INDEPENDENT ASSESSMENT OF SATELLITE CHANNEL ECOLOGICAL RESERVE #67: WITH RESPECT TO THE GSX PIPELINE

FINAL REPORT

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1.0 INTRODUCTION

1.1 Background

Satellite Channel Ecological Reserve #67 (ER67), located between Saltspring Island and Saanich Peninsula, was designated in 1975 to conserve rich benthic communities typical of fine-grained, level-bottom environments in the southern Gulf Islands (Figure 1). Under the *Ecological Reserve Act*, industrial uses are prohibited in ecological reserves (ER) to protect the environmental values associated with these special areas for future generations.

Georgia Strait Crossing Pipeline Ltd. (GSXPL) evaluated[1] thirteen pipeline routes[2] near ER67 and Vancouver Island (Aker Maritime 2000). The evaluation concluded that the routes going through the reserve were preferable, followed by routes which minimally encroach on the reserve, followed by routes which avoid the reserve. However, in recognition of the *Ecological Reserve Act*, the application submitted by GSXPL to the National Energy Board (NEB) in April 2001 proposed that the pipeline be routed north of ER67 in the steep foreshore between the ER and Saltspring Island (Georgia Strait Crossing Pipeline Ltd. 2001a). A subsequent environmental assessment of the routes for GSXPL concluded that slightly less ecological disturbance and habitat modification would occur if the pipeline were routed through the more level areas of the ER (TERA Environmental Consultants Ltd. 2000a). As a result, and taking into account the results of the pipeline routing evaluation, the proponent approached BC Parks to explore the possibilities of routing the pipeline through ER67.

BC Parks cannot permit this alternative route through the ecological reserve, as it is contrary to the *Ecological Reserve Act*. This alternative route would require a change in ER67 boundaries via an act of the Legislature. BC Parks therefore sought direction from the Minister. The Minister concurred that it was necessary to conduct a more detailed evaluation of the site and environmental implications of the proposed options on the long-term well being of the reserve. The information from this detailed evaluation will assist the Minister in developing a provincial position on this issue.

For the remainder of the report the term 'proposed route' refers to the route north of ER67 that was assessed as part of the GSXPL application to the NEB, while the term 'alternative route' refers to the optional route through ER67 that GSXPL is asking the Ministry to consider.

1.2 Objectives and Principles

The goal of this project is to identify the inherent values of ER67 and surrounding area to ensure the protection or enhancement of the key values and purposes for which the reserve was created, and to determine the likely consequences and mitigation measures required for the proposed and alternate pipeline routes through and around the ER. Specifically, the project objectives are:

[1] The routes were evaluated based on: potential anchor damage; constructability; bathymetry; shore crossing site and relative cost difference.

[2] Five routes avoided ER67, four routes minimally encroached ER67 by cutting across the northeast corner, and four routes crossed through ER67.

1. To identify the values, purposes and role that Satellite Channel Ecological Reserve contributes to the BC protected areas system.
2. To identify and review existing data within the marine and seabed portion of the study area as it relates to both proposed routes (*i.e.*, through the ER and to the north of the ER boundary).
3. To determine whether a full range of possible options to avoid the protected area has been considered.
4. To identify the impacts on the biophysical, human use and First Nations' values of the two proposed routes.
5. To identify options and implications based on the principles (see below) under which this independent technical assessment is to be undertaken, with an emphasis on mitigation and no-net-loss options.
6. To deliver a full set of options and implications for the Minister to consider in the development of a provincial position on this issue.

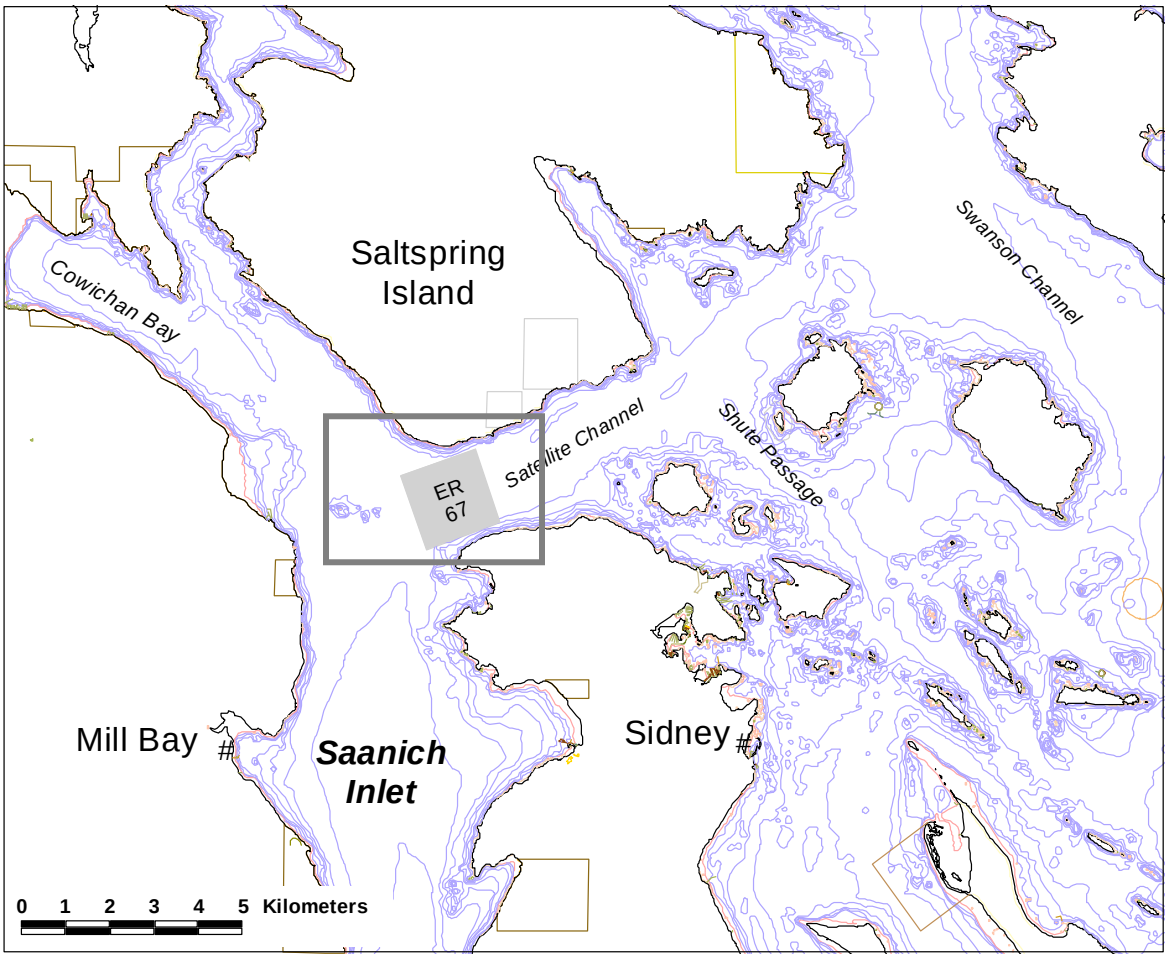


Figure 1. Satellite Channel Ecological Reserve Study Area

The study is guided by the following principles:

1. The long-term protection of protected areas in BC and the integrity of their associated ecological, recreational and cultural values remain paramount.
2. Given the legislative protection afforded protected areas, there will be few circumstances where boundary modifications will be considered. Therefore, all development proponents will be advised to avoid protected areas.
3. In exceptional circumstances there may be overarching public interest reasons to consider proposals to modify protected area boundaries. Evaluation of all such proposals must adhere to the following requirements:
   - demonstration of compelling provincial social and environmental benefit that exceeds preserving the integrity of the existing boundary;
   - demonstration that the full range of possible options to avoid the protected area have been considered and exhausted;
   - demonstration that the development proposal and mitigation measures will have the least possible impact on protected area integrity and attributes; and
   - identification of compensation measures that would result in no-net-loss to the protected area values.
4. The process for evaluating proposals that could lead to recommendations to modify protected area boundaries will only be advanced after public consultation is conducted by a neutral party. This process will be applied consistently and may require:
   - comprehensive proponent-funded studies and technical evaluation as required;
   - appropriate open and thorough proponent-funded public and First Nations consultation; and
   - adequate time to undertake evaluation and consultation.

1.3 Study Approach

An independent assessment, guided by existing available information and public input, was conducted by AXYS Environmental Consulting Ltd, in association with Coastal & Ocean Resources Inc. and CEF Consultants. The objective of the public input was to ensure that all available technical information is considered and to receive input on the range of values, implications and mitigation options of the pipeline routes. A list of provincial, federal and First Nations governments, and stakeholders including NGOs, academia, government and recreation and commercial fishing organisations contacted during the course of the project is presented in APPENDIX A. Subsequent to compiling the information and conducting preliminary assessment, a workshop was held on Monday, 11 March 2002 in Victoria, to review and comment on the data and exchange additional information on biophysical, human use and First Nations values associated with the pipeline routes. A summary of the workshop discussions is presented in APPENDIX B. It was noted in the workshop that the timeframe for First Nations and public input including a one-day workshop was insufficient in length and breadth to fully consult with affected parties and the general public. Further, workshop participants did not feel they had sufficient time to comprehensively review the various background reports (which were made available) and to adequately assess the implications of the alternative route on the ecological reserve, First Nations values or human use.

2.0 SATELLITE CHANNEL ECOLOGICAL RESERVE

2.1 Role of Satellite Channel Ecological Reserve #67

The Satellite Channel Ecological Reserve comprises 343 ha of seafloor habitats. Most of the width of Satellite Channel is included in the ER, which measures one square nautical mile. The northern boundary comes within 200 m of the Saltspring Island shoreline at Cape Keppel. The southern edge comes within 200 m of Saanich Peninsula on the north side of Moses Point.

The Satellite Channel Ecological Reserve was established in 1975, although recognition of the marine values of this area preceded establishment of the reserve by many years. Satellite Channel was the subject of a multi-year research project by University of Victoria biologists beginning in the mid 1960s. Largely as a result of this research, it was determined that a representative area of the seafloor of Satellite Channel should be given protected status to conserve its benthic communities and to provide a benchmark for future research. As a relatively unpolluted and undisturbed inlet, the site was chosen as a potential reference area for long-term studies of polluted inlets. Upon establishment, the stated purpose of the Satellite Channel Ecological Reserve was:

"to conserve rich benthic communities typical of fine-grained, level-bottom environments in the southern Gulf of Georgia" (BC Parks 1987).

Most of the reserve is relatively level at a depth of 55 to 80 m (Figure 2 and Figure 3). The shallowest areas, about 18 m, are found at the reserve's southwest corner. The fine-grained bottom sediments generally consist of 62% sand, 24% silt and 14% clay. The reserve is characterised by a high diversity and biomass of benthic fauna, as well as several species of ecological significance. At the time of establishment, 67 marine species had been identified. Of these species, bivalve and gastropod molluscs, errant and sedentary polychaetes and echinoderms were found to be particularly diverse. A summary of the reserve's geophysical and biological values is presented in Sections 2.2 and 2.3.

It should be emphasised that the ecological reserve designation applies only to the seafloor and not the water column above. Human uses of the surface and water column, including First Nations traditional uses, commercial fisheries, marine navigation and recreation, are managed and regulated under the jurisdiction of agencies other than BC Parks. For the most part, these uses occur incidentally, and with the exception of some types of commercial fishing, are not influenced by the presence of the subtidal reserve. A summary of human use is provided in Sections 2.4 and 2.5.

The Satellite Channel Ecological Reserve was at the time of establishment, and remains today, the only completely subtidal ecological reserve in British Columbia. The reserve provides representation of benthic habitats and species that are typical of level, soft-bottom seafloor environments. Several years of research data, which are tied to defined sampling sites, provide a basis for monitoring changes in the reserve over time and comparing conditions inside the reserve with those of the surrounding marine environment. Together, these qualities define the role of the Satellite Channel Ecological Reserve in the provincial protected areas system.

Figure 2. Satellite Channel Bathymetry

Figure 3. 3D Perspective Looking West along Satellite Channel

2.2 Geophysical Characteristics

Sediment and Morphology

ER67 and the surrounding area are part of an inter-island channel complex that includes Satellite Channel, Swanson Passage and Shute Passage in the southern Gulf Islands of British Columbia (see Figure 1). The site is thought to be typical of moderate depth channel complexes throughout the Gulf Islands. Previously published sediment maps show a flat plain of sandy mud sediments through Satellite Channel and extending to Swanson Channel to the North of Moresby Island (Dunhill and Ellis 1969). Features that distinguish ER67 include: a relatively flat seabed of sandy mud, moderate current velocities that promote flushing and productivity on the seabed and steep side-wall slopes of coarser sediment and bedrock. Considerable high resolution geophysical information has been collected as part of the GSX project, and the data types are summarised in Table 1.

Table 1. Summary of Geophysical Data Used in Ecological Assessment

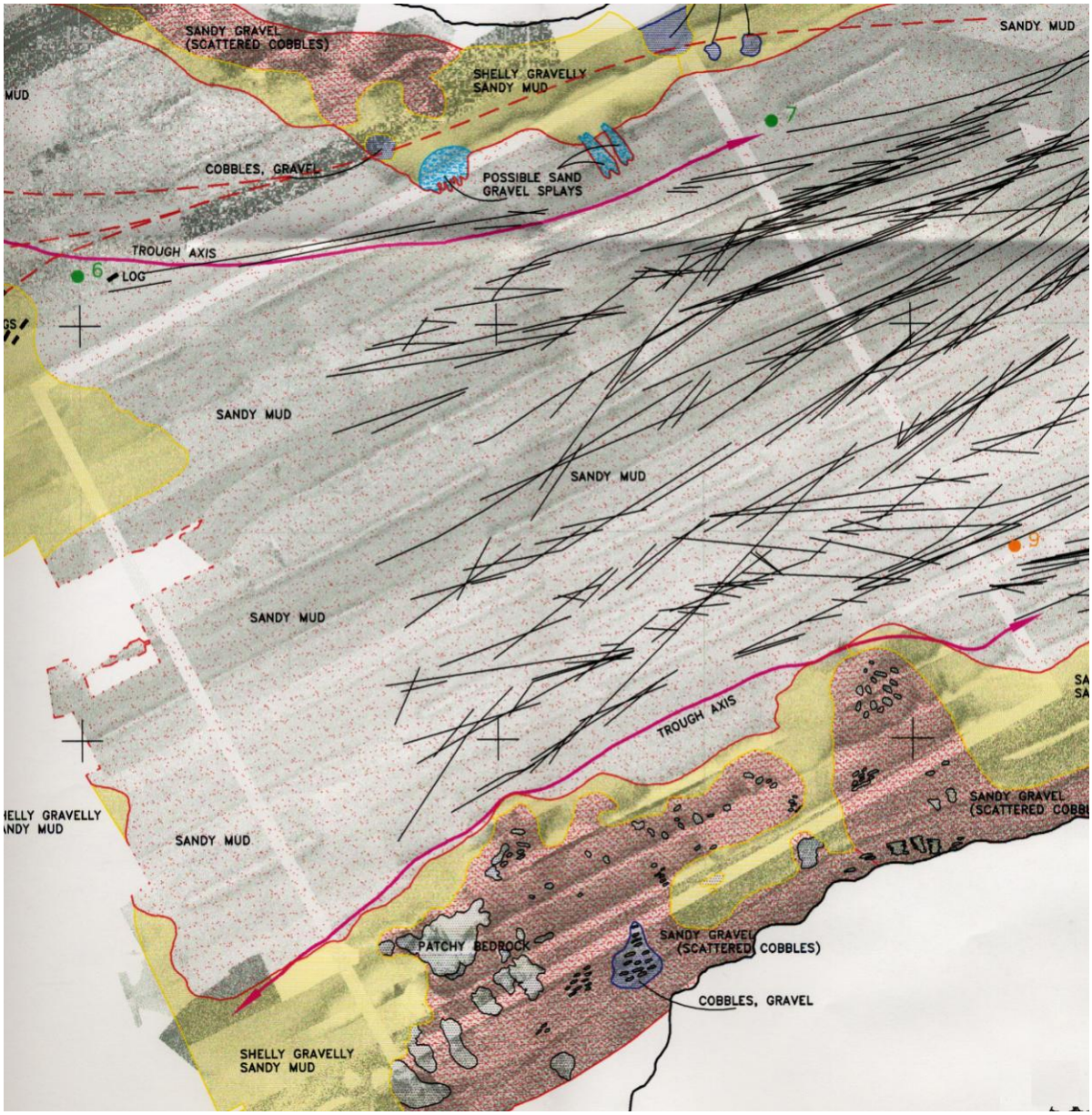
Feature	Data Type	Reference
bathymetry	multibeam hydrographic surveys	Terra Remote Sensing 2000
seabed morphology and sediment	side-scan sonar imagery	Terra Remote Sensing 2000
sub-bottom sediment thickness	high-resolution seismic profiling	Terra Remote Sensing 2000
sediment type and seabed macro-biota	ROV and towed video imagery	Terra Remote Sensing 2000 Archipelago Marine Research 2001
subsurface sediments	seabed cores	Jaques Whitford Associates 2001a
surficial sediment grain size	infaunal grab samples	Burd and Glaholt. 2000

ER67 and its surrounds can be most conveniently sub-divided into three general morphological units:

Channel Flat – this flat has very low relief with the most prominent features consisting of small hummocks created by burrowing predators (*e.g.*, sunstars, crabs) and numerous seabed striations, which appear to be the result of bottom trawling (Terra Remote Sensing 2000). The trawl marks were very prominent on the side-scan sonar imagery (Figure 4), but were generally not visible in the ROV imagery from the area. Only one subtle scour mark was observed and this striation appeared as a low linear ridge, <5 cm in height and <10 cm in width (Figure 5). This unit comprises more than 80% of the ER67 seabed. Sediments are muddy sands and appear to be at least 5 m in thickness. Grain size analyses of recently collected samples confirm a sand-to-mud ratio of about 1:1 in and around ER67 (Burd and Glaholt 2000). Only a few sediment ripples were noted from the ROV imagery.

Trough – a subtle trough exists near the base of the slope on both the north and south sides of the channel (Figure 4). The trough is believed to have been created by tidal current scour. The base of the trough contains coarse sediments, including boulders and cobbles, and as a result, there is also a unique, hard-substrate fauna within the unit, as observed in the ROV imagery. The exposure of parchment tube-worm casts within this unit suggests that the unit is non-depositional or erosional. The high resolution seismic profiling indicates that the surface sediments within the trough appear to be uniform and at least five metres thick (Terra Remote Sensing 2000). No bedforms were noted on the ROV imagery (Terra Remote Sensing 2000).

Figure 4. Generalised Substrate and Morphological Features on the Seabed as Interpreted from Side-scan Sonar Imagery



Source: Terra Remote Sensing 2000

Source: Terra Remote Sensing 2000.

Figure 5. Video Capture of Possible Trawl Mark

Slope – the slope extends from the shoreline to depths of about 75 m. Typical slopes of this unit are 10° and the maximum observed slope is approximately 22° (Jaques Whitford Associates 2001a). The sediments on the channel slopes are variable, ranging from bedrock outcrops, to gravel, to gravely sand. The bedrock outcrops occurring in this unit indicate that surficial sediments are discontinuous and relatively thin (Terra Remote Sensing 2000). The sediment thickness on the slopes is highly variable ranging from zero to over five metres in thickness; gravelly sand appears to be the most common sediment type of the immediate subsurface, underlain by tills and then bedrock (Jaques Whitford Associates 2001). Sediment thickness in bore-holes ranged from 3.5 m to greater than 13 m. There is some evidence of sediment failures in the form of gravel splays at the base of the slope (Terra Remote Sensing 2000).

Shoreline Classification

The shoreline along the southern coast of Saltspring Island is primarily sand and gravel beach with some segments containing rocks in the sand/gravel mixture (Figure 6). The shoreline along North Saanich is predominantly rock with sand and gravel beach with occurrences of rock cliff and rock platform.

Figure 6. Physical Shoreline Classification

2.3 Ecological Values

2.3.1 Infaunal Biota

The infaunal community (organisms living on or in sandy and muddy seabeds) in Satellite Channel was studied intensively between 1965 and 1974 by the University of Victoria Biology Department (Figure 7). Throughout Satellite Channel, it was found that shallower communities within level bottom plains tended to have richer standing crop biomass. In collections taken from the length of Satellite Channel, 17 species occurred in every replicate from six stations. The east and west ends of Satellite Channel had lower standing crop biomass than the centre of the channel.

Over the ten years of sampling, fourteen samples were taken at a station approximately midpoint of the channel within ER67. Voucher specimens are maintained by the Royal British Columbia Museum and the Los Angeles County Museum of Natural History. The site was characterised by a large number of sedentary polychaete worms (*e.g.*, *Maldane glebifex*, *Prionospio* sp.), forming a matted network near the sediment interface, errant polychaetes (*e.g.*, *Nephtys* sp.), molluscs, amphipods and echinoderms (Figure 8). The large Pacific milky venus clam (*Compsomyax subdiaphana*) was consistently the heaviest species present in the samples and usually in the top ten species in terms of frequency and number of individuals. Eight other species of bivalves (e.g., *Macoma elimata, M. carlottensis, M. brota, M. clacarea, Yoldia ensifera, Y. amygdalea, Pandora grandis*), particularly clams, predominated the samples. Characteristic biota included the notched brittle star (*Ophiura sarsi*), two species of sea cucumbers (*Molpadia intermedia* and *Pentamera lissoplica*) and the heart urchin (*Brisaster latifrons*). Nine species were considered ecologically significant although the criteria against which these were determined are uncertain (Table 2). Due to varying sampling techniques and taxonomic precision, it is difficult to estimate the extent of species biodiversity over the years. However, it is estimated that using a 2 mm mesh, approximately 30-40 species/m^2 were identified and the number of organisms fluctuated between 250 and 750/m^2. While there were fluctuations in species biodiversity and abundance over the ten-year sampling program, there were no trends thus indicating that this is a stable benthic community within a variable norm (Ellis 2002).

Table 2. Ecologically Significant Species in ER67

Group	Species
Errant polychaetes	*Lumbrinereis sp* *Nephtys sp*
Sedentary polychaetes	*Maldane glebiflex* *Sternaspis fossor* *Prionospio sp*
Bivalves	*Compsomya subdiaphana* *Macoma elimata* *Yoldia ensifera*
Brittle Star	*Ophiura sarsi*

Source: BC Parks 1987

Figure 7. Benthic Sampling in Satellite Channel

Figure 8. Examples of Species Sampled in Satellite Channel (1965-1974)

Pista Cristata

Maldane glebifex

Compsomyax subdiaphana

Ophiura sarsi

Brisaster latifrons

No other benthic surveys were conducted around Satellite Channel until 2000 when surveys were conducted for the environmental impact assessment of the GSX pipeline. Two surveys were conducted within ER67, and five were conducted to the east, following the proposed and alternative pipeline routes (see Figure 7). The results of the surveys are presented in Table 3. Using a 0.5 mm sieve, 127 taxa were collected ranging from 85 to 118 per grab, which seemingly, was relatively high for the type of habitat sampled and the sampling method used. There was no apparent difference in faunal composition among the sites although the most abundant taxon (*Monobrachium parasitium*), a one-tentacled hydroid forming parasitic colonies on bivalves, was relatively uncommon in the two Satellite Channel sites. Otherwise, abundance, species richness and biomass were fairly homogeneous among sites. This was considered to be due partly to the homogeneity of depth (73 – 86 m) and substrate type (sandy-silt) of the sample areas.

Unfortunately, due to variation in sampling effort, measurement of weight and taxonomic precision, it is difficult to make comparisons between the 1965-1974 and 2000 survey programs, although several observations can be made. Eight of the nine ecologically significant species reported in 1965-1974 were present in the 2000 survey. However, the most abundant taxon in 2000 (*Monobrachium parasitium*) was not present in earlier surveys. This may be attributable to the parasitic species not being enumerated rather than the species not being present. In addition, no sea cucumbers, nor the high number of polychaetes counted in the surface mats in the earlier surveys were evident in the 2000 survey.

Table 3. Infaunal Communities in Satellite Channel

Station	Total Abundance (no. of individuals)	Number of Taxa	Biomass (g)	Most Common Taxa (> 100 individuals)
ER67-1	1485	102	12.6	*Monobrachium parasitum* (hydroid) *Spiophanes berkeleyorum* (polychaete) *Axinopsida serricata* (gastropod) *Euphilomedes producta* (ostracod)
ER67-2	1065	91	16.5	*Monobrachium parasitum* (hydroid) *Axinopsida serricata* (gastropod)
SC-1	1140	98	17.1	*Axinopsida serricata* (gastropod)
SC-2	1307	85	11.2	*Monobrachium parasitum* (hydroid) *Axinopsida serricata* (gastropod) *Euphilomedes producta* (ostracod)
SC-3	1660	102	9.8	*Lafoea spp.* *Monobrachium parasitum* (hydroid) *Axinopsida serricata* (gastropod)
SC-4	1437	105	12.2	*Monobrachium parasitum* (hydroid) *Spiophanes berkeleyorum* (polychaete) *Axinopsida serricata* (gastropod)
SC-5	1202	118	9.1	*Obelia* spp. *Spiophanes berkeleyorum* (polychaete)

Source: Burd and Glaholt 2000.

2.3.2 Epiflora and Macro Epifauna

Macro epifauna were systematically observed and mapped during several of the GSX surveys, and are useful in showing generalized distributions of epibenthos (Figure 9 and Figure 15). Most of the observations were of fauna but some include epiflora that were attached to coarse substrate in the shallow depths (<20 m) where the proposed routing of the pipeline occurs. The occurrence of macroinvertebrates and fish are summarised in terms of the three morphological units, and is based on observations from Terra Remote Sensing (2000) and Archipelago Marine Research (2001).

Channel Flat Unit

Most of the imagery was from the deeper, mud/sand channel flat unit. The biological community within this morphological unit was characterised by burrowing infauna, including visible holes of worms and other infaunal species. Drift algae, predominately fragments of bladed kelp and the occasional eelgrass shoot, were also commonly observed. The spiny mud star (*Luidia foliatum*) was common in this unit. *L. foliatum* inhabits mud and sandy bottoms and feeds on a wide variety of invertebrates including brittle stars ((Figure 12), polychaete worms and crustaceans (Lambert 1981). Pandalid shrimp (spot prawns, sidestripe shrimp and pink shrimp) were uniquely associated with this morphological unit (Figure 13). These species undergo diurnal vertical migrations and may be more common in shallower depths during the night. Fish were relatively common, being observed in approximately 6% of classified images within this unit. Flatfish are widely distributed within this morphological unit (Figure 10).

Trough Unit

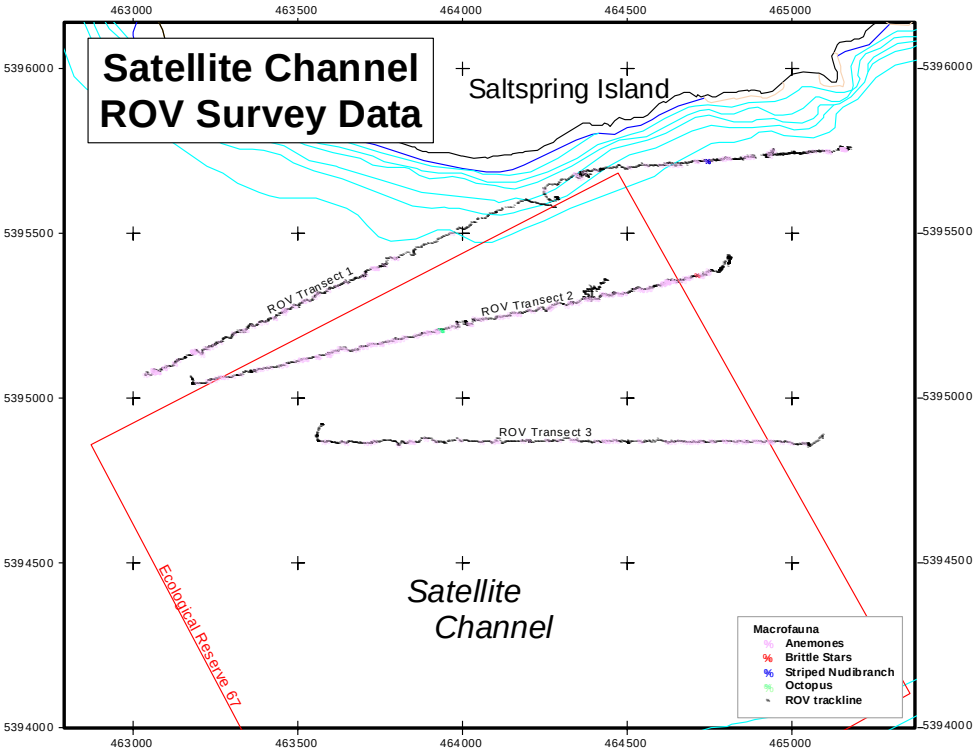
Less than 3% of the transect imagery was from the trench unit, however a number of unique biotic features were observed. An emergent, parchment tube worm (species unidentified) was abundant throughout the area (Figure 15). Other observations of this parchment worm were from areas immediately adjacent to the trench unit. Red sea urchins (*S. franciscana*) were observed on a number of boulders in the trench unit (Figure 14). These are the only records of red sea urchins in the transect area. The parchment tube worms are suspension feeders and their presence, as well as the occurrence of sea pens in adjacent areas, may be indicative of a stronger tidal current regime in this area. Fish were also relatively common in the trench area, being observed in approximately 9% of the classified images from this unit (Figure 10).

Slope Unit

Surveys of the slope unit included ROV imagery collected in January 2000 (Terra Remote Sensing 2000) and towed video imagery (Archipelago Marine Research 2001).

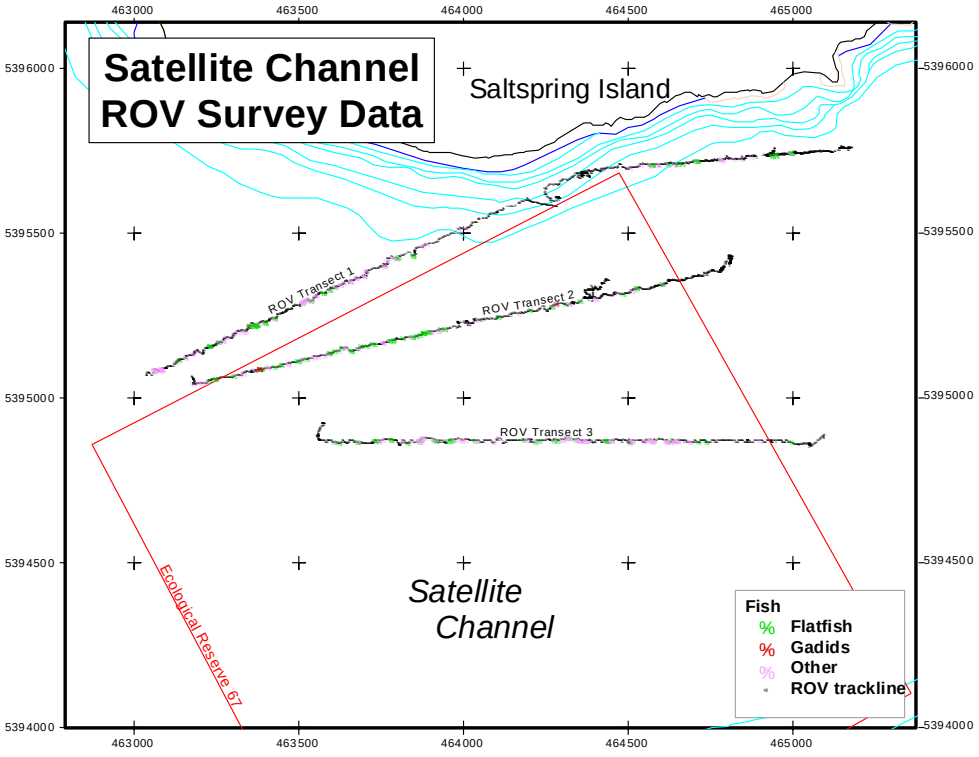
Because this area extends into shallow waters (<20 m), there was attached algae on the coarse sediments of the seabed. In general, the vegetation cover was sparse to low (<25% cover), and was restricted to depths of less than 20 m; a few patches of vegetation with cover greater than 25% were observed in the shallowest portions of the survey area (<10 m). The algal vegetation was predominately kelps (>75% of the classified imagery was *Laminararia spp* or *Agarum spp*;(Figure 16). Green algae (*Ulva spp*) and filamentous algae (similar in form to *Neoagardiella spp* but could not be identified) were also observed at sparse to low covers in the shallowest portion of the survey (<10 m). A fringe bull kelp (*Nereocystis leukeana*) bed occurs just east of the survey area (Figure 18). The observed algal groups were typical on this type of habitat in the southern Strait of Georgia.

Figure 9. Macro-fauna Observations from ROV Imagery



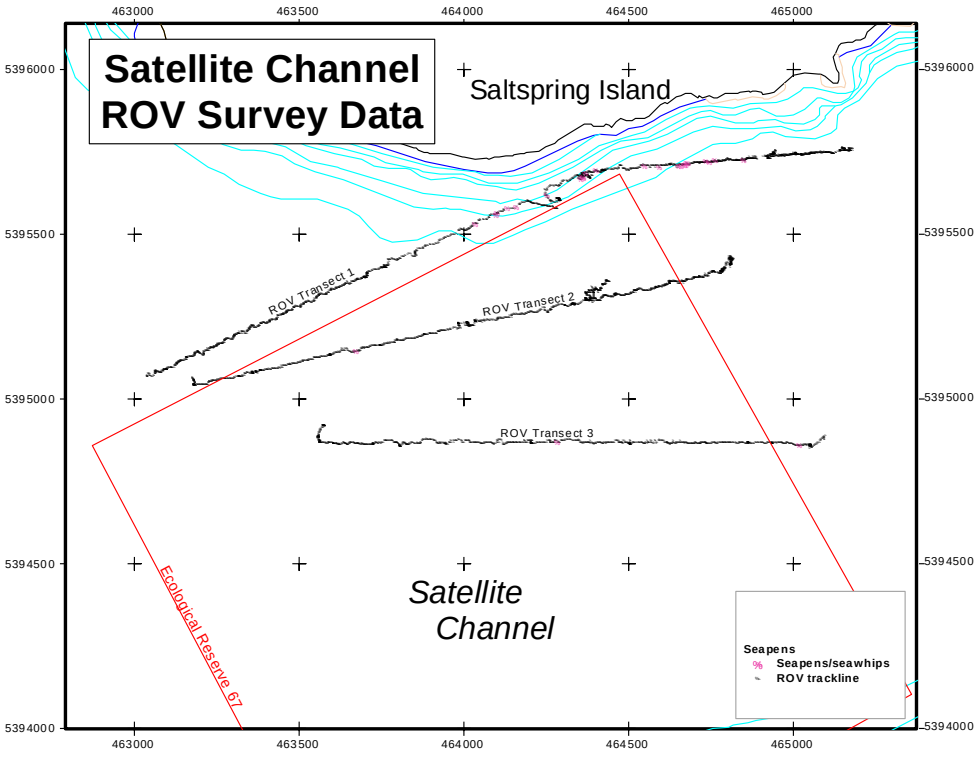
Source: Terra Remote Sensing 2000

Figure 10. Fish Observations from ROV Imagery



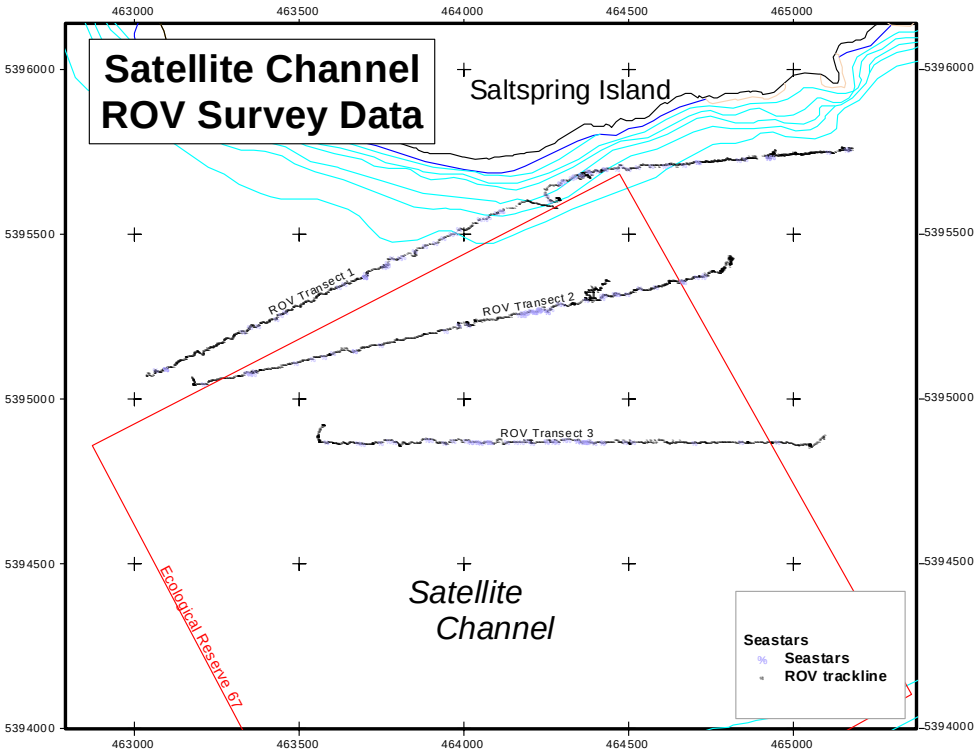
Source: Terra Remote Sensing 2000

Figure 11. Sea Pen Observations from ROV Imagery



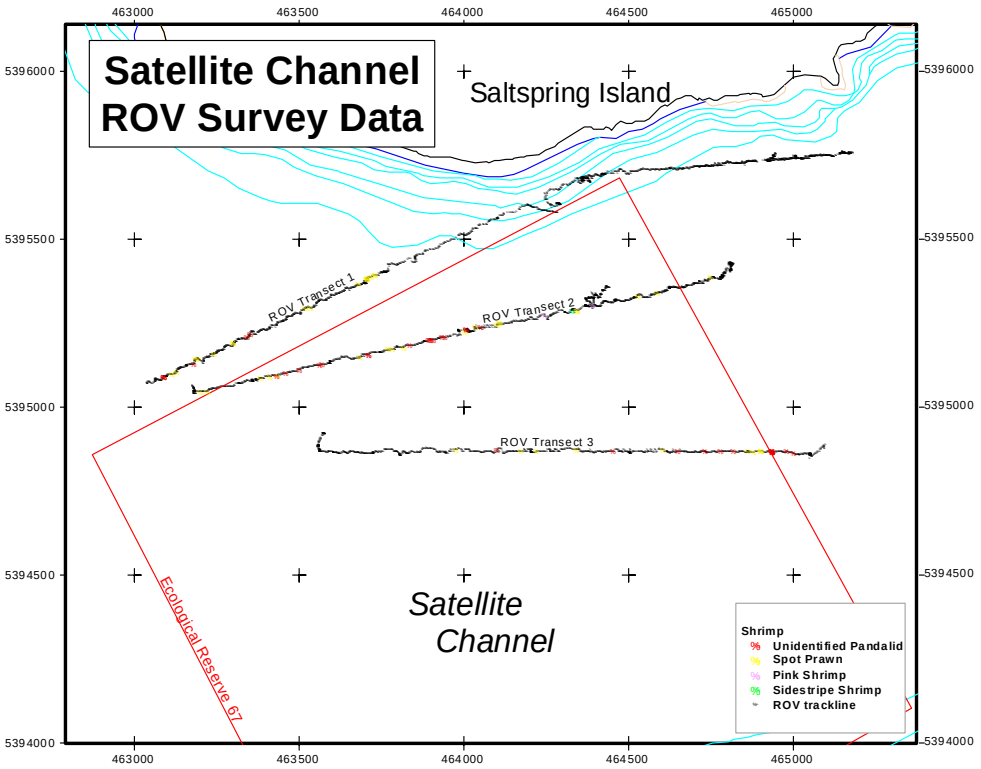
Source: Terra Remote Sensing 2000

Figure 12. Sea Star Observations from ROV Imagery



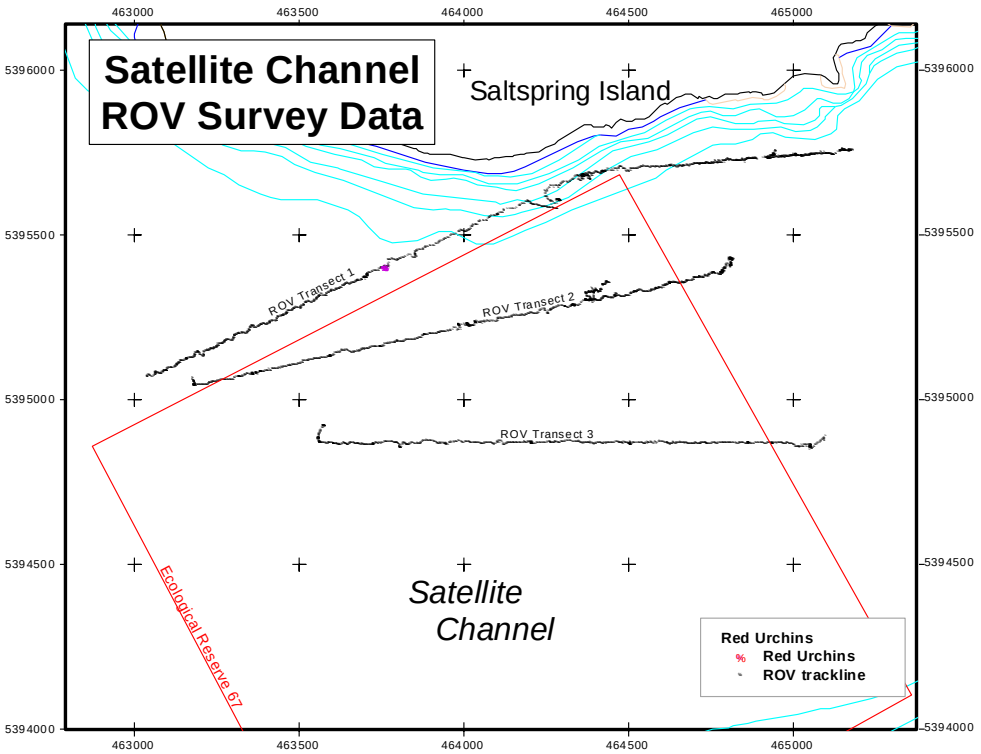
Source: Terra Remote Sensing 2000

Figure 13. Shrimp Observations from ROV Imagery



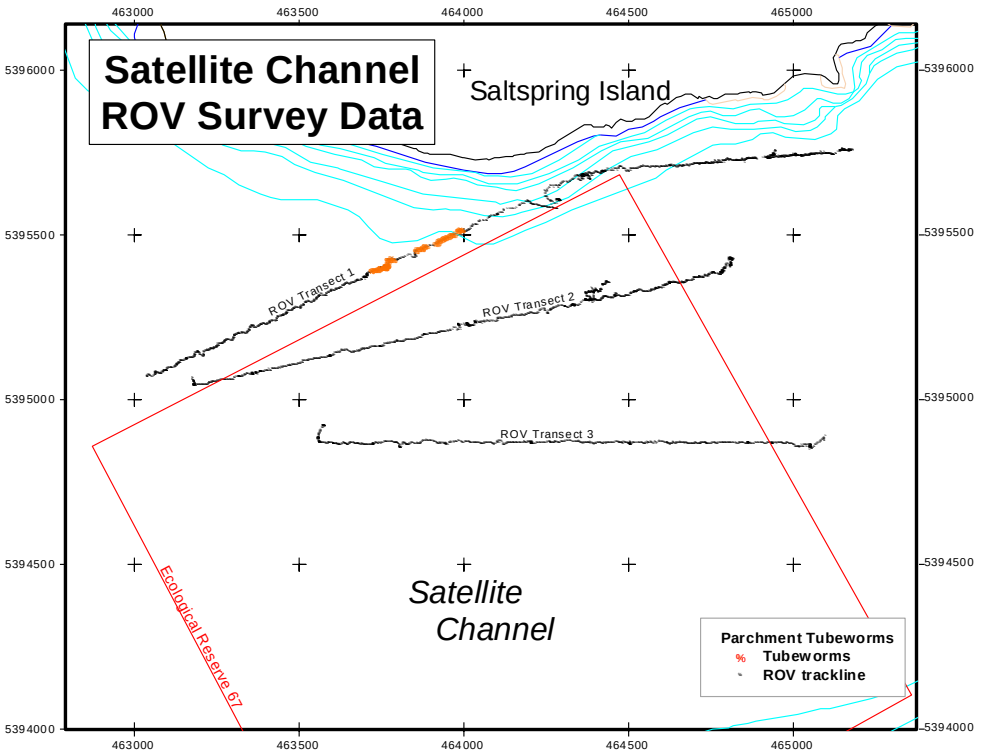
Source: Terra Remote Sensing 2000

Figure 14. Urchin Observations from ROV Imagery



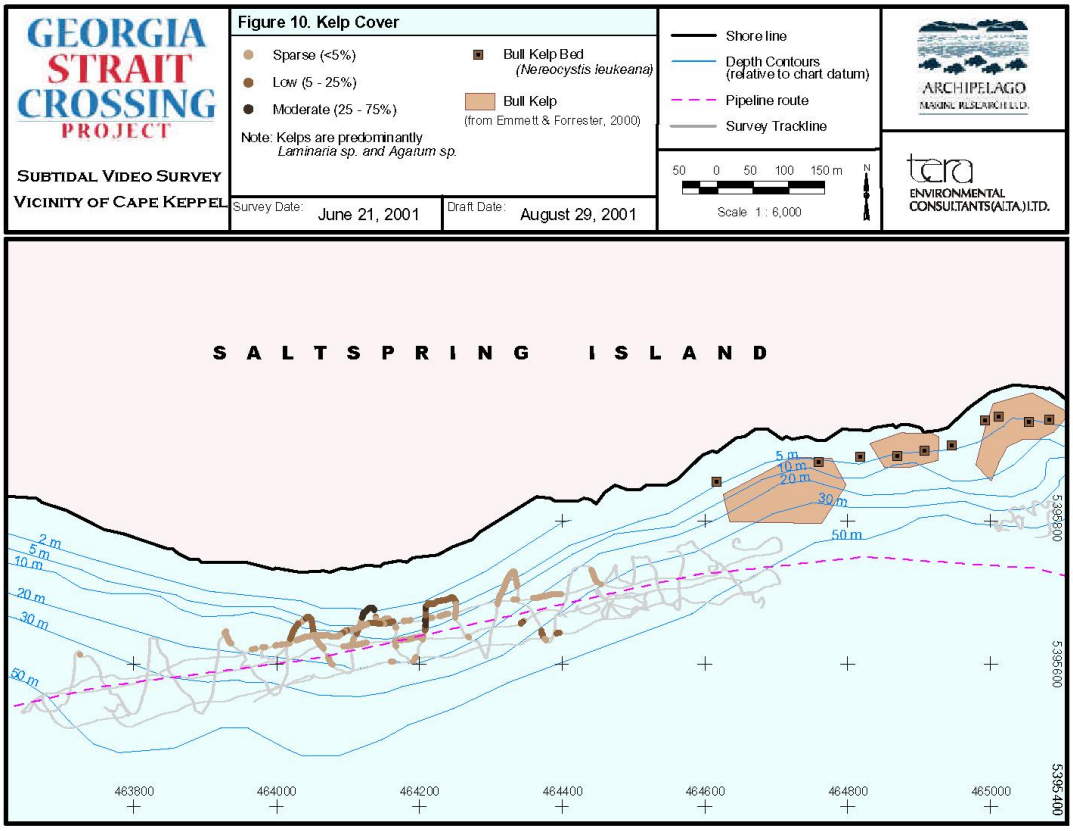
Source: Terra Remote Sensing 2000

Figure 15. Tubeworm Observations from ROV Imagery



Source: Terra Remote Sensing 2000

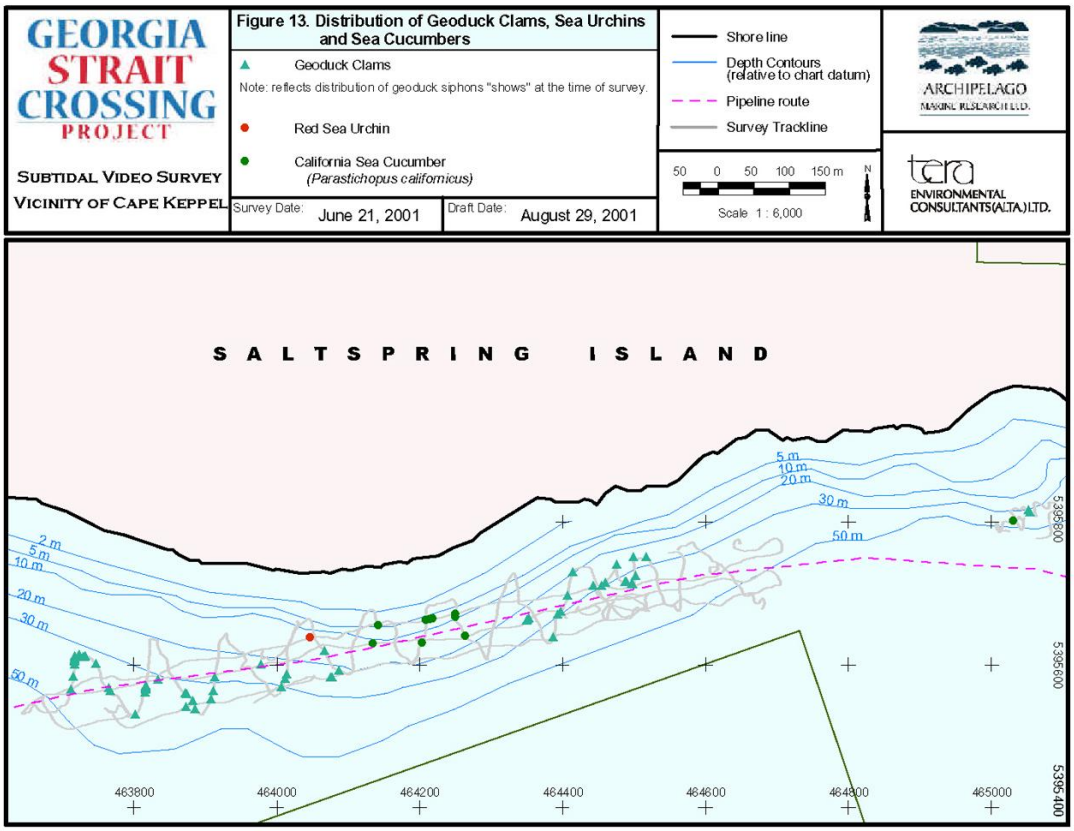
Figure 16. Kelp Observations from Towed Video Imagery



Source: Archipelago Marine Research 2001

Figure 17. Biological Resources

Figure 18. Selected Invertebrate Observations from Towed Video Imagery



Source: Archipelago Marine Research 2001

No algae were observed below the 20 m isobath and a variety of mobile and sessile biota were observed in both the towed video survey and January 2000 ROV survey. Orange sea pens (*Ptilosarus gurneyi*) and plumose anemone (*Metridium spp*) were two of the larger macroinvertebrate species characteristic of the slope unit (Figure 9 and Figure 11). Sea pens are a suspension-feeding colonial anthozoan (anemones and corals). Geoduck clams (*Panope abrupta*) were observed on the slope unit during the towed video survey but not in the ROV survey (Figure 18), possibly because the geoduck siphons were retracted during the January 2000 ROV survey. A few California sea cucumbers (*Parastichopus spp*), a commercially harvested species, were noted in the shallower (<15 m) parts of the survey. Red urchins were not common (Figure 13 and Figure 18), probably due to the lack of dense algal cover. Crabs (*Cancer spp*) were widely distributed at depths greater than 10 m and several Tanner crabs (*Chionecetes spp*) were noted at depths of 50 m during the towed video survey.

Sea stars were abundant throughout the area, with the mottled sea star (*Evasterias troscheli*) common on the coarser substrates and most abundant in shallow water. The spiney mud star (*Luidia foliolata*) was more common on deeper mud/sand bottom. The vermillion star (*Mediaster aequallis*) was relatively abundant and possibly related to sea pens, a major prey item for this sea star species. The pink sea star (*Pisaster brevispinus*), which feeds primarily on larger bivalves (Lambert 1981), was widely distributed in the survey area.

Observation of fish in the video imagery are summarised in Table 4. It should be noted that some species of fish were attracted to the towfish and ROV whereas some fish may have scattered. Therefore, the results are not necessarily comprehensive and some species could be selectively missed by the surveys. In both the towed video survey and the January 2000 ROC survey, most of the unidentified fish were small goby-like fish, but species identification was not possible. Fish species diversity appears to be similar in the channel flat and slope units (Figure 10 and Figure 19).

Table 4. Comparison of Fish in the Slope and Trough Units

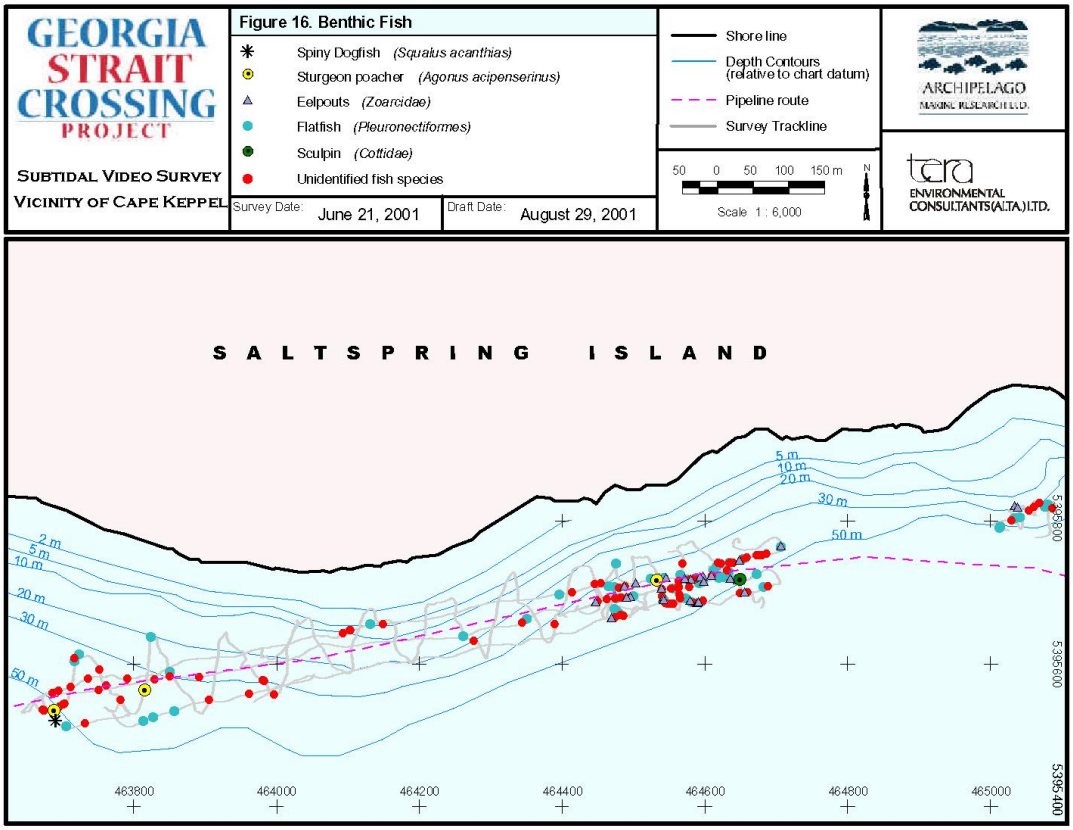
Family	Common Name	Scientific Name	Cape Keppel SIMS[1]	ER67 ROV[2]
			Slope Unit	Trough Unit
Unidentified fish			C	C
Eelpout		*Zoarcidae*	C	P
Poacher	Sturgeon poacher	*Agonus acipenserinus*	P	P
Flatfish	Unidentified flatfish		C	C
	Pacific sanddab	*Citharichthys sordidus*	NI	P
	Dover, flathead, slender or rex sole	*Microstomus pacificus, Hippoglossoides elassodon, Lyopsetta exilis, Glyptocephalus zachirus*	NI	C
	English sole	*Parophys vetulus*	NI	C
	Pacific cod	*Gadus macrocephalus*	NO	P
	Pacific hake	*Merluccius productus*	NO	P
Dogfish	Spiny dogfish	*Squalus acanthias*	P	NO
Sculpin	Unidentified sculpin	*Cottidae*	P	P

Notes: C = common; P = present; NI = not identified; NO = not observed

[1] Archipelago Marine Research 2001

[2] Terra Remote Sensing 2000

Figure 19. Fish Observations from Towed Video Imagery



Source: Archipelago Marine Research 2001

2.4 First Nations Values

The ecological reserve was not established for the purpose of protecting First Nations values and sites, as is the case with some other protected areas. Nonetheless, the Satellite Channel area is traditionally and presently important to First Nations, and a decision regarding pipeline routing may affect these values.

Eight First Nations have used the study area, including:

- Cowichan Tribes;
- Malahat First Nation;
- Pauquachin First Nation;
- Semiahmoo First Nation;
- Tsawwassen First Nation;
- Tsawout First Nation;
- Tsartlip First Nation; and
- Tseycum First Nation.

Each of the First Nations has been involved, to varying degrees, in discussions and negotiations with GSX PL regarding the potential effects of the pipelines through their traditional territories. To date, traditional use studies (TUS) specific to the pipeline area are underway or have been completed for the Cowichan, Tsawout, Tsartlip and Tseycum First Nations. The Sencot'en Alliance (which includes Tsawout, Tsartlip, Pauquachin and Semiahmoo Nations) has proposed to incorporate into a broader TUS work that already has been undertaken for member nations. The traditional use studies, which involve research and interviews with elders, are intended to document traditional and contemporary uses of First Nations in the area of the pipeline, and to identify specific sites or areas of concern which may be affected by the GSX project. Much of the information contained in the studies, particularly site-specific information, is considered confidential. The following discussion of First Nations values and uses has largely been compiled from relevant sections of the GSX Pipeline application to the NEB. Although all First Nations were contacted and invited to participate in the March 11 workshop, there was insufficient time to collect detailed, first-hand information of the values and uses of ER67 and the vicinity.

First Nations throughout coastal British Columbia have historically relied upon and placed a high value on marine resources, and marine environments continue to be an integral and inseparable part of these First Nations' way of life. A subtidal archaeological survey of the pipeline route did not identify any subtidal artifacts, such as middens. However, numerous traditional use sites have been identified in Satellite Channel and along the shores of Saltspring Island and the Saanich Peninsula, within the study area for this assessment. In the vicinity of the proposed pipeline route, the Cape Keppel area at the south end of Saltspring Island was noted as a particularly important place. Historically, First Nations used this area for reef fishing for salmon and cod, hunting for octopus, gathering of seaweed, and harvesting of clams, crabs, scallops and sea cucumbers. In addition to marine harvesting, the shore provided First Nations with access to inland hunting and gathering sites. There are at least two legends of the Cowichan peoples associated with the Cape Keppel area, and five known archaeological sites along the shore provide evidence of early Cowichan use of this area. The Tsartlip TUS also specifically references this area as historically important.

The largely unpolluted area surrounding Cape Keppel continues to be an important site for fishing and food gathering by First Nations. For example, the intertidal areas are used to harvest clams and cockles mainly, but also sea cucumbers and urchins. Kelp beds found along the shores provide habitat for juvenile salmon. Crabs are trapped by First Nations in the area between the shore and ER67, as well as to the east and west. The northern and western shores of the Saanich Peninsula receive some use by First Nations for bivalve harvesting, although this use is concentrated in Deep Cove, south of the study area. In the deepwater areas of Satellite Channel, there are presently First Nations fisheries for prawns, sole, greenlings, salmon and herring. The area of ER67 is used as part of the First Nations seine fishery for salmon.

Although difficult to quantify, marine areas have a spiritual value to First Nations who live by their shores and rely on their bounty. Maintaining the ecological integrity of these areas is of immeasurable importance to First Nations communities and individuals.

2.5 Human Use Values

The human values and uses considered under this section include:

- historical and heritage values;
- research and education;
- commercial fisheries;
- recreational fisheries;
- other recreation and tourism; and
- transportation.

With the exception of research and education, none of these values and uses contributes to the role of the ecological reserve. However, as these uses occur incidentally in the study area, and may be influenced by the pipeline routing decision, they are considered as part of the assessment. There are no aquaculture licenses, mineral tenures or oil and gas tenures in the study area.

2.4.1 Historical and Heritage Values

In addition to First Nations historical use, the study area was investigated for evidence of other heritage and historical values including prehistoric archaeological sites (e.g., subtidal middens), shipwrecks, and other historical artifacts or sites of significance. As part of the GSXPL environmental impact assessment, an underwater archaeological survey was conducted of the proposed route (ARCAS Consulting Archaeologists 2000). The archaeological survey covered the entire Satellite Channel waterway, including the area of ER67 (D. Stone, pers. comm.). No sites of significance were identified, however, visual inspections of sonar-detected targets are planned for the coming months as a follow-up measure.

2.4.2 Research and Education

Between approximately 1965 and 1975, University of Victoria biologists undertook research on faunal stability, diversity and biomass in Satellite Channel (e.g., Ellis 1967a, 1967b and 1968). As discussed under Section 2.1, these research activities were the impetus for creation of ER67 to conserve representative benthic habitats and provide a benchmark for future research. However, the University of Victoria research was halted in the mid

1970s as a result of funding shortfalls. No work of a comparable scale has since focused on the reserve area. A few noteworthy studies have occurred in the broader Satellite Channel area, which have contributed to the knowledge base:

- nearshore subtidal dive observations were made in 1979 at 39 sites on the Saltspring Island shoreline (Lim 1980), four of which were between Isabella Point and Cape Keppel in the vicinity of the proposed GSX pipeline route; algae and invertebrate species were documented;
- an environmental impact assessment for a Chevron fuel loading facility at Hatch Point included ER67 within its study boundary (Debrocky Seatech 1981); eelgrass and bull kelp beds were documented along with invertebrate communities;
- the Saanich Inlet Study (Austin *et al.* 1996) included intertidal and subtidal surveys of the inlet with some general observations applicable to ER67; eelgrass and bull kelp beds were documented along with invertebrate communities;
- the shorelines of Saltspring Island and the Saanich Peninsula were classified and mapped as part of a physical shore unit classification study (Howes *et al.* 1994); and
- during the course of planning for the GSXPL, data have been obtained on the physical characteristics and the occurrence and distribution of species and benthic habitats along the proposed pipeline route including portions of ER67.

Although the research potential of the ecological reserve is considered high, it is clear that this potential has not been fully realised. In fact, since the reserve was established, all research activity has been largely ancillary. No efforts have been made to continue monitoring the status of benthic communities within the reserve or to compare benchmark sites from within the protected area to sites elsewhere. In this regard, the educational benefits of the ecological reserve have similarly been underemphasized. There are currently no known educational programs specific to ER67. The ecological reserve does not appear on marine charts and there appears to be limited awareness of the reserve by the broader public.

2.4.3 Commercial Fisheries

The Satellite Channel area is open to commercial fishing and marine harvesting by federal regulation. Within Satellite Channel, ER67 falls within two DFO statistical subareas: about three-quarters of the reserve falls under subarea 18-6 (easternmost) while one-quarter falls under subarea 18-7. Despite ecological reserve status since 1975, the waters above the protected seabed have been subject to fishing pressures. Although trawling has been prohibited from subarea 18-7 since the ecological reserve was designated, closures for shrimp trawling and prawn trapping were not established for the eastern portion of the reserve until 1999, while groundfish trawling continued until 2000. Trawl scour marks remain visible on the seafloor within the ER67 (Terra Remote Sensing 2000).

The area in and around ER #67 has been traditionally used by crab fishers, groundfish trawlers, prawn fishers and shrimp beam trawlers. Within the ecological reserve, the main commercial fisheries are the salmon gillnet fishery, occurring in the fall, although crab trapping is more concentrated in the nearshore area south of Saltspring Island (Figure 20 and Figure 21). Other species may be fished using methods other than bottom trawling.

Figure 20. Commercial Finfish Fisheries

Figure 21. Commercial Invertebrate Fisheries

Outside the reserve, Satellite Channel is a known area for shrimp trawling, prawn trapping, crab trapping, groundfish trawling, salmon gillnetting and the harvest of intertidal and subtidal bivalves. Most shrimp trawl activity takes place to the east of the ecological reserve, although along the proposed pipeline route, at depths generally greater than 40 m. Shrimp trawling is open on a quarterly basis. Prawn trapping is known to occur in Sannich Inlet, although occasionally prawn traps are set commercially along the shoreline of Saltspring Island to the north and east of the ecological reserve (K. Erikson, pers. comm.). The commercial fishing season for prawns is from late April to July/October. Southern Saltspring Island is also an important area for crab trapping, which can occur year-round. In this area, most trapping occurs between the shoreline and the north boundary of the ecological reserve, although trapping is not restricted in the reserve itself. Salmon gillnetting, aimed at Cowichan River chum salmon, occurs throughout Satellite Channel in the fall of some years. Other species that may be fished in the deeper waters of Satellite Channel include English and rock sole (the primary target species of the groundfishery), sculpin, starry flounder, dogfish, Pacific hake and possibly walleye pollock. Portions of Satellite Channel historically supported a herring fishery, but there has been no herring spawn activity near the ecological reserve since the 1950s (Hay and McCarter 1999).

In nearshore areas, intertidal clams are harvested commercially along Cape Keppel at depths to about 30 m, predominantly in the winter months. The Cape Keppel foreshore is also important for subtidal species, namely geoducks. The geoduck fishery occurs on a three-year rotational basis with the next fishery in the southern Strait of Georgia slated to occur in 2003. The geoduck fishery takes place throughout the year, providing water quality criteria are met. Other species that may be commercially harvested in the shallows along the south shore of Saltspring Island include red and green sea urchins, although these species are more commonly found farther east. The majority of urchin harvesting takes place between September and January. California sea cucumbers are also present in this area, however, sea cucumbers have not been commercially harvested in the southern Gulf Islands since 1996. As noted above, the south shore of Saltspring Island is also important for crab fishers. During a recent SIMS survey of the nearshore areas of Cape Keppel for GSXPL, geoducks were noted at depths of 20 to 40 m, and Dungeness crabs were common throughout this area.

2.4.4 Recreational Fisheries

The Satellite Channel area, including ER #67, is open to recreational fishing and marine harvesting by federal regulation, and experiences year-round activity. The recreational harvesting of intertidal species, such as clams, cockles and oysters, occurs in nearshore areas except those that are closed due to contamination (Figure 22). The southern Saltspring Island shoreline, just north of the ecological reserve, is open to recreational bivalve harvesting, and is a known area of use. Recreational crab trapping also occurs in this area. There is a recreational fishery for prawns in Saanich Inlet to the south of the ecological reserve and likely not within the study area boundary. Satellite Channel is also used for the recreational fishing of chum salmon, ling cod and walleye pollock (Figure 23). These recreational fisheries are not restricted in the ecological reserve, however, the level of use of the reserve area for recreational fishing is unknown.

Figure 22. Recreational Invertebrate Fisheries

Figure 23. Recreational Finfish Fisheries

2.4.5 Other Recreation and Tourism

There exists a Use, Recreation and Enjoyment of the Public (UREP) site north of ER67 along the foreshore of Saltspring Island, extending about 150 m into Satellite Channel (UREP #1404485). Presently managed by BC Waters and Lands, this site has been reserved by BC Parks for possible future inclusion in the provincial protected areas network. Marine-based recreation in southern coastal British Columbia has shown an increasing trend in recent years and further growth of this industry is expected as a result of the proposed Southern Gulf Islands National Park Reserve. Within the study area, pleasure craft such as sail and power boats traverse Satellite Channel on a regular basis with traffic highest in the summer months. There are no boat havens, anchorages or marinas in the study area. Kayaks and smaller boats use the areas closest to shore on either side of the channel (Figure 24). There is a known sea kayak route along the southern shore of Saltspring Island, in the vicinity of the proposed pipeline route, and along the western shore of Saanich Inlet south of ER67. There are no formal campsites or kayak staging areas within the study area. Whale watching activity occurs throughout the southern Gulf Islands. Recreational diving does not occur in the centre of Satellite Channel due mainly to water depth (D. Stone, pers. comm.). Diving is known to occur around Arbutus Island to the east of the study area, within Deep Cove to the south, and on Patey Rock. None of the above noted recreational activities are directly linked to the values or role of the ecological reserve.

2.4.6 Transportation

The presence of the ecological reserve has no bearing on vessel traffic through Satellite Channel, and the reserve itself is not noted on marine charts. Nonetheless, a variety of vessel types regularly traverse Satellite Channel and the selection of a pipeline route may have some impact on marine navigation. Satellite Channel is one of the main corridors for vessels in the southern Strait of Georgia wishing to access the east cost of Vancouver Island (*e.g.* Cowichan Bay Dock in Chemainus Harbour). Vessel types that use this area include fishing boats, tugs and barges, and pleasure craft. Deep-sea vessels also use the channel occasionally, and there is a group of eight designated deep-sea anchorage sites located north and west of ER67. The two anchorages closest to the reserve will be decommissioned if the pipeline is approved (Aker Engineering 2000). BC Ferries vessels enter the eastern part of Satellite Channel as part of their Tsawwassen-Swartz Bay route, but they do not traverse the ecological reserve.

Figure 24. Recreational Features

3.0 PIPELINE ROUTING OPTIONS

3.1 Pipeline Installation

The pipeline is to be of uniform diameter (40 cm or 16 in) throughout the full length of the route. It will be concrete coated which will increase its diameter to 53 cm (21 in). The pipeline is scheduled to be installed between December 2003 and March 2004 by a lay barge thus allowing it to be assembled and laid continuously. Dynamic positioning will direct the positioning of the lay barge during laying operations ensuring that the pipeline is installed within a few metres of the planned route. An unmanned submersible will monitor touchdown of the pipeline. A 10 m right-of-way (5 m either side of the pipeline) will be established around the marine pipeline. Throughout the route, the pipeline will alternate between being laid on the surface or buried in a trench. Trenching is intended to minimise impact to bottom trawlers and to facilitate movement of crabs and other benthic organisms in the long term. The installation methods will be similar for the proposed and alternative routes; differences between the two options are described below.

3.2 Proposed Route

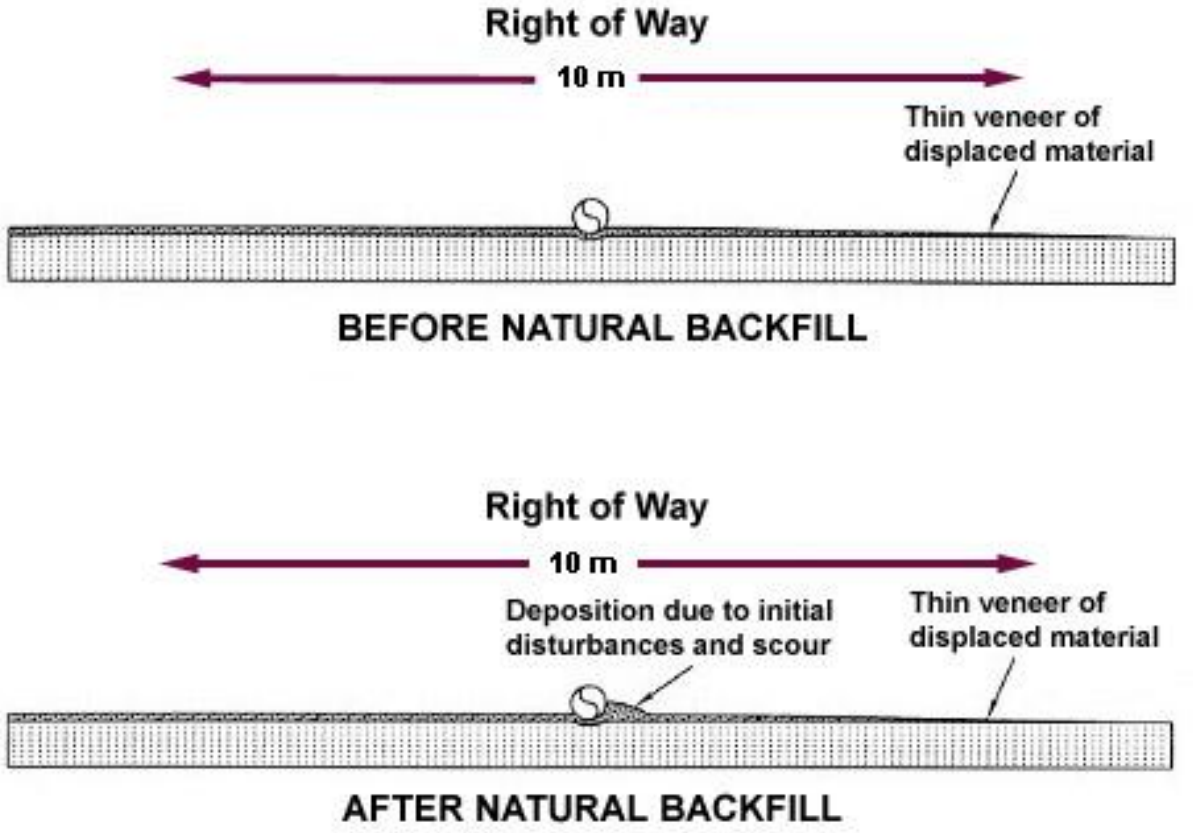
The proposed pipeline route would lie to the north of ER67 between kilometre posting 60 and 65 of the pipeline route (Figure 25). The closest point to ER67 is at the northeast corner where the route would lie about 10 m from the ER. In this portion of the route, the pipeline would rise from a depth of approximately 75 m to approximately 10 m depth then down to 75 m depth along a 15-20% slope (see Figure 3).

The proposed pipeline will lay on the seabed bottom immediately adjacent to ER67 between 60.5 km and 63 km (Figure 25 and Figure 26). Along the remainder of the route around ER67 it will be buried (see Section 3.3 for discussions on pipeline burial). Natural back fill will likely deposit sediment on the upslope side of the pipeline. Due to the steep and relatively unstable slopes, the pipeline will be braced by about thirteen pilings in proximity to ER67. The pilings are 27 cm (10.6 in) in diameter and 6 m (19 ft 8 in) long. Pilings will be installed in pre-drilled 40 cm (16 in) holes and grouted into place. It is anticipated that the pilings will be buried to 5.6 m (18 ft 6 in) in depth, leaving 0.4 m (16 in) (the diameter of the uncoated pipeline) exposed. It is anticipated that the pilings will be installed over a three-week period in November 2003.

Concerns have been raised that pipeline segments laying on the surface will impede migrating Dungeness crabs and other benthic invertebrates. It is anticipated that the pipeline will not lay flat on unlevel areas of the seabed and thus will create bridges under which benthic organisms will be able to travel. In areas where these spans do not exist, engineers have proposed installing articulated concrete mattresses along the route (Figure 27). As Figure 27 implies, these mattresses are generally intended to minimise vibrations in areas were the pipeline spans the surface. However, the mattresses will not be used in this capacity along the GSXPL route. Instead, the mattresses are expected to function as bridges for migrating organisms by presenting a more climbable surface than the pipeline. Hence a more appropriate diagram would show the pipeline laying on the seabed bottom rather than suspended across a span as represented in the Figure 27.

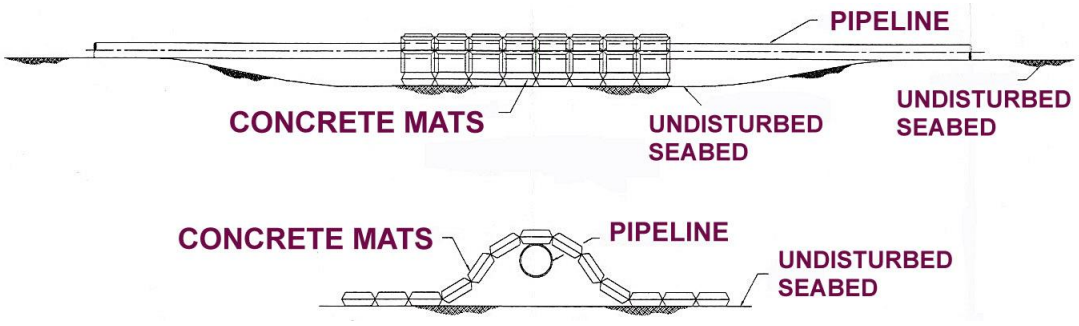
Figure 25. Pipeline Routing Options

Figure 26. Bottom Lay of Pipeline



Adapted from Georgia Strait Crossing Pipeline Ltd. 2001g

Figure 27. Articulated Concrete Mattress



Adapted from Georgia Strait Crossing Pipeline Ltd. 2001f

3.3 Alternative route

The alternate pipeline route traverses approximately 1.5 km through the northeast corner of ER67 along a relatively flat-sloped plain at around 80 m depth (see Figure 3 and Figure 25). The alternative route is 96 m shorter than the proposed route. The triangular area to the northeast of the pipeline is about 42 ha or 12% of ER67.

It is anticipated that this segment of the pipeline would be buried in a shallow key-in trench. The pipeline will be laid first and the trench will be excavated around the pipeline one month after its installation. The trench is intended to be as deep as the diameter of the pipeline, thereby the top of the pipeline would lie flush with the surface of the seabed once the trench has been infilled (Figure 28). The trench would be naturally infilled by sloughing of the trench walls, sediment transport by currents, and natural sedimentation from the particulates in the water column. Depending on the trenching mechanism (see below), slumping of the trench walls can be expected to fill the trench to between one third and one half of the depth, shortly after trenching. Natural sedimentation is expected at a rate of 1-10 mm/yr and therefore, will contribute negligibly to the infilling process. Therefore, after the immediate trench walls collapse, sediment transportation will be the primary mechanism for infilling. Due to weak sediment transport in the deeper areas of Satellite Channel, the natural infilling period is estimated to be greater than five years and possibly up to the order of decades (Hodgins 2001).

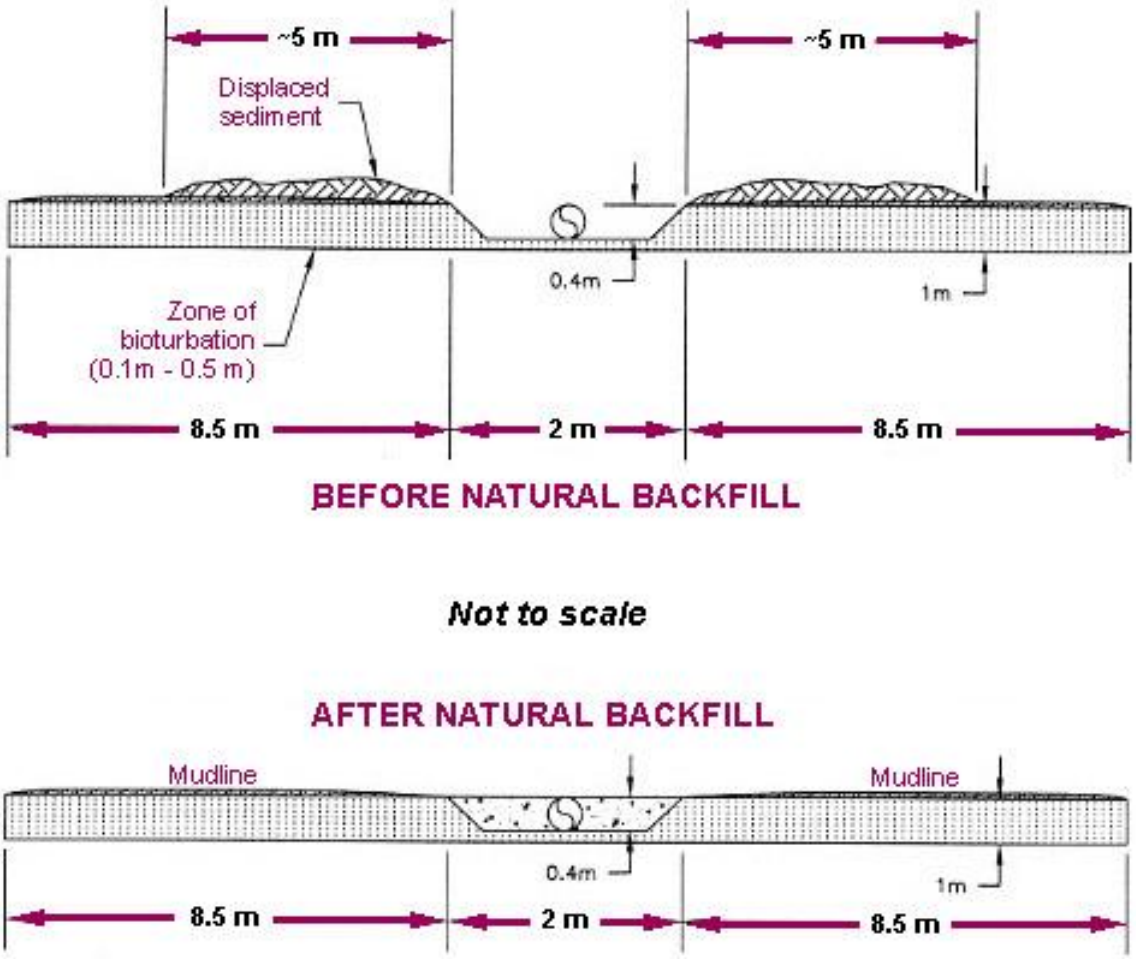
Three trenching options are being considered: jetting, mechanical excavating and ploughing.

Jetting displaces sediments under and beside the pipeline using high pressure jets of sea water. The jets are mounted on adjustable claws which facilitate cutting, disaggregating and moving the sediment. The soil mass is liquidised and soil grains are blown out from around the pipeline and suspended into the water column. The jet sled is supplied by water, air and instrumentation umbilicals from a barge which tows the sled (Figure 29). The jet sled structure, which straddles the pipeline, is supported by pontoon skids riding directly on the seabed. A remotely operated vehicle (ROV) or divers can be deployed to monitor the progress. It is estimated that the jet sled will advance at a rate of 50-100 m/hr removing 0.54 m^3 of sediment per lineal metre of pipeline (Hodgins *et al*. 2001).

Hodgins *et al*. (2001) describe the trench geometry and sediment dispersion. It is estimated that based on a 40 cm depth (not taking into account increased size due to concrete coating), the trench would be two metres wide at the surface (Figure 30). During the trenching process, coarser materials will settle close to the trench. Finer materials can be suspended as high as 30 m and disbursed several kilometres on either side of the trench. They can also remain in suspension for up to four days. Medium to fine sands are expected to settle in less than nine hours. Greatest accumulation of sediment will be within 300 m of the trench to a thickness of about 1 cm. Soft soil and the degree of liquefaction would produce a considerable amount of slumping of the side walls of the trench, possibly immediately burying the pipeline to one half its diameter.

In the mechanical excavating method, the soil is loosened by rotating mechanical arms and then raised and blown out of the trench by water or air jets, as with the jet sled; therefore, the sediment dispersion will be similar to that described above.

Figure 28. Pipeline Burial



Adapted from Georgia Strait Crossing Pipeline Ltd. 2001g

Figure 29. Jet Sled

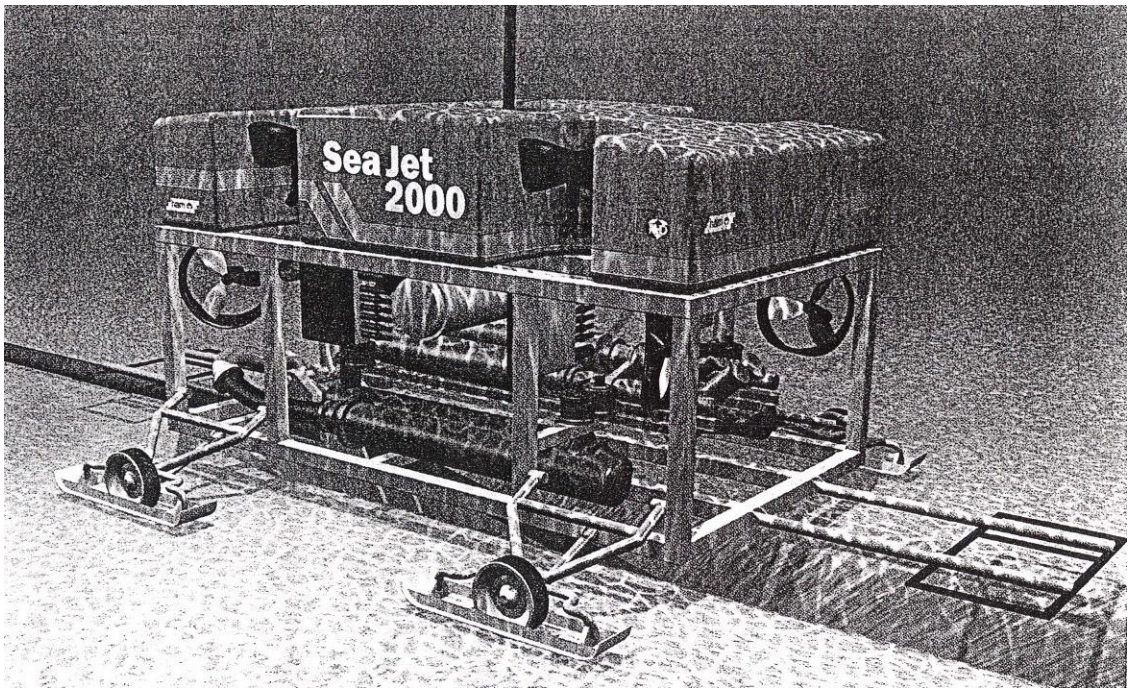
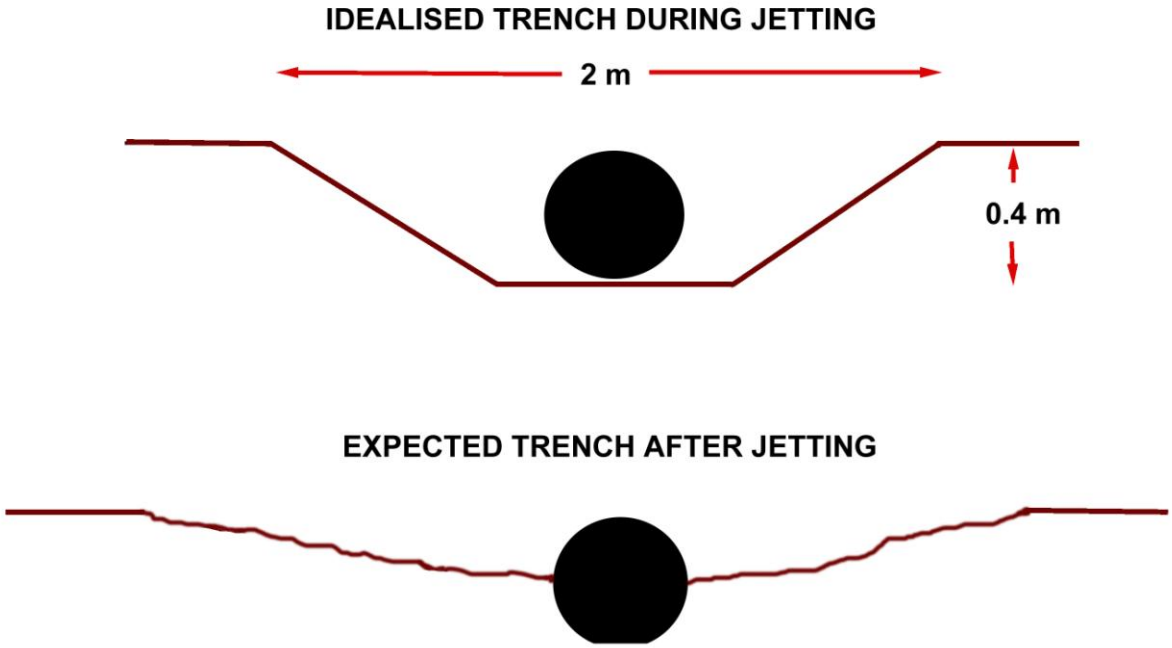


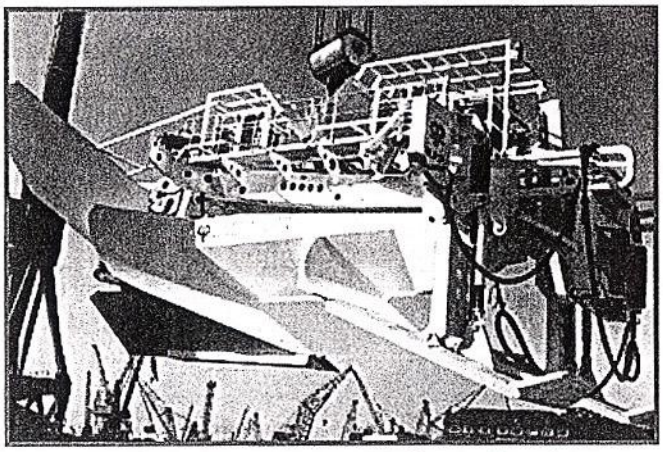
Figure 30. Jetted Trench



Adapted from Hodgins 2001

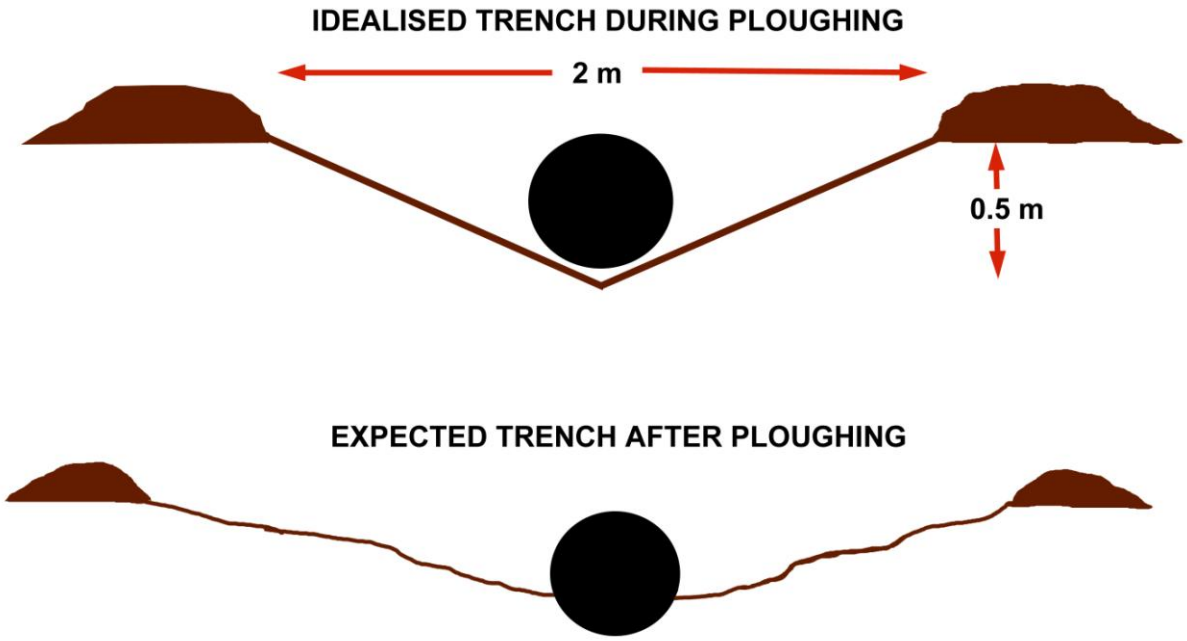
Alternatively, the pipeline could be trenched by moving the soil from under the pipeline by a plough with split shares (Figure 31). The plough is placed on the pipeline with shares open, then the shares are closed and the plough pulled forward. Similar to the jet sled, the plough is pulled behind a barge on skids straddling the pipeline and is monitored by an ROV or divers. Curves in deep water are more difficult to handle with a plough and the plough is more susceptible to skips and rollovers which can damage a pipeline without heavy concrete protection (Hodgins *et al.* 2001). The plough can advance at a speed of 1 km/h removing 0.5 m^3 per lineal metre (based on a 40 cm diameter pipeline) (Hodgins *et al.* 2001). The plough cuts a cleaner V-shaped trench than the jet sled and produces two berms alongside the pipeline (Figure 32). These berms can be 3 m wide and 20 cm in height (Hodgins *et al.* 2001). Unlike the jet sled, the majority of the displaced sediment will be located in the berms next to the trench, and less than 10% of the sediment will be re-suspended to a height of less than 10 m. There is less tendency for the walls to slump than with the jetting process, and it can be expected that the pipeline will be buried to approximately one third of its diameter immediately after trenching.

Figure 31. Trench Plough



Coflexip Stena Offshore Multipass Plough

Figure 32. Ploughed Trench



4.0 COMPARISON OF ROUTE OPTIONS

4.1 Values at Risk from Proposed and Alternative routes

4.1.1 Biophysical Values

Substrate

The seabed substrate is a valued resource in that associated biological communities are substantially dependent on substrate type. If the seabed substrate is altered, then there is likely to be some associated alteration of the benthic community. This concern was expressed at the workshop in terms of substrate changes that could affect the habitat of prawns and crabs, important commercial species in the area.

There are several mechanisms that could alter substrate in the vicinity of both the proposed and alternative route options:

- introduction of a hard substrate (i.e., the pipeline) in an otherwise soft-sediment bottom creating a 'reef effect';
- altering the surficial sediment texture during the trenching operation; this would occur if coarser sediment were brought to the surface along the trench;
- siltation of previously hard-substrates during the construction process; and
- alteration of sediment dispersal processes by the pipeline where the pipeline might cause a barrier to bottom traction movement of sediment.

The creation of hard-substrate (the pipeline) on a soft bottom is likely to occur in the alternate routing scenario as no backfilling of the trench is proposed. This procedure would create a hard-substrate benthic community that is not currently represented within ER67, at least on the northern half of the reserve. It is not certain how this hard substrate would affect the benthic community away from the pipeline. Some species such as crabs may shelter in the crevice between the pipeline and the substrate. The magnitude of this effect is probably low, except that the primary purpose of ER67 is to preserve an undisturbed benthic community for monitoring purposes. Therefore, even small changes in benthic community structure at the monitoring sites would be considered important. In the absence of any specific data on the 'zone of influence' of hard substrate on surrounding benthic communities, this effect must be considered at least a moderate concern. The effect could potentially be mitigated by backfilling of the trench so that no pipeline is left exposed; the pipeline should be buried to a depth of least 20 cm to permit normal infauna to establish above the pipe.

The introduction of the hard pipeline on the slope unit is considered less of an impact in that there is already a hard substrate on the slope in the form of boulder and cobble material (Terra Remote Sensing 2000; Archipelago Marine Research 2001). This coarse gravel provides a stable substrate to which hard-substrate epifauna can attach.

There is a concern that the trenching operation associated with the alternative routing through the reserve could exhume coarse sediments that would then provide a hard substrate along the pipeline route in addition to the

pipeline itself. However, the high resolution seismic profiling from the ER67 area indicates that sediments are uniformly fine to depths of at least five metres, where gas within the sediment obscures further penetration of the sound waves. As such, it is unlikely that coarser sediments would be exhumed during the trenching process.

Siltation of hard substrates during the construction process was expressed as a concern at the workshop. Siltation could occur with either of the two routing options. In the proposed routing, the pipe will be surface laid adjacent to ER67 and trenched to the east and west. ER67 would likely be affected by the trenching process, particularly if hydraulic jets are used. In addition, approximately thirteen pilings will be required to secure the pipe on steeper portions of the slope; these pilings will create a sediment plume in the immediate vicinity. Existing sediments on this slope area are gravelly sands and similarly, subsurface sediments are mostly gravelly sands (Jaques Whitford Associates 2001a). The ubiquitous presence of sea pens on this slope unit suggests that currents are moderate and capable of dispersing silt and clay plumes. It is likely that there will be minimal alteration of the existing substrate due to the pile-drilling operations because the subsurface sediment that will be exhumed during the drilling process appears to be the same as the existing surface sediment, and the currents in this slope area are sufficiently strong to disperse finer fractions that settle out near the drilling sites. There does not appear to be any mitigation for reducing the sediment plumes from drilling.

In the alternative route, sediment plumes could be created from the jetting operation. Hodgins *et al*. (2001) indicate there would be a low-concentration sediment plume that could extend several kilometres from the trench, and a higher-concentration sediment plume that would be limited to within 300 m of the trench. While the low-concentration plume might create a dusting of hard substrates in the trough and slope units near ER67, sediment thicknesses are likely to be less than one centimetre (Hodgins *et al*. 2001), and these sediment drapes would most likely be swept away as a result of the stronger currents that appear to prevail on the trough and slope units. The significance of the impact is considered low due to the short duration of the potential impact and the adaptation of organisms to sedimentation events associated with the Cowichan River plume.

Sediment build-up is commonly noted along one side of bottom-laid pipeline indicating that sediment is being trapped along the updrift side of the pipeline. If this trapped sediment is taken out of the sediment transport system, alterations in substrate could occur on the down-drift side of the pipeline. Both routing alternatives could cause this effect. The potential effect on the trenching alternative through ER67 is likely to be minimal as the trench would probably infill quickly if considerable volumes of sediment were being transported along the seabed, and even if there were a temporary interruption of transport, the sediments are very uniform spatially and with depth, so it is unlikely that a substrate change would occur as result of sediment trapping against the pipe. The potential effect could be mitigated by backfilling of the trench. On the proposed route, where the pipeline is installed on the seabed and anchored by pilings, there is the potential to capture material moving downslope, against the up-slope side of the pipe. Gravel splays noted at the base of the slope (Terra Remote Sensing 2000) suggest there has been downslope movement of material in the past and Jaques Whitford Associates (2001a) notes the potential of boulders (30 cm in diameter) to move downslope during earthquake events for which the pipeline has been designed to withstand. There may be some trapping of sediment against the upslope side of the pipe, however, the degree of impact is unknown because sediment movement rates are unknown. It is likely that any substrate change at this particular location will be limited to a corridor that is a few pipeline diameters in width. The only potential for mitigating this effect, which is expected to be of low significance, is to trench the pipe into the slope surficial sediments.

The most marked impact associated with substrates is the introduction of hard substrate of the pipeline into the soft-bottom seabed of ER67 as part of the alternate routing option. The impact of the hard-substrate community on the surrounding soft-bottom benthic community is not known, and in that the primary purpose of the ecological reserve is to protect this soft bottom community for research monitoring, this effect is considered at least of moderate significance, although the effect could be mitigated by back-filling of the trench. The proposed routing option has no marked impact to substrate alteration.

Benthic Fauna

The benthic fauna is of concern in this area in that this faunal assemblage is the very value that the ER is protecting. This community may have been adversely affected by groundfish and prawn trawling which were not restricted until around 1999 to 2000 (see Section 2.5); numerous striations on the seabed are interpreted as trawls marks. Comparison of recently collected samples (Burd and Glaholt 2000) to early samples (*e.g.*, Ellis 1969) is inconclusive as to whether the bottom community has changed since the 1960s to early 1970s.

The primary impact to the infauna is the physical disturbance of the trench digging and smothering from the trench berm and sediment plume. It is estimated that approximately 750-810 m^3 of sediment over 3000 m^2 (~0.09% of the ER) will be excavated for the trench in the ER displacing organisms living within 0.5 m of the surface. Depending on the trenching method and the size of the organism, the biota will be deposited between 3 m (ploughing) and 300 m (jetting) of the trench buried under 20 cm (ploughing) and 1 cm (jetting) of sediment (Table 5). While it is known that some infaunal animals will have structures and behaviour to avoid smothering, many of the studies on recovery refer to estuaries where there are naturally high suspended sediment and burial events with an associated limited diversity but often high biomass of tolerant species adapted for rapid colonisation (Bill Austin, pers. comm.). In addition, the limited amount of surveying of ER67, particularly since designation, makes it difficult to fully characterise the infaunal community which may be affected. In addition, once buried, the pipeline may act as a barrier to infaunal movement.

Geoducks are known to occur in the proposed pipeline route and some are likely to be directly disturbed during the construction process and possibly after construction if the pipeline serves as a habitat for geoduck predators. Archipelago Marine Research (2001) noted about 50 geoduck siphons during their shallow-water survey of the proposed route. This survey covered approximately 5600 m^2 of seabed in the 10 m to 50 m water depths suggesting a minimum density of one geoduck per 1000 m^2 of seabed; densities are likely greater than this value because only geoducks with extended siphons were inventoried.

There is likely to be some impact to geoducks by the proposed route. There is no known mitigation for this impact, although some compensation could be provided for geoduck nursery programs. The substrate of the alternate routing is such that geoducks are unlikely to occur on the Channel Flat and none were observed in the ROV surveys.

Table 5. Comparison of Sediment Disturbance in ER67 from Different Trenching Options

	Trenching Method	
	Jetting	Ploughing
Volume of displaced sediment*	810 m^3	750 m^3
Area of displaced sediment	3000 m^2	3000 m^2
Distance of sediment displacement	300 m	3 m
Depth of displaced sediment	1 cm	20 cm

*These volumes are calculated based on a 40 cm diameter pipeline. The concrete-coated pipeline will be 53 cm in diameter, therefore, the volume of actual displaced sediments will likely be greater.

Source: Derived from Hodgins *et al*. 2001.

Crab Migration

Commercial, subsistence and recreational crabbing occur in and around ER67, and alteration of crab distributions is of concern to all of these users. In particular, there is a concern that a pipeline could impede the migration of crabs on the seabed. GSXPL conducted studies of crabs migrating across a pipeline (TERA Environmental Consultants and Biologica Environmental Services, 2000) and showed that pipelines do act as an obstacle to crab movement.

The degree to which the pipeline would form an impediment to crabs is dependent upon the height of the impediment, but may also be affected by crab migration patterns. When considering the height of the impediment, the proposed route would have a greater impact since the pipeline is likely to be fully exposed on the seabed (*i.e*., approximately 50 cm in height) whereas the pipeline in the alternative route through ER67 would be at least partially buried, and could be fully buried if backfilling was performed as a mitigation measure (although this is not presently planned). If backfilling is not performed, it could take decades for the pipe to completely bury. The proponent has suggested that the barrier-effect could be partially mitigated by the use of concrete mattresses laid over the pipe to facilitate crab migration, however, this is an unproven mechanism.

Little is known about the migration patterns of crabs or how the location of the pipeline may affect their migration. Crabs are trapped throughout Satellite Channel indicating that their habitat spans a relatively large area. No data are available to determine the distribution of crabs within the channel. Notwithstanding the height of the exposed pipe, it could be argued that the alternative route through ER67 bisects a greater segment of crab habitat and may, therefore, create a barrier to proportionately more crabs than the proposed nearshore route.

Due to the lack of information on crab distribution and migration, and the unknown length of time that crabs would be exposed to some form of barrier, it is concluded that both route options will have an adverse impact on crabs. The impacts are probably somewhat greater for the proposed route due to the known, long-term barrier caused by the exposed pipe segments.

Kelp and Potential Herring Spawn

Kelp beds are considered a highly valued nearshore resource in their own right and are also intimately associated with herring spawn. The *Nereocystis* kelp beds noted near Cape Keppel are not identified as a herring spawn area in the DFO kelp inventory data; however, these data focus primarily on commercial spawn sites. Given that there are known spawn sites within a few kilometres in Deep Cove, there is a reasonable possibility that these kelp beds support low-levels of herring spawn.

Both the proposed and alternate pipeline routes could affect these kelp beds, primarily through sediment plume contact during the construction period. While the sediments along the proposed segment are mostly gravelly sands, there are considerable components of silt and clay (10% to 40%; Jaques Whitford Associates 2001a) that are likely to be suspended during the drilling process for the pilings. Some of the drilling will occur within 500 m of the known kelp beds and plumes from the drilling operations are likely to reach these beds. The significance of the impact is considered low in that (a) the kelp beds are likely to experience turbidity plumes on a regular basis from the Cowichan River and (b) the duration of the impact is short (three weeks). There is also the possibility of sediment plumes reaching the shorelines of Deep Cove, where spawning is known to occur. The impact of sediment plumes on spawning can be mitigated by scheduling construction around typical herring spawning periods.

The alternate pipeline route through ER67 may also create sediment plumes during the pipeline installation process, especially if a jetting system is used to key-in the pipe. Kelp and spawn areas are likely to be affected by a low-concentration sediment plume associated with hydraulic jetting, but are unlikely to be affected by the higher-concentration sediment plume that may occur within 300 m of the trench. The significance of the impact is considered low in that (a) kelp beds are likely to experience on a regular basis the high turbidity plumes originating from the Cowichan River and (b) the duration of the impact is short (a few days). The impact is potentially mitigatable by (a) the use of ploughing to install the pipe (ploughing creates much smaller plumes; Hodgins *et al*. 2001), or by scheduling installation around typical herring spawn periods.

Both of the route options are likely to have a low impact on kelp beds and herring spawn; scheduling or use of different installation procedures could mitigate the impacts. The proposed route is considered to have a slightly higher impact potential due to the proximity of the pile-drilling procedure to kelp beds near Cape Keppel.

4.1.2 First Nations

GSXPL has documented First Nations issues and concerns regarding the pipeline as part of their submission to the NEB. Satellite Channel and its shores were specifically referenced by First Nations as areas of concern largely due to their relative importance for marine harvesting. The key issues that have the greatest influence on the present assessment regarding ER67 are:

- potential impacts to First Nations historical and traditional use sites;
- potential decrease in productivity of traditionally used fishing areas as a result of fish mortality and degradation of habitat;
- decline in invertebrate fisheries production due to habitat loss both along shorelines and the ocean bottom;
- potential restrictions on fishing types or methods used by First Nations, such as bottom trawling and

reef netting;
- effects relating to both initial construction of the pipeline (e.g., trenching, siltation, damage to reefs), and long-term impacts such as from malfunctions and leaks; and
- cumulative effects of multiple activities occurring in First Nations traditional territories.

In addition to these issues is the overarching concern, expressed by First Nations people, about the "loss of the wholeness and spiritual integrity of the area" (typically First Nations people do not differentiate the ER from the surrounding area) should a pipeline pass through.

Traditional and Historical Sites

In considering the two pipeline route options, the proposed route would have greater potential to result in damage to First Nations traditional sites in the study area. Although the exact locations of these sites are confidential, it is generally known that the south shore of Saltspring Island was intensively used by First Nations. It contains several traditional use sites as well as inland archaeological sites. Further, this area is presently important for marine resource harvesting activities. The fact that this shoreline is largely unpolluted, unlike other areas in the south coast, makes this area even more important for the Cowichan and possibly other First Nations (J. Kotaska, pers. comm.). The shoreline may also contain First Nations sacred sites. Conversely, there are no known subtidal traditional or archaeological sites along the alternative route through the ecological reserve. Although the intent would be to align the pipeline to avoid damage to First Nations traditional sites, the proximity of the proposed route to the shoreline would create a greater risk to traditional sites than the alternative route through ER67.

The mere presence of the pipeline, although not visible to the eye, may also be considered an intrusion on the spiritual significance of the area and may be more pronounced should the pipeline be routed closer to shore. From both a spiritual and conservation perspective, it is not known how First Nations would view the intrusion of the pipeline into the ecological reserve.

Current Fishing and Harvest Areas

First Nations presently use both Satellite Channel and its associated shoreline for fishing and marine harvesting. The environmental impact assessment for the proposed route indicates that impacts on the productivity of marine fish and intertidal species, as a result of both mortality and habitat degradation, will be short-term and insignificant (Georgia Strait Crossing Pipeline 2001e). Without confirming or disputing these results, when comparing the risks to First Nations uses of the two route options, it is concluded that there is a greater risk to First Nations fishing and harvesting usage if the proposed route is selected due to the proximity of the pipeline to nearshore fishing and harvesting areas, namely areas used for crab trapping and bivalve harvesting. These areas may be temporarily inaccessible during the construction period. Additionally, construction activities and infrastructural requirements associated with the proposed route have a greater potential to affect habitats of importance for First Nations' fisheries. Deepwater fisheries in Satellite Channel are likely to be less affected by either construction activities or the presence of the pipeline on the seafloor, with the possible exception of crab, as discussed in Section 4.1.1. No changes to gear type are anticipated with either route option in the vicinity of ER67. It is not possible to compare long-term impacts associated with malfunctions and leaks.

Cumulative Effects

First Nations are concerned about the cumulative impacts of multiple development activities in their traditional territories. The scope of this assessment precludes a detailed review of cumulative effects. Further, given the fact that ER67 is a protected area, a comparative cumulative effects assessment would be inappropriate since the non-protected portion of the study area is, by nature, subject to greater development pressures.

4.1.3 Human Use

Historical and Heritage Values

Aside from the First Nations values discussed above, there are no known historical or heritage values associated with either of the two pipeline routes in the vicinity of ER67. Hence, no values are at risk.

Research and Education

The assessment of impacts of the pipeline on research and education does not include research that would be necessary for the alignment, installation or monitoring of the pipeline itself. Further, the monitoring of changes to ecological or social components of the reserve or its surroundings as a result of the pipeline are not considered here. The discussion is focused on the implications of the two pipelines routes on the values and role of the ecological reserve for research and education.

Since the pipeline will not impede access for research (except perhaps during construction), the main issue is the effect of the pipeline on the ecological values of the reserve that form the basis for scientific research and education. Routing the pipeline through the reserve will have a greater effect on the ecological, and therefore, research values of the reserve than would the proposed route to the north. This is especially true for the benthic communities. Despite the present low use of the reserve for research and education, one of its roles is to provide a benchmark site for research. This role would be compromised if the pipeline were permitted to bisect the reserve. The degree to which this role would be compromised is dependent upon the ability of the benthic communities to recover from the pipeline disturbance and the timeframe for recovery. Conversely, the proposed route is expected to have less, if any, effect on the ecological values of the reserve itself, leaving its research and educational values intact.

The potential benefits to research and education associated with compensation (*e.g.*, the establishment of a research fund for the reserve) are discussed in Section 5.7.

Commercial Fisheries

The role of ER67 is to conserve representative benthic habitats. While protecting this area may have some 'spin-off' benefit to certain commercial fisheries, the impacts to commercial fisheries as a result of pipeline routing should be considered separate from the impacts of routing on the values of the ecological reserve. Commercial fishing is not a value of the reserve nor does commercial fishing contribute to achievement of this reserve's identified purpose and role. However, commercial fisheries will be affected in different ways depending upon the pipeline routing, and therefore, are included in this assessment.

Implications of the pipeline include access restrictions or disruptions during construction, and impacts to commercially harvested species either due to mortality or habitat degradation. The environmental impact assessment for the proposed route indicates that access disruption and impacts on the productivity of marine

fish and intertidal species, as a result of both mortality and habitat degradation, will be short-term and insignificant (Georgia Strait Crossing Pipeline 2001e). Without confirming or disputing these results, the potential impacts discussed below are in relation to the comparative differences between the two routing options.

As described in Section 2.5, commercial fisheries occur within ER67, however, more intensive use occurs outside its boundaries and particularly along southern Saltspring Island between the Cape Keppel shoreline and the reserve. Access restrictions and disruptions would be greater if the proposed route were selected largely due to the longer construction period. There would be only a minimal effect on access if the pipeline were routed through the ecological reserve. In the case of either route, the impacts will be relatively short-term and could be mitigated through notification to fishers and/or through compensation. It should be noted that the 'no net loss' requirement of the alternative route may result in changes to existing access or patterns of use if the reserve boundaries are altered and if DFO modifies fisheries closures or regulations in consideration of the new boundaries (see Section 5.0 for more discussion).

Pipeline construction is not expected to result in consequential mortality of commercially harvested species. However, the risks of mortality are greater with the proposed route given its proximity to nearshore fishing grounds, the greater complexity associated with laying the pipe, and the longer duration of construction.

The question of habitat degradation is of greatest significance since these impacts may be of a longer term than those of access or species mortality. Crab fishers are concerned that the pipeline will create a barrier to migrating crabs, an effect that is not well understood at this time (J. Elliott, pers. comm.). In laboratory experiments, exposed pipe was a greater barrier to female crabs than males (TERA Environmental Consultants and Biologica Environmental Services 2000). The barrier effect may result from either routing option. Based on the height of exposed pipe, which correlates with the degree to which the pipe acts as a barrier (TERA Environmental Consultants and Biologica Environmental Services 2000), the proposed route would have a greater impact on crabs, and this impact would be long-term. However, the impact on crab migration may also occur if the pipeline were routed through the reserve, since the pipe would bisect areas of possible crab activity to a greater degree. No studies have been performed to determine if the location of exposed pipe is as important a factor as the height of exposed pipe. In the case of Satellite Channel, it is not known what proportion of crabs would be impeded by the proposed versus the alternate options, however, the proposed route through the ER bisects a greater segment of crab habitat. In either case, mitigation options, such as trenching and the use of concrete mattresses, have been proposed, although their success is unproven. In addition, the results from laboratory experiments showed that both the California sea cucumber and green sea urchin demonstrate a willingness to cross exposed pipe segments (TERA Environmental Consultants and Biologica Environmental Services 2000).

In addition to impacts associated with construction activities, some underwater harvesters are concerned that the infrastructure required to stabilize the pipe on the proposed route along the steep foreshore will affect a large amount of shallow, subtidal habitat (G. Dovey, pers. comm.). Conversely, routing the pipeline through the reserve would have a lesser effect on the habitats of commercially harvested species, with the possible exception of crabs.

Given the impacts and considerations discussed above, it is concluded that the proposed route will have a greater overall impact on commercial fisheries (e.g., prawn and bivalves) than would the alternative route. Both routes would result in impacts to the commercial crab fishery, and compensation is currently being addressed. The impact on commercial fisheries of the alternative route will depend on possible changes to fisheries regulations that may result from altering the boundary of the ecological reserve.

Recreational Fisheries

The Satellite Channel area, including the ecological reserve, is open to recreational fishing and marine harvesting. As for commercial fisheries, the implications of the pipeline for recreational fisheries include access restrictions or disruptions during construction, and impacts to recreationally harvested species either due to mortality or habitat degradation. These impacts have been discussed above in relation to the commercial fisheries. It has been concluded that the greatest impacts would occur in the nearshore areas and that the proposed route has greater potential to alter access to fishing and harvesting grounds (and for a longer period of time), and to disrupt habitats for those species that are more commonly fished and harvested. These conclusions also apply to recreational harvesting of intertidal species and recreational crab trapping that occurs along the southern shores of Saltspring Island. Deepwater recreational fisheries would only be affected by construction activities, a relatively short-term and mitigatable impact.

Other Recreation and Tourism

Recreational use is generally not encouraged in provincial ecological reserves although protected areas, in general, are attractive to recreational users due to their relatively pristine environments. In the case of ER67, recreational activities are ancillary to the reserve itself and presently, have no measurable impact on its subtidal environments[3].

All potential impacts of the GSX pipeline on recreation and tourism are associated with the construction phase, and would mainly affect recreational boat traffic from a navigational perspective. Given the longer construction period, the proposed route may result in greater inconvenience to recreational users on the nearshore area. However, both routes will likely have only minor, if any, effect on recreation and tourism use. Further, these impacts have no bearing on the values of the ecological reserve. The proposed route may compromise, to some degree, the integrity of the UREP site located along the foreshore of southern Saltspring Island. However, the proposed route would only affect a very small portion.

Transportation

The Navigable Waters Protection Division of the Canadian Coast Guard is presently reviewing the GSX crossing to determine the impacts for marine navigation and safety. Potential impacts that have been identified, regardless of the selected route, are generally limited to the construction phase of the project and include: impacts to navigation routing for commercial and recreation traffic; timing, notification and communication with vessel traffic regarding navigational changes; and marine safety around pipe-laying vessels and equipment. Discussions with the Coast Guard as part of this assessment indicate that, from a navigation point of view, the proposed route would likely have the least impact, however, neither route is expected to result in impacts that

[3] Although not considered as part of the routing assessment, recreational boating and marine harvesting may have some impact on water quality and other marine components that could influence the health and productivity of benthic habitats in the reserve. However, these impacts would be very difficult to quantify.

could not be mitigated (J. Mackie, CCG, pers. comm.). In either case, the impacts will be short-term and will have no bearing on the values or role of the ecological reserve.

4.1.4 Ecological Reserve Integrity

The integrity of the ecological reserve as a whole, can be compromised by risks to the values it aims to protect and by the alteration of its boundaries. Risks to the reserves ecological values, for which is was designated, are described in the Section 4.1.1, while the risks to research and educational values are outlined in Section 4.1.3. The implications of boundary changes are discussed in Section 5.0.

One of the goals of the provincial protected areas system is to protect and conserve representative areas and habitats. Thus, while the reserve does not necessarily protect rare elements or unique features, its value in the system is no less important and its boundaries no less definite. Changes to the surrounding environment since the time the ER was established lessen the likelihood that a comparable representative area can be designated either adjoining to, or in the vicinity of ER67. Similarly, long-term monitoring plots have been established within the ER, and although some problems with data comparability exist, there is value to retaining these plots within the reserve boundaries.

It is more difficult to characterise the socio-political risk of altering the boundary of an ecological reserve. Satellite Channel Ecological Reserve is named and described in Schedule B of the *Protected Areas of British Columbia Act* (2000). Accordingly, any amendments to its boundary to accommodate the pipeline can only occur by an Act of the Legislature. There was great concern expressed at the workshop that altering the boundaries to accommodate a pipeline, particularly when a feasible alternative exists with marginal increase in environmental impact, would set a dangerous precedent and may be perceived to be a threat to the provincial protected area system. The long-term impact of such a precedent on the protected areas system is impossible to quantify.

4.2 Summary

Table 6. Summary of Values at Risk or Constraints

	Key Value	Risks or Constraints	
		Proposed Route	Alternative route
Biophysical	Substrate	No values at risk	Moderate impact due to introduction of a hard surface on a soft substrate community
	Benthic fauna	Less impact due to predominant surface laying	Greater potential risk due to trenching including disturbance from digging, smothering and barrier effect
	Crab migration	Impact as a barrier, based on the height of exposed pipe. Possible lesser proportion of crabs disturbed due to location of pipe	Lower impact if pipe is sufficiently buried although complete burial unlikely and mitigation unproven
	Kelp and herring spawning	Greater impact from trenching near kelp beds	Impact from sediment plume due to jet trenching

	Key Value	Risks or Constraints	
		Proposed Route	Alternative route
First Nations	Historical values and sites*	Greater potential risk to First Nations historical sites and values since a greater proportion of traditional sites are found in nearshore areas (e.g., south Saltspring Island) than are found in the reserve area	Concern for integrity of the reserve
	Present Uses*	Greater impacts on First Nations use as a result of a longer construction period (e.g., more disruption to access and greater risk of species mortality) and the more extensive infrastructural requirements (e.g., greater impact to habitats of traditionally harvested species).	Shorter construction period means less disruption to First Nations uses. With the possible exception of crabs, lesser overall impact to habitats of harvested species
Human Use	Historical and heritage values*	No values are at risk	No values at risk
	Research and education	No values are at risk	The integrity of the reserve, as a benchmark site, would be compromised
	Commercial fisheries*	Greater impacts on commercial fishers as a result of a longer construction period (e.g., more disruption to access and greater risk of species mortality) and the more extensive infrastructural requirements (e.g., greater impact of habitats of commercially harvested underwater species)	Shorter construction period means less disruption to fishing activity. With the possible exception of crabs, lesser overall impact to habitats of commercial harvested species. Impacts to crab migration may be mitigated by trenching and eventual infilling
	Recreational fisheries*	Some impacts on recreational harvesting of intertidal species and crab trapping. These uses are incidental to the ecological reserve	No values at risk.
ER Integrity		No impact on integrity of ER	Concern for precedence setting and minimising the significance of ecological reserve

* These uses are incidental to the role and values of the ecological reserve.

5.0 BOUNDARY IMPLICATIONS AND MITIGATION

In keeping with the no-net-loss principle of this study, if the alternate pipeline routing were to proceed, the boundaries of ER67 would have to be amended by:

1. relocating the ER in its entirety;
2. cleaving off the northeast corner of the ER and compensating for this loss of area; or
3. excluding the pipeline corridor and compensating for this loss of area.

It was suggested at the workshop that any re-configuration of the reserve should more than compensate for its present size. In addition to compensation in area, other forms of compensation, e.g., monetary, are also considered.

The status quo, in which the pipeline is constructed outside the ER as proposed, is also presented as an option.

Whichever option is selected, it is recommended that the boundaries of the reserve be denoted on marine charts.

5.1 Option A - Relocate the ER and Maintain Square Configuration

It was raised at the workshop that while a square configuration may not have an ecological foundation, it is an easily recognisable shape and in its current configuration, allows for a buffer of the soft substrate in the centre of the channel. To maintain the square configuration and size, the ER would have to be relocated approximately one kilometre to the west towards Patey Rock (Figure 33). The ER would no longer be oriented along the channel, but would be situated more to the entrance of Saanich Inlet. It would encompass about 50% of the current ER. The average depth would be shallower than the existing ER. While the detailed substrate mapping does not fully encompass this potential relocated ER, it does indicate that the substrate would still be predominantly sand/mud composition with bedrock patches approaching Patey Rock. As the channel is considerably wider in this area, current velocities, which influence the benthic community diversity, are likely to be slightly lower than in the existing reserve area. All of the historic sampling sites would be maintained within the new ER, however, they would be on the eastern half rather than in the centre of the reserve. Year 2000 sampling sites would be excluded from the reserve. The boundaries of the potential new ER would not afford a substantial buffer area for the soft substrate communities as do the current boundaries. The western extension of the potential new reserve would be almost entirely in statistical subarea 18-6 and therefore, would have less impact from historic trawling activity. Shifting the boundaries of the ER is likely to have limited effect on present users of the area. Recreational diving occurs around Patey Rock, and these users may be excluded from the ER or would be required to obtain permits. Approximately 15% of the new ER would lie within the 300 m disturbance zone of jet trenching but just beyond the 30 m disturbance zone of plough trenching.

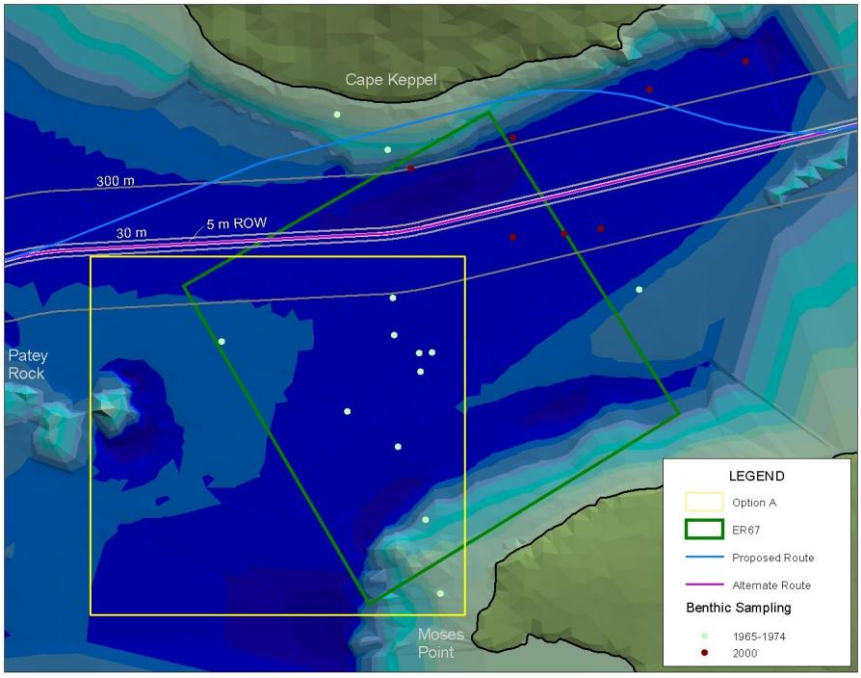


Figure 33. Option A: Relocate ER, Square Configuration

5.2 Option B – Relocate ER in Rectangular Configuration

The ER could be changed to a rectangular configuration that would generally follow the orientation of Satellite Channel (Figure 34). The reserve would retain a recognisable shape and would continue to be situated between Saltspring Island and North Saanich. This option would encompass more of the existing ER than would Option A. The average depth would be similar to the current ER, but it would exclude the trench to the north of Satellite Channel. The soft-bottom community then, could be more susceptible to edge effect than in the existing ER since the subtidal hard substrate slope of Saltspring Island, which currently acts as a buffer for the core area of the ER, would be excluded. The substrate would be predominantly sand/mud as in the existing ER. All of the historic sampling sites would be maintained in the centre of the new ER. Year 2000 sampling sites would be excluded. The ER would be elongated to the west encompassing more area not subjected to trawling. Similar to Option A, there would be limited impacts on First Nations values and human use as a result of an amended boundary. About 10% of the new ER would lie within the 300 m disturbance zone of jet trenching and just beyond the 30 m disturbance zone of plough trenching.

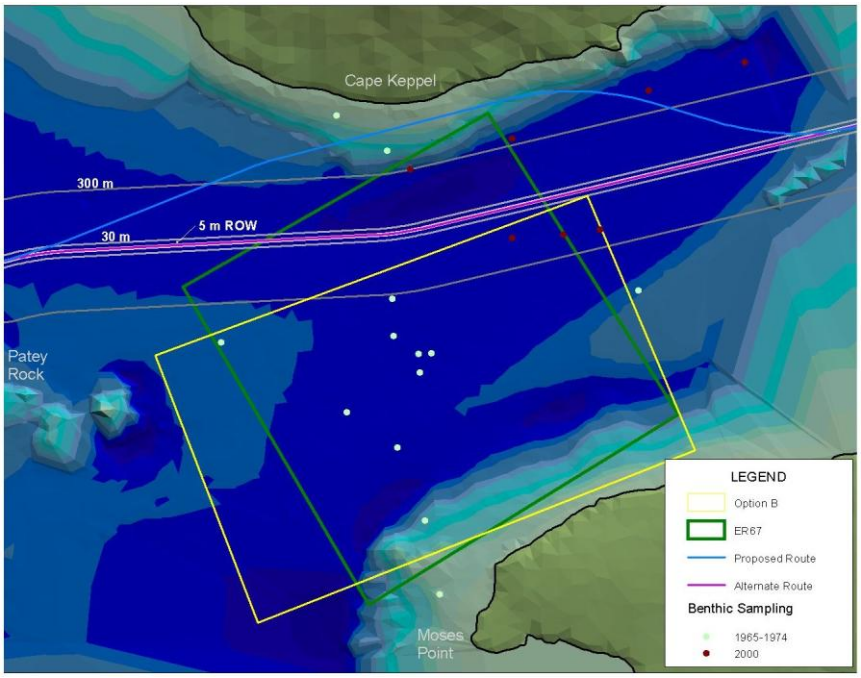


Figure 34. Option B: Relocate ER, Rectangular Configuration

5.3 Option C – 'Cleave' Northeast Corner

Option C attempts to maintain more of the existing ER by following the alternate pipeline route and compensating for the northeast corner by extending the boundary to the east and west (Figure 35). The new ER would follow the orientation of Satellite Channel but would be configured in an irregular shape which would be more difficult to enforce. The average depth would be similar to the current ER, but it would exclude the trench to the north of Satellite Channel. As with Option B, the soft-bottom community then, could be more susceptible to edge effect than in the existing ER, although the eastern and western extensions would increase the buffer for the centre of the channel. The substrate would be predominantly sand/mud as in the existing ER. The new ER would maintain all of the historic sampling sites at its centre, and it would encompass one site currently outside the ER boundaries. The ER would be elongated to the west encompassing more area not subjected to trawling. However, because it would also be elongated to the east there may be some implications for current fishing activity. About 15% of the new ER would lie within the 300 m disturbance zone of jet trenching and just beyond the 30 m disturbance zone of plough trenching.

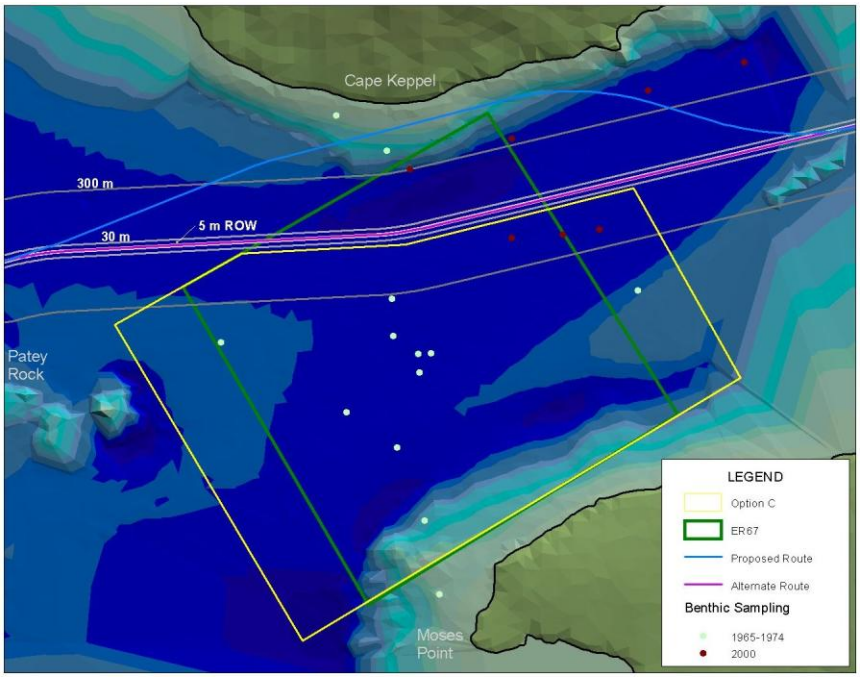


Figure 35. Option C: 'Cleave' off Northeast Corner

5.4 Option D – Pipeline Corridor

Assuming a scenario in which the alternate pipeline is constructed, the integrity of the current ER would be maximised by de-regulating only the pipeline corridor and compensating for this area (Figure 36). The corridor could be 10 m wide to include the right-of-way as a minimum or it could be wider (e.g., 100 m) to avoid more of the trench disturbance zone. This would fragment the ER but only until the pipeline is buried. The southern component of the ER would be slightly smaller than Option C. The northeastern component could be extended to the east to align with the eastern boundary of the southern portion. Comprising these two sections, the ER would be 20% larger than the current ER. Additionally, when the pipe in buried, the excluded right-of-way would essentially function as part of the ER since it is unlikely that any activities or uses, other than the pipe itself, would occur along the right-of-way. While this is an irregular shape with the exclusion of the corridor, in effect it is a rectangular area. The average depth would be similar to the current ER and it would include the trench to the north of Satellite Channel, and therefore maintain its northern buffer. The eastern and western extensions would increase the buffer for the centre of the channel. The substrate would be predominantly sand/mud as in the existing ER. The new ER would maintain all of the historic sampling sites at its centre, and it would encompass one site currently outside the ER boundaries. The ER would be elongated to the west encompassing more area not subjected to trawling. However, because it would also be elongated to the east, there may be some implications for current fishing activity. About 25% of the new ER would lie within the 300 m disturbance zone of jet trenching and just beyond the 30 m disturbance zone of plough trenching.

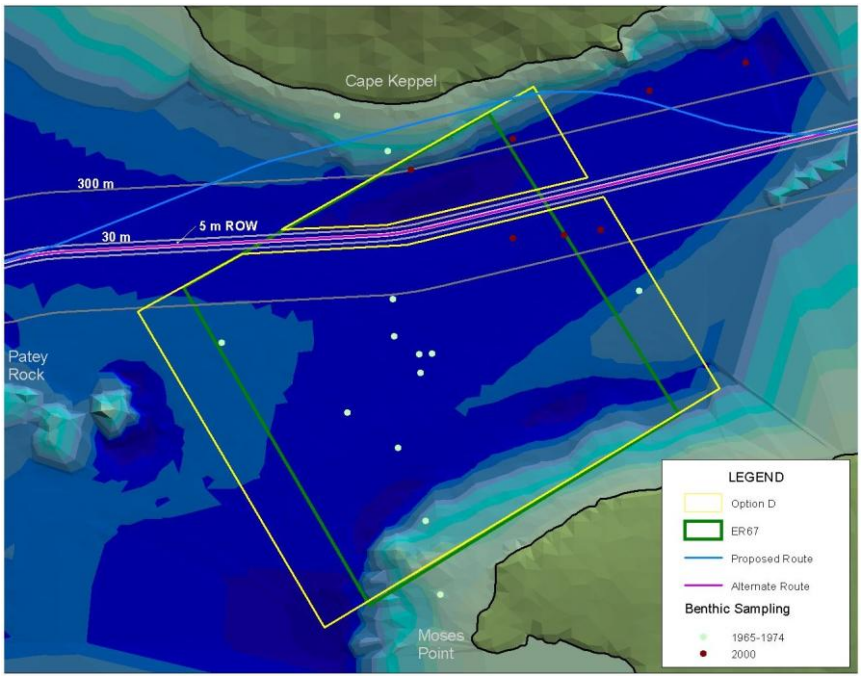


Figure 36. Option D: Deregulate Pipeline Corridor

5.5 Option E – Status Quo

Option E assumes that the alternate pipeline is not approved and the proposed pipeline is constructed. In this case, the boundaries of the current ER are maintained (Figure 37). Since the proposed pipeline in the immediate vicinity of the ER would lay on the surface rather than be trenched, there would be minimal incursion of sedimentation into the ER.

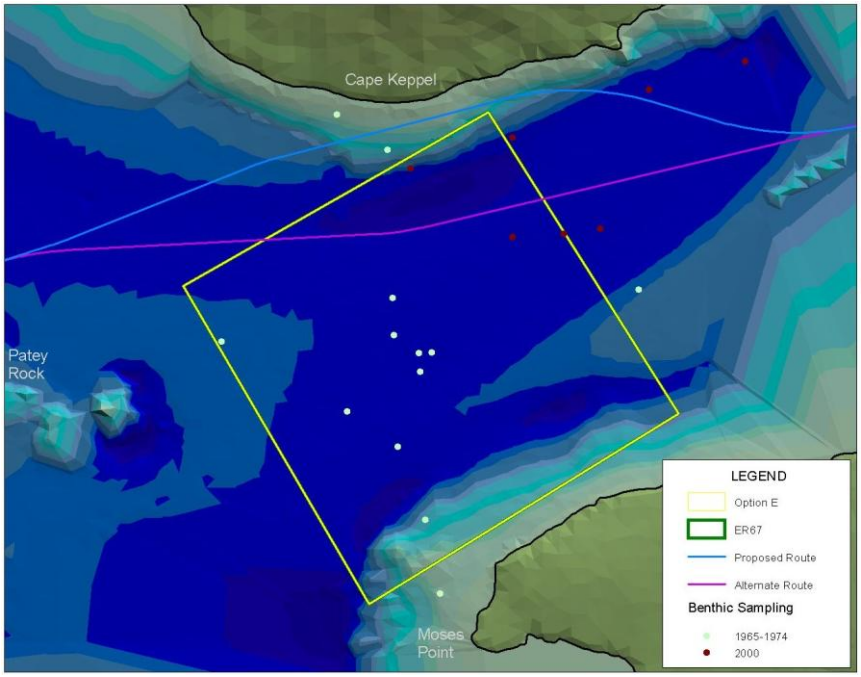


Figure 37. Option E: Maintain Current ER

5.6 Summary of No-Net-Loss Options

All the no-net-loss options presented in the previous sections are summarised against several criteria in Table 7. Of the scenarios involving construction of the alternative pipeline, Option B appears to strike the best balance among shape, overlap with ER and substrate similarity with the existing ER. It also includes a greater portion of area not recently subjected to trawling, and it maintains the historic sampling sites within its centre.

Some participants at the workshop felt that, if the alternative route were approved, there should be a net gain in the area of the ER. Some of the reasons for supporting increasing the size of the ER include uncertainties about the impacts of the pipeline on ER values, creating a larger buffer around key values, and providing a disincentive to future proposals for boundary changes to protected areas by creating a net-gain precedent. Unlike Option C, the overall size of the ER would not be increased with Option B, however, there may be opportunities to increase its size pending further consultation with users of the adjacent areas.

Table 7. Summary of No-Net-Loss Options

	Option A	Option B	Option C	Option D	Option E
Shape	Square	Rectangle	Irregular	Rectangular	Square
Size (to ER67)	4% larger	Equal	20% larger	20% larger	Equal
Overlap with Current ER	~ 50%	75%	80%	~90%	100%
Depth	Shallower	Similar (excluding trench)	Similar (excluding trench)	Similar	Same
Substrate	Sand/mud Patchy rugged bedrock	Sand/mud	Sand/mud	Sand/mud	Same
Sampling Sites	All within eastern half	All within centre	All within centre Encompass one additional site	All within centre Encompass one additional site	All within centre
Pipeline Impact	~10% within 300 m of jetting disturbance zone	~10% within 300 m of jetting disturbance zone	~15 % within 300 m of jetting disturbance zone	~25% within 300 m of jetting disturbance zone	~15% within 300 m of jetting disturbance zone
Impact to Human Uses	Limited (SCUBA diving)	None	Unknown (commercial fisheries)	Unknown (commercial fisheries)	None

5.7 Mitigation

In the previous sections, several mitigation measures have been discussed. The pipeline will lay fully exposed for a month between pipeline installation and trenching thus presenting a barrier to migrating animals, of which crabs are of particular concern. The biggest impact on the ecological reserve from the alternate pipeline routing is from the trenching process, which has yet to be finalised. Both jetting and ploughing will excavate and displace benthic habitat. The plough would cause more localised impact (within 30 m of the pipeline) than jetting (primarily within 300 m but sediment may be disbursed several kilometres), although the berms created by the ploughs are likely to cause a greater smothering effect. Once trenched, the pipeline will lay exposed between one third and one half its diameter until it is naturally infilled. This may take in the order of five years to decades, introducing a hard substrate into a soft bottom environment and again presenting a barrier to organisms. One option to minimise the effect of the exposed pipeline is to bury the pipelineit about 20-30 cm below existing bottom surfacethe diameter of the pipeline and to backfill during the trenching operation. While the increased trench depth will increase the volume of sediment excavated, it will also enhance recolonisation of the surface sediments. Backfilling will more quickly return the habitat to its original state, thereby eliminating exposure of the hard substrate in a soft substrate community and minimising the barrier effect. Backfilling can be done manually, or through the use of a modified jetting process. Since the substrate in ER67 is predominantly sand/mud, the substrate can be fluidised by the jets, allowing the pipeline to sink under its own weight. This technique minimises the surrounding turbidity.

It was also suggested at the workshop that financial compensation by the proponent could be targeted towards resuming much-needed research of ER67 to its intended role. The funds may also allow the reserve to function as an *in situ* laboratory for a variety of environmental impacts due to the pipeline such as barrier effect, recolonisation and recovery and rate of sedimentation. While this may be an appealing opportunity, the irony of introducing a disturbance into an ecological reserve to study its impacts would not be lost. In other words, financial compensation should not be a motivating factor for constructing the alternate pipeline. However, if the alternate pipeline were justified on other grounds, the establishment of a research fund could be considered a form of compensation.

6.0 OTHER CONSIDERATIONS

If ER67 did not exist, then a decision based solely on ecological and socio-economic merits would likely tip the scales towards the alternative route. However, the presence of an ecological reserve introduces a socio-political dimension to the issue that cannot be ignored. While the Terms of Reference for the present evaluation of route options is limited to a review of environmental and socio-economic impacts in relation to ER67, some of the messages revealed by government stakeholders, First Nations, and other interest groups through the workshop and other discussions speak to the more personal, political and perhaps farther-reaching aspects of the routing decision.

Several participants at the workshop raised concerns regarding the integrity of the ER and its boundaries. While there is some precedent for altering protected area boundaries to permit activities that would otherwise be excluded, the examples are largely limited to developments for which there was no other feasible option. In the case of the GSX Pipeline, a feasible routing option exists outside the ER; the proponent's environmental impact assessment identified no significant residual environmental or social impacts associated with this option notwithstanding the greater complexity of the pipe-laying process. If the alternate route were to be approved, the subtidal area near Cape Keppel would be maintained in its present state in the short term, however, given that it has no protected area status, it is still open to potential future development and disturbance. In contrast, if the proposed pipeline were to be approved, ER67's long term protected status would be maintained.

Perhaps more important is the concern raised at the workshop that not only the ecological integrity of ER67, but also the socio-political integrity of the protected area system is at stake by the alternative route[4]. Some participants spoke about the irony of establishing a protected area, particularly the most stringent protected area designation within the provincial protected area strategy, only to alter its values in the interest of development. Furthermore, fears were expressed about the precedent set for other ecological reserves, and protected areas in general, should the boundaries of ER67 be amended without overwhelming evidence of environmental or social benefit. This point was reiterated in a press release, issued the day after the workshop, by the Georgia Strait Alliance, the Canadian Parks and Wilderness Society (BC Chapter) and the GSX Marine Coalition. Despite a willingness to participate in the workshop, compare the impacts of the two routes and discuss potential compensation measures, several groups are likely to remain adamantly opposed to any decision which compromises the values and integrity of the ER.

[4] It should be noted that while some groups at the workshop opposed the GSX pipeline altogether, if faced with a choice between the proposed and the alternative routes, these groups were more clearly opposed to the alternative route than specifically in favour of either.

7.0 CONCLUSION

Routing the GSX pipeline through ER67 and the resulting boundary modification requires compelling ecological and social benefit in comparison to the values of the ecological reserve that would be lost. The following sections summarise the outcomes, benefits and implications of the two route options based on the preceding science-based evaluation and likely socio-economic consequences.

7.1 Environmental Outcomes

The proposed route will have lesser impacts on substrate and infauna due to predominant surface laying of the pipe, but greater impacts to nearshore species and habitats when considering the effects of construction activities and infrastructure needed to stabilise the pipe along the steep shoreline. Of these, nearshore kelp beds, potential herring spawn locations, and bivalve invertebrate species are values that are noted as being at risk. The proposed route may also pose a greater barrier to crabs since the whole of the pipe will be exposed for the life of the project although the location of the 'barrier' in comparison with the alternative route may result in a lower number of crabs being affected depending on crab migration patterns. While seismic activity has been taken into account in the pipeline design, there remain concerns about the stability of the pipeline along the proposed route.

Conversely, the alternative route avoids impacts to nearshore species and habitats, but would result in greater impact on the ER itself. Substrates within the ER would be moderately affected by the introduction of a hard surface on a soft substrate community. The alternative route would also present a risk to infauna due to trenching including disturbance from digging, smothering, turbidity in the water column and barrier effect. If the pipe is sufficiently buried, the barrier effect to megafauna can be lessened. Complete burial would be the only way to ensure full mitigation of this effect, although the pipeline may remain a barrier to infauna. There are no stability concerns associated with the alternative route.

7.2 First Nations Outcomes

To the Cowichan Band, the Cape Keppel area is steeped in legend and spirituality which may be intruded upon by the proposed pipeline route even though there will be no visual or surface effect beyond the installation phase. This area is also historically important to other First Nations who have traditionally resided in and used the coastal areas of the Saanich Peninsula and Saltspring Island. Marine resource harvesting by First Nations continues to occur along these shorelines and may be affected by the proposed route in the vicinity of Cape Keppel. Although the deepwater areas, which would be bisected by the alternate pipeline route, are also traditionally and presently important to First Nations, the alternate route is unlikely to place any of these values at risk.

It is concluded that the proximity of the proposed route to the more intensely used nearshore area will have a greater impact on First Nations traditional values and on First Nations subsistence uses than would the alternative route. However, it should be noted that some First Nations have expressed an interest in maintaining the integrity of the ecological reserve, while also minimising the impacts to nearshore historical and present use sites.

7.3 Socio-Economic Outcomes

From a fisheries perspective, now that all trawling is prohibited in ER67, the alternative route would likely have no to minimal effect on commercial or recreational fisheries with the possible exception of crab (which could also be affected by the proposed route). There may, however, be some implications on commercial fisheries arising from relocation or expansion of the ER as part of the no-net-loss compensation. Conversely, the proposed route would pose greater risks to commercial and recreational fisheries resulting from both construction activities and habitat alterations in closer proximity to nearshore fishing areas. Some potential impacts to geoducks, crabs and herring spawning have been identified. Commercial fishers, in general, support the alternative route due to their concerns of the proposed route regarding access to fishing areas during the construction period and impacts to nearshore habitats that support commercially important species. Although mitigation will likely reduce these risks and compensation agreements have been negotiated with some fishing interest groups, the short- and long-term impacts of the proposed route on the crab and geoduck fisheries remain of concern for fishers.

From a research and education perspective, the integrity of the reserve as a benchmark site for research would be compromised if the alternative route were selected. Although there has been virtually no systematic research in ER67 in the 25 years since designation, the reserve serves a valuable research and education role with data and specimens dating back 35 years. The fact that ER67 is the only completely subtidal reserve of its kind in BC, combined with its relative accessibility, makes this reserve not only important but unique in the province.

No marked effects to non First Nation historical values, recreation, tourism or transportation have been identified for either route option.

7.4 Conclusion

The role of Satellite Channel Ecological Reserve is to conserve rich benthic communities typical of fine-grained, level-bottom environments in the southern Gulf of Georgia (BC Parks 1987). Additionally, the area is deemed representative of the seafloor of Satellite Channel and, as such, was initially intended to provide a benchmark for future research. The Satellite Channel Ecological Reserve was at the time of establishment, and remains today, the only completely subtidal ecological reserve in British Columbia. The impacts of the pipeline on these values should be the first and overriding consideration in decision-making regarding the two routes.

While there is still much to learn regarding the soft substrate communities of ER67 and the potential effects of a pipeline, it is concluded that the overall environmental impacts of pipeline installation of the alternative route may be marginally less than the proposed route, when considering the study area as a whole. This is predominately due to the greater risks to nearshore environmental values as a result of an extended and more complex construction period of the proposed route, the more extensive infrastructural requirements to stabilise the pipe, and the inability to bury the pipe creating a long-term barrier to organisms.

However, when considering the risks to ER values, the alternative route would clearly result in greater risks, some of which are not fully understood based on the available information. If the alternative route is selected, complete burial by infilling at the time of trenching would minimise the impacts of this option on the environmental values of the reserve. Nonetheless, this evaluation has failed to identify any appreciable ecological or social benefits to the ER that would result from an approval of the alternative pipeline route.

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APPENDIX A - LIST OF GOVERNMENT AGENCIES AND STAKEHOLDERS CONSULTED

The following were contacted to locate any further information pertaining to Ecological Reserve 67 and to extend an invitation to the consultation workshop:

First Nations
Cowichan Tribes (Larry George, Jana Kostaka, Chuck Seymour)
Malahat First Nation (Chief Vincent Harry, Randy Daniels)
Pauquachin First Nation (Chief Mavis Henry)
Tsartlip First Nation (Chief Curtis Olsen, Wendy Edwards)
Tsawout First Nation (Chief Allan Claxton, Eric Pelkey)
Tsawwassen First Nation (Chief Kim Baird, Andrew Bak)
Tseycum First Nation (Chief Vern Jacks)

Federal Government
Canadian Wildlife Service (Ken Morgan, Tom Wood, Rick McElvey)
Geological Survey of Canada (Vaughn Barrie)
Fisheries and Oceans Canada (Scott Northrup, Dave Carter, Graeme Ellis, Jim Morrison, John Mackie)
Parks Canada (Bill Henwood)

Provincial Government
BC Assets and Lands (Mark Harvey)
BC Ferries (Betty Nicholson, Rob Hamilton)
Coastal and Marine Planning Division of the Ministry of Sustainable Resource Management (John Bones)
Ministry of Sustainable Resource Management (Doug Biffard, Stephen Sutherland, Carol Ogborne, Mark Zacharias)
Royal BC Museum (Phil Lambert)

Local Government
District of North Saanich (Mayor and Council, Councillor Sheila Irving)
Islands Trust, Saltspring office (David Borrowman, Linda Adams, Beverly Byron)
Islands Trust, Victoria office (Gordon McIntosh, Marie Smith)

NGOs
Canadian Parks and Wilderness Society - BC Chapter (Keith Symington, Bob Peart)
Cowichan Valley Naturalists' Society (Loren Duncan, Eric Marshall)
Friends of Ecological Reserves (Peggy Frank, Lynne Milnes)
Georgia Strait Alliance (Laurie McBride, Patricia Nordin, Peter Ronald)
GSX Marine Coalition (Susie Washinton Smyth)
Saanich Inlet Protection Society (Fran Pugh, Bob Hunter)
Salt Spring Island Conservancy (Karen Hudson, Maureen Milburn)
Saltspring Island Trail and Nature Club (Nancy Braithwaite)
Victoria Natural History Society (Tom Gillespie)

Fisheries Associations
BC Tuna Fishermen's Association (Larry Teague)
BC Beam Trawlers Association (Robert Taylor)
Green Sea Urchin Harvesters' Association (Michael Callow)
Gulf Crab Fisherman's Association (John Elliott, Tim Webster)
Pacific Coast Shrimpers Cooperative Association (Lorne Clayton)
Pacific Prawn Fisherman's Association (Brian Van Dorp, Kevin Erikson)
Pacific Sea Urchin Harvesters Association (Mike Featherstone)
Pacific Trollers Association (Stan Walterson)
South Islands Aquatic Stewardship Society (Susan Low)
Underwater Harvesters Association (Michelle James, Jamie Austin, Grant Dovey)
West Coast Trollers' Association (Kathy Scarfo)

Marine Biology Experts
Bill Austin (Marine Ecology Station)
Brenda Burd
Derek Ellis (University of Victoria)
Bristol Foster
Randal Glaholt (TERA Environmental Consultants_
Rick Hoos
Neil McDaniel

Recreation
Sport Fishing Institute of British Columbia (Tom Bird)
UnderwaterCouncil of BC (Tom Beasley)

Proponent
BC Hydro (Ken Farquharson)

Other
Tsehum Harbour Authority (Janet Rooke)
Underwater Archaeological Society of British Columbia (John Pollock)

APPENDIX B – WORKSHOP SUMMARY

A focused consultation workshop was held at Dunsmuir Lodge, Sidney on March 11, 2002. It was hosted by AXYS Environmental Consulting Ltd. The following AXYS staff were present at the workshop: Rosaline Canessa, Tracey Cooper, Susan Dunlop, John Harper, Nick Poushinsky and March Sangret. AXYS was assisted at the workshop by John Harper of Coastal and Ocean Resources Inc.. Chris Kissinger of BC Ministry of Water, Land and Air Protection, Parks and Protected Areas Branch, Ken Farquharson of BC Hydro and Randal Glaholt of TERA Environmental Consultants attended as resources to provide further information. The following participants represented a wide range of interests and expertise:

- Bill Austin, Marine Ecology Station
- Doug Biffard, BC Ministry of Water, Land and Air Protection, Parks and Protected Areas Branch
- Nancy Braithwaite, Saltspring Island Trail and Nature Club
- Beverley Byron, Islands Trust
- Dave Carter, Department of Fisheries and Oceans
- John Elliot, Gulf Crab Fisherman's Assocation
- Derek Ellis, University of Victoria
- Kevin Erikson, Pacific Prawn Fisherman's Association
- Peggy Frank, Friends of Ecological Reserves
- Tom Gillespie, Victoria Natural History Society
- Bill Henwood, Parks Canada
- Bob Hunter, Saanich Inlet Protection Society
- Sheila Irving, District of North Saanich
- Vern Jacks, Tseycum First Nation
- Jana Kostaska, Cowichan Tribes
- Eric Marshall, Cowichan Valley Naturalists Society
- Ken Morgan, Canadian Wildlife Service
- Carol Ogborne, BC Ministry of Sustainable Resource Management
- Fran Pugh, Saanich Inlet Protection Society
- Peter Ronald, Georgia Strait Alliance
- Stephen Sutherland, BC Ministry of Sustainable Resource Management
- Keith Symington, Canadian Parks and Wilderness Society
- Susie Washington Smyth, GSX Marine Coalition

Welcome, **Introductions and Workshop Objectives**

Nick Poushinsky of AXYS opened the workshop with a welcome to all attendees. He explained that the workshop had the narrow focus of identifying the values inherent in Ecological Reserve 67 and determining the likely consequences and mitigation measures required for the proposed and alternate GSX pipeline routes through and around the ecological reserve. It was stressed that the purpose of the workshop was not to discuss any of the other issues related to the GSX pipeline, including whether it should be approved at all.

Questions*/*discussion

- It was noted that one public workshop is insufficient public consultation. Opportunity should also have been made available for the general public to comment, not just those invited. The invitees also felt that

the amount of time before and during the workshop would not provide them with enough time to be able to properly comment.
- Participants asked to receive copies of the report resulting from the current assessment.
- It was confirmed that participants would receive a copy of the report.

PROJECT DESCRIPTION – presentation by Rosaline Canessa, AXYS

Questions/discussion

- There was considerable discussion of the use of concrete "mattresses" to form a bridge over the pipeline where it is not trenched. The purpose of the mattresses is to decreases the slope of the pipeline for migrating crabs and other benthic organisms. This technique is common for marine pipelines for reducing the effects of vibration but has not been used/tested specifically to facilitate crab migration. Experience of other pipelines with the mattresses shows a greater occurrence of predation at the mattresses. Mattresses would be located where the pipeline is not trenched and where pipeline does not fit flush to the ground, but studies have not been done to determine whether these locations are best for crabs. There will be about 15 locations along the entire length of the pipeline where the mattresses will be installed. TERA was comfortable with putting the pipeline in without the mattresses.
- After presentation on the different mechanical methods of laying the pipeline, the question was raised as to why the pipeline was laid first, then the trench for pipeline was created. For all methods of trenching, for better precision of placement, the pipeline goes down first, then trench around it.

BIOPHYSICAL ENVIRONMENT – presentation by John Harper, Coastal and Ocean Resources and Rosaline Canessa, AXYS

Questions/discussion

- Regarding information on seismic activity in the area of the Ecological Reserve, a series of faults in the area have been identified (Jacques Whitford, 2001b). While seismic activity represents an issue mitigation measures have been incorporated into the design, e.g., laying the pipeline on the surface and bracing the pipeline on the slopes of Saltspring Island.
- By-catch of fishing done in the reserve has not been examined.
- While it is difficult to compare data from work done in 60s with more recent surveys due to changes in sampling techniques and taxonomy, samples from surveys in the 60s are held in the Royal BC Museum for comparison.
- It was speculated that the reason the most common species counted in recent surveys (a hydroid) was not identified in the earlier surveys is because as a parasite it may not have been counted as opposed to not being present.
- The original intent of the Satellite Channel sampling programme in the 60s and 70s was to establish a time series for monitoring natural changes, e.g., due to El Nino. However lack of federal funding prevented continuation. Improved techniques used in recent studies e.g. using smaller sized screens, enable greater biodiversity to be detected.
- The boundaries of the reserve extend beyond the immediate soft bottom community to encompass a convenient 1 nm squared area.
- It was noted that based on previous studies, the benthic community will come back in a couple of years

after pipeline disturbance.

- First Nations are governments and not stakeholders. One First Nation representative noted that the area holds many values for the First Nations and the integrity of the ecological reserve should be preserved.

HUMAN USE ENVIRONMENT AND FIRST NATION VALUES – presentation by Marcy Sangret, AXYS

Questions/discussion

- There are two First Nations legends associated with the area at Cape Keppel and along the shore. There are also five known archaeological sites along shore of Cape Keppel. A pipeline close to shore could impair the spiritual integrity of the area. In addition, food gathering remains an important use. The unpolluted waters of Satellite Channel in contrast to other areas in the Cowichan territory are key for harvesting, e.g, scallop and sea cucumber. The kelp beds along the shore of Saltspring Island are home to juvenile salmon, shake, sea cucumber.

ROUTING IMPLICATIONS ON THE ECOLOGICAL RESERVE – presentation by Rosaline Canessa, AXYS

Questions/discussion

- The Ecological Reserve Act was strengthened in spring of 2000 requiring an Act by the legislature rather than an Order in Council for changing boundaries of ecological reserves.
- "No-net-loss" with regards to ecological reserves refers to the size of the area but also takes into account ecological values. In contrast the DFO definition of "no net loss" refers to habitat.
- Changing the boundaries of the reserve would not trigger the Canadian Environmental Assessment Act. That would be taken into account by the environmental impact assessment of the development.

BREAK-OUT GROUPS

Workshop participants were divided into three break-out groups to discuss the implications of the alternative route on ER67.

General questions/discussion

- All break-out groups again emphasized that one workshop is not sufficient consultation, in either length or breadth, and there should have been opportunity for the general public to comment. Participants wanted to have time to review the various background reports on Ecological Reserve 67.
- The integrity of ecological reserves was raised as a key consideration and precedence would be set if the boundaries of ER67 were changed.
- ER 67 does not show up on marine charts or other maps used by the general public. This should be changed so there is greater awareness of the ecological reserve. Additions to marine charts are included when the chart is updated.

Information available and needed

- It was noted that there has been insufficient time to review the existing data to determine whether there is sufficient data.
- Commercial crab fishing and geoducks were missing on maps provided by MSRM and clam harvesting

was shown in area where the fishery is closed.
- If exist, by-catch data from trawl records and prawn trap may be useful.
- Further information is needed on First Nations spiritual values and values in general.
- DFO was asked for its official position.
- The information collected in the 60s and 70s including the reference specimens held at the Royal BC Museum has not been fully used and collated.
- Proponents installation – just vs. plough vs. excavation? back fill possibility? Connectors and collars?
- There was uncertainty as to how far the reef effect of the pipeline may extend.
- The benthic grabs did not sample to the full depth of the pipeline. Furthermore, they represent a snapshot in time and therefore do not accurately characterise the environment. It was noted that longer term sampling is needed.
- The option of not trenching should be explored.
- Participants have anecdotal information from work in the area that can confirm or refute what was presented in the plenary.
- Information is needed on the impact of similar pipelines in similar environments, e.g., CentraGas (Sechelt to Texada, Texada to Comox).
- More information on effects on fish habitat, human use, marine mammals, sea birds.
- More information is needed on natural sedimentation rates.
- More information is needed on the impacts of noise of gas going through the pipeline and electrical fields around the pipeline.
- Information on species recovery to sedimentation is primarily based on estuarine environments and not typical of Satellite Channel.
- The laboratory studies provide insufficient information on the barrier-effect posed by the pipeline on crabs. Immediate backfilling the trench was suggested as the best means to mitigate.

Comparative impacts of two routing options
- The proposed route around the reserve could cause impacts on crab, greater impact on geoduck; sediments changes due to construction, impacts sedimentation on herring spawning, interference from other fisheries and be a barrier to migration of invertebrates.
- The alternative route through the reserve would create a reef effect of introducing a hard substrate (mitigatible with backfill), sedimentation plumes, effect on herring spawning, impacts on commercial fishing during construction, and a barrier to invertebrate migration between pipeline installation and complete burial by natural infilling.
- Leaving the pipeline unburied on the sediment surface is better for dealing with shifting due to earthquakes. Alternatively, it would introduce a hard substrate to a soft-bottom community altering the typical community composition. It was noted that a buried pipeline would have less impact once buried.
- A buried pipeline could also present a barrier to infaunal species.
- Regardless of the routing option, the pipeline will modify the environment and have an impact on different communities whether exposed or buried. Going around the reserve may also impact the reserve with slow drift of sediment.
- A third routing option 'clipping' the northeast corner of the reserve should be re-examined. Concern was raised that this option was rejected due to impact on diversity of critters that can be "seen" in that area – emphasis on "sexy" species. It was suggested that the creatures in the trench could re-colonise

better than mid-channel benthic invertebrates.

- It was noted that the north slope of the reserve does not fit the description given for the purpose of the reserve – to preserve soft bottom benthic habitat. However, the boundaries of the reserve include a buffer for the soft bottom habitat. The pipeline route would eliminate this buffer.
- Some participants noted that there is generally insufficient science to adequately assess the impacts of the pipeline and construction process on marine areas and communities and pilot studies on the various trenching options should be conducted.
- About 60-70% of Satellite Channel will trenched to facilitate crab migration.
- It was noted that it is better to protect the integrity of the reserve rather than protecting biota that are not already protected.
- DFO thinks the north side of the reserve is more productive in terms of bio-diversity, but it was noted that DFO is traditional focused on commercial species.
- Beaver Creek Park was raised as an example of a protected area whose boundary was changed to accommodate the Southern Cross pipeline. However, this was a park not an ecological reserve and there was no alternative but to go through the park.
- The core holes for the pilings would be constructed by a 2 ft. diameter drill to create a socket. The barge would have to be anchored and drilling muds would be recirculated.
- Species vary in regeneration rates. Experience of the CentraGas pipeline could help to answer questions about regeneration.
- The proposed route would pose a greater risk of damage because it is a smaller ecosystem and the pipeline laying process would take longer. Drilling for the pilings would create more of a disturbance (physical/mechanical) and there is a greater chance of mechanical problems and disasters. The alternative route would pose less overall long-term disturbance as the pipeline will likely be eventually buried.
- The foot print of the pipeline through the reserve would be small in relation to the size of the reserve and mud bottoms typically restore more quickly than rocky terrains.
- One must consider the political implications of going through the ER to accommodate development.
- It was questioned whether the function of the reserve could remain the same if its boundaries were changed.
- It was questioned whether the role of the reserve has been met, in terms of ecological protection and research.
- Concern was raised that the earthquake issue has not been adequately addressed.

Impact mitigation

- Monitoring should be established immediately to fulfill a need for greater intensity of monitoring and long-term monitoring.
- Compensation could provide 10-20 year fund for local researchers to study long-term impacts, impacts of global warming, ecological studies and, co-management.
- It was suggested that compensation area should be greater than area removed from the reserve.
- It was questioned how loss of commercial fishing areas from newly designated areas could be compensation.
- Backfilling is a possible mitigation measure but more information is required.
- Co-management by the Cowichan people could mitigate impacts.

- It was suggested that new boundaries for the reserve should be ecologically derived.
- Time series studies should be continued.
- More comprehensive infaunal studies are required prior to pipeline installation.
- The ecological reserve never received the protection it was intended to have. It is important to start monitoring and protecting which should have occurred.

No-net-loss options

- There is insufficient information to address boundary modification issues. Additional systematic surveys are needed to select the best no-net-loss areas.
- Consideration should be given to appending an area which has not been impacted by trawling.
- There is an important sampling station is right in the middle of the reserve which should be protected if boundaries are redrawn.
- Reserve boundaries need to be indicated on marine charts.
- The shape of the boundary should remain square as it is easier for the public to 'obey.
- There were mixed feelings at the workshop on whether there was compelling benefit to changing the reserve.
- Changing the boundaries of the reserve when there is a feasible alternative would set a poor precedent.
- Changing the boundaries of the Ecological Reserve will be controversial and politically difficult.
- Some participants requested that the report reflect that there is great concern about either route.