, geese), and mineral and/or oil and gas reserves were repeatedly encountered themes in the CEDP strategies examined. Regulatory mechanisms governing the safety of the food stream, particularly in respect of licensing of facilities and product inspection services, clearly presented significant challenges to new food product development.

Each of Tuktoyaktuk and Gjoa Haven had several retail operations while Sachs Harbour relied entirely on its one cooperative store. Gjoa Haven also benefited from a

local cooperative which had diversified into providing a variety of other services. Suitable space to undertake a spectrum of new business activities was in short supply in all three communities. Besides being full, many existing business premises often required renovation or replacement, and in the case of Sachs Harbour were sufficiently deteriorated as to present air quality and other concerns.

Identified economic development avenues were also tied to specific skills, often in short supply locally. Skills inventories and training needs assessments were referred to by informants, but none were available at the time of writing. It appeared, however, that most of the training required would entail residents leaving their community for extended periods.

In all three communities, the traditional and wage economies co-existed, although to varying degrees. More employment opportunities existed in Tuktoyaktuk and Gjoa Haven thanks to their larger populations and the regional services they each hosted. Some jobs available in Sachs Harbour were difficult to fill due to a variety of worker issues (i.e. lack of necessary training and/or certifications, addictions, disinterest), and it was observed that staff turn-over, stress and illness rates were relatively high.

9.2.6 Public and Institutional Services

The Hamlet was the focal institution in each community for purposes of the research, and the largest local employer thanks to the array of facilities and services it provided. Each Hamlet maintained a main office and meeting space for their Council, a public works garage, a fire hall, and recreational facilities. All of the communities hoped to obtain new recreational facilities (i.e. gym, pool) in order to offer community youth

more activities. In Sachs Harbour however, an unserviceable arena and a gymnasium shared with the school stood in the way of the development of some of the sporting activities common elsewhere in the region. Tuktoyaktuk was the only hamlet maintaining a swimming pool over the research period. Organized winter outdoor activities such as skiing were not generally engaged in, but ballfields were available in all three communities and Gjoa Haven had also developed a small golf course. The beaches and shoreline in all three communities attracted much informal summertime activity.

The Hamlet administrations were thus critical determinants of community function. Tuktoyaktuk and Gjoa Haven, as larger settlements, each had larger departmentally-structured units managed by experienced senior personnel. Sachs Harbour had a very small staff that had experienced greater recent turn-over and which continued to exhibit difficulties over the research period. Tuktoyaktuk and Gjoa Haven's administrations were relatively more stable over the same period, but in the case of Gjoa Haven also reflected an active professional development effort. Whereas in the ISR communities, the Hamlet Financial Officers (FO) could and did temporarily step into the Senior Administrative Officer's (SAO) role if that individual was away or the post was vacant, in Gjoa Haven there was a formal twinning of the SAO with an Assistant SAO position that both provided for more seamless transitions and scaffolding of more information and skills-sharing.

The Community Corporations in Sachs Harbour and Tuktoyaktuk played significant roles in relation to the ongoing evolution of the Inuvialuit Settlement Region governance framework. As the local face of the Inuvialuit Regional Corporation, on occasion they functioned as the 'new' governance authority scrutinizing the activities of

the 'old' local government authority that retained jurisdiction over most matters within designated municipal boundaries. This was observed to produce a 'self-government in waiting' dynamic between the two organizations that had the potential to be divisive, especially if their respective executive membership emphasized other familial or political divisions at play in the community. Effective communications on the part of staff and the respective Board and Council members were essential for progress on territorial or federally-funded initiatives seen to require concurrence on the part of both organizations. In contrast, under self-government in Gjoa Haven, there was no equivalent to the community corporation as their Hamlet *was* the local Inuit government authority. In practical terms, the Nunavut Hamlet benefited from a streamlined local governance role relative to its ISR peers, and Gjoa Haven presumably had the latitude to redirect the energies consumed in each of Sachs Harbour and Tuktoyaktuk by their community corporations.

A final keystone governance organization in all Arctic settlements is the Hunters and Trappers' Committee/ Organization ('HTC' in the ISR, 'HTO' in Nunavut). In the ISR, the HTC was a committee of the Community Corporation whereas under the new self-government framework, the HTO are the local representative bodies with responsibilities pursuant to the Nunavut Land Claim related to territorial wildlife administration. In addition to managing a variety of roles in relation to wildlife management and traditional harvesting rights, they were the local group in each of the three communities that appeared to review the bulk of research-license related inquiries. These were small organizations typically operated by a single administrator. There were regular staff turnovers that affected communications and other aspects of the HTC

operations in both Sachs Harbour and Tuktoyaktuk during the study period. Gjoa Haven's HTO had a longstanding administrator and a variety of membership initiatives.

All three communities hoped to see the development of a new multi-purpose civic gathering place, alternately described as a 'family centre', 'heritage centre' or 'wellness centre'; Sachs Harbour was the only community that succeeded in obtaining a grant supporting the construction of a new facility of this type during the project.

Educational services were prominently featured among the community concerns raised during consultations. School premises were generally needed to augment the gathering places that were otherwise described as being in short supply. This in turn meant that much depended on the relative 'openness' and availability of these facilities and their administrations. The relationships between transient teaching staff, administrators and the community at-large presented ample sources of potential misunderstanding and discord, expressed by desires for cultural sensitivity training and more Inuit teaching staff. The intensity of concern for those presently in school also reflected some of the ongoing process of coming to terms with the prior residential schooling regime.

Organized childcare services were lacking in the communities and would appear to be necessary as an alternative to family and other care arrangements. Tuktoyaktuk had a youth centre, Gjoa Haven had extensive extracurricular activities at the school, and Sachs Harbour's Recreation Coordinator maintained a series of after-hours programs for children there.

Community recycling systems were desired and, relative to longer-term waste management considerations (i.e. reducing volumes for burial and burning), worth investing in.

The circumstances of the faith groups in the three communities varied significantly. The small church building in Sachs Harbour had not been used in some time. There were small Catholic, Anglican and Pentecostal congregations (the latter running a well-attended youth group) in Tuktoyaktuk, each with their own places of worship. The Anglican and Pentecostal congregations worshipped together at the Anglican Church in Gjoa Haven and there was another substantial Catholic Church and congregation in town. Given the changing ground conditions, the cemeteries in each of the three communities will need to be monitored. In Tuktoyaktuk, the proximity of the cemetery to the eroding shoreline suggests that a new site and a plan for the existing gravesites should be made in coming years.

The Rangers – the Arctic equivalent of a militia unit – had troops in all three communities but their activities were most prominent in Sachs Harbour during the study period. Besides weapons and field skills training, the Rangers comprised most of the local first responders in case of emergency or call for search and rescue services.

9.2.7 Community Wellness

The extent of the health and wellness challenges facing Arctic communities is alarming. Over the period this research was undertaken, there has been increased reporting and public media attention paid to aboriginal circumstances thanks to the increasing prominence of Inuit politicians, the Prime Minister's apology for the

government's part in the harm done by residential schooling, and major reviews of aboriginal community conditions (Auditor General of Canada, 2011). While a detailed study of this key component of the community resilience assessment framework clearly exceeds the scope of this particular research, the full story demands that it be fully explored: in the composite of community characteristics to be examined, this is a critical element of context.

The human capacity of all three communities has been compromised to varying degrees by addictions, hunger, abuse, and other manifestations of mental and physical distress. A multi-generational view has to be taken of the consequent dynamics: community health services never seem to meet local needs; run-ins with the law mark too many lives; former traditional kinds of community interchange have been disrupted by intervening institutions; and a chasm has opened between the experiences of the youngest and oldest residents. New dependencies have been introduced that run against the grain of the Inuit. Central to the people are themes of cultural loss attached to the passing of the older generation and lifeways. The provision of suitable gathering places for the community could reinforce the role of Elders in processes of cultural transmission. Language retention and/or recovery programming is a prominent related concern, as is the management of offenders and the justice system more generally.

There is a 'wellness deficit' that will continue to bear upon Arctic communities for some time to come and that must inform any and all planning. The trajectory towards self-governance entails addressing systemic symptoms, causes and substantial adaptations. At the local level, this direction was apparent in the Inuit-driven organizations and in some of the scaffolding available to support Inuit advancement into

evermore senior roles in relation to the services there. There remain numerous professional service domains where Inuit are conspicuously absent.

The importance of Elders in the community was regularly asserted in all three communities, but their actual circumstances varied significantly. Most Elders wish to live independently or with family. Tuktoyaktuk was the only community with a dedicated residential facility for Elders, albeit constructed in the vicinity of eroding shoreline terrain where other infrastructure had already been damaged and removed. Although meant as a regional facility, it did not offer a sufficient level of care to attract more than a handful of residents. In Sachs Harbour, a couple of housing units had been built for seniors on the poorly drained 'subdivision': freeze and thaw heaving of the terrain there caused cracking and other damage to those units. Oil siphoning was also said to be occurring in order to provide Elders' homes with sufficient heating fuel. Organized Elders' activities (i.e. Local Committee, crafts meetings, special celebrations) were present in Tuktoyaktuk and Gjoa Haven, but not in Sachs Harbour.

In relation to the physical hazards examined during the study, Tuktoyaktuk was the only community where an update to an existing emergency plan was needed to address an identified local risk (e.g. adding a flood risk scenario to the series of protocols). Sachs Harbour had begun the emergency planning process on a number of occasions but had never gotten very far. No reference was made to an emergency plan in Gjoa Haven.

9.3 Arctic Community Capacity

As earlier noted, the impressionistic characterizations employed here are not intended to 'rank' so much as capture something of the composite nature of various aspects of the 'resilient' community as described. The outcomes of any assessment of this sort can be critiqued based on the subcategories used, how they might be weighted in relation to one another, or how 'complete' they might be seen as being relative to the 'whole'. Objective measures and 'sure' outcomes do not exist here. There are however significant trends, probabilities, and a 'sense of what's going on' that locally knowledgeable speakers offer. In a comparative exercise such as this that has relied on a deconstruction to organize the information gathered, some attempt should be made to reassemble what has been taken apart. A simple 'average', 'overall', or 'composite of composites' that might be seen as following on the characterizations proposed in Table 9.1 is presented in Figure 9.1 below.

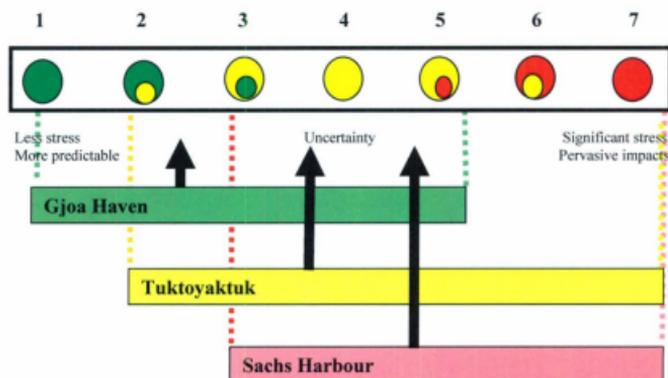


Figure 9.1 – Notional 'averaged' circumstances and community ranges

Considering the 'average' (*arrows*) together with the range (*bars*) expressed in each of the communities' composite assessments, there emerges a band-width of characterized stress and uncertainty being sustained by each community. These can be considered relative to the two operating variants of 'resilience' examined in this study.

The first of these is the Resilience Alliance definition:

"The capacity of a system to absorb disturbance, undergo change and still retain essentially the same function, structure, identity and feedbacks."

All three settlements are products of a radical period of historic change for Arctic Inuit peoples. While they retain characteristics of the preceding Inuit systems and may be seen to be consciously reasserting others, the 'communities' examined by this research may be treated, materially and relationally, as relatively distinct or 'new' systems. These new systems are now absorbing varying degrees of environmental disturbance, but at present do not appear to have altered their respective core functions or structure as a result of climate change related influences. Given their political context, however, the identity and feedbacks of these 'new' systems have been in flux since they were created. Alternatively, the settlements might be thought of as a systemic overlay; a change through which preexisting Inuit systems continue to be asserted, resulting in a new stream of twinned feedbacks that may be melding over time. From either viewpoint, the three communities exhibit resilience to the extent they have been 'disturbed' to date. During the study period, the two Western Arctic hamlets sustained themselves in settings where significant and pervasive material impacts and imputed stresses were present, thus having more opportunity to display their resilience than did Gjoa Haven.

The second variant of 'resilience' was to be derived from a definition offered for the 'resilient community' (CCE 2000):

"A resilient community is one that takes intentional action to enhance the personal and collective capacity of its citizens and institutions to respond to and influence the course of social and economic change.

...resilience is not a fixed quality within communities. Rather, it is a quality that can be developed and strengthened over time."

From Figure 9.1, the ranges, represented by the span of the horizontal bars over which each community experienced stress and impacts, may be greater or lesser. Tuktoyaktuk was attributed the greatest range of imputed levels of stress and impacts. Gjoa Haven and Sachs Harbour each spanned similar ranges, but they occupied opposite ends of the scale, thus reflecting the polarities of 'less' and 'more' stress and impacts. Read in light of the Resilience Alliance definition, Sachs Harbour is more likely to be demonstrating resilience at this time, as it is sustaining some significant and pervasive stresses and impacts. Relative to Tuktoyaktuk, Sachs Harbour's range is smaller, and the composite experience across the range of categories used is characteristic of generally higher levels of stress and impact. If a 'resilient community' is in a position to demonstrate its resilience (i.e. is experiencing significant stress), as Sachs Harbour is, then it should be possible to observe the evolving resilience over time as a shift of both the 'average' and range of the imputed stresses and impacts, towards lesser, more predictable stresses. Although it may not be possible to alleviate or control the most serious stresses and impacts in the short term, this portrayal suggests the alternative of

increasing the overall span of imputed stresses and impacts towards the lower generalized values. In Sachs Harbour, examining opportunities to make improvements in those themes already approaching the “less, more predictable” pole of the range could be seen as meriting equal consideration with alleviating the most seriously-rated in the short-term. For example, Residential Infrastructure and Services was rated at “Category 3”, followed by Community Lands & Physical Hazards, and Transportation and Communications, both consolidated as “Category 4”. Alleviation of difficulties surrounding residential infrastructure could have equally or more satisfactory results than would efforts to address difficulties associated with physical hazards. Without overstating its value relative to the need to address serious issues in core local services and economic development, this approach would seek to inject some ‘high points’ to counter what would otherwise be uniformly challenging local circumstances.

Translating from the graphical sliding scale back into the relational logic that operates in community and informs the actions of residents, more uniformly difficult circumstances are wearing on a population. There need to be some ‘bright spots’ to lighten spirits and reinforce the sense that positive change is worth working towards. Existing intentional actions of residents must be valued and, moreover, must be seen to be valued. In communities seen to be experiencing the most significant stress and pervasive impacts, attention needs to be paid to more than the most serious circumstances; it must also be directed to finding ways to widen the overall range by getting easier jobs done as well. Simple evaluative methods applied in a more comprehensive fashion can serve to positively reinforce efforts that build resilience by providing for timely feedback on the direction of change. Where means are available to make the change process and

outcomes more legible to the community at-large and its various partners, they will greatly facilitate necessary discussions and cooperation across governance and knowledge domains.

9.4 Arctic Community Planning

Examining three very different Arctic communities within a research framework that set out both to examine adaptation planning themes and to be adaptive in the manner used to do so, it was not surprising that three different ‘planning’ outcomes were obtained.

Table 9.2: Imputed Dimensional Attributes by Community

Dimensions of Community Resilience	<i>Material</i>		<i>Relational</i>	
	Resources		People	Organizations & Institutions
	<i>Physical Hazards</i>	<i>Economy & Infrastructure</i>		
Tuktoyaktuk NWT				
Sachs Harbour NWT				
Gjoa Haven NU				



Less stress
More predictable

uncertainty

Significant stress
Pervasive impacts

Reaggregated along the lines of the adapted 'Dimensions of Community Resilience' employed in the study design, the composite dynamics of the three communities may be read somewhat differently (Table 9.2). The potential for both compensatory or deprecating influences to arise between various spheres or cycles of intertwined community adaptations addresses the fourth dimension missing here, 'Relationships'. In that the researcher had sought to reassert the relational in an evaluative, adaptation-oriented exercise which otherwise could have become too narrowly focused on material system characteristics, this portrayal can be seen to correlate too with her experience of adaptive engagements with communities.

Tuktoyaktuk became the community with the best-resourced research effort; it also might be seen as the one with the most conventional outcomes from a planning perspective. As a consequence of the partners engaged, there were more circumscribed and externally defined endpoints to be accounted for. A process was pursued and a plan document delivered, much along the lines of what was originally conceived. Practices governing the contractual nature of the relationship that afforded this case study some additional funding from Infrastructure Canada had to be respected. So too did those defined by the particular circumstances of partnerships with the government researchers, conference organizers, and community organizations that all contributed in important ways to the research setting.

Tuktoyaktuk was also a place about which much was 'known': it had well-publicized and researched erosion issues; it was popularly compared to Alaskan communities such as Shishmaref that were facing relocation; and it was a community that knew itself as 'in for the long haul' with a strong voice at the Inuvialuit governance table.

Shown in Figure 9.1 as a community in a position to both demonstrate resilience, and having the greatest range or variability in assessed categories of current community conditions, it was also the community with the longest operating experience under the 'new' or 'overlaid' colonial settlement system. A lengthy period of tinkering with the physical infrastructure had elapsed there, and the melding of in-situ relationships across various domains of governance and enterprise had been through a few more cycles of adaptation.

Sachs Harbour was a setting that suggested the opposite end of the scale: a small and remote settlement with bare-bones services and infrastructure, and a community with a relatively readily identified core of active residents wearing 'multiple hats' in order to round out the voluntary contributions their local organizations needed to function. In this community there were simultaneously great needs and few expectations. Openness and resignation could be discerned as co-habiting most planning discussions. The specifics of what might emerge were in practice less of concern than the practicalities of what needed doing immediately. A long view was a luxury for another day, and thus the outcomes of the Sachs Harbour planning exercises seemed to flow more so from connections made after the fact. The key plan document in this instance was in actuality more of a briefing note: an instrument that could rebroadcast existing conditions in a number of circumstances and that invited matchmaking and troubleshooting in unforeseen ways.

Sachs Harbour was also interpreted (Figure 9.1) as a community in a position to demonstrate resilience, but it had less variability across its assessed categories of current community conditions than Tuktoyaktuk. It was the community with the second-longest operating experience under the 'new' or 'overlaid' settlement system. The small scale of

the settlement meant that there was less physical infrastructure to tinker with, which combined with its remoteness and the constrained local economy provided fewer and seemingly slower cycles of 'new' system, melded insider-outsider relationships. The historic narrative of Sachs Harbour as a community that self-reliant and enterprising Inuvialuit chose to create, and the involvement of residents with the groundbreaking *Sila* video initiative suggest the tremendous capacity existing there and the extent to which available resources have been leveraged. The community has, however, also experienced a spate of chronic problems involving regional agents who appeared either unaware of or indifferent to local conditions.

Finally, Gjoa Haven offered a circumstance where there was no shortage of things being planned. The researcher was confronted by needing to identify a practice to suit a context where the frame of reference was externally constrained to avoid duplication and confusion with other ongoing governance efforts, while still satisfying the earlier research commitment negotiated with the community. The adaptive process diverged once again from the envisaged adaptation plan track, in effect becoming a gap analysis. As in other communities, some components of the resilience assessment framework were readily culled from recent documentation, and could thus reduce the likelihood of consultation fatigue. Of the three communities, Gjoa Haven was the only one that had not been engaged by an earlier research effort entailing consolidated accounts of local climate change observations. This identified gap became the entry point for the researcher in grounding and confirming observations and information gleaned from secondary sources.

Among the three communities, Gjoa Haven was experiencing the least stress and environmental change and, insofar as it was not contending with a significant disruption,

it could not be said to be demonstrating resilience in the fashion that either Sachs Harbour or Tuktoyaktuk were. It did demonstrate many of the characteristics that residents of the other two case sites identified as features they wished to recover or strengthen in their respective communities (i.e. living language, Inuit self-governance, greater community cohesion). Gjoa Haven Elders referred to a longstanding collective awareness of coming change and an appreciation of the lessons to be learned from those who were experiencing more serious changes elsewhere.

The settlement of Gjoa Haven is the most recent of the three studied 'new' community systems. As of 1999, it passed with many others from the Northwest Territorial Government to the newly minted Nunavut framework. While that certainly marked a new phase of the existing community, was its nature that of another overlay on the larger and longer Inuit adaptive cycle? Or was it perhaps more of a peeling away of what had not, in a couple of intervening generations, adhered to the evolving Inuit way of being?

The trajectories of self-government and the recovery of regional control by the Inuit across the Canadian North now provide several working examples which will no doubt be monitored for years to come for lessons about how to negotiate decolonialization. The institutions and practices exercised under these changing governance settings may or may not be seen as having been influenced significantly by simultaneous changes in the Arctic climate, but the coincidence of these vectors of change has certainly raised the profile of the Inuit and their knowledge systems. For now, a number of factors differentiate the expressions of autonomy in Nunavut from those in

the Inuvialuit Settlement Region, but Inuit across these two territories continue to pursue some joint initiatives to strengthen their collective circumstances.

Table 9.3: Ten Key Observations - Synthesis

1. Community members recognize that climate changes are occurring and most anticipate further changes, however, they usually do not regard them as the most significant or immediate issues they face.
2. Settlement-scale consequences of environmental changes relate mainly to the changing physical conditions of frozen ground and shoreline terrain; the damage or disruptions these may cause in relation to the infrastructure built there; and, in the case of earthen structures, the likelihood that original design assumptions made about their year-round structural integrity may no longer hold true. Local governments must pay additional attention to drainage systems; waste disposal practices; aggregate resources; and monitoring of terrain and infrastructure.
3. Vegetation is generally observed to be changing in terms of both plant varieties, ranges and timing (i.e. fruiting) across the region but to date has not produced many impacts the communities identify as either negative or positive overall.
4. Changes in the prevalence and variety of wildlife, particularly insects and foraging species, have been noted in the vicinity of communities.
5. Storm impacts are more frequent across the region and are creating the most significant problems for coastal infrastructure during open-water periods (e.g. flooding, erosion, vessel damage).
6. Declining ice extent and duration is observed throughout the region and presents challenges ranging from individual travel safety to less predictability in the operations of ice roads. Increases in marine-based tourism are already apparent and other marine transportation developments (e.g. northern ports upgrades, naval infrastructure planned at Nanisivik) are being implemented.
7. Permafrost thaw impacts are affecting critical community infrastructure across the region including local water supplies, waste management infrastructure, and fuel storage facilities, but to date there appear to be few measures in place that anticipate or respond to these potential issues.
8. While economic and cultural impacts of environmental change may be acknowledged, community issues arising in these areas are more generally discussed in relation to the ongoing pursuit of Inuit/Inuvialuit self-governance.
9. Community members regularly raised concerns and under-appreciated issues related to 'hidden' legacies of prior development in their locale (i.e. landfilled areas, contaminants potentially buried in former dumpsites) which deserve serious investigation.
10. Emerging physical hazards and related critical infrastructure issues require new monitoring measures be implemented at the local level to ensure that community managers are better able to judge altered infrastructure lifecycles and forthcoming operational needs.

Conclusions: Planning for Resilience

"The inchoate formation of a common circumpolar culture, based on common environmental problems, and on ethnic and cultural mixture, is thus gaining momentum through modern communications and diffusion."

John J. Teal, Jr., "Immigrant Populations" in
Geography of the Northlands (1955), p. 185

Teal, an anthropologist and then Director of the Institute of Northern Agricultural Research, an organization he founded at the University of Alaska to encourage domestication of northern herd species as an alternative to hunting, clearly refers to a different era. However, the comment nonetheless resonates with early 21st century experience in the Arctic. (ACIA 2004; Forbes 2011).

10.1 Addressing the Capacity for Change

To stay or to go? To change minds and/or habits? To accept that some sacrifice will be required in order to preserve a compensatory advantage? How much to learn from others' experiences? There are many adaptation options to be considered even across the very small sample of case study communities considered in this research. Across a spectrum of possible community-environmental change combinations, the three selected have suggested a range of physical impacts, from obvious, continuous and pervasive terrain loss to episodic indications that physical changes are afoot. They are arrayed across demographic and political circumstances that reveal something of the dynamic

range of factors that in varying degrees influence what has variously been termed social capital, coping capacity, adaptability or resilience.

Used in its most everyday sense, individuals and groups 'plan' to maintain or adjust existing activities in relation to a myriad of daily feedbacks. Memory informs and anticipates appropriate actions based on variations within a range defined over a longer time period. These adjustments will be experienced as unremarkable and within the ambit of normal functioning. In the absence of other complicating factors, when problematic changes experienced outside these parameters become more pronounced or numerous, the adjustments they require may be acknowledged as creative solutions. If successful over a sufficient period of time, they may be added to the repertoire of normalized practice. These internalized processes of learning are construed as characteristic of a well-functioning human system, one which may then be less 'interested' in examining externally-derived alternatives to internally-proven practices.

When perceived changes more regularly challenge a given vocabulary of learned responses, the process of adjustment itself becomes a new 'normal'. This adaptive condition marks a threshold across which the effort expended by those coping with the change influences may be seen as exceeding their available resources or the confidence placed in their conventional practices. In becoming remarkable, as is the case for the adaptations occasioned by Arctic climate change, both the change at hand and the responses to it have become more amenable to externalized thought processes and the involvement of other interested actors. The experienced magnitude, speed and nature of the impacts occasioned by the change will henceforth be made more or less challenging

by those additional relations depending on the resources and ideas they bring into play. This contingency introduces its own dynamic to processes of adaptation.

10.2 Relationships, Relationships, Relationships

In consciously embraced and externalized experiences of change, formerly less-considered internal regulation that might be equated with 'planning' will become more explicit in response to relational processes. Its order and logic may be tested then by various means and players wherein those elements found to be of greatest value are accorded greater weight in subsequent decision making. Because the valuations and the conclusions drawn on this basis may differ significantly among parties engaged by a given change experience, adaptation processes may be highly contested. Under contemporary conditions of environmental change, the idea of adaptation as merely adjustments that sustain 'business as usual' must be broadened to encompass the eventuality of complete transformation as a viable path to survival.

The order of risk that demands systemic 'transformation' is, as a scenario, susceptible to the critique that the medicine may be worse than the condition it was meant to cure. This level of threat to human populations, increasingly forecast, remains a heady notion that cries out for grounding in lived experience day-to-day: What will these changes look like? Taste like? Feel like? As has been discussed earlier, many of the adaptations already attributed to the Arctic populations we have looked at might be more correctly termed 'transformations'. Again though, however salient the distinction between sustaining a challenged system and investing in a new one, this is a perceptually nuanced appraisal with provocative moral dimensions.

10.3 Learning Systems, Learning Organizations

It is perhaps easier, then, to attempt to distinguish the experiences of human adaptation and transformation using a proxy. In effect, I have done this by maintaining a focus on local organizations and governance throughout this research. The embodiment of relations through the legal mechanism of incorporation introduced a foreign order of non-human entities to Inuit, producing confusions from the start. Today, the uneven correspondence of these corporate 'bodies' to their Southern-bred cousins remains apparent, even after a half-century in the case of some of the oldest Hamlet Councils in Arctic Canada. While it is not possible to conclude from this study that there is any more of a 'fixed' character to the relations engendered by the established institutions of the state in the two Northwest Territories communities than is the case for their counterparts in a still-fledgling Nunavut, there were definite differences observed. In Gjoa Haven, there is evident continuity from the earlier NWT administration in respect of the form and functions of the municipal governing body and other key community organizations (i.e., Hunters' and Trappers' Organization, Housing Office). In the case of the Hamlet Council however, there was also ample evidence of the Inuit value framework (IQ) that permeates the Nunavut governance design. Here was a comprehensively 'planned' undertaking that plainly aimed to transform the circumstances of a people.

In each case study community, municipal governance processes and practitioners were examined in relation to the environmental changes observed locally. At this scale, the abstracted construction of 'process' was more readily resolved as 'practice', allowing more normative observations of what does or does not appear to be working. Here too were observed instances of the corrective and sustaining intervention of individual

practitioners using independent judgment and acting in fashions that incrementally responded to change.

Forgetting, perhaps the most insidious of the impacts of protracted change processes, was seen as impeding social learning. Staff turn-over regularly undermines institutional memory throughout the North, and language loss has interrupted the transmission of cultural knowledge between generations. Planning is ontologically consistent with the modernist project: embracing a unidirectional 'arrow of time', its emphasis has always been placed on the investment to be made in the better *future* rather than a better *right now*. In keeping with a necessary commitment to honouring both outside and indigenous ways of knowing, there must be a greater acknowledgement of the 'blind spots' that characterize the scientific and technocratic knowledge traditions that play such predominant roles in the construction of our current understandings of change. There remain weaknesses and gaps in these knowledges and domains of incommensurability for which different vocabularies are required. Chief among these may be the consideration of thresholds, scale and context-dependent aspects of the information that is needed to support certain types of decisions. Similarly, a greater appreciation for the cognitive processes that inform experiential and intuitive learning (Gladwell, 2005) confirm the need for Northern organizations that capitalize on those traits by allowing for experimentation in their ongoing activities.

10.4 Towards a more adaptive planning practice in the North

Finally, there was the metanarrative concerning the intruding institutional framework that conditions the formalized practice of planning in the Canadian North and,

by extension perhaps, in other similarly non-urban territories. Conceived as a double-edged sword in relation to communities under stress, I have asked the reader to consider the implications of professional planning status and the lineage of the practice as a means of producing communities that are legible to the state (c.f. Scott, 2005). I have attempted to demonstrate the local scale at which planning thought processes might be expected to support adaptation most constructively were they exercised to make conditions visible to both the state and the population itself. The sustained, local character of the engagement needed to do so, however, has not been well served by the regionalized service models that prevail in the North. The relative scarcity of the accredited planner, not unlike other professional practitioners in the Arctic, has done the population a disservice. This continues despite the often repeated promises to train northern residents to take over roles that have for years suffered from the flow-through conditions of both consulting practitioners or the ongoing pattern of short tenure employees hired from outside the region.

Returning to the twinned themes of theory and practice – and ‘professional’ practice at that – it must be asked, are the derivative nature of planning theory and the compensatory emphasis on planning experience and procedures creating problems? In a world struggling to retain connections, is there not a special place for the ‘jack of all trades’ – those practitioners actively bridging what are otherwise considered distinct knowledge domains? If there are technologies of connection, are not planners their technologists?

This project has suggested that the answers to all of the above are, “yes”. Yes, experience is a great teacher, but there are evident gaps in the discourse respecting plans,

planners and the planned-for in the Arctic which cannot be filled by holding the present course. Yes, the adaptation challenges in the Arctic today are exactly the kinds of 'wicked' problems (c.f. Rittel and Webber, 1973) which call for competent interdisciplinary and intercultural practitioners. Yes, the relatively commonplace emphasis on communication and consultation functions of planners operating within conventional North American governance frameworks suggests that planners should have significant interest and expertise invested in the facilitating 'tools' of a connective trade.

But planning practices, as they might be envisaged in support of Arctic community adaptation, should not be allowed to remain such a rare and commoditized service. I am not suggesting that existing degree-granting planning programs elsewhere in Canada ramp up their student output to fill Northern vacancies either. Where retention is already an acknowledged problem throughout the North, a number of parallel and transferable local management skill sets should instead be identified to receive greater attention at the regional community college level and provide in-service and on-the-job professional development options for resident community staff.

Where small 'p' planning functions are to be encouraged, chief among these should be facilitation and dialogue-assisting practices. A culturally-informed sensitivity to circumstances that frustrate or exert controls on communications, information-sharing or collaboration is a useful starting point, but educational resources respecting the means to overcome these obstacles are needed in the region.

I have sought to cast the local exercise of more generalized planning processes as a determinant of community success. I am convinced, however, that if the credentialed, professional practice of planning and the wider experience of the domains acknowledged

as contributing to its theory were sieved through the wide mesh of 'What makes *these* communities work?', professional planning practitioners are seldom significant players in the active change management processes that communities such as these must engage in on a more or less continual basis. Plans that have repeatedly been addressed to material needs without sufficient attention paid to relational circumstances have not served the needs of these communities. The skill sets that are associated with effective planning processes are not limited to the urban land use policy and paralegalistic development control contexts with which they are often associated and, if the broad objectives of community adaptation are kept in mind, nor should they be.

The ability to monitor and reassert a balance between material and relational conditions at the local level needs to be recognized and supported. Process expertise must, therefore, be cultivated throughout the system, and obstacles to acquiring this expertise should be examined and removed where possible. The lessons of contemporary learning systems suggest that the adaptation 'project' should embody a variety of means and incentives for contributing individuals that are at odds with the traditional preserves of the market professional. The flattening of the project hierarchy to simplify the roles of champion, facilitator and contributor, any and all of which may be played by all participants, is certainly a direct challenge to the conventional government planning 'order'. Are we ready to set these transformative processes in motion ?

To the limited extent humankind may be able to 'plan' for managing the cascading global changes we have brought upon ourselves, a foundation is always laid locally. To varying degrees, each of Tuktoyaktuk, Sachs Harbour and Gjoa Haven demonstrate that conventional approaches to development, planning, and management

more generally are challenged by the contemporary Arctic context. Operational experiments already occur on a regular basis in these hamlets as a natural response to both change influences and constrained local resources. This is not in itself remarkable: we are all acquainted with occasions when flying 'under the radar' of standard operating procedures and other formalized governance can be justified. The maxim, 'necessity is the mother of invention' however, is not only consistent with the realities of these smaller communities; it also underlines a creative mode of social function that is integral to moments of profound systemic choice. In the 'backloop' of the adapting community, it is a resident characteristic to be anticipated and leveraged by governments and other organizations seeking to foster resilience. Recognizing that Canadian Arctic communities have become places where the distance from experiment to adoption may be very short indeed, their residents must be equipped with both the material and relational means to balance and build capacities where they live.

Bibliography

- Abel, K. (1993). *Drum Songs: Glimpses Of Dene History*. Montreal and Kingston: McGill-Queen's University Press.
- Aboriginal Affairs and Intergovernmental Relations [on-line]. Last accessed 03 Feb 2011 at http://www.daair.gov.nt.ca/_live/pages/wpPages/InuvialuitLandClaim.aspx
- Advisory Commission on the Development of Government in the N.W.T (ACDGNWT)(1966). *Northern Settlements (Books I-III)*. Ottawa.
- Advisory Commission on the Development of Government in the Northwest Territories (ACDGNWT) (1966). Sachs Harbour (*also annotated "45"*). In *Settlements of the Northwest Territories Book 4 – Settlements 41-51*. 30 pp. unnumbered.
- Advisory Commission on the Development of Government in the Northwest Territories (ACDGNWT) (1966). Tuktoyaktuk. In *Settlements of the Northwest Territories Book 4 – Settlements 41-51*.
- Agrawal, A. (2002) Common Resources and Sustainable Governance. In *Institutions for Managing the Commons*, (eds) E. Ostrom, T. Dietz, N. Dolsak, P. Stern, S. Stonich, and E. Weber. Pp. 41-85. NAS Press, Washington DC.
- Air & Waste Management Association (2003). *Adapting to Climate Change in the Coastal Pacific Northwest: Challenges for Ecosystems, Communities, Industries and Institutions* (conference proceedings).
- Alexander, D. (2007). Making Research on Geological hazards relevant to stakeholders' needs. *Quaternary International*, 171-172: 186-192.
- Allmendinger, P. (2002). *Planning Theory*. Palgrave, Hampshire, U.K.
- Allmendinger, P. and Tewdwr-Jones, M., Eds.(2002). *Planning Futures: New Directions for Planning Theory*. Routledge, New York, NY. Pp. 258.
- Alunik, I., Kolausok, E.D., and Morrison, D. (2003). *Across Time and Tundra: The Inuvialuit of the Western Arctic*. Raincoast Books, Vancouver. 230 pp.
- Amundsen, R. (1909) *De Noordwestelijke Doorvaart: De Aarde en haar Volken*. <http://www.gutenberg.org/files/21878/21878-h/21878-h.htm>
- Anderson, S.W. and Fink, J.H. (1990). The development and distribution of lava textures at the Mount St. Helens dome. In: *Lava Flows and Domes: Emplacement Mechanisms and Hazard Implications*, J.H. Fink, Ed., IAVCEI Proc. Volcanol. 2:25-46.
- Arctic Climate Impact Assessment (ACIA) (2004). *Impacts of a Warming Arctic: Arctic Climate Impact Assessment Synthesis Report*. Cambridge University Press. 140p. Last accessed 01 May 2007 at <http://www.acia.uaf.edu> .
- ACIA (2005). *Arctic Climate Impact Assessment*. Cambridge University Press. 1042p. Last accessed 01 May 2007 at <http://www.acia.uaf.edu> .
- Arctic Human Development Report (AHDR)(2004). *Arctic Human Development Report*. Stefansson Arctic Institute, Akureyri. Last accessed 21 June 2011 at <http://www.svs.is/AHDR> .

- AMAP (2011). The Arctic as a Messenger for Global Processes – Climate Change and Pollution. Copenhagen, May 3-6, 2011 (Conference programme). Last accessed 12 June 2011 at <http://www.amap.no/Conferences/Conf2011/programme.pdf>
- Armstrong, T., Rogers and Rowley (1978). *The Circumpolar North*. Methuen, London.
- Arnstein, S. (1969). A Ladder of Citizen Participation. *Journal of the American Institute of Planners*, 35, 216-224.
- Arora, V.K. and Boer, G.J. (2001). Effects of simulated climate change on the hydrology of major river basins. *Journal of Geophysical Research*, 106(D4): 3335-3348.
- Asch, M. J. (1982). "Dene Self-Determination and the Study of Hunter-Gatherers in the Modern World." In *Politics and History in Band Societies*, Eleanor Leacock and Richard Lea, eds., Cambridge University Press, 347-371.
- Aspen Institute [on-line]. Accessed 12 August 2011 at <http://www.aspeninstitute.org>
- Associated Press (2009). "Tuktoyaktuk on front line of climate change". Last accessed 20 July 2011 at <http://www.cbc.ca/news/technology/story/2009/09/08/climate-change-tuktoyaktuk-erosion.html>
- Atkinson, D.E.; Brown, R.; Alt, B.; Agnew, T.; Bourgeois, J.; Burgess, M.; Duguay, C.; Henry, G.; Jeffers, S.; Koerner, R.; Lewkowicz, A.G.; McCourt, S.; Melling, H.; Sharp, M.; Smith, S.; Walker, A.; Wilson, K.; Wolfe, S.; Woo, M-K.; and Young, K.L. (2006). Canadian Cryospheric Response to Anomalous Warm Summer: A Synthesis of the Climate Change Action Fund Project "The State of the Arctic Cryosphere during the Extreme Warm Summer of 1998". *Atmosphere-Ocean* 44(4):347-375.
- Auditor General of Canada (2011). Programs for First Nations on Reserves. Chapter Four in 2011 June Status Report of the Auditor General of Canada. Available online at http://www.oag-bvg.gc.ca/internet/English/parl_oag_201106_e_35354.html
- Aurora Research Institute (ARI) (2009). Sachs Harbour Wind Energy Study. Backgrounder, 8 pp. Last accessed 11 June 2011 at <http://www.nwtresearch.com/docs/sachs-harbour-wind-reports/2011/01/05/2009-wind-energy-summary-report---sachs-harbour.pdf>
- Aveco Infrastructure Consultants (1986). *Shoreline Erosion Protection – Tuktoyaktuk: Final Report*. Government of the Northwest Territories, Public Works and Highways
- Awa, S. (undated – 2000s). *Inuit Qaujimatuaqangit* Orientation Workshop. Economic Development & Transportation
- Back, M. (1995). Environmental Legislation – The new rules and what they mean for the meat industry. CSIRO Last accessed 13 June 2011 at http://www.meatupdate.csiro.au/data/Meat_95_64.pdf
- Baird, P. (1964). *The Polar World*. Longmans, London.
- Balicki, A. (1963). Shamanistic Behavior among the Netsilik Eskimos. *Southwestern Journal of Anthropology* 19(4):380-96. Available on-line at <http://www.jstor.org/stable/3629285>
- Balicki, A. (1968). The Netsilik Eskimos: adaptive processes. In *Man the Hunter*, R.B. Lee and I. DeVore, eds. Chicago, Aldine Publishing Co. <http://www.jstor.org/stable/3316936?seq=14>
- Balicki, A. (1970). *The Netsilik Eskimo*. Natural History Press, pp. 264.

- Ballantine, B and Ballantine, I., eds. (1993) *The Native Americans: An Illustrated History*. Turner Publishing Inc., Atlanta, GA.
- Balsom, A. (2000). *A Scientific Expedition from the Gulf of Alaska to the Canadian Arctic Archipelago* (on-line travelogue of St. Roch II Voyage of Rediscovery expedition). Last accessed 23 April 2011 at <http://merrow1.tripod.com/coldwaters/index.html>
- Bastedo, J. (2006) *Standing Up to Climate Change: Northern Problems and Possibilities*. Last accessed 28 July 2011 at http://www.taiga.net/nce/resources/other/nwtsummit2007/discussion_paper.pdf
- Bazemore, G. and Schiff, M., Eds. (2001) *Restorative community justice : repairing harm and transforming communities*. Cincinnati, OH : Anderson Pub. 375 p.
- Bell, J. and Phillips, T. "Footprints in new snow: the NIC's first report", *Nunatsiaq News*, 12 May 1995. Last accessed 01 August 2011 at http://www.nunatsiaqonline.ca/archives/april0199/nvt90401_34.html
- Belliveau, K. (2007). *Coastal Geomorphology of Southwest Banks Island, NWT: Historical and Recent Shoreline Changes and Implications for the Future*. Unpublished M. Sc. thesis, Environmental Science, Memorial University, St. John's NL, Canada, 237 pp.
- Bender, M., Sowers, T., and Brook, E. (1997). Gasses in ice cores. *Proc. Natl. Acad. Sci. USA*, 94:8343-49.
- Berger, T. R. (1977). *Northern Homeland, Northern Frontier: the Report of the Mackenzie Valley Pipeline Inquiry, Volume One*. James Lorimer and Co., Toronto.
- Berkes, F. (1999). *Sacred Ecology: Traditional Ecological Knowledge and Resource Management*. Taylor and Francis, London, 209pp.
- Berkes, F., Colding, J., and Folke, C. (2003). *Navigating Social-Ecological Systems: Building Resilience for Complexity and Change*. Cambridge University Press, London, 416 pp.
- Berman, M. et al. (2004). *Adaptation and Sustainability in a small Arctic Community: Results of an Agent-based Simulation Model*. *Arctic* 57(4): 401-414.
- Bird, E. (2000). *Coastal Geomorphology: An Introduction*. John Wiley & Sons, Ltd., U.K.
- Blanchard-Boehm, R.D. (1996). *When scientists and emergency managers warn, does an at-risk public hear and respond?* In Amin, S.G., Fullerton, S. (Eds.), *International Business Practices, Contemporary Readings*, 1996 Edition. Academy of Business Administration, Cumberland, Maryland, pp. 523-529.
- de Blij, H.J., Muller, P.O. et al., Eds. (2005) *Physical Geography: The Global Environment*. Oxford University Press, Ontario, Canada. 756 pp.
- Bone, Robert M. (1992) *The Geography Of The Canadian North: Issues And Challenges*. Oxford University Press, Toronto.
- Briggs, J. (1970). *Never in Anger: Portrait of an Eskimo Family*. Harvard University Press, Cambridge, MA.
- Briggs, J (1979). *Aspects of Inuit Value Socialization*, Canadian Ethnology Service Paper No. 56, National Museum of Man Mercury Series, Ottawa.
- Brody, H. (1975). *The People's Land: Eskimos and Whites in the Eastern Arctic*. Penguin Books Ltd., Markham, ON. 249 pp.

- Brody, H. (1981). *Maps and Dreams: Indians and the British Columbia Frontier*. Penguin Books Canada Ltd., Markham, Ontario. 297 pp.
- Burn, C.R. (2010) *The Mackenzie Delta: An Archetypal Permafrost Landscape*. Pp. 1-12. In *Geomorphological Landscapes of the World*, P. Migon, ed., London, Springer.
- Burton, I. (2007). *Living with Nature's Extremes: The Life of Gilbert Fowler White* by Robert E. Hinshaw (book review), *Annals of the Association of American Geographers*, 97(4):820-823.
- Cabrol, N.A., Grin, E.A., and Pollard, W.H. (2000). Possible Frost Mounds in an Ancient Martian Lake Bed. *Icarus*, 145(1):91-107.
- Cahill, C. <http://www.learnalberta.ca/content/ssognc/aCommunityProfile/index.html>
- CBC News (2006). "Unique 'grolar bear' to be shipped from N.W.T." Last accessed 28 July 2011 at <http://www.cbc.ca/news/canada/north/story/2006/12/04/grolar-pizzly.html>
- CBC (2007). *The Rangers: Guarding sovereignty in remote coastal, northern regions*. CBC News "In Depth", Canadian military backgrounder. Last accessed 23 May 2011 at <http://www.cbc.ca/news/background/cdnmilitary/rangers.html>
- CBC (2008). *Sachs Harbour welcomes new muskoxen hunt*. Last accessed 11 June 2011 at <http://www.cbc.ca/news/canada/north/story/2008/02/12/sachs-muskox.html>
- CBC (2011). "Federal budget promises \$150M for NWT highway". Last accessed 12 April 2011 at <http://www.cbc.ca/news/canada/north/story/2011/03/22/north-fed-budget-highway-reax.html>
- CBC (2011). "N.L. residential school survivors seek recognition". Last accessed 12 August 2011 at <http://www.cbc.ca/news/canada/north/story/2011/06/30/trc-inuvik-labrador-inuit.html>
- Canadian Communications Foundation (2007). *CBAC-AM, Tuktoyaktuk. Radio Station History*. Last accessed 24 July 2011 at http://www.broadcasting-history.ca/index3.html?url=http%3A%2F%2Fwww.broadcasting-history.ca/listings_and_histories/radio/listings.php%3Fpt%3D233%26r%3D%26ac%3D%26former%3Dy
- CEAA (2005). *Sachs Harbour Muskox Offal Ocean Disposal*, Environmental Assessment Registry Ref. No. 05-01-14699. Last accessed 02 July 2011 at <http://www.ceaa.gc.ca/052/details-eng.cfm?pid=14699>
- Canadian Habitat Secretariat (1976). *Human Settlement in Canada*. Ottawa, Ontario.
- Canadian Institutes of Health Research, Natural Sciences and Engineering Research Council of Canada, Social Sciences and Humanities Research Council of Canada (1998 with 2000, 2002 and 2005 amendments). *Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans*, 1st Edition. Last accessed 12 August 2011 at http://www.pre.ethics.gc.ca/archives/tcps-epct/docs/TCPS%20October%202005_E.pdf
- Canadian Press (2011). "Study finds Canada's Arctic coastline eroding faster than anywhere else". *The Vancouver Observer*, Earth Matters posting. Last accessed 03 July 2011 at <http://www.vancouverobserver.com/blogs/earthmatters/2011/04/17/study-finds-canadas-arctic-coastline-eroding-faster-anywhere-else>
- Carpenter, E. (1973). *Eskimo Realities*. Holt, Rinehart and Winston. (Note: See also Kashley Entertainment (2007). *Eskimo Realities (dust-jacket transcription)*. Last accessed 08 Feb 2008 at www.Amazon.com)

- Catto, N.R. (1999). Embayed Gravel Coastlines of Conception Bay, Newfoundland: Climate Variation, Geomorphic Response, and Management Issues. *Salzburger Geographische Arbeiten*, 34:119-142.
- Catto, N.R. (2006). Sensitivity, exposure, and Vulnerability to Petroleum Pollution, Gjoa Haven Coastline, NU. Abstract/Poster, ArcticNet Annual Meeting, Victoria, BC, Canada.
- Catto, N.R., and Catto, G. (2004). Climate Change, Communities, and Civilizations: Driving Force, Supporting Player, or Background Noise? *Quaternary International*, 123-125: 7-10.
- Catto, N., and Papadimitriou, S. (2006). Sensitivity, exposure, and Vulnerability to Petroleum Pollution, Gjoa Haven Coastline, NU. Abstract, ArcticNet Annual Meeting, Victoria, BC, Canada.
- Catto, N. and Parewick, K. (2008a) Things Change, We Change: Community Adaptation Dynamics. Presentation. KOA Project Symposium, Ottawa, ON
- Catto, N. and Parewick, K. (2008b). Hazard and Vulnerability Assessment and Adaptive Planning: Mutual and Multi-lateral Community-Researcher Communication, Arctic Canada. Geological Society, London, Special Publications 305:123-140. Paper previously presented April 2007 at the European Geosciences Union General Assembly, Vienna.
- Catto, N., and Parewick, K. (2009). Hazard and Vulnerability Assessment and Adaptive Planning: Mutual and Multi-lateral Community-Researcher Communication, Arctic and Atlantic Canada. In Liverman, D., ed., *Communicating Geoscience*. Geological Society of London 305, 123-140.
- Catto, N. and Parewick, K. (2011). Resilience and Adaptive Capacity in Arctic Coastal Communities. In D. L. Forbes et al. (eds.) *State of the Arctic Coast 2009: Scientific Review and Outlook, IASC/LOICZ/AMAP (AWI)*, Potsdam, Germany.
- Census Canada. Population and Dwelling Counts, for Canada, provinces and territories, 2006 and 2001 Censuses – 100% Data. Last accessed 24 July 2009 at <http://www12.statcan.gc.ca/census-recensement/2006/db-pd/hlt/97-550/Index.cfm?Page=INDX&LANG=Eng>
- Centre for Community Enterprise (2000). *The Community Resilience Manual: A Resource for Rural Recovery and Renewal*. CCE, Port Alberni, B.C. Last accessed 25 August 2011 at http://files.uniteddiversity.com/Transition_Relocalisation_Resilience/Community_Resilience_Manual_Part1-The_Guide.pdf (See also Colussi et al. 2000)
- Chapin III, F.S. et al. (2004). Resilience and Vulnerability of Northern Regions to Social and Environmental Change. *Ambio* 33(6): 344-349
- Chapin III, F.S., Jeffries, R., Reynolds, J., Shaver, G.S., Svoboda, J. (eds). *Arctic Ecosystems in a Changing Climate: an ecophysiological perspective*. Academic Press, San Diego.
- Chapman, V.J. (1976) *Coastal Vegetation*, 2nd Edition. Pergamon Press Ltd., Ontario.
- Chapman, W.L. and Walsh, J.E. (1993). Recent Variations of Sea Ice and Air Temperatures in High Latitudes. *Bulletin American Meteorological Society*, 74(1):33-46.
- Chaskin, R. J., Brown, P., Venkatesh, S., and Vidal, A. (2001). *Building Community Capacity*. Walter de Gruyter, Inc., New York, NY. 268 pp.
- Chaturvedi, S. (1996). *The Polar Regions: A political geography*. John Wiley and Sons, Chichester
- Checkland, P.B. and Winter, M.C. (2006). Process and content: two ways of using SSM. *Journal of the Operational Research Society*, 57(12): 1435-1441.

- Checkland, P.B.(1999). *Systems Thinking, Systems Practice- Soft Systems Methodology: a 30-year retrospective*. John Wiley and Sons, Ltd., U.K. 330 pp.
- Checkland, P.B. and Winter, M.C. (2000). The relevance of soft systems thinking. *Human Resource Development International*, 3(3):411-417.
- Checkland, P.B.(2004). The need for 'passionate' (not 'dispassionate') research in management. *Systemist* 26(2): 142-149.
- Chester, D. (1993). *Volcanoes and Society*. London, Edward Arnold, 351p
- Climate Change Impacts and Adaptation Directorate (2002). *Climate Change Impacts and Adaptation: A Canadian Perspective – Coastal Zone*. Natural Resources Canada. Last accessed 03 September 2008 at www.adaptation.nrcan.gc.ca/perspective_e.asp
- Coates, K . (1985). *Canada's Colonies: A History of the Yukon and Northwest Territories*. Toronto: James Lorimer and Co.
- Coates, K. (1991) *Best Left As Indians: Native-White Relations In The Yukon Territory, 1840-1973*. Montreal and Kingston: McGill-Queen's University Press.
- Cohen, S.J. (1997). What if and so what in northwest Canada: could climate change make a difference to the future of the Mackenzie basin? *Arctic* 50(4):293-307.
- Collings, P. (2005). Housing Policy, Aging, and Life Course Construction in a Canadian Inuit Community. *Arctic Anthropology* 42(2): 50-65.
- Colussi M., Lewis M., Rowcliffe P. (2000). *The Community Resilience Manual: A resource for rural recovery and renewal*. Centre for Community Enterprise, Port Alberni, B.C. (See also CCE. 2000)
- Committee on the Human Dimensions of Global Change/Ostrom, E., Dietz, T., Nives Dolšak, N., Stern, P.C., Stonich, S., and Weber, E.U., eds. (2002). *The Drama of the Commons*. National Academy Press, Washington, DC.
- Community of Sachs Harbour, Wildlife Management Advisory Council (NWT) and Joint Secretariat (2008). *Sachs Harbour Community Conservation Plan: A plan for the conservation and management of renewable resources and lands within the Inuvialuit Settlement Region and in the vicinity of Banksland, Northwest Territories*. Last accessed 21 July 2011 at http://www.eirb.ca/pdf/ccp/SachsHarbour_CCP.pdf
- Community Planning Division (1992) Reports Listings. Municipal and Community Affairs, Yellowknife, N.W.T. 23 pp. typed. – *lone report listing for "Sachs Harbour 1968 Planning Report"*
- Couture, R; Robinson, S; Burgess, M; Solomon, S. (2002). Climate change, permafrost, and community infrastructure: a compilation of background material from a pilot study of Tuktoyaktuk, Northwest Territories. Last accessed 03 May 2010 at http://gsc.nrcan.gc.ca/permafrost/reports1_e.php
- Crowe, K. (undated - 2000?). "The Road to Nunavut". Nunavut '99 website. Last accessed 03 August 2011 at <http://www.nunavut.com/nunavut99/english/road.html>
- Department of Indian and Northern Affairs Canada (1984). *The Western Arctic Claim: The Inuvialuit Final Agreement* . Available on-line formerly at www.ainc-inac.gc.ca/agr/inu/wesar_e.pdf (not working)
- Dept. of Northern Affairs and National Resources (Canada) (1964). Q-book: *Qaujivaallirutissat*. Ottawa, Ontario. 302 pp.

Department of Justice Canada (1984). Western Arctic (Inuvialuit) Claims Settlement Act 1984 c.24. Available on-line formerly at <http://laws.justice.gc.ca/en/w-6.7/108810.html>

Diamond, J. (2005). *Collapse: How Societies Choose to Fail or Succeed*. Penguin Group (USA) Inc. New York. 576 pp.

Dooling, D.M. and Jordan-Smith, P., Eds. (1989) *I Become Part of It: Sacred Dimensions in Native American Life*. The Society for the Study of Myth and Tradition/Parabola Books, New York, N.Y.

Dorais, L. (1997). *Quaqtaq: Modernity and Identity in an Inuit Community*. University of Toronto Press, Toronto, 132 pp.

Driver, T.S. and Chapman, G.P., eds. (1996). *Time-scales and Environmental Change*. Routledge, London. 275 pp.

Dyck, N. Ed. (1985). *Indigenous Peoples and the Nation-State: 'Fourth World' Politics in Canada, Australia and Norway*, Social and Economic Papers No. 14. ISER, St. John's, NL

EarthTech (2005). *Hamlet of Tuktoyaktuk Operation and Maintenance Documentation: Sewage Treatment Facility*. Last accessed on 11 August 2011 at <http://www.docstoc.com/docs/44085439/Sewage-Treatment-Facility>

Efron, S. (2005). *Tuk Eroding*. Canadian Geographic Last accessed on 14 June 2011 at <http://www.sarahefron.com/stories/tuktoyaktuk.shtml>

Engineering Programs Branch, Department of Public Works (1971). *Investigation of Effects in the Mackenzie Delta Region: Investigation of Storm – September 13-16, 1970*.

Environment Canada [on-line]. *Climate Data, Temperature and Precipitation (various)*. Last accessed 10 August 2011 at <http://www.climate.weatheroffice.ec.gc.ca>

Farrington, David P.; Welsh, Brandon C.. (2006). *Preventing Crime: What Works for Children, Offenders, Victims, and Places* Retrieved 27 January 2008, from <http://www.myilibrary.com.qe2a-proxy.mun.ca/Browse/open.asp?ID=62488&loc=160>

F.F. Slaney & Company Limited (1975). *1974 Summer Environmental Program: Mackenzie River Estuary, Vols. 1-3 (1- Aquatic Studies, 2- Terrestrial Studies, 3 – Marine Mammal Studies)*. Prepared for Imperial Oil Limited/Sun Oil Company Limited. Vancouver, BC.

Ferguson, J.D. (1961). *The Human Ecology and Social Economic Change in the Community of Tuktoyaktuk, N.W.T.*

Forbes, B.C. et al. (2004) *Geographic Variations in Anthropogenic Drivers that influence the Vulnerability and Resilience of Social-Ecological Systems*. *Ambio* 33(6): 377-382.

Forbes, D.L., ed. (2011). *State of the Arctic Coast 2010: Scientific Review and Outlook*. International Arctic Science Committee (IASC), Land-Ocean Interactions in the Coastal Zone (LOICZ), Arctic Monitoring and Assessment Programme (AMAP), International Permafrost Association (IPA). Helholz-Zentrum, Geesthacht, Germany, 178 pp.

Forbes, D.L., Craymer, M., Solomon, S.M., Manson, G.K. (2004). *Defining Submergence and Erosion Hazards in the Canadian Arctic*. *Arctic Coastal Dynamics: Report of the 4th International Workshop*, St. Petersburg, Russia, November 2003. *Berichte zur Polar und Meeresforschung*, 482, 196-202.

- Forbes, D.L., Orford, J.D. et al. (1995). Morphodynamic evolution, self-organisation, and instability of coarse-clastic barriers on paraglacial coasts. *Marine Geology* 126:63-85.
- Forbes, D.L., Parkes, G.S. et al. (2004). Storms and shoreline retreat in the southern Gulf of St. Lawrence. *Marine Geology* 210:169-204.
- Forbes, D.L., Shaw, J. and Taylor, B. (1995). Differential preservation of coastal structures on paraglacial shelves: Holocene deposits of southeastern Canada. *Marine Geology* 124:187-201.
- Ford, J. D. and Smit, B. (2004). A Framework for Assessing the Vulnerability of Communities in the Canadian Arctic to risks associated with Climate Change. *Arctic* 57(4): 389-400.
- Fortier, D., Allard, M., and Shur, Y. (2007). Observation of rapid drainage system development by thermal erosion of ice wedges on Bylot island, Canadian Arctic Archipelago: Permafrost and Periglacial Processes 18:229-243.
- Foucault, M. (1969). *L'Archéologie du Savoie*. Editions Gallimard, Paris, France. Translated (1972) as "The Archaeology of Knowledge" by Tavistock Publications Limited, U.K.
- Fox, S.L. (2000). "Arctic Climate Change: Observations from the Inuvialuit Settlement Region". In: F. Fetterer and V. Radionov, eds. Arctic climatology project, environmental working group arctic meteorology and climate atlas. Boulder, CO: National Snow and Ice Data Centre.
- Fox, S.L. (2002). These are Things That are Really Happening: Inuit Perspectives on the Evidence and Impacts of Climate Change in Nunavut. In: I. Krupnik and D. Jolly, eds. *The Earth is Faster Now: Indigenous Observations of Arctic Environmental Change*. Fairbanks, Alaska: Arctic Research Consortium of the United States, 12-53.
- François, C. (1997). *International encyclopedia of systems and cybernetics*. Munich: K. G. Saur.
- Freeman, M.M.R. (2011). Looking back—and looking ahead—35 years after the Inuit land use and occupancy project. *Canadian Geographer* 55(1): 20-31
- Freeman, M.M.R. ed. (1976a). *Land Use and Occupancy, Vol. 1, Inuit Land Use and Occupancy Project Report*. Supply and Services Canada , Ottawa, Ontario
- Freeman, M.M.R. ed. (1976b) *Supporting Studies, Vol. 2, Inuit Land Use and Occupancy Project Report*. Supply and Services Canada , Ottawa, Ontario.
- Freeman, M.M.R. ed. (1976c) *Land Use Atlas, Vol. 3, Inuit Land Use and Occupancy Project Report*. Supply and Services Canada , Ottawa, Ontario.
- French, H.M. (1976). *Geomorphological processes and terrain disturbance studies, Banks Island, District of Franklin*. Geological Survey of Canada Paper 76-1A: 289-292.
- French, H.M., Harry, D.G. (1990). Observations on Buried Glacier Ice and Massive Segregated Ice, Western Arctic Coast, Canada. *Permafrost and Periglacial Processes* 1: 31-43.
- Friesen, T.M. (2010). Dynamic Inuit Social Strategies in Changing Environments: A Long-Term Perspective. *Danish Journal of Geography* 110(2):215-225.
- Friesen, T.M., and Arnold, C.D. (2008). The Timing of the Thule Migration: New Dates from the Western Canadian Arctic. *American Antiquity*, 73(3):527-538.

Froese, D., Vandall, J. and Henderson, N., eds (2008). Protected Area Policies and Climate Change: The Case of the Prairie Ecozone, Saskatchewan. PARC Summary Document No. 08-02. Last accessed 21 January 2012 at http://www.parc.ca/pdf/research_publications/summary_docs/SD2008-02.pdf

Furgal, C., Martin, D. and P.Gosselin. (2002). Climate Change and Health in Nunavik and Labrador: Lessons from Inuit Knowledge. In: I. Krupnik and D. Jolly, eds. The Earth is Faster Now: Indigenous Observations of Arctic Environmental Change. Fairbanks, Alaska: Arctic Research Consortium of the United States, 266-300.

Gagnon, J. (2011). "Screen passengers and cargo for booze: Gjoa Haven", Northern News Service, 07 February 2011. Available on-line at http://www.nnsf.com/northern-news-services/stories/papers/feb7_11scr.html

Gajda, R. T. 1960. The Canadian ecumene: Inhabited and uninhabited areas. *Geographical Bulletin* 15: 5 to 18.

Ganopolski, A. and Rahmstorf, S. (2002). Abrupt Glacial Climate Changes due to Stochastic Resonance. *Physical Review Letters*, 88(3)

George, J. (2000). Poor Housing Plagues Canada's Inuit. Nunatsiag News. Iqaluit, NU. Last accessed 10 July 2007 at <http://www.nunatsiag.com>

Gerein, H.J.F. (1980) Community Planning and Development in Canada's Northwest Territories. GNWT, Yellowknife, NWT.

Gibson, W. (1932). Some Further Traces of the Franklin Retreat. *The Geographical Journal*, 79(5):402-404. Available on-line at <http://www.jstor.org/stable/1783940>

Gladwell, M. (2000). *The Tipping Point: How Little Things Can Make a Big Difference*. Little Brown and Company, New York, NY.

Gladwell, M. (2005). *Blink: The Power of Thinking Without Thinking*. Little, Brown and Company, New York, New York, U.S.A. 277 pp.

Government of Canada (1988). Flood Risk Map: Tuktoyaktuk, Northwest Territories.

Government of the Northwest Territories (1977). *Towards Decentralized Government (1977 Northwest Territories Annual Report)*

GNWT, Municipal and Community Affairs (1992). *Planning By-Laws Handbook: A Guide to the Enactment of General Plans, Zoning By-Laws and Amendments*. Community Planning Division

GNWT (1988). Planning Act, R.S.N.W.T 1988, c.P-7 (as amended). Last accessed 12 June 2011 at <http://www.justice.gov.nt.ca/PDF/ACTS/Planning.pdf>

GNWT (2007). NWT Greenhouse Gas Strategy 2007-2011 Available at http://www.enr.gov.nt.ca/eps/pdf/GHG_Strategy-FINAL-070313.pdf

GNWT (2009) Permafrost, Chapter 13. In *State of the Environment Report*. Last accessed 10 August 2011 at http://www.enr.gov.nt.ca/_live/pages/wpPages/soe_permafrost.aspx

GNWT (2010). GNWT Report on Drinking Water. Last accessed 12 July 2011 at http://www.maca.gov.nt.ca/resources/GNWT_Report_on_Drinking_Water_2010.pdf

- GNWT MACA (2011a). Boil Water Advisory – Details. Northwest Territories Drinking Water Quality Database (on-line). Last accessed 02 August 2011 at <http://www.maca.gov.nt.ca/operations/water/boilWaterView.asp?community=Sachs%20Harbour>
- GNWT MACA (2011b). Community Descriptions. Northwest Territories Drinking Water Quality Database (on-line). Last accessed 02 August 2011 at <http://www.maca.gov.nt.ca/operations/water/commsys.htm>
- GNWT MACA (2011c). Definitions. Northwest Territories Drinking Water Quality Database (on-line). Last accessed 02 August 2011 at <http://www.maca.gov.nt.ca/operations/water/definitions.htm#small>
- GNWT MACA [on-line]. ATLAS GIS (Community Mapping System portal). Last accessed 12 Jan 2012 at <http://gis.maca.gov.nt.ca/Website/index.asp>
- Government of Nunavut (1999). *Pinasuaqtavut: The Bathurst Mandate*. <http://www.nald.ca/library/learning/unipkausivut/page34.htm>
- Government of Nunavut (2003). "Inuit Qaujimagauqanginnik Tukimuagutit". Presentation file. C&SS Division, Department of Education. Last accessed 12 August 2011 at <http://nunavusiutit.wikispaces.com/file/view/IQ+PRINCIPLES-FINAL.pdf>
- Government of Nunavut (2003). *Pinasuaqtavut: 2004-2009*. Last accessed 14 August 2011 at <http://www.nunavuteconomicforum.ca/public/files/library/POLITICA/PINASUAQ.PDF>
- Government of Western Australia (2007). Rural Abattoirs. Water Quality Protection Note 98, Department of Water. Last accessed 14 June 2011 at <http://www.water.wa.gov.au/PublicationStore/first/82569.pdf>
- Granovetter, M. (1985). Economic action and social structure: The problem of embeddedness. *American Journal of Sociology*, 91:481-510.
- Grant, S. (1988). *Sovereignty or Security?: Government policy in the Canadian North, 1936-1950*. Vancouver: UBC Press.
- Grant, S. (1998) Arctic Wilderness and Other Mythologies. *Journal of Canadian Studies* 32(2):27-
- Green, M.E. (2009). "Nanisivik naval depot project on schedule". *The Maple Leaf*, 12(35). Available online at <http://www.forces.gc.ca/site/Commun/ml-fe/article-eng.asp?id=5711>
- Gunderson, L., and Holling, C.S. eds. (2002). *Panarchy: Understanding Transformations in Human and Natural Systems*. Island Press, Washington, 450 pp.
- Gunn, A., Shank, C., and McLean, B. (1991). The History, Status and Management of Muskoxen on Banks Island. *Arctic* 44(3):188-195.
- Hamilton, J. D. (1994). *Arctic Revolution: Social Change in the Northwest Territories, 1935-1994*. Dundurn Press, Toronto.
- Hardin, G. (1968). The Tragedy of the Commons. *Science* 162(3859):1243-1248.
- Hassan, F. (2007). Extreme Nile floods and famines in medieval Egypt (AD 930-1500) and their climatic implications. *Quaternary International* 173-174: 101-112.

- Heiberg-Harrison, N. (2011). "Boil water advisory in Sachs Harbour", Northern News Services Online. Last accessed 10 Aug 2011 at http://www.nnsf.com/northern-news-services/stories/papers/jun20_11/wat.html
- Henriksen, G. (1973) Hunters in the Barrens: The Naskapi on the Edge of the White Man's World. Newfoundland Social and Economic Studies No. 12. ISER, St. John's, NL.
- Henry, R.F. (1984). Flood Hazard Delineation at Tuktoyaktuk. Canadian Contractor Report of Hydrography and Ocean Sciences No. 19, Institute of Ocean Sciences, Dept. of Fisheries and Oceans, Sidney, B.C.
- Hequette, A., Ruz, M-H., Hill, P.R. (1995). The Effects of the Holocene Sea Level Rise on the Evolution of the Southeastern Coast of the Canadian Beaufort Sea. *Journal of Coastal Research* 11, 494-507.
- Hewitt, K. (ed.) (1983) Interpretations of calamity from the viewpoint of human ecology. Allen & Unwin, 304 p.
- Heyd, T. (2007). Rapid Natural Changes: A perspective from environmental philosophy. *Quaternary International* 173-174:161-165.
- Hill, P.R., Solomon, S.M. (1999). Geomorphic and Sedimentary Evolution of a Transgressive Thermokarst Coast, Mackenzie Delta Region, Canadian Beaufort Sea. *Journal of Coastal Research*, 15, 1011-1029.
- Hinshaw, R.E. (2006). Living with Nature's Extremes: The Life of Gilbert Fowler White. Johnson Books, Boulder, CO.
- Hipwell, W., Mamen, K., Viviane Weitzner, and Gail Whiteman (2002). Aboriginal Peoples and Mining in Canada: Consultation, participation, and prospects for change, North-South Institute Working Discussion Paper.
- Hodge, G. (1986). Planning for Canadian Communities: An Introduction to the Principles, Practice and Participants. Methuen, Toronto.
- Hofstede, J. L.A. (1999). Regional Differences in the morphological behaviour of four German Wadden Sea barriers. *Quaternary International* 56:99-106.
- Holling, C.S., (1973). Resilience and stability of ecological systems. *Annual Review of Ecology and Systematics* 4:1-24.
- Holling, C.S. (1986). The resilience of terrestrial ecosystems: local surprise and global change. In Clark, W.C., and Munn, R.E., eds., *Sustainable Development of the Biosphere*, Cambridge University Press, 292-317.
- Huntington, H.P. (2000). Using traditional ecological knowledge in science: methods and applications. *Ecological Applications*, 10, 1270-1274.
- Indian-Eskimo Association of Canada (1957-70). Fonds 95-006, Trent University Archives. On-line record available at www.trentu.ca/admin/library/archives/95-006.htm
- Institute for Dynamic Educational Advancement (IDEA) (2007). Adaptive vs. Predictive: Is the end clear? Last accessed 11 June 2007 at <http://www.i-d-e-a.org/adaptive.html>
- International Institute for Geo-Information Science and Earth Observation (ITC) (2006). Last accessed 11 June 2007 at http://www.itc.nl/education/courses/short_courses/2007/0763.asp

International Institute for Sustainable Development (IISD) (1999). Inuit Observations on Climate Change Trip Report 1: June 15–21, 1999, Sachs Harbour. Last accessed on 20 May 2011 at <http://www.iisd.org/pdf/inuittriprpt1.pdf>

International Institute for Sustainable Development (IISD) (2005). "Sila Alungotok: Inuit Observations on Climate Change". Video, International Institute for Sustainable Development, Winnipeg, Manitoba, Canada; www.iiisd.org

International Polar Year [on-line]. Last accessed 20 August 2011 at <http://ipy.arcticportal.org/>
ITC (2001). Timelines and Milestones: 30 Years with ITC. *Inuit Today* (Special Edition) 90. Last accessed 12 July 2011 at <http://www.itk.ca/sites/default/files/InukMagazine90.pdf>

ITC (2006). "Multi-hazard risk assessment" [course description]. Last accessed 13 June 2008 at <http://www.preventionweb.net/english/professional/trainings-events/events/v.php?id=1246>

Inuvialuit Communications Society (1983). *Tusaayaksat*, (First Edition); 1(1) October 1983. Inuvik, N.W.T. Available through mailing list from <http://groups.yahoo.com/group/tusaayaksat/>

Iyer-Raniga, U. and Treloar, G.H. (2000). A context for participation in sustainable development. *Environmental Management* 26:349–361

Jacobs, J. (1961). *The Death and Life of Great American Cities*. Vintage Books, New York, NY.

Jacobs, J. (1969). *The Economy of Cities*. Vintage Books, New York, NY.

Jacobs, J. (2004). *Dark Age Ahead*. Random House Canada,

Jacobs, J.D. et al. (1997). Climate and Vegetation of the Interior Lowlands of Southern Baffin Island: Long-term Stability at the Low Arctic Limit. *Arctic*, 50(2):167-177.

Janssen, M. et al. (2006). Scholarly networks on resilience, vulnerability, and adaptation within the human dimensions of global environmental change. *Global Environmental Change*, 16: 240-252.

Janssen, M. (2007). An Update on the scholarly networks on resilience, vulnerability, and adaptation within the human dimensions of global environmental change. *Ecology and Society*, 12(2): 9. [online at www.ecologyandsociety.org/vol12/iss2/art9/]

Jarroll, E.L. Jr., Bingham, A.K., and Meyer, E.A. (1980). Effectiveness of *Giardia* Cyst Destruction Methods. *American Journal of Tropical Medicine and Hygiene*, 29(1):8-11. Last accessed 25 July 2011 at <http://www.ajtmh.org/content/29/1/8.short>

Jenkins, R.E.L., Kanigan, J.C.N. and Kokelj, S.V. 2008. Factors contributing to the long-term integrity of drilling-mud sump caps in permafrost terrain, Mackenzie Delta region, Northwest Territories, Canada. In D.L. Kane and K.M. Hinkel (Editors), *Proceedings of the Ninth International Conference on Permafrost*, 29 June to 3 July 2008, University of Alaska Fairbanks, Vol. 1, 833-838.

Johannessen, O. M., Shalina, E. V. and Miles, M. W. (1999). Satellite evidence for an Arctic Sea Ice Coverage in Transformation. *Science* 286, 1937–1939.

Johannessen, O., Bengtsson, L., Miles, M.W., Kuzmin, S.I, Semenov, V.A., Alekseev, G.V., Nagurnyi, A.P., Zakharov, V.F., Bobylev, L.P., Petterson, L.H., Hasselman, K., Cattle, H.P. (2004). Arctic Climate Change: Observed and Modelled Temperature and Sea-Ice Variability. *Tellus*, 46, 328-341.

- Johnson, K. (2001). "Community Planning and Climate Change in the Canadian North". Plan Canada, 41(1):16-17. Last accessed 20 July 2011 at <http://members.shaw.ca/cryofront/V4-n1.htm>
- Johnson, K, Solomon, S, Berry, D. and Graham, P. (2003). Erosion progression and adaptation strategy in a northern coastal community. In Permafrost: Proceedings of the Eighth International Conference on Permafrost, Zurich, Switzerland, July 20-25, 2003, Phillips, Springman and Arenson (eds.), International Permafrost Association 8, pp. 489-494. Swets & Zeitlinger, Lisse. Available on-line at http://research.iarc.uaf.edu/NICOP/DVD/ICOP%202003%20Permafrost/Pdf/Chapter_087.pdf
- Jolly, D., Berkes, F., Castleden, J., Nichols, T., and the community of Sachs Harbour. (2002). We Can't Predict the Weather Like We Used to: Inuvialuit Observations of Climate Change, Sachs Harbour, Western Canadian Arctic. In: I. Krupnik and D. Jolly, eds. The Earth is Faster Now: Indigenous Observations of Arctic Environmental Change. Fairbanks, Alaska: Arctic Research Consortium of the United States, 92-125.
- Kanigan, J.C.N., Kokelj, S.V. (2010). Review of current research on drilling-mud sumps in permafrost terrain, Mackenzie Delta region, NWT, Canada. GEO 2010: Canadian Permafrost Conference Proceedings, Calgary, Alberta. Pp.1473-1479. Last accessed 23 July 2011 at <http://pubs.aina.ucalgary.ca/cpc/CPC6-1473.pdf>
- Keith, R.F., Fischer, D.W. et al. (1976) Northern Development and Technology Assessment Systems: A Study of Petroleum Development Programs in the Mackenzie Delta-Beaufort Sea Region and the Arctic Islands. Science Council of Canada, Background Study No. 34, Ottawa.
- Kettles, I.M., Tarnocai, C., and Bauke, S.D. 1997. Predicted permafrost distribution in Canada under a climate warming scenario. Current Research 1997-E, Geological Survey of Canada, p. 109-115.
- Kimble, G.H.K., (1955) Geography of the Northlands
- King, D. (1999) The history of the federal residential schools for the Inuit located in Chesterfield Inlet, Yellowknife, Inuvik, and Churchill, 1955-1970. M.A. thesis, Trent University. National Library of Canada, Ottawa: National Library of Canada - Canadian theses on microfiche collection.
- Kitikmeot Heritage Society (various) <http://www.kitikmeotheritage.ca>
- Klengenberg, C. (1983). "Memories of a Reindeer Herder – Jimmy Komeak", Canku Ota 61 (18 May 2002). Last accessed 18 July 2011 at http://www.turtletrack.org/Issues02/Co05182002/CO_05182002_Reindeer.htm
- Kokelj, S.V., Jenkins, R. E., Milburn, D., Burn, C.R. and Snow, N. (2005). The Influence of Thermokarst Disturbance on the Water Quality of Small Upland Lakes, Mackenzie Delta Region, Northwest Territories, Canada. *Permafrost and Periglac. Process.* 16: 343-353
- Kolberg, T.O. and Shah, V.K. (1976). Tuktoyaktuk, N.W.T.: Shore Erosion and Protection Study, Stage 2 Report, Volume I (Report No. 41 - Sept. 1976) and II (Nov. 1976). Design and Construction, Marine Engineering, Marine Directorate, Western Region, Public Works Canada.
- Kooiman, J. (1999). Socio-political governance: overview, reflections and design. *Public Management* 1(1):67-92.
- Kooiman, J. (2003). *Governing as Governance*. SAGE Publications, London. 249 p.

Kooiman, J. and Bavinck, M. (2005). The Governing Perspective. In *Fish for Life: Interactive Governance for Fisheries*, Kooiman, J., Bavinck, M., Jentoft, S., Pullin, R. eds., Amsterdam University Press, Amsterdam, pp. 11-24.

Krotz, L. (1980). *Urban Indians: The Strangers in Canada's Cities*. Hurtig Publishers Ltd., Edmonton. 157 pp.

Krupnik, I. and Jolly, D. eds. (2002) *The Earth is Faster Now: Indigenous Observations of Arctic Environmental Change*. Arctic Research Consortium of the United States (ARCUS), Fairbanks, Alaska. 384 pp.

Kuhn, T. (1962). *The Structure of Scientific Revolutions*.

Kukla, G.J. et al. (2002). Last Interglacial and Early Glacial ENSO. *Quaternary Research* 58: 27-31.

Kunuk, M. (2007). Resource Development & Northern Transportation Conference (presentation), Whitehorse, Yukon, 28-30 May 2007. Available on-line at <http://www.vanhorne.info/files/vanhorne/Kunuk.pdf>

Kunuk, Z. and Mauro, I. (2010). *Qapirangajuaq: Inuit Knowledge and Climate Change*. Last accessed 12 Jan 2012 at IsumaTV [online] <http://www.isuma.tv/hi/en/inuit-knowledge-and-climate-change> .

Kusel, J. (1996). Well-being in forest-dependent communities. Part I: A New Approach. Chapter 12 in *Sierra Nevada Ecosystem Project: Final Report to Congress. Vol. II, Assessments and scientific basis for management options*, p. 361-373. Centers for Water and Wildland Resources, University of California, Davis, CA. Last accessed 12 July 2011 at http://ceres.ca.gov/snep/pubs/web/PDF/VII_C12.PDF

Lacelle, D., Bjornson, J. et al. (2004). Segregated-intrusive ice of sub-glacial meltwater origin in retrogressive thaw flow headwalls, Richardson Mountains, NWT, Canada . *Quaternary Science Reviews* 23:681-696.

Latour, B. (1993). *We Have Never Been Modern (English translation by Catherine Porter after 1991 « Nous n'avons jamais été modernes : Essai d'anthropologie symétrique »)*. Harvard University Press, Cambridge Mass., USA

Law Commission of Canada (2002). *Institutional child abuse [online]*. Last accessed 08 December 2009 at www.lcc.gc.ca/en/index.asp

Lent, P. C. (1999) *Muskoxen and Their Hunters: A History*. Vol. 5, Animal Natural History Series. University of Oklahoma Press, Norman,

Lippa, K. (2003). "Aging equipment stifles Gjoa Haven: Community can't move forward says Mayor". Northern News Services, 04 August 2003. http://www.nns1.com/frames/newspapers/2003-08/aug4_03equip.html

LPS Aviation Inc.(2007). *Airport Runway Optimal Lengths and Issues in the Northwest Territories*. Available on-line at http://www.dot.gov.nt.ca/_live/documents/content/FinalGNWTRunwaysCompleteWeb.pdf

Lopez, B. (1986). *Arctic Dreams: imagination and desire in a Northern landscape*. Macmillan, London.

Mackay, J.R. (1972) The world of underground ice. *Ann. Assoc. Am. Geo.* 62:1-22.

Mackay, J.R. (1973) The growth of pingos, western arctic coast, Canada. *Can. J. Earth. Sci.* 10:979-1004.

- Mackay, J.R. (1977) Pulsating pingos, Tuktoyaktuk Peninsula, N. W. T. Can. J. Earth Sci. 22:209-222.
- Mackay, J.R. (1979) Pingos of the Tuktoyaktuk peninsula area, northwest territories. Geog. Phys. Quat. 33: 3-61.
- Mackay, J.R. (1987) Some mechanical aspects of pingo growth and failure, western Arctic coast. Can. J. Earth Sci. 24:1108-1119.
- Manning, T.H. (1956). Narrative of a Second Defence Research Board Expedition to Banks Island. Arctic, 9:3-76.
- Manson, G.K., Solomon, S.M., Whalen, D. (2005) Storm Surge Flooding at Tuktoyaktuk, Map 1: Flood Extent. Geological Survey of Canada (poster).
- Manson, G.K., Solomon, S.M., Whalen, D. (2005) Storm Surge Flooding at Tuktoyaktuk, Map 2: Flood Depth. Geological Survey of Canada (poster).
- Manson, G.K., Solomon, S.M., Whalen, D. (2005) Storm Surge Flooding at Tuktoyaktuk, Map 3: Flood Depth in 2050. Geological Survey of Canada (poster).
- Manson, G.K., Solomon, S.M., Forbes, D.L., Atkinson, D.E., Craymer, M. (2005). Spatial Variability of Factors Influencing Coastal Change in the Western Canadian Arctic. Geo-marine Letters, 25, 138-145.
- Markey, S., Pierce, J.T., Vodden, K., and Roseland, M. (2005). Second Growth: Community Economic Development in Rural British Columbia. UBC Press, Vancouver, BC.
- McCarthy, J. (2002). First World Political Ecology: Lessons from the Wise Use movement. Environment and Planning A 34: 1281-1302.
- McDonald, M and Fleming, B. (1993). Community-Based Economic Development and Resource Management in the Hudson Bay Area. Chapter 7 in Traditional Ecological Knowledge: Concepts and Cases pp. 63-68. IDRC [online at www.idrc.ca/en/]
- McMahon, K. (1988) Arctic Twilight: Reflections on the Destiny of Canada's Northern Land and People. James Lorimer & Company, Publishers, Toronto, Ontario. 254 pp.
- McMichael, A.J. and Kovats, R.S. (2000). Climate Change and Climate Variability: Adaptations to reduce Adverse Health Impacts. Environmental Monitoring and Assessment 61:49-64.
- McNeill, J.R. and Unger, C.R., ed. (2010) Environmental Histories of the Cold War. Cambridge University Press, Cambridge, UK. 376 pp.
- Memorial University (2003). Policy on Ethics of Research Involving Human Participants. Last accessed on 10 July 2011 on-line at http://www.mun.ca/research/researchers/human_subjects1.php#2
- Minogue, S. (2004). "Eleven new mayors, one returning mayor" Nunatsiaq News, 24 Dec 2004. Last accessed 04 October 2008 at http://www.nunatsiaqonline.ca/archives/41224/news/nunavut/41224_08.html
- Minogue, S. (2005). Where Housing Is Concerned, Even Old News Is Good News. Nunatsiaq News. Iqaluit, NU. Available on-line at <http://www.nunatsiaq.com>
- Moore, P.D. and Bellamy, D.J. (1974). Peatlands. Springer-Verlag New York Inc.

- Morrison, D. (1999). The Earliest Thule Migration. *Canadian Journal of Archaeology* 22:139-156.
- Moteff, J. and Parfomak, P. (2004). *Critical Infrastructure and Key Assets: Definition and Identification*. CRS Report for Congress, Resources, Science and Industry Division, Washington, D.C. 19 pp. Last accessed 11 June 2010 at <http://www.fas.org/sgp/crs/RL32631.pdf>
- Municipal and Community Affairs (MACA) GNWT, (undated). Hamlet of Tuktoyaktuk Zoning Bylaw #258. Available at http://www.maca.gov.nt.ca/lands/community_planning/Tuktoyaktuk/Hamlet_of_Tuktoyaktuk_Zoning_Bylaw_258.pdf
- Nabokov, P. (1991). *Native American Testimony: A Chronicle of Indian-White Relations from Prophecy to the Present, 1492-1992*. Penguin Books, New York, NY.
- Natural Resources Canada (2001). Taking the Chill Off: Climate Change in the Yukon and Northwest Territories. Poster available on-line at http://adaptation.nrcan.gc.ca/posters/wa/wa_09_e.php
- Natural Resources Canada. [on-line]. The Atlas of Canada, 6th Edition. Last accessed 23 Jan 2012 at <http://atlas.nrcan.gc.ca/site/index.html>
- Natural Resources Canada [on-line]. GeoGratis. Last accessed 23 Jan 2012 at <http://geogratias.gc.ca/en/index.html>
- Nesbitt, T.H.D. and Howell, J.D. (1988). Plan for the Reservation and Development of Granular Materials in the Vicinity of Tuktoyaktuk, N.W.T., Report CE00992/T. Prepared for Indian and Northern Affairs Canada. Hardy BBT Limited and Avati Associates, Calgary, Alberta and Yellowknife, NWT (respectively). 70 pp. Last accessed 12 August 2011 at <http://pubs.aina.ucalgary.ca/gran/33418.pdf>
- Nichol, R. A. (2000) Factors contributing to resilience in Aboriginal persons who attended residential schools (M.S.W. thesis). University of Manitoba [microform]. National Library of Canada, Ottawa.
- Nichols, T., Berkes, F., Jolly, D., Snow, N., and the Community of Sachs Harbour (2004). Climate Change and Sea Ice: Local Observations from the Western Canadian Arctic. *Arctic* 57(1): 68-79.
- Nickels, S., Furgal, C., Casteldon, J., Moss-Davies, P., Buell, M., Armstrong, B., Dillon, D., Fonger, R. (2002). "Putting the Human Face on Climate Change Through Community Workshops: Inuit Knowledge, Partnerships, and Research", pp. 300-333. In *The Earth is Faster Now: Indigenous Observations of Arctic Environmental Change*. Krupnik, I. and Jolly, D., eds. (2002).
- Nickels, S., Furgal, C., Buell, M., Moquin, H. (2006). *Unikkaaqatigit – Putting the Human Face on Climate Change: Perspectives from Inuit in Canada*. Ottawa: Joint publication of Inuit Tapiriit Kanatami, Nasivvik Centre for Inuit Health and Changing Environments at Université Laval and the Ajunnginiq Centre at the National Aboriginal Health Organization.
- Nickels, S., Shirley, J. and Laidler, G. (eds). (2007). *Negotiating Research Relationships with Inuit Communities: A Guide for Researchers*. Inuit Tapiriit Kanatami and Nunavut Research Institute: Ottawa and Iqaluit. 38 pp. Available on-line at www.itk.ca/publications/negotiating-research-relationships-inuit-communities-guide-researchers
- Nord, M. (1994). Natural Resources and Persistent Rural Poverty: In Search of the Nexus. *Society and Natural Resources* 7: 205-220. (stacks)
- Nordquist, M.H., Moore, J.N. and Skaridov, A.S., Eds. (2005). *International Energy Policy, the Arctic and the Law of the Sea*. Martinus Nijhoff Publishers, Boston, MA.

Norterra Inc. [on-line]. Last accessed 12 June 2011 at www.norterra.com
Northwest Territories Power Corporation (NTPC). Corporate website. Last accessed 10 August 2011 at <http://www.ntpc.com>.

Nunatsiaq News. - Vol. 1, No. 1 (Feb. 9, 1973) - . - Iqaluit, N.W.T. : [Nortext], 1973- . - vol. - Irregular. - Text in English and Inuktitut. - Access: www.nunatsiaq.com

Nunavut Housing Corporation and Nunavut Tunngavik Inc. (2004). Nunavut Ten-Year Inuit Housing Action Plan. Available on-line at <http://www.nunavuthousing.ca/apps/Docs/displayDocs.aspx?cat=&page=2>

Nunavut Implementation Commission (1995) *Footprints in New Snow*.

Nunavut Implementation Commission (1996) *Footprints II*.

Nunavut Implementation Training Commission (NITC) (1994). *Nunavut Implementation Training Study*, Vols. 1-7.

Nunavut Tunngavik Inc. (various) *Complete on-line document collection for NLCA*
<http://www.tunngavik.com/category/publications/nunavut-land-claims-agreement/>

Nuttall, M. and Callaghan, T.V. (2000). *The Arctic: Environment, People, Policy*. Harwood Academic Publishers, Amsterdam, 647 pp.

Omhundro, J. T. (1995). *Living Off the Land*. In *Living on the Edge: The Great Northern Peninsula of Newfoundland*. L. W. Felt and P. R. Sinclair (eds.). St. John's, Nfld. Institute of Social and Economic Research, Memorial University of Newfoundland

Osherenko and Young (1989). *The Age of the Arctic: hot conflicts and cold realities*. Cambridge University Press, Cambridge. (QEII – UA 880 074 1989)

Ostrom, E. (2002). *The Drama of the Commons*. (See *Committee on the Human Dimensions of Global Change*)

Owlijoot, P. (2008). *Guidelines for working with Inuit elders*. Nunavut Arctic College. Last accessed 12 August 2011 at <http://www.arcticcollege.ca/publications/books/elder%20guide%20english.pdf>

Page, R. *Northern Development: The Canadian Dilemma* (Toronto: McClelland and Stewart, 1986).

Pahl, R. E. (1988). *Some Remarks on Informal Work, Social Polarization and the Social Structure*. *International Journal of Urban and Regional Research* 12:247-267.

Paine, R. (1971). *Animals as Capital: Comparisons among Northern Nomadic Herders and Hunters*. *Anthropological Quarterly* 44(3):157-72

Papadimitriou, S. (2007). *Climate-related hazards and risks to community infrastructure: Gjoa Haven, Nunavut*. Unpublished Research Report, Masters of Environmental Science, Memorial University of Newfoundland, St. John's, NL, Canada, 109 pp.

Papadimitriou, S., Catto, N.R. (2008) *Permafrost-related Hazards and Community Development, Gjoa Haven, Nunavut, Canada*. European Geosciences Union, Vienna, April 2008; EGU 2008-A-07499.

Papadimitriou, S., Catto, N., Brown, T., and Edinger, E. (2006). *Climate-Related Hazards: Gjoa Haven, Nunavut*. Poster presented at ArcticNet Annual Science Meeting, Victoria, B.C.

Papadimitriou, S., Catto, N.R., Brown, T., Edinger, E. (2006). Ursuqtuq Impacted by Climate Change: Hazards and Risks to Community Infrastructure. Canadian Risks and Hazards Research Network Congress, Montreal.

Parewick, K. (2005). Things Change, We Change: Community Planning for Resilience in the Canadian Arctic. Poster presented at ArcticNet Annual Science Meeting, Québec, QC and again later at the Arctic Coastal Dynamics Working Group Meeting, Groningen, Netherlands (October 2006).

Parewick, K. (2006a). Things Change, We Change: Planning for Resilience. Nunavut Adaptation Planning Workshop, Iqaluit, Nunavut (presentation)

Parewick, K. (2006b). Dark Age Ahead: Jane Jacobs and Planning for Resilience. Presentation, Canadian Risk and Hazards Network Symposium, Montreal, QC.

Parewick, K. (2006c). Planning for Resilience in Tuktoyaktuk: Window on a Local Adaptation Process & Things Change, We Change: Planning for Community Resilience in Tuktoyaktuk. Presentations, Coastal Zone Canada Conference, Tuktoyaktuk, NWT

Parewick, K. and Catto, N. (2006). Things Change, We Change: Community Planning for Resilience in Tuktoyaktuk, A Contribution to ArcticNet Project 1.2. Poster presented at ArcticNet Annual Science Meeting, Victoria, BC; Nunavut Adaptation Planning Workshop, Iqaluit, Nunavut; and Arctic Coastal Dynamics Working Group Meeting, Groningen, Netherlands.

Parewick, K. (2007). Things Change, We Change: Planning for Resilience in the Canadian Arctic. IPY Pilot Project Launch, Clyde River, Nunavut (presentation).

Parewick, K. and Catto, N. (2007a). Things Change, We Change: Community Adaptation Dynamics. Poster and presentations delivered at ArcticNet Annual Science Meeting, Collingwood, Ontario, Dec 2007 and Canadian Geophysical Union Conference, Banff, AB, May 2008.

Parewick, K. and Catto, N. (2007b) Things Change, We Change: Planning for Resilience in Coastal Arctic Communities. Canadian Risk and Hazards Network Symposium, Vancouver, BC. (presentation).

Parewick, K. and Catto, N. (2008) Community Adaptation and Resiliency in Arctic Canada. Canadian Risk and Hazards Network Symposium, St. John's, NL (presentation).

Parewick, K., Catto, N.R., Forbes, D.L., Bell, T., Pollard, W., Edinger, E., and Couture, N. (2005). Integrating Coastal Science into Regional Impacts Assessment and Local Decision-Making to Build Community Resilience in the Canadian Arctic. Presentation, ArcticNet Annual Science Meeting, Quebec.

Parewick, K., Catto, N., Forbes, D.L., Solomon, S., Edinger, E. (2008). Climate Change and the Built Community: Practical Lessons for Adaptation Governance. Poster presented at Arctic Change Conference (ArcticNet), Québec, QC and later delivered at Arctic Science Summit Week, Bergen, Norway, March 2009 (presentation).

Parewick, K., Ford, J. and Haquebord, L. (2008). Coasts and People Working Group Report. In P. Overduin and N. Couture (eds.) The 6th Annual Arctic Coastal Dynamics (ACD) Workshop (proceedings), Reports on Polar and Marine Research 576, Alfred Wegener Institute, Potsdam, Germany.

Parks Canada (undated). Pingo National Landmark [on-line]. Last accessed 12 August 2011 at <http://www.pc.gc.ca/eng/docs/v-g/pingo/index.aspx>.

- Parks Canada (2011a). Aulavik National Park of Canada: Draft Management Plan for Consultation. Last accessed 23 July 2011 at <http://www.pc.gc.ca/pn-np/nt/aulavik/plan.aspx>
- Pasquaré, F. and Pozzetti, M. (2007). Geological hazards, disasters, and the media: The Italian Case Study. *Quaternary International* 173-174: 166-171.
- Peterson, B.J. et al. (2002). Increasing River Discharge to the Arctic Ocean. *Science*, 298:2171-2
- Pilkey, O.H., Young, R.S. et al. (1993). The Concept of Shoreface Profile of Equilibrium: A Critical Review. *Journal of Coastal Research* 9(1): 255-278.
- Pimlott, D.H. et al. Eds. (1973). *Arctic Alternatives: A National Workshop on people, resources and the environment north of 60*. Canadian Arctic Resources Committee, Ottawa.
- Pinard, J-P. and Maissan, J.F. (2011). Sachs Harbour Wind Energy Pre-Feasibility Study. Aurora Research Institute. Last accessed 12 July 2011 at <http://www.nwtresearch.com/docs/sachs-harbour-wind-reports/2011/01/05/sachs-harbour-wind-energy-pre-feasibility-study.pdf>
- Prigogine, I. and Stengers, I. (1984). *Order out of Chaos: Man's new dialogue with nature*. Bantam. 349 pp.
- Prigogine, I. and Stengers, I. (1997) *The End of Certainty, Time, Chaos and the New Laws of Nature*. The Free Press, New York, NY.
- Prince of Wales Northern Heritage Centre [on-line]. Last accessed 10 August 2011 at <http://pwnhc.learnnet.nt.ca/timeline>
- Prowse et al. (2009). Climate Impacts on Northern Canada: Regional Background. *AMBIO* 38(5): 248-56.
- Prowse, T.D. et al. (2009) Implications of Climate Change for Economic Development in Northern Canada: Energy, Resource, and Transportation Sectors. *Ambio* 38(5):272-281.
- Public Infrastructure Engineering Vulnerability Committee (PIEVC) [on-line]. Last accessed 12 December 2011 at www.pievc.ca/e
- Rea, K. J. (1968). *The Political Economy of the Canadian North: An Interpretation of the Course of Development in the Northwest Territories of Canada to the Early 1960s*. University of Toronto Press, Toronto.
- Reed, M. G. (2007). Uneven Environmental Management: A Canadian comparative political ecology. *Environment and Planning A* 39, 2 (February): 320-338.
- Resilience Alliance (RA) [on-line]. Last accessed 02 May 2011 at www.resalliance.org
- RA (2007). *Assessing and managing resilience in social-ecological systems: A practitioners workbook*. Volume 1, version 1.0. Available online [<http://www.resalliance.org/3871.php>].
- RA (2007). *Assessing resilience in social-ecological systems: A scientists workbook*. Available online [<http://www.resalliance.org/3871.php>].
- Richling, B. (1985). 'You'd Never Starve Here': Return Migration to Rural Newfoundland. *Canadian Review of Sociology and Anthropology*. 22:236-49.
- Riewe, R. and Oakes, J. eds. (2006). *Climate Change: Linking Traditional and Scientific Knowledge*. Aboriginal Issues Press, University of Manitoba.

- Rittel, H. and Webber, M. (1973). "Dilemmas in a General Theory of Planning." *Policy Sciences*, 4:155-169.
- Robbins, P. and Aydede, M. (2009). A Short Primer on Situated Cognition. In: *The Cambridge Handbook of Situated Cognition*. Cambridge University Press, New York, NY. p. 3-10.
- Robbins, P. and Kreuger, R. (2000). Beyond Bias? The Promise and Limits of Q Method in Human Geography. *Professional Geographer*, 52(4):636-648.
- Robertson, H. (1970). *Reservations are for Indians*. James Lorimer & Company, Toronto.
- Roots, F. (1989). Climate Change: high latitude regions. *Climate Change* 15:223-5.
- Ross, C. (2009?). Officer backup in small detachments: Flexibility the name of the game. Last accessed 13 July 2011 at <http://www.rcmp-grc.gc.ca/gazette/vol71n1/c-backup-renfort-eng.htm>
- Ruddiman, W.F. (2001). *Earth's Climate: Past and Future*. W.H. Freeman and Company, New York, NY. 465 pp.
- Sabin, P. (1995). "Voices from the Hydrocarbon Frontier: Canada's Mackenzie Valley Pipeline Inquiry (1974-1977)." *Environmental History Review* 19(1): 17-48.
- Saku, J. and Bone, R. (2000) Modern Treaties in Canada: The Case of Northern Quebec Agreements and the Inuvialuit Final Agreement. *Canadian Journal of Native Studies*, 20(2): 283-308.
- Salisbury, R.F. (1986). *A Homeland for the Cree: Regional Development in James Bay 1971-1981*. McGill-Queen's University Press, Montreal.
- Sandberg, L. Anders, and Joel Sloggett. "Geography in the Canadian North, c. 1945-1988," *Geografiska Annaler* 71B, 2 (1989), 125-134.
- Scheffer, M., and F. R. Westley. 2007. The evolutionary basis of rigidity: locks in cells, minds, and societies. *Ecology and Society* 12(2): 36 [on-line]. Last accessed 22 January 2012 at <http://www.ecologyandsociety.org/vol12/iss2/art36/>
- Scholz, R. W. and Tietje, O. (2002). *Embedded Case Study Methods: Integrating Quantitative and Qualitative Knowledge*. London: Sage Publications Inc.
- Scoones, I. (1999). New ecology and the social sciences: what prospects for a fruitful engagement? *Annual Review of Anthropology* 28:479-507.
- Schweitzer, P. et al., Eds. (2001) *Hunters and Gatherers in the Modern World: Conflict, Resistance, and Self-determination*.
- Scott, D. and Lemieux, C. (2005). Climate Change and Protected Area Policy and Planning in Canada. *The Forestry Chronicle* 81(5): 696-703.
- Scott, J.C. (2005). *Seeing Like A State: How Certain Schemes to Improve the Human Condition Have Failed*. Yale University Press, New Haven, CT.
- Serreze, M.C. et al. (2000). Observational Evidence of Recent Change in the Northern High-Latitude Environment. *Climate Change* 46:159-207.

- Shah, V.K. et al (1982). Performance of Sand-filled Tube Shore Protection, Tuktoyaktuk, Northwest Territories, Canada. Coastal Engineering, pp. 1901-1912.
- Shaw, J., Taylor, R.B., Forbes, D.L., Ruz, M.-H., and Solomon, S. (1998a). Sensitivity of the Coasts of Canada to Sea-level Rise. Geological Survey of Canada Bulletin 505. Ottawa.
- Shaw, J., Taylor, R.B., Solomon, S., Christian, H.A., and Forbes, D.L. (1998b). Potential Impacts of Global Sea-Level Rise on Canadian Coasts. The Canadian Geographer 42(4):365-379.
- Shea, G. M. (1999). Institutional child abuse in Canada: Civil cases [electronic resource]. Law Commission of Canada, Ottawa. Last accessed 13 May 2010 at http://epe.lac-bac.gc.ca/100/200/301/lcc-cdc/inst_child_abuse_civil-e/index4.html
- Shrader-Frechette, K. S. (2002). Environmental justice [electronic resource] : creating equality, reclaiming democracy. Oxford ; New York : Oxford University Press, 269 p. Internet access <http://qe2a-proxy.mun.ca/login?url=http://site.ebrary.com.qe2a-proxy.mun.ca/lib/memorial/Doc?id=10142422>
- Siku News (2010). "Booze means more work for Nunavut's police: RCMP in places like Gjoa Haven need more permanent members, they say" 23 June 2010. Available on-line at <http://www.sikunews.com/News/Canada-Nunavut/Booze-means-more-work-for-Nunavut%27s-police-7726>
- Siku News (2010). "TB boom year in Nunavut: The territory's rate is 60 times the national Canadian average", 10 December 2010. Available on-line at <http://www.sikunews.com/News/Canada-Nunavut/TB-boom-year-in-Nunavut-8326>
- Smith, J.B., Klein, R.J.T., Huq, S., eds. (2003). Climate Change, Adaptive Capacity and Development. Imperial College Press, London, U.K., 347 pp.
- Smith, J.B., M. Hulme, J. Jaagus, S. Keavallik, A. Mekonnen and K. Hailemariam (1998). Climate Change Scenarios. In: J.F. Feenstra, I. Burton, J. Smith and R.S.J.Tol (eds.). Handbook on Methods for Climate Change Impact Assessment and Adaptation Strategies, Version 2.0. United Nations Environment Programme and Institute for Environmental Studies, Vrije Universiteit, Amsterdam, pp. 3-1 - 3-40.
- Smith, J.S., Bell, T. and Rankin, L. (2003). Quaternary Geology and Landscape Change, Porcupine Strand, Labrador. Current Research, Newfoundland Department of Mines and Energy, Geological Survey, Report 03-1: 293-305.
- Smith, M.W., Henry, K., Riseborough, D.W. (current). Impact of Climate Change on Permafrost in Canada. On-line at <http://http-server.carleton.ca/~msmith2/default.htm>, Carleton University, Ottawa.
- Smith, S.L. and Burgess, M.M. (2000a). Ground temperature database for northern Canada; Geological Survey of Canada Open File Report 3954.
- Smith, S.L. and Burgess, M.M. (2000b). The Sensitivity of Canadian Permafrost to Climate Warming; Geological Survey of Canada (Poster). Available online at <http://gsc.nrcan.gc.ca/permafrost/pdf/wkshpsensitivityposter2.pdf>
- Smith, S.L. and Burgess, M.M. (2002) Permafrost thickness database for northern Canada Geological Survey of Canada Open File Report 4173.
- Solomon, S.M. (2002). Tuktoyaktuk Erosion Risk Assessment Report. Geological Survey of Canada, Natural Resources Canada.

Solomon, S.M. (2005). Spatial and Temporal Variability of Shoreline Change in the Beaufort-Mackenzie Region, Northwest Territories, Canada. *Geo-Marine Letters* 25 (2-3): 127-137.

Sou, T. and Flato, G. (2009). Sea Ice in the Canadian Arctic Archipelago: Modeling the Past (1950–2004) and the Future (2041–60). *Journal of Climate*, 22(8): 2181–2198.

Soules, M. (2007) Edmund Carpenter (Became What He Beheld). Last accessed 08 Feb 2008 at www.media-studies.ca/articles/carpentr.htm

Statistics Canada (2006). Community Profiles, 2006 Census. Accessed 11 June 2007 at <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm>.

Statistics Canada (2007). Gjoa Haven, Nunavut (Code6208081) (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Released March 13, 2007. <http://www12.statcan.ca/census-recensement/2006/dp-pd/prof/92-591/index.cfm?Lang=E> (accessed May 16, 2011).

Statistics Canada (2007). Sachs Harbour, Northwest Territories (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Released March 13, 2007. Last accessed March 28, 2007 at <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Stefansson, V. (1921). The Canadian Arctic Expedition of 1913 to 1918. *The Geographical Journal* 58(4):283-305.

Steward, J.H. (1955) *Theory of Culture Change: The Methodology of Multilinear Evolution*. University of Illinois Press, Urbana, IL.

Stott, L. et al. (2002). Super ENSO and Global Climate Oscillations at Millennial Time Scales. *Science* 297: 222-226.

Such, P. (1978) *Vanished Peoples: The Archaic Dorset & Beothuk People of Newfoundland*. NC Press Limited, Toronto.

Sugden, D. (1982). *Arctic and Antarctic: a modern geographical synthesis*. Basil Blackwell, Oxford.

Susman, P., O'Keefe, P. and Wisner, B. (1983). Global disasters, a radical interpretation. In *Interpretations of Calamity from the Viewpoint of Human Ecology*, K. Hewitt, ed., pp. 279-80. Allen & Unwin, Winchester, MA

Takahashi, T. et al. (1997). Global air-sea flux of CO₂: An estimate based on measurements of sea-air pCO₂ difference. *Proc. Natl. Acad. Sci. USA* 94:8292-8299.

Tanner, A. (1979) *Bringing Home Animals: Religious Ideology and Mode of Production of the Mistassini Cree Hunters*. *Social and Economic Studies* No. 23. ISER, St. John's, NL

Teal, J.J. (1948) *Alaska: Fulcrum of Power*. Foreign Affairs

Teal, J.J. (1952). *Greenland and the World Around*. Foreign Affairs

Tester, F.J. and Irniq, P. (2008). Inuit Qaujimagatuqangit: Social History, Politics and the Practise of Resistance. *Arctic* 61(5):48-61.

Thorpe, N., Hakongak, N., Eyegetok, S., and the Kitikmeot Elders (2001). *Thunder on the Tundra: Inuit Qaujimajatuqangit of the Bathurst Caribou*. Vancouver, British Columbia: Generation Printing.

Thorpe, N., Eyegetok, S., Hakongak, N., and the Kitikmeot Elders. (2002). *Nowadays it is Not the Same: Inuit Qaujimajatuqangit, Climate and Caribou in the Kitikmeot Region of Nunavut, Canada*. In: I. Krupnik and D. Jolly, eds. *The Earth is Faster Now: Indigenous Observations of Arctic Environmental Change*. Fairbanks, Alaska: Arctic Research Consortium of the United States, 198-239.

Transportation Safety Board of Canada (1991). *Aviation Occurrence Report Number A89W0232: Aklak Air Ltd., Sachs Harbour Airport, 22 September 1989*. Ottawa, Canada.

Trillium Engineering and Hydrographics Inc. (1997). *Tuktoyaktuk Erosion Control using Monolithic Concrete Slabs*. Prepared for the Hamlet of Tuktoyaktuk, Edmonton, Alberta.

Troadee, J-P. (2000). *Adaptation Opportunities to Climate Variability and Change in the Exploitation and Utilization of Marine Living Resources*. *Environmental Monitoring and Assessment* 61: 101-112.

Tuan, Y-F. (1974). *Topophilia: A Study of Environmental Perception, Attitudes, and Values*. Prentice-Hall Inc., New Jersey.

Tungavik Federation of Nunavut (1990) *Our Land, Our Future: Questions and Answers about the Nunavut Land Claim Agreement-in-Principle*. Ottawa, Ontario, 49 pp.

UMA Engineering Ltd. (2001). *Hamlet of Tuktoyaktuk Zoning By-Law No. 258 Schedule B (Poster format)*. Available at http://www.maca.gov.nt.ca/lands/community_planning/Tuktoyaktuk/Tuktoyaktuk_Zoning_Map_Schedule_B.pdf

UMA Engineering Ltd. (2001). *Tuktoyaktuk Community Plan*. (Poster format). Available at http://www.maca.gov.nt.ca/lands/community_planning/Tuktoyaktuk/Tuktoyaktuk_Community_Plan.pdf

U.S. Environmental Protection Agency (EPA). *ReVA Overview, Regional Vulnerability Assessment (ReVA) Program* [on-line]. Last accessed 12 December 2011 at www.epa.gov/rev/a/overview.html

Usher, P. J. (1976). *Inuit Land Use in the Western Canadian Arctic*. In *Inuit Land Use and Occupancy Project, Volume 1: Land*. Prepared by Milton Freeman Research Limited for Department of Indian and Northern Affairs, Ottawa.

Usher, P. J. (1981). *Staple Production and Ideology in Northern Canada*. In *Culture, Communication and Dependency: The tradition of H.A. Innis*. Wililam H. Melody, Liora R. Salter, Paul Heyer, eds. 177-186. Norwood, N.J.: Ablex Publishing.

Usher, P. (1981). "Subsistence or Recreation? The Future of Native Wildlife Harvesting in Northern Canada". In *Proceedings of the First International Symposium on Renewable Resources and the Economy of the North*. M. Freeman (ed.). Ottawa. Association of Canadian Universities for Northern Studies and Canada and Man Biosphere Programme.

Vancouver International Strategic Services Ltd.(1998). *NWT Runway Issues Study*. Available on-line at http://www.dot.gov.nt.ca/_live/documents/content/RunwayIssues_fullreport.pdf

Vandenbergh, J. (2001). *A typology of Pleistocene cold-based rivers*. *Quaternary International* 79:111-121.

Vincent, J-S. (1982). The Quaternary History of Banks Island, N.W.T., Canada. *Geographie Physique et Quaternaire* 36(1-2):209-232.

Waldman, C. (1985) *Atlas of the North American Indian*. Facts on File Publications, New York, NY.

Washburn, S.L. (1968). The Central Eskimo: a marginal case? In *Man the Hunter*, R.B. Lee and I. DeVore, eds. Chicago, Aldine Publishing Co. <http://www.jstor.org/stable/3316936?seq=14>

Watkins, M., ed. (1977) *Dene Nation: The Colony Within*. University of Toronto Press, Toronto.

Wavell, S. (1999). "*This Land is Our Land*". *Sunday Times Magazine*, 28 March 1999. Last accessed 19 June 2011 at <http://www.stuartwavell.com/page6.htm>

Weiss, C., Cillis, P. and Rothwell, N. (2008). *The Population Ecumene of Canada: Exploring the Past and Present*. Geography Working Paper Series, Statistics Canada Catalogue no. 92F0138M. Ottawa.

Whitridge, P. (1999). *The Construction of Social Difference in a Prehistoric Inuit Whaling Community*. Ph.D. Dissertation, Department of Anthropology, Arizona State University, Tempe.

Whittles, M. (2005). Economic Development as if Culture Matters: Inuvialuit Wild Game Harvesting, Community-Based Economic Development, and Cultural Maintenance in the Western Arctic. *Journal of Aboriginal Economic Development* 4(2):129-140.

Winter, K. (2010). *An Arctic Accident*. MacLeans.ca. Available on-line at <http://www2.macleans.ca/2010/09/16/an-arctic-accident/>

White, G. (1945). *Human Adjustment to Floods*. University of Chicago, Department of Geography Research Paper No. 29, Chicago, IL. 225 pp. Last accessed 12 August 2011 at www.colorado.edu/hazards/gfw/images/Human_Adj_Floods.pdf

World Commission on Environment and Development (1987). *Our Common Future* (a.k.a. "The Brundtland Report"). Oxford: Oxford University Press. Last accessed 21 July 2011 at <http://www.un-documents.net/wced-ocf.htm>

World Wildlife Fund (WWF) (2006). "Inuit sound the alarm in Ottawa over escalating Arctic climate crisis". Ottawa, Ontario. Last accessed 18 August 2011 at <http://wwf.ca/newsroom/?1293>

Zaslow, M. (1988). *The Northward Expansion of Canada, 1914-1967*. Toronto: McClelland & Stewart.

Zhang, X., Vincent, L.A., Hogg, W.G. and Niitsoo, A. (2000). Temperature and precipitation trends in Canada during the 20th Century. *Atmosphere Ocean*, 38(3): 395-429.

Various authors (2009). Special edition on Northern Canadian climate impacts and implications. *AMBIO* 38(5):245-292.

2.0 Statement of Ethical Issues and Proposed Responses

2.1 Project Benefits

The primary benefit of the proposed research will be the discussion and decision-making processes that I will be facilitating respecting the climate change-related adaptations the participants believe the community as a whole will need to undertake. This process and its outcomes will be documented in a plan acceptable and accessible to the involved community at-large.

The increased awareness and understanding that participants will gain respecting ongoing scientific activities and findings respecting local climate change impacts will be an important secondary benefit of this project. The knowledge they hold will in turn support their communities' forthcoming adaptations.

The Inuvialuit recognize indigenous scholarship as a means to give their communities a greater voice in many domains. A further benefit of this project will arise from the effort I will make to involve Inuvialuit youth in my research: youth participation in the planning exercises will be sought and efforts will also be made to recruit a local student research assistant to help me during my stays in each of the communities.

2.2 Potential Harms/Issues and Proposed Actions

The following table summarizes the potential research-related issues that have been identified along with the means by which I propose to address them during the project. I am not aware of any other physical, psychological, economic or social risks to participants or the community at-large that may arise from this project.

Potential Harms/Issues	Proposed Actions
<p>Sensitive Traditional Knowledge</p> <p>Care must be taken to ensure that the research conducted will not result in the unintentional release to the public domain of sensitive traditional knowledge. In particular, information respecting traditional land uses must remain in the control of the community.</p> <p>As a community-based exercise, the research proposed will take place in a substantially public context where extremely sensitive information is unlikely to be raised in any detail. The researcher, however, will also be conducting some individual and small group interviews during the course of the project which may yield more potentially sensitive information.</p>	<p>Throughout the project, documented information will be reviewed by designated "community editors" (including HTC representatives) and any affected participants to ensure that it is complete, accurate and to determine the level of distribution it shall receive (i.e. suitable for the general public vs. restricted to persons authorized by the Inuvialuit).</p> <p>Dissertation contents will exist in the public domain. Again, the community editors will assist the researcher in reviewing the document. Sensitive material that cannot be masked or otherwise disassociated will not be included in the dissertation.</p>

Potential Harms/Issues and Proposed Actions cont'd

Potential Harms/Issues	Proposed Actions
<p>Participant Recruitment</p> <p>The participatory planning process proposed will be “open” to all residents of the community it takes place in. The researcher intends to pursue a variety of consultation means, including public meetings and information sessions, in order to solicit and accommodate as many potential participants as possible. Often though, regardless of efforts made to engage many people in a given community in a planning project, there will only be a small number of actual participants. This small group may or may not be representative of the community at-large. Biased, inaccurate and mistaken outcomes may arise if care is not taken to appropriately recruit research participants.</p> <p>In particular, the researcher will seek to balance the input obtained throughout the project from:</p> <ul style="list-style-type: none"> • men and women; • older and younger participants; and, • persons of various categories of livelihood. 	<p>Some project participants will be actively recruited at the outset of the project by the researcher. They will include:</p> <ul style="list-style-type: none"> • Organizational representatives and/or staff – key individuals from organizations with a defined interest in the project outcomes. These would include the Hamlet Councils, the local Hunters and Trappers Committees (HTC), GNWT Planning/Engineering staff, and others to be identified in consultation with the aforementioned. • Individuals with stated expertise and knowledge (Elders, retired organizational staff, others with recognized expertise as may be determined in consultation with the community) • Other individuals with express interest (youth, other community residents not otherwise recruited).

<p>Cultural/Linguistic Issues</p> <p>Biased, inaccurate and mistaken outcomes may also arise if cultural differences are not planned for. English is the mother tongue of the researcher and the language in which all research activities will be pursued. Some Inuvialuit participants may not speak or understand English well enough to participate in the research without supporting translation.</p>	<p>In consultation with the local HTC and Hamlet Councils, individuals participating in the research who are not comfortable in English will be identified early in the project. Arrangements will then be made to ensure that translation of information (by other bilingual participants in keeping with mutually supportive Inuvialuit cultural practise) is made available to those persons at whatever meetings they may choose to join.</p>
<p>Free and informed Consent</p> <p>The public nature of this project requires the researcher to work with established community organizations and leadership. In a sense, in that much of the information that will be addressed already exists in the public domain, these community leaders will in many instances be consenting on behalf of their community at-large. Nonetheless, all individual participants must have the opportunity to know how the information they may provide will be used, secured and how they may choose to limit the record of any proceedings to ensure sensitive personally identifying content is not publicly released.</p>	<p>Interviewees and meeting participant candidates will be chosen as indicated above, and approached either by email, telephone, through a local intermediary (i.e. the HTC) or in person. All participants in the research project – those involved in group exercises and those interviewed individually – will be asked to read an information sheet concerning the project. Where deemed necessary or desirable by the HTC and/or Hamlet Council, they might also be asked to then sign a consent form (working drafts of these documents are included with this application). The use of individual consent forms would likely be limited to one-on-one or small group interviews or discussions where sensitive matters are expected to arise. Some Individuals who are directly quoted would also be asked to complete a consent form.</p>

Potential Harms/Issues and Proposed Actions cont'd

Potential Harms/Issues	Proposed Actions
<p>Privacy and Confidentiality</p> <p>The research required for the community profiles will involve information already documented in the public domain (i.e. legal and institutional governance structures and processes) or by other researchers (i.e. coastal survey findings), or readily surveyed by the researcher “on the ground” (i.e. current</p>	<p>Under those rare circumstances determined to require participant anonymity, individuals will be identified in all final research documents only by an assigned number (i.e. “Informant 5”). Where consent is granted to do so, contextually useful descriptive information respecting the individual’s livelihood and relationship to the community will also be included (i.e. “hunter, trapper and community</p>

<p>community infrastructure). Interviews used to supplement the documentation may occur with current or former government officials and other stakeholders with detailed knowledge of community in question.</p> <p>The interviews and planning meetings will not be taped. Instead, the researcher will keep written notes that will be transcribed for review in a subsequent meeting and/or by community editors.</p> <p>As noted above, there will be ongoing communications with the local HTC and Hamlet Council to ensure that while participation in the project is encouraged by keeping the process open, accessible and relatively informal, there are also measures taken as required to preserve confidential information and assure participant anonymity.</p>	<p>elder”).</p> <p>All general research records will be secured in the researcher’s office at Memorial University during the research and dissertation writing periods. Efforts will be made to ensure a similar level of security for materials as they are being compiled during the “field” or community research phases of the project.</p> <p>Any sensitive contents identified by either the informant or the community advisors (as discussed above), will be separated from the general research materials and additionally secured (i.e. in a locked file cabinet) when not in use.</p> <p>During the project, arrangements will be made with local and regional organizations and officials respecting the ultimate, post-project storage location of various research materials. It is expected that most individual interview materials and all sensitive records will be archived by the Inuvialuit Joint Secretariat. Researcher notes and other documentation respecting the planning process will generally be used to compile “minutes” or similar records that will be reviewed and edited as required in consultation with participants. The final versions of these records will constitute the official documentation of events in the planning process and will likely be reproduced so that copies would be held by the Inuvialuit archives, the files of key local organizations (the Hamlet Offices and HTCs) and any other interested government bodies (i.e. MACA). Any materials not archived will be destroyed upon completion of the project.</p>
--	---

Appendices

- *Project Information Hand-out*
- *Participant Consent Form**
- *Sample Lines of Questioning*

* *For use in circumstances where recommended by local HTC, Hamlet officials, or when handling sensitive information. It is not thought to be appropriate or constructive to expect every participant in the process to complete a consent form.*

Memorial University of Newfoundland

*Consent to Take Part in Research***Project Information Hand-out**

TITLE: *Climate Change and Coastal Community Adaptation in the Canadian High Arctic*

INVESTIGATOR: Kathleen Parewick

SPONSOR: ArcticNet

You have been invited to take part in a research project. It is up to you to decide whether to be in the project or not. Before you decide, you need to understand what the research project entails, what role you would play in it and what benefits you might receive. This consent form explains the project.

The researcher will:

- discuss the project with you
- answer your questions
- keep confidential any information which you may believe to be sensitive
- be available during the project to deal with problems and answer questions

You may decide not to take part in or to leave the project at any time.

1. Introduction/Background:

Arctic communities are experiencing dramatic climate change. Along the coasts of the region, rising sea levels, increased wave action and permafrost melting are causing the land to erode faster and flood in places where it hasn't in the past. The weather isn't as predictable as it once was. A lot of things are changing. Animals are being affected. Transportation is being affected. Traditional practises are being affected. Community infrastructure is being affected.

This project is looking at how your community intends to address the changes it is seeing and may experience in the future. There are a lot of things to think about and people will need to work together to solve problems and to take advantage of any opportunities that the changes may present.

2. Purpose and benefits of research project:

The purpose of this research is to examine available information concerning local climate change impacts and to determine what the community's best course of action is in order to address ongoing and predicted changes.

The research will be undertaken in partnership with the people of [*insert name of Community*]. Community consultation participants will examine available scientific information and traditional

knowledge concerning the impacts that the community is experiencing associated with climate changes in this region (i.e. coastal erosion, flooding, less ice, etc.).

During the community consultation period, as individuals and groups, people participating in this project will be asked to consider how *[insert name of Community]* needs to adapt to these changes. The ideas raised will be discussed in some detail and further researched in coming months in order to develop a plan document that will record the community's preferred approach to dealing with local climate impacts. The researcher will work in partnership with the community to arrange, record and otherwise facilitate the discussion, research, documentation, writing, editing and other communications associated with this planning process.

In the end, this project will give *[insert name of Community]* a plan describing the manner in which the community wishes to tackle local climate change impacts. The planning process will provide the community with detailed information respecting the changes that are occurring and that may be expected to occur in the future. Participants in the consultations may learn things that will help them make decisions about their own affairs, but in general, it is hoped that this project will help the community as a whole by raising everyone's awareness and understanding of local climate change issues.

3. Description of the research exercises:

Kathleen will be working in *[name of community]* from *[date]* to *[date]*. During this period, her office will be in *[location]*. In consultation with the HTC, she will be setting up a series of meetings – with individuals, small groups of people and sessions open to everyone in the community. Some meetings will be short (1/2 – 1 hour). Other sessions may stretch (with breaks) over a couple of days. No participant is expected to attend all meetings but Kathleen will be trying to find good times to meet in order to have as many participants as possible involved in this project.

A meeting with Kathleen may proceed as one of:

- An interview;
- A general presentation and discussion;
- A guided discussion on a particular topic;
- An interactive ideas-generating session involving some guided group activities;
- A working session involving problem-solving and decision-making;
- A combination of any of the above.

When not otherwise involved in planned meetings or presentations, Kathleen will also be available to meet informally with anyone interested in her project. You can contact her through the office (Telephone xxxxxxx) *[or by...]*

4. Confidentiality and Anonymity:

Any information which you provide concerning climate changes and proposed adaptations will be incorporated into the researcher's final reports only with your consent. No personal information will be used and no persons will be identified without their consent.

5. Questions:

If you have any questions about taking part in this study, you can meet with the researcher (contact information supplied above) or her supervisor, Dr. Norm Catto at Memorial University, via telephone (709) 737-8413, fax 737-3119, or e-mail at ncatto@mun.ca.

Or you can talk to someone who is not involved with the project at all, but who can advise you on your rights as a participant in a research study. Following the required procedure instituted by Memorial University, this project has been reviewed by the Interdisciplinary Committee on Ethics in Human Research (ICEHR), and will thereby follow the guidelines set by the ICEHR. You may contact the ICEHR directly at 709-737-8368.

Project Consent Form

Project title: *Climate Change and Coastal Community Adaptation in the Canadian High Arctic*

Investigator: Kathleen Parewick

To be filled out and signed by the participant:

Participant

Name: _____

Your occupation(s) (i.e. hunter, trapper, mother, craftsperson...): _____

I have read the project information and/or have had it explained to my satisfaction. I am prepared to participate in Kathleen's community planning project. I understand that I may choose to withdraw from the project at any time and that I may ask for anonymity in respect of some or all of the information I may choose to contribute to the process.

Signature of participant

Date

Assent of minor participant (if appropriate):

Signature of minor participant

Date

Relationship to participant named above

Age

Sample lines of questioning

It is not possible to describe the exact form and format the proposed participatory planning consultations will take, nor do I wish to pre-judge their direction. As a facilitator for the process however, I am formulating a variety of questions that may serve as logical discussion-starters at each stage of the process. The following sampling of questions will suggest the scope and character of the information being sought.

Preliminary community visits

Objectives: To obtain general project approval of community leaders, Hamlet staff and other interested parties; to discuss and obtain direction vis-a-vis research/consultation approach; to assess local climate-change awareness and topics of greatest local concern; and, to begin handling consultation logistics.

- What changes are occurring locally? What are some of the most significant changes you've observed to date?
- Have you been doing things differently in order to adjust to the physical/climate changes experienced? Are you anticipating further changes?
- Have there been any physical changes made to date? Buildings or other infrastructure moved, redesigned or replaced?
- Are there community projects that (have been/may be/will be) affected by the changes you're experiencing?
- How aware of local climate changes and related effects is the community at-large? Are there things that more people need to be aware of?
- How familiar is the population with ongoing scientific activities in the area? How would you like to see the findings of local climate change research put to use in your community?
- Who would you like to see involved?

Adaptation Planning Exercises/Consultations

Objectives: To identify and achieve consensus on what constitute the most significant local climate change impacts (both observed to date and predicted); to carefully consider the implications (physical, social, economic...) for the community on short, medium and long terms; and to identify and achieve consensus on what constitute appropriate responses/adaptations.

The exact line of questioning will be developed in consultation with community members engaged in preliminary community visits. General subject areas will however include:

- Physical changes already observed in the land and sea in the area;
- Animal life, vegetation and harvesting pattern changes;
- Predicted extent of changes to come (and the limits of those predictions);
- Impacts on local infrastructure;
- Impacts on local livelihoods/economy;
- Impacts on health, welfare and community fabric;
- Individual versus collective responses/adjustments;
- Governance mechanisms and other means that may be used to address issues; and,
- Gaps in local information and awareness.



