6.2 Public Consultation

DIAND had carried out an extensive public consultation program with stakeholders to discuss the remediation of the FOX-C site and to solicit input from the public regarding concerns they may have with the program. The concerns raised have been incorporated into the environmental assessment.

A summary of the consultation program is presented below.

May 2004: initial meetings with Hunters & Trappers Organizations, Hamlet Councils, Qikiqtani Inuit Association representatives and the public in Clyde River and Qikiqtarjuaq to briefly introduce the project, especially the planned site investigation.

July 2004: initial meeting with Nunavut Impact Review Board (NIRB) & Nunavut Water Board (NWB) representatives to introduce project and obtain feedback on regulatory approval requirements and submissions.

August 2004: transported Hunters & Trappers and Hamlet representatives from Qikiqtarjuaq to the site during investigation work to illustrate work being carried out and to familiarize them with the site and specific issues.

December 2004: presented the results of site investigation and preliminary remedial design options to regulators.

December 2004: community public consultations in Clyde River & Qikiqtarjuaq; results of the site investigations and preliminary remediation work plans were presented.

December 2004 Qikiqtaaluk Environmental was contracted to review the Site Specific Risk Assessment (SSRA) and to interview Clyde River and Qikiqtarjuaq elders about the project and project area.

February 2005: presented summary results of site investigation and preliminary remediation options to NIRB. NIRB has drafted a "checklist" of submission requirements and provided these to DIAND/PWGSC to be included with the Ekalugad regulatory submission.

February 2005: presented a brief overview of the project to Fisheries and Oceans Canada (FOC) representatives with specific focus on aquatic and marine elements. Based on the discussions, a Barrel Removal & Culvert Installation Protocol has been completed.

March 2005: PWGSC presented the government contracting process to Inuit businesses.

March 2005: met with potential contractor bidders to familiarize them with the remedial project specifics.

DIAND has made a concerted effort to identify and address concerns raised by members of the public and pertinent regulators through a variety of means. The final Remediation Work Plan was modified to incorporate comments and to address community concerns, wherever possible.

A second meeting that focused on similar project-related issues was held with the Nunavut Impact Review Board in February 2005.

While the scope of comments and concerns has covered a wide variety of types, a few issues have consistently been identified as areas of significant concern that require detailed discussions and effective solutions. Table 6-1 identifies some of the major concerns raised by the public and/or regulators throughout the consultation period, as well as DIAND's planned responses to address each of these issues in turn.

Table 6-1: Public Consultation Issues and Responses

Category	Residents' Concerns	DIAND's Response
Health and Safety	Locals ingesting contaminated fish from site waterbodies	Site Investigation work plan was modified to include tissue analysis of fish taken from site waters. It was determined that fish present at the site do not contain contaminants at levels above other fish populations in the eastern arctic.
Environment	The location of site landfills	There was some concern that leachate from site landfills would impact on adjacent water bodies. DIAND demonstrated that the landfills are being sited a considerable distance from water bodies and will be adequately engineered using proven northern technologies.
Waste Management	The potential for wastes remaining at the bottom of the lake	2004 site investigation focused on sampling water and sediments in lake. No contaminants were identified. DIAND does not believe further action is required at this time. See attached letter for further details.
Waste Management	Barrels remaining in the river and glacial stream	All barrels will be removed during the remediation project. To ensure that this is done in a consistent, environmentally responsible manner a site specific Barrel Removal Protocol has been completed and is attached.
Business Opportunities	Jobs for locals	DIAND will implement a contracting process that increases the credibility of the project within the communities.

DIAND also provided funding and invited Qikiqtaaluk Corporation (QC) to comment on the SSRA. QC did a thorough review of the assessment and provided a number of conclusions in the form of a report. DIAND has officially responded to these conclusions in the form of a letter.

Three of the four QC comments focused on the technical protocols used by the risk assessors. It was determined that these were attributable to professional differences in approach and were not weaknesses in the assessor's risk model.

The fourth comment was that DIAND should not be solely relying on the results of the risk assessment to formulate the site clean up criteria. In fact, DIAND will use these site specific risk based criteria only where no suitable criteria is available.

6.3 Air Quality

6.3.1 Existing Environment

The climate on the east coast of Baffin Island is humid and extremely cold and is marked by very short, cold summers. The mean annual temperature is approximately -11.5°C with a summer mean of 1°C and a winter mean of -23°C. The mean annual precipitation ranges from 200 mm to 400 mm (Ecological Stratification Working Group 1995).

6.3.2 Air Quality Impact Assessment

6.3.2.1 Study Area Boundaries

The spatial boundary for the assessment of project effects on air quality is the airshed around Ekalugad Fjord. The temporal boundary is the remediation field work period as well as the additional monitoring period following completion of the project.

The administrative boundaries for the assessment refer to the jurisdictions within which and for which the assessment is being prepared. In this case, the assessment is being prepared under CEAA and NIRB for review by other federal and territorial departments following the CEAA process with additions to meet the NIRB requirements. Technical boundaries of the air quality assessment are the lack of site-specific meteorological data and the limited time frame associated with the environmental screening.

6.3.2.2 Identification of Issues, Interactions and Potential Effects

During the remediation activities, there will be moderate emissions of greenhouse gases, nitrogen oxides (NO_x), sulphur dioxide (SO_2) particulate matter (PM) and carbon monoxide (CO) due to combustion of diesel fuel or gasoline in vehicles. There is also the potential for generation of dust during vehicle movement. These emissions will be of short-term duration and will be restricted to the local area around the site. Table 6-2 is an environmental assessment matrix for the Air Quality VEC.

6.3.2.3 Mitigation

Mitigative measures for controlling fugitive dust emissions during the project activities will be detailed in procedures that the contractors will be required to follow (*i.e.*, watering down roads and exposed portions of the project site, covering exposed soil piles). Windblown dust during project activities is expected to be minor.

Table 6-2: Environmental Effects Assessment Matrix: Air Quality

Project Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Evaluation Criteria for Assessing Residual Environmental Effects				
			Magnitude	Geographic Extent	Duration/ Frequency	Reversibility	Ecological/Socio-Cultural and Economic Context
Site Preparation Activities	Emissions of greenhouse gases, nitrous oxides, sulphur dioxide, particulate matter, and carbon monoxide from vehicles (A).	• None	1	2	2/5	R	1
	Vehicle movement will generate dust (A).	• Dust control measures will be implemented. Water will be used for dust suppression. Exposed soil piles will be covered.	1	2	2/5	R	1
Hazardous Materials Removal	The removal of the contaminated soil from the environment will reduce the risk of effects on air quality (P).	• N/A					

KEY:

Magnitude:

1 = Low: emissions predicted to be within the CCME National Ambient Air Quality Objectives
3 = High: Emissions predicted to exceed the CCME National Ambient Air Quality Objectives

Geographic Extent:

1 = <1 km²
2 = 1-10 km²
3 = 11-100 km²
4 = 101-1000 km²
5 = 1001-10,000 km²
6 = >10,000 km²

Duration:

1 = <1 month
2 = 1-12 months
3 = 13-36 months
4 = 37-72 months
5 = >72 months

Frequency:

1 = <11 events/year
2 = 11-50 events/year
3 = 51-100 events/year
4 = 101-200 events/year
5 = >200 events/year
6 = continuous

Reversibility:

R = Reversible
I = Irreversible

Ecological/Socio-cultural and Economic Context:

1 = Relatively pristine area or area not adversely affected by human activity.
' = Evidence of adverse effects.
N/A = Not Applicable

6.3.2.4 Residual Environmental Effects

Definition of Significance

Significant impacts to the atmospheric environment are defined to occur when ground-level concentrations associated with emissions from activities exceed ambient air quality standards that have been established by the government to protect human health and the environment. In this case, the

National Ambient Air Quality Objectives from the Canadian Council of Ministers of the Environment (CCME 1999) are the standards used.

Residual Environmental Effects Summary

Table 6-3 summarizes the residual environmental effects of the project activities on air quality. The effects of vehicle and equipment emissions during the remediation are not expected to exceed CCME ambient air quality objectives, although no monitoring of emissions has been carried out. Emissions will be short term and intermittent and will not be unlike those from low traffic volumes in a city such as Iqaluit. Dust generation is expected to also be low in volume and infrequent.

Table 6-3: Residual Environmental Effects Summary Matrix: Air Quality

Phase	Residual Adverse Environmental Effect Rating	Likelihood (of significant adverse environmental effects)	
		Probability of Occurrence	Scientific Uncertainty
Site Preparation Activities	NS		
Removal and Transport of Hazardous Material and Fuel	P		

KEY:

Residual Environmental Effects Rating:

S = Significant Adverse Environmental Effect
NS = Not Significant Adverse Environmental Effect
P = Positive Environmental Effect

Probability of Occurrence: based on professional judgement:

1 = Low
2 = Medium
3 = High
n/a = effect not predicted to be significant

Scientific Uncertainty: based on scientific information, and statistical analysis or professional judgement:

1 = low level of confidence
2 = medium level of confidence
3 = high level of confidence
n/a = effect not predicted to be significant

6.3.2.5 Summary of Environmental Effects on Air Quality

Remediation at FOX-C Intermediate DEW Line Site will not have a significant impact on the air quality. The FOX-C Intermediate DEW Line Site remediation will have a positive impact on air quality in terms of removing contaminated soil from the environment, thereby reducing the risk of dust from this soil affecting air quality.

6.4 Soil Quality

6.4.1 Existing Environment

Dominant soils in the FOX-C Intermediate DEW Line Site area are Turbic Cryosols developed on a discontinuous colluvial, alluvial and morainal deposits. Bare bedrock is common (Ecological Stratification Working Group 1995). Soils consist of sand and gravel with small amounts of clay and organic material that are imperfectly drained and lack profile development (Qikiqtaaluk Corporation 2001).

6.4.2 Soil Quality Impact Assessment

6.4.2.1 Study Area Boundaries

The spatial boundary for the assessment of project effects on soil quality is the FOX-C Intermediate DEW Line Site and the extent beyond the site in which soil contaminants may be expected to migrate. The temporal boundary is the remediation field work period as well as the additional monitoring period following completion of the Project.

The administrative boundaries for the assessment refer to the jurisdictions within which and for which the assessment is being prepared. In this case, the assessment is being prepared under CEAA and NIRB for review by other federal and territorial departments following the CEAA process with additions to meet the NIRB requirements.

Technical boundary of the soil quality assessment is the limited time frame associated with the environmental screening.

6.4.2.2 Identification of Issues, Interactions and Potential Effects

The remediation phase of the Project has the potential to interact with soil quality through the exposure of hazardous materials and contaminated soil to leaching during invasive remediation and through accidental events such as spills. The operation of the work camp will include treatment and disposal of waste, and could negatively affect soil quality if not carried out properly. Table 6-4 is an environmental assessment matrix for the Soil Quality VEC.

Table 6-4: Environmental Effects Assessment Matrix: Soil Quality

Project Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Evaluation Criteria for Assessing Residual Environmental Effects				
			Magnitude	Geographic Extent	Duration/ Frequency	Reversibility	Ecological/Socio-Cultural and Economic Context
General Clean-up Activities	Hazardous materials or contaminated soils may be exposed to leaching during remediation (A).	• Investigators will have reviewed previous site assessments and activities near known areas of contamination will be carried out in a manner to minimize disturbance to the contaminated materials.	1	2	2/1	R	2

Table 6-4: Environmental Effects Assessment Matrix: Soil Quality								
Project Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Evaluation Criteria for Assessing Residual Environmental Effects					
			Magnitude	Geographic Extent	Duration/ Frequency	Reversibility	Ecological/Socio-Cultural and Economic Context	
	Accidental spills may result in soil degradation (A).	• Proper handling, storage and transportation procedures for hazardous materials will be implemented. • All workers will be trained in proper handling procedures for all hazardous materials on site. • Hazardous materials or fuel will not be stored in the beach area. • Spill contingency plans have been developed and will be implemented as necessary. • Contingency plans related to all materials and equipment will be available on site. • All fuel will be handled in accordance with the Contingency Plan.	1	2	2/1	R	2	
	The operation of the construction camp will include treatment and disposal of waste, which could degrade soil quality (A).	• Hazardous materials will not be disposed of in the camp waste system. • All hazardous materials will be removed from the site for disposal. • All sewage will be disposed of in accordance with applicable regulations and guidelines.	1	2	2/1	R	2	
Landfill Development/ Landfill Closure	The migration of contaminants from the new landfills has the potential to degrade soil quality if not constructed properly (A).	• New facilities will be sited away from natural drainages. • The Tier II facility will incorporate leachate containment, which includes synthetic liners and freezeback of permafrost. • Existing landfills will be remediated to eliminate the risk of leachate production and migration. • Upon closure, existing landfills will be graded to promote surface runoff.	1	1	5/1	R	2	
	The closure of the existing landfill will reduce the risk of impacting soil quality (P).	• N/A						

Table 6-4: Environmental Effects Assessment Matrix: Soil Quality

Project Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Evaluation Criteria for Assessing Residual Environmental Effects				
			Magnitude	Geographic Extent	Duration/ Frequency	Reversibility	Ecological/Socio-Cultural and Economic Context
Contaminated Soil Disposal/ Hazardous Materials Removal	The removal of the contaminated soil and hazardous materials from contact with the environment will improve soil quality (P).	• N/A					
Removal and Transport of Hazardous Material, Fuel and Contaminated Soil	The potential exists for accidental release of hazardous materials, contaminated soil and/or fuels that could degrade soil quality (A).	• Proper handling, storage and transportation procedures for hazardous materials will be implemented. • All workers will be trained in proper handling procedures for all hazardous materials on site. • Hazardous materials or fuel will not be stored in the beach area. • Spill contingency plans have been developed and will be implemented as necessary. • Contingency plans related to all materials and equipment will be available on site. • All fuel will be handled in accordance with the Contingency Plan.	1		3/1	R	2

KEY:

Magnitude:

1 = Low: Soil chemical composition is not altered to the extent that vegetation currently present is affected.
2 = Moderate: Soil chemical composition is altered such that a moderate percentage of the vegetation is affected.
3 = High: Soil chemical composition is altered such that all vegetation is degraded and/or contaminants leach to groundwater.

Geographic Extent:

1 = <1 km²
2 = 1-10 km²
3 = 11-100 km²
4 = 101-1000 km²
5 = 1001-10,000 km²
6 = >10,000 km²

Duration:

1 = <1 month
2 = 1-12 months
3 = 13-36 months
4 = 37-72 months
5 = >72 months

Frequency:

1 = <11 events/year
2 = 11 50 events/year
3 = 51-100 events/year
4 = 101-200 events/year
5 = >200 events/year
6 = continuous

Reversibility:

R = Reversible
I = Irreversible

Ecological/Socio-cultural and Economic Context:

1 = Relatively pristine area or area not adversely affected by human activity.
2 = Evidence of adverse effects.

N/A = Not Applicable

6.4.3 Mitigation

During the remediation activities, Project personnel will be apprised of known locations of hazardous waste and disturbance of these sites will be kept to a minimum. Spill prevention and spill contingency plans will be in effect during all activities.

The new landfills will be sited away from natural drainages. The existing landfills are being remediated to eliminate the risk of leachate production and migration, and they will be graded to promote surface runoff.

Proper handling procedures will be implemented for the storage and transportation of hazardous materials. All workers will be trained to properly handle all hazardous materials on site, and no hazardous materials or fuel will be stored on the beach area. Contingency plans for spills will be followed, and will be available on site, and all fuel will be handled in accordance with the contingency plan.

Hazardous materials will not be disposed of in the camp waste system. The disposal of all sewage will be in accordance with applicable regulations and guidelines.

6.4.3.1 Residual Environmental Effects

Definition of Significance

Significant Impacts are defined as those altering soil such that one or both of the following occurs:

- soil chemical composition is altered such that it will not support vegetation in areas where vegetation previously grew and the extent is greater than 1 km from the facility; and
- soil chemical composition is altered such that it is a threat to groundwater and surface water.

Residual Environmental Effects Summary

Table 6-5 summarises the residual environmental effects of the project activities on soil quality. Activities during the remediation phase are not expected to affect soil quality significantly.

Table 6-5: Residual Environmental Effects Summary Matrix: Soil Quality

Phase	Residual Adverse Environmental Effect Rating	Likelihood (of significant adverse environmental effects)	
		Probability of Occurrence	Scientific Uncertainty
General Clean Up Activities	P		
Landfill Closure	P		
Landfill Development	NS		
Removal and Transport of Hazardous Material and Fuel	NS		

Table 6-5: Residual Environmental Effects Summary Matrix: Soil Quality			
Phase	Residual Adverse Environmental Effect Rating	Likelihood (of significant adverse environmental effects)	
		Probability of Occurrence	Scientific Uncertainty

KEY:

Residual Environmental Effects Rating:

S = Significant Adverse Environmental Effect
NS = Not Significant Adverse Environmental Effect
P = Positive Environmental Effect

Probability of Occurrence: based on professional judgement:

1 = Low
2 = Medium
3 = High
n/a = effect not predicted to be significant

Scientific Uncertainty: based on scientific information, and statistical analysis or professional judgement:

1 = low level of confidence
2 = medium level of confidence
3 = high level of confidence
n/a = effect not predicted to be significant

6.4.3.2 Summary of Environmental Effects on Soil Quality

Activities associated with the remediation at FOX-C Intermediate DEW Line Site are assessed as not having a significant effect on soil quality.

The potential exists for an accidental release of hazardous materials, contaminated soil and/or fuels that could impact soil quality. However, proper handling procedures for hazardous materials will be implemented for their storage and transportation. Also, all workers will be trained to properly handle hazardous materials on site, and no hazardous materials or fuel will be stored on the beach areas. Spill contingency plans will be followed, and will be available on site. All fuel will be handled in accordance with the contingency plan.

The operation of the work camp will include the treatment and disposal of waste, and has the potential to degrade soil quality. However, hazardous materials will not be disposed of in the camp waste system, and the disposal of all sewage will be in accordance with applicable regulations and guidelines.

6.5 Water Quality

6.5.1 Existing Environment

There is an unnamed freshwater lake to the immediate west of the lower site that is approximately 3 km long and 1 km wide. It is fed primarily by meltwater from the Fox Charlie Glacier, snow melt, and a larger lake 2 km to the west. The lake discharges into Ekalugad Fjord through a river approximately 1.5 km long. Previous work at FOX-C used the small freshwater lake as a source of drinking water (Qikiqtaaluk Corporation 2001).

6.5.2 Water Quality Impact Assessment

6.5.2.1 Study Area Boundaries

The spatial boundary for the assessment of the effects of project activities on the water quality of the area is the local watershed for the site. The temporal boundary is the remediation field work period as well as the additional monitoring period following completion of the project.

The administrative boundaries for the assessment refer to the jurisdictions within which and for which the assessment is being prepared. In this case, the assessment is being prepared under CEAA and NIRB for review by other federal and territorial departments following the CEAA process with additions to meet the NIRB requirements. Technical boundaries of the water quality assessment are the lack of site-specific water quality data and the limited time frame associated with the environmental screening.

6.5.2.2 Identification of Issues, Interactions and Potential Effects

Interactions between the remediation phase and the water quality environment will be similar to those for the soil quality environment, *i.e.*, the potential for leachate from exposed hazardous materials and contaminated soil, and the potential for spills of fuel and hazardous materials to enter waterbodies and affect water quality.

Some fuel drums that have been dispersed throughout the site by wind action are on the flood plain and in the stream connecting the freshwater lake with the ocean. The freshwater lake also includes drums and debris along the beach and embankments. The removal of these drums and debris will require activities within the stream and lake, potentially resulting in water quality degradation.

The movement of heavy equipment to portions of the site for remediation will require crossing of the stream. The construction of access roads across the stream will require the placement of culverts in the stream. The placement of culverts as part of the road upgrading could result in siltation and degradation of water quality.

Table 6-6 is an environmental assessment matrix for the Water Quality VEC.

Table 6-6: Environmental Effects Assessment Matrix: Water Quality								
Project Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Evaluation Criteria for Assessing Environmental Effects				
			Magnitude	Geographic Extent	Duration/Frequency	Reversibility	Ecological/Socio-Cultural and Economic
General Clean Up Activities	Hazardous materials or contaminated soils may be exposed to leaching during investigations; the leachate may degrade water quality (A).	• Investigators will have reviewed previous site assessments and activities near or in known areas of contamination will be carried out in a manner to minimize disturbance to the contaminated materials and the potential for leaching.	1	2	2/1	R	1
	Accidental spills may result in water quality degradation (A).	• Proper handling, storage and transportation procedures for hazardous materials will be implemented. • All workers will be trained in proper handling procedures for all hazardous materials on site. • Hazardous materials or fuel will not be stored in the beach area. • Spill contingency plans have been developed and will be implemented as necessary. • Contingency plans related to all materials and equipment will be available on site. • All fuel will be handled in accordance with the Contingency Plan.	1	2	2/1	R	1
Landfill Development/Landfill Closure	The migration of contaminants from the new landfills has the potential to degrade water quality if not constructed properly (A).	• New facilities will be sited away from natural drainages. • Existing landfills will be remediated to eliminate the risk of leachate production and migration.	1	1	5/1	R	2

Table 6-6: Environmental Effects Assessment Matrix: Water Quality								
Project Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Evaluation Criteria for Assessing Environmental Effects					
			Magnitude	Geographic Extent	Duration/Frequency	Reversibility	Ecological/Socio-Cultural and Economic	
		• Upon closure, existing landfills will be graded to promote surface runoff.						
	Closure and remediation of landfills and the removal of the contaminated soil and hazardous materials from the environment will reduce the risk of contamination of surface and active layer water (P)	• N/A						
Contractor Support	The operation of the camp will include treatment and disposal of waste, and could degrade water quality (A).	• Hazardous materials will not be disposed of in the camp waste system. • All sewage and graywater will be disposed of in accordance with applicable regulations and guidelines.	1	2	2/1	R	1	
Contaminated Soil Disposal / Hazardous Materials Removal	The removal of the contaminated soil and hazardous material from the environment will reduce the risk of contamination of surface and active layer water (P)	• N/A						

Table 6-6: Environmental Effects Assessment Matrix: Water Quality

Project Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Evaluation Criteria for Assessing Environmental Effects				
			Magnitude	Geographic Extent	Duration/Frequency	Reversibility	Ecological/Socio-Cultural and Economic
Removal and Transport of Hazardous Material, Fuel and Contaminated Soil	The potential exists for accidental release of hazardous materials, contaminated soil, and./or fuels that could degrade water quality (A).	• Proper Handling, storage and transportation procedures for hazardous materials will be implemented. • All workers will be trained in proper handling procedures for all hazardous materials on-site • Hazardous materials or fuel will not be stored near water. • Spill contingency plans related to all materials and equipment will be available on-site. • All fuel will be handled in accordance with the Contingency Plan.	1	2	3/1	R	1
Site Grading, Borrow Source Development	The erosion of soil and sedimentation of water bodies during grading and gravel extraction activities has the potential to degrade water quality (A).	• Siltation will be prevented by use of berms and/or silt fences. • Equipment will not be operated within the wetted perimeter. • Disturbed areas adjacent to water will be stabilized, if required.	1	2	3/1	R	1
	Grading and gravel extraction activities will also alter the terrain, and has the potential to disturb drainage (A).	• Grading and gravel extraction activities will be sited away from natural drainages • Upon completion of gravel extraction activities, the areas will be graded to blend with the natural terrain, and where appropriate , to promote surface runoff	1	2	3/1	R	1
	Some improvements to drainage may be expected as a result of properly grading existing disturbed sites (P).	• N/A					

Table 6-6: Environmental Effects Assessment Matrix: Water Quality

Project Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Evaluation Criteria for Assessing Environmental Effects				
			Magnitude	Geographic Extent	Duration/Frequency	Reversibility	Ecological/Socio-Cultural and Economic
Removal of fuel drums within the watershed	Activities within the watershed could result in sedimentation and the release of hazardous materials (A).	• An environmental protection plan for the removal of fuel drums in the watershed has been developed (Appendix B)	1	2	3/2	R	1
Placement of culverts	Soil erosion and resulting sedimentation of the stream may occur during placement. (A)	• An environmental protection plan for the installation of culverts has been developed (Appendix B)	1	2	3/2	R	1

KEY:

Magnitude:

1 = Low: e.g., Minor changes to water quality but not to the extent that aquatic life is affected or water that was previously potable is now non-potable.

2 = Medium: e.g., Moderate changes to water quality, affecting aquatic life at a local level or decreasing the quality of potable water (e.g., odour problem).

3 = High: e.g., Major changes to water quality, affecting aquatic life at a regional level or rendering previously potable water non-potable.

Geographic Extent:

1 = <1 km²
2 = 1-10 km²
3 = 11-100 km²
4 = 101-1000 km²
5 = 1001-10,000 km²
6 = >10,000 km²

Duration:

1 = <1 month
2 = 1-7 months
3 = 8-36 months
4 = 37-72 months
5 = >72 months

Frequency:

1 = <11 events/year
2 = 11-50 events/year
3 = 51-100 events/year
4 = 101-200 events/year
5 = >200 events/year
6 = continuous

Reversibility:

R = Reversible
I = Irreversible

Ecological/Socio-cultural and Economic Context:

1 = Relatively pristine area or area not adversely affected by human activity.

2 = Evidence of adverse effects.

N/A = Not Applicable

6.5.2.3 Mitigation

The new Landfills will be sited away from natural drainages. The existing landfills are being remediated to eliminate the risk of leachate production and migration, and they will be graded to promote surface runoff. Material handling and spill contingency plans will be in place and the disposal of camp wastes will meet all regulatory standards.

Proper handling procedures will be implemented for the storage and transportation of hazardous materials. All workers will be trained to properly handle all hazardous materials on site and no hazardous materials or fuel will be stored on the beach area. Contingency plans for spills will be followed, and will be available on site, and all fuel will be handled in accordance with the contingency plan.

Hazardous materials will not be disposed of in the camp waste system. The disposal of all sewage will be in accordance with applicable regulations and guidelines. The freshwater lake adjacent to the lower site will likely be used for drinking water. Camp personnel will be instructed on procedures to meet the applicable water quality guidelines and on withdrawing water so that fish habitat is not adversely affected. Culverts will not be installed in fish bearing waters.

During grading and gravel extraction activities, siltation will be prevented by the use of berms and/or silt fences, and equipment will not be operated within the wetted perimeter. Additionally, disturbed areas adjacent to water will be stabilized if required. Grading and gravel extraction activities will be sited away from natural drainages, and upon completion, the area will be graded to blend with the natural terrain and where appropriate to promote surface runoff.

An environmental protection plan for the removal of fuel drums within the watershed and culvert installation and removal has been developed and will be implemented (Appendix B)

6.5.2.4 Residual Environmental Effects

Definition of Significance

A significant impact to water quality is defined as one of sufficient magnitude so as to alter the quantity or quality of water to a degree that will result in a significant impact on aquatic life as defined in the impact significance definitions for other related VECs.

Residual Environmental Effects Summary

Table 6-7 summarizes the residual environmental effects of the project activities on water quality. Activities during the detailed site assessment and preliminary waste consolidation phase are not expected to affect water quality significantly.

Table 6-7: Residual Environmental Effects Summary Matrix: Water Quality

Phase	Residual Adverse Environmental Effect Rating	Likelihood (of significant adverse environmental effects)	
		Probability of Occurrence	Scientific Uncertainty
Landfill Development	NS		
Landfill Closure	P		
Contaminated Soil Disposal / Removal	P		
Removal and Transport of Hazardous Material, fuel and Contaminated Soil	NS		

Table 6-7: Residual Environmental Effects Summary Matrix: Water Quality			
Phase	Residual Adverse Environmental Effect Rating	Likelihood (of significant adverse environmental effects)	
		Probability of Occurrence	Scientific Uncertainty
Site Grading / Borrow Source Development	NS		
Site Grading	P		
Contractor Support	NS		
Removal of Fuel Drums from the Watershed	NS		
Culvert Installation	NS		

KEY.

Residual Environmental Effects Rating:	Probability of Occurrence: based on professional judgement:	Scientific Uncertainty: based on scientific information, and statistical analysis or professional judgement:
S = Significant Adverse Environmental Effect	1 = Low	1 = low level of confidence
NS = Not Significant Adverse Environmental Effect	2 = Medium	2 = medium level of confidence
P = Positive Environmental Effect	3 = High	3 = high level of confidence
	n/a = effect not predicted to be significant	n/a = effect not predicted to be significant

6.5.2.5 Summary of Environmental Effects on Water Quality

The effects of the FOX-C Intermediate DEW Line Site remediation on water quality are assessed as not significant.

6.6 Terrain

The terrain VEC includes surficial geology, soils and vegetation. The soils component refers to the physical characteristics of the surficial material; soil quality is addressed as a separate VEC in Section 6.3.

6.6.1 Existing Environment

6.6.1.1 Geology and Soils

Surficial Geology

The geology in the FOX-C DEW Line Site area is comprised largely of high, rugged hills and is characterized by large boulders and slabs of rock. The upper site is situated at the summit and is surrounded by steep outwash valleys to the south and west, a small chain of lakes to the east, and Ekalugad Fjord to the north. The upper site is primarily bedrock (consisting of granite and quartz monzonite) and colluvium, while the lower site is a combination of bedrock, alluvium deposits from the river, till, and coarse beach sediments. The area is well drained and permafrost is widespread and continuous (Qikiqtaaluk Corporation 2001).

Soils

The FOX-C site is located in the Baffin Mountain ecoregion where bare bedrock is common and Turbic Cryosols developed in discontinuous morainal, alluvial, and colluvial deposits are commonly found. Soils at the FOX-C site could be classified as cryosolic and regosolic and consisting of sand and coarse rock with small amounts of organic material and clay in some locations (Qikiqtaaluk Corporation 2001).

6.6.1.2 Vegetation

The high-arctic climate limits the vegetation to herbaceous species only due to extreme cold, high winds and lack of soil cover. Higher elevations are largely devoid of vegetation cover other than lichens and mosses. Lower mountain slopes and coastal margins provide some vegetative cover, which consists of herbaceous tundra communities. Dominant species include sedges and cottongrass (Ecological Stratification Working Group 1995).

The lower site has a higher diversity of vegetation compared to the upper site. Grasses (*Alopecurus* sp.), sedges (*Carex* sp.) and willows (*Salix* sp.) dominate the lower site, particularly the outwash valley, while the upper site is restricted to small, isolated patches of mosses and lichens (Reimer et al. 1994).

There are over 1000 species of vascular plants in Nunavut. Of these only 18 species have been reviewed as to their general status in the territory. To date no rare or endangered vegetation species have been identified (Department of Sustainable Development, 2001). A botanical survey was completed for the site in 1967. Table 6-8 provides a list of species that occur around the site.

Table 6-8: Vegetation species identified at Ekalugad Fjord

Family	Scientific Name	Common Name
Lichens	*Rhizocarpon geographicum* DC.	Map Lichen
	Thamnolia subuliformis	Worm Lichen
	Cladonia rangiferina Web.	Reindeer Lichen
	Umbilicaria sp.	Rock Tripe
	Xanthoria elegans	Jewel Lichen
Mosses	*Rhacomtrium lanuginosum* (Hedw.) Brid.	
	Rhodobryum roseum (Weis) Limpr.	
Equisetaceae (Horsetail Family)	*Equisetum arvense* L.	Common Horsetail
Lycopodiaceae (Club-moss Family)	*Lycopodium selago* L.	Club Moss
Poaceae (Grass Family)	*Alopecurus alpinus* J.E. Smith	Foxttail
	Arctagrostis latifolia (R.Br.) Griseb sp. *latifolia*	Polargrass
	Deschampsia cespitosa (L.) Beauv. spp. *brevifolia* (R.Br.) Tzvelev	
	Festuca ovina L. var. *brachyphylla* Piper	Fescue
	Hierchloe alpina (Sw.) R.&S.	Holygrass
	Phippsia algida (Sol.) R.Br.	
	Poa arctica R.Br. spp. *arctica*	Arctic Bluegrass
	Trisetum spicatum (L.) Richt. *s.lat.*	