Chapter 7 – Assessment of Mitigation Requirements



7. Assessment of Mitigation Requirements

This chapter describes the potential mitigation measures that may be required to reduce the impacts of the proposed landfill extension to the environmental, socioeconomic and cultural heritage resources of the Project area.

The classifications used were presented in Section 5.1. The assessment includes a level of concern with each Project interaction on various Valued Environmental Components (VECs). The individual attributes include an assessment of summary effects, probability, spatial extent, frequency, reversibility, and mitigation measures. An assessment of residual effects after recommended mitigation measures are also included.

7.1 Environmental

7.1.1 Geophysical Environment

The geophysical environment consists of three distinct features: geological, hydrogeological, and soils. Potential for impacts on these features is high during the construction and operations phase as excavation and site clearing will alter the surface of the Project area. The specific impacts are outlined below.

7.1.1.1 Geology

Some changes to geological features are expected during excavation and placement of fill. The likelihood of hazards, such as natural landslides, is expected to increase.

Recommended mitigations to avoid or minimize potential effects to geological resources are provided below:

- Construction
  - Landfill will be constructed in phases to limit spatial extent of operations
- Operations
  - No further impacts expected
- Closure
  - Area will be reclaimed as part of the closure plan

7.1.1.2 Soils

Impacts to soil may occur during project activities such as removal of topsoil and excavation. Three potential impacts to soils that were considered in this assessment include:

1. Disturbance and erosion
2. Loss of topsoil
3. Soil contamination and reduction of soil quality

The potential residual impacts include altered landform, surface compaction, erosion and/or soil contamination. Proposed mitigations to avoid or minimize potential effects to soil resources are provided below:

- Construction
  - Construct the landfill using a phased approach so that the disturbed and potentially exposed area will be minimized
  - Implement appropriate soil handling, salvage and storage strategies to help mitigate potential impacts such as loss of soil and soil quality
  - Strip, salvage, and store topsoil during the construction phase only
  - Minimize the potential for soil contamination with the use of a spill prevention program, where any spills that occur are cleaned up using absorbent materials, and with the use of any other required remedial actions

- Operations
  - Maintain spill prevention program
  - Seed topsoil stocks to prevent erosion

- Closure
  - Restore stored topsoil to areas from which it was lost during the construction and operations phases
  - Reseed topsoil to prevent erosion

7.1.1.3 Surface and Groundwater

The introduction of sediment into any waterbody can be destructive to fish and fish habitat and is strictly prohibited under the federal *Fisheries Act*, which is administered and enforced by the Department of Fisheries and Oceans (DFO). Furthermore, the landfill extension area is located in an area of natural groundwater discharge. Groundwater from the bedrock beneath the site discharges upwards towards the slope and will therefore prevent the downward migration of leachate into the bedrock.

Two potential impacts to surface and groundwater resources were considered in this assessment:

1. Alteration, sedimentation, or pollution of water features as a result of Project activities
2. Water contamination from improper waste disposal or leachate migration

Potential residual impacts may include altered surface water flow paths, contamination and/or altered groundwater resources.

Recommended mitigations to avoid or minimize potential effects to soil resources are provided below:

- Construction
  - Although there are no permanent waterbodies within the Project area, a sediment management plan will ensure that there is no off-site migration to impact nearby fisheries resources
  - Stormwater will be directed around the landfill into a constructed drainage ditch; an environmental management system and surface water control will manage the stormwater

  - Water contamination will be avoided through the use of safe storage and handling practices; an emergency response plan will outline the spill response plan, and equipment will be well maintained and monitored

- Operations
  - The leachate management system for the landfill will include a double liner, a leachate collection system, and a leachate recirculation system

- Closure
  - The leachate management system will remain in place during the post-closure period

Table 7-1 summarizes the geophysical assessment for the proposed Project.

TABLE 7-1
Projected Impacts on the Geophysical Environment

Construction (C)/ Operation (O)	Project Activity	Summary of Effect	Probability of Occurrence	Spatial Extent	Frequency	Duration	Reversibility	Monitoring/ Mitigation	Residual Effect
C & O	Excavation and placement of fill	Major and minor physiographic and surficial geological features will be changed	High	Low	Medium	Long-term	Reversible	Landfill will be constructed in phases to limit spatial extent of operations. Area will be reclaimed as part of the closure plan.	Low
		Increase in natural geological hazards potential (debris flow, natural landslide)	Low	Low	Low	Long-term	Reversible	Landfill will be constructed in phases to limit spatial extent of operations. Area will be reclaimed as part of the closure plan.	Low
		Changes to surface drainage patterns	High	Low	Low	Long-term	Reversible	Drainage will be managed during operation with a constructed drainage ditch. Drainage will be re-established as part of the closure plan.	Low
		Reduction of soil quality	High	Low	Low	Medium-term	Reversible	Salvaging and replacing topsoil in disturbed areas following closure will restore land to pre disturbance condition.	Low
C & O	Excavation	Removal of topsoil	High	Low	Low	Medium-term	Reversible	Topsoil will be stripped, stockpiled and re-used for reclamation.	Low
		Increased soil erosion	High	Low	Medium	Medium-term	Reversible	Landfill will be constructed in phases to minimize the area exposed.	Low
C & O	Stockpiling of Topsoil	Soil loss through erosion	High	Low	Medium	Medium-term	Reversible	Stockpiles should be seeded if left for long periods of time.	Low
C & O	Landfill surface water drainage	Reduction of off-site surface water quality	Low	Low	Medium	Short-term	Reversible	Storm water will be directed around landfill into constructed drainage ditch; environmental management system and surface water control will manage stormwater.	Low
C & O	Spills and contamination	Impact on soil and water quality	Low	Low	Low	Short-term	Non Reversible	Spill response will be managed with the ERP for the site and the use of clean up materials and techniques.	Low
O	Landfill operation	Leachate leakage impacts to surface and groundwater	Low	Medium	Low	Long-term	Non Reversible	Leachate management system includes a double liner with a leak detection system which will remain in operation as long as needed following landfill closure.	Low

7.1.2 Atmospheric Environment

Expected impacts of Project activities on the atmospheric environment include landfill site emissions, particulate matter and dust, and odours.

Sources of air emissions at the Project site include: fugitive landfill gas (LFG) emissions, fugitive dust generated by the on-site hauling activities, combustion emissions from the utility equipment (LFG), flare (LFG), and on-site vehicles.

Landfill gas is a product of the biodegradation of refuse in landfills and consists primarily of methane and carbon dioxide, with trace amounts of non-methane organic compounds (NMOC) and air pollutants.

Under conventional operations (dry conditions) the model predicts a maximum total landfill gas flow rate of 1,585 cubic feet/minute (cfm) peaking in 2024.

Methane is expected to account for approximately 55 percent (by volume) of landfill gas generation. Carbon dioxide is expected to account for 45 percent (by volume). Table 7-2 summarizes the landfill gas generation in the peaking year (2024).

TABLE 7-2
Landfill Gas Generation in 2024

Operation Type	Landfill Gas Generated (cfm)			
	Landfill Gas	Methane	Carbon Dioxide	NMOC
Conventional	1585	872	713	12.7

Landfill gas will be collected using horizontal trenches which will draw landfill gas out of the landfill under a vacuum induced by blowers at the site's blower/flare facility. The gas will be conveyed through an underground header pipe constructed from high density polyethylene (HDPE) pipe.

Belkorp is planning to convert landfill gas at the existing Cache Creek Landfill to liquefied natural gas and use this to fuel the trucks that long haul the refuse. Landfill gas generated in the landfill extension will likely tie into this LNG facility. Any landfill gas that is collected but not used will be flared to convert the methane to carbon dioxide and destroy other trace compounds. Conversion of the methane will reduce greenhouse gas (GHG) impacts as methane has 21-times the GHG potential as carbon dioxide.

Uncontrolled LFG emissions are assumed to account for 15 to 25 percent of the total LFG generated on-site. This portion of the LFG will directly emit to the atmosphere as fugitive emissions. Table 7-3 summarizes the fugitive landfill gas emissions in the peaking year (2024).

TABLE 7-3
Fugitive Landfill Gas Emissions in 2024

Operation Type	Landfill Gas Generated (cfm)			
	Landfill Gas	Methane	Carbon Dioxide	NMOC
Conventional	396	218	178	3.2

NOx, CO, PM_{10}, and VOCs will be emitted from the utility equipment and/or flare when they are burning on LFG.

For the commonly used utility equipment, combustion emissions were calculated based on the assumption that all collected LFGs will be flared. Emission factors and control efficiencies from the USEPA AP-42 Section 2.4 – Municipal Solid Waste Landfills were used in emission rates estimates and are shown in Table 7-4. The calculated emission rates are summarized in Table 7-5.

TABLE 7-4
Emission Factor for Secondary Compounds Exiting Control Devices and Control Efficiency for LFG Constituents

Control Device - Flare	NOx	CO	PM	NMOC
Emission Factor (lb/10^3 dscf Methane)	40	750	17	
Control efficiency (%)				99.2

TABLE 7-5
Fugitive Landfill Gas Emissions in 2024

Operation Type	Flared Methane (cf/hr)	Flared NMOC (lb/hr)	Emission Rate (lb/hr)			
			NOx	CO	PM	NMOC
Conventional	39240	128	1.6	29.4	0.7	1.0

Other combustion sources include on-site equipment powered by diesel engines, on-site vehicles, and on-site space heating equipment. Most of these emissions are from mobile sources. Typical diesel combustion contaminants include NOx, CO, SO_2 and PM_{10}. Emission rates are determined by the type, number and engine capacity of the sources and their operating schedule.

As this Project is an extension of the existing landfill, a significant increase in vehicles and on-site equipment is not predicted. The exhausts from on-site fuelling equipment and vehicles will be similar to those from the existing landfill. These types of emissions are not expected to increase significantly due to the proposed extension. Similar emission sources

also exist in surrounding farmland (farming equipment) and the Trans-Canada Highway, nearby.

Particulate matter and dust may be created by on-site activities, such as overburden removal, grading, bulldozing, and relocating borrow material to the new cell. Road dust from on-site roads (paved and unpaved) and access roads also contribute to site-wide particulate matter emissions. Emission rates are determined by the number, weight, and speed of the vehicles, length of the on-site and access roads, and area of the operating surface.

The particulate matter emissions will be similar to those from the existing landfill, and are not expected to increase significantly due to the proposed extension. Similar emission sources also exist in the Trans-Canada Highway, nearby.

With the enhanced mitigation measures, the impact of the proposed extension project in the study area on air quality will be low.

Recommended mitigations to avoid or minimize potential effects to atmospheric resources are provided below:

- Construction
  - Employ a dust control program, including hydroseeding, dust suppressants and water trucks as needed
  - Stormwater will be directed around the landfill into a constructed drainage ditch; an environmental management system and surface water control will manage stormwater
  - Water contamination will be avoided through safe storage and handling practices; an emergency response plan will outline the spill response plan, and equipment will be well maintained and monitored
- Operations
  - Maintain a small operating face, spreading and compacting refuse as soon as it is tipped and covering waste immediately
  - Monitor odours and complaints
  - Use commercially available odour control substance when warranted
- Closure
  - Reclamation will include re-vegetation to avoid wind erosion and dust generation

Impacts and recommended mitigations to atmospheric resources are outlined in Table 7-6 following.

TABLE 7-6
Projected Impacts on Air Quality

Construction (C)/ Operation (O)/ Closure (CL)	Project Activity	Summary of Effect	Probability of Occurrence	Spatial Extent	Frequency	Rever-sibility	Duration	Monitoring/ Mitigation	Residual Effect
C & O	Movement of in-bound and out-bound trucks and on-site construction and material handling activates, such as unloading, grading, bulldozing	Fugitive Dust Emissions - impact the growth of the vegetation in surrounding area	High	Low	Medium	Reversible	Short-term	Use of an on-site water truck to water-down access roads and other materials on an as-required basis. Dust suppressants, such as magnesium chloride, will also be used on an as-required basis.	Low
O	Landfill operation	Fugitive emission of LFG – contribute to global worming	High	Low	High	Reversible	Long-term	Enhance the LFG monitoring program and maintain the maximum efficiency of the LFG collection system.	Low
O	LFG beneficial utility/flare	CAC emissions from LFG combustion – vegetation growth and human health	High	Low	High	Reversible	Long-term		Low
O	Space heating	CAC emissions from fuel combustion – vegetation growth and human health	Medium	Low	Medium	Reversible	Long-term		Low
O	Operation of vehicles and material handling equipment	CAC emissions from diesel Engine exhausts – vegetation growth and human health	High	Low	Medium	Reversible	Long-term		Low
O	Landfill operations	Odour – impact in the nearby area	High	Low	High	Reversible	Long-term	Maintaining a small operating face. Spreading and compacting the refuse as soon as it is tipped. Placing cover over the waste. Monitoring odour on an ongoing basis, with specific attention paid to any complaints received. When warranted, a commercially available odour control substance will be applied to refuse on the operating face to control odours from migrating off-site.	Low

7.1.3 Aquatic Resources

Fish populations could be affected negatively during the unchecked discharge of stormwater into the drainage ditches and subsequently into the watercourses. Any introduction of silts into the watercourses could potentially have deleterious effects on fish within the watercourses. Young and small fish are sensitive to conditions associated with water flow, oxygen availability, the presence of toxic materials, and the deposition of silt. Impacts to fish species from construction, operation, and closure may include:

- Direct mortality caused by increased turbidity, decreased water quality, and toxic substances entering the watercourse
- Increased mortality of egg and fry from the silting of spawning beds suffocating eggs and trapping fry in the gravels
- Loss of fish food by covering the habitat (gravels) of these organisms with silt

Recommended Mitigations to avoid or minimize potential effects to aquatic resources are provided below:

- Construction
  - Contain stormwater drainage from construction areas and divert to a drainage ditch
  - Ensure that any material that is placed within 100 m of the drainage channels is non-toxic to fish
  - Remove debris or soil inadvertently deposited within the drainage channels in a manner that minimizes disturbance to the channels
  - Stop construction if unfavourable soil, moisture, or rainfall conditions exceed the operations' capabilities for sediment control
  - Pile the soils away from the drainage channels where possible
  - Construct a berm or silt fence to prevent any spoil piles formed near the drainage channels from entering the channels
  - Construct silt fences along the drainage channels prior to clearing, and maintain them in good repair
  - Prevent deleterious substances from entering the drainage channels
  - Do not dispose of any excavated materials in any portions of either drainage channel
  - Ensure that backfill is well compacted on any banks and slopes; where erosion is likely, soils will be protected with appropriate measures such as geo-textile matting or erosion blankets
  - A detailed Erosion Sediment Control Plan (ESCP) will be prepared; the best management practices (BMPs) will be employed as appropriate on-site
  - An Emergency Response Plan for spills will be developed

- Operations
  - The day-to-day operations will be incorporated into the existing ISO 14001 Environmental Management System already in place for the Cache Creek Landfill.
  - As with the existing Cache Creek Landfill facility, the proposed landfill extension design will include measures to ensure the incorporation of a proper surface water control system
  - The proposed surface water control system will include plans to ensure that surface waters that flow down the natural slope towards the landfill extension are diverted through a perimeter ditch to be located on the outside of the previously noted berm
  - A berm is proposed to be installed around the landfill perimeter, which will delineate the edge of the lining system and divert surface water around the landfill footprint
- Closure

Appropriate mitigation measures include the use of erosion blankets on disturbed areas, silt traps (silt fences), an environmental management system, a surface water control system, construction of a berm and surrounding drainage ditch, and the proposed plan for moisture content enhancement. Assuming these measures are followed, impacts to the watercourses and fisheries are expected to be minor in magnitude, sub-regional in extent, and of short-term duration.

A summary of the most notable residual effects is provided in Table 7-7.

TABLE 7-7
Projected Impacts on Aquatic Resources

Construction (C)/ Operation (O)/ Closure (CL)	Project Activity	Summary of Effect	Probability of Occurrence	Spatial Extent	Frequency	Duration	Reversibility	Monitoring/ Mitigation	Residual Effect
C	Site construction activities: drainage ditch, clearing and site preparation	Potential release of sediments and/or toxic materials into the adjoining drainage channels that lead to the Bonaparte and Thompson Rivers	Low	Low	Low	Short-term	Reversible	Stormwater from site will run through the existing drainage channels: additional erosion control measures shall be installed and implemented.	Low
O	Drainage	Potential water quality degradation in the water courses from surface water drainage	Low	Low	Medium	Medium-term	Reversible	Stormwater will be directed around landfill into constructed drainage ditch: environmental management system and surface water control system will manage stormwater.	Low
CL	Stormwater runoff and sediment release during the closure activities	Potential release of sediments and/pr potentially toxic materials into the adjoining drainage channels that lead to the Bonaparte and Thompson Rivers	Low	Low	Low	Short-term	Reversible	A conceptual closure plan for the landfill and other onsite facilities will be detailed in a separate report and will detail a surface water drainage management plan.	Low

7.1.4 Terrestrial

7.1.4.1 Vegetation

Construction and operation of the landfill site will result in both temporary and permanent alteration or loss of vegetation as described below. A summary of these effects is provided in Table 7-8.

Impacts to vegetation may occur as a result of clearing, introduction of weeds, and unsuccessful reclamation or reclamation with non-native species. Clearing has the potential to remove natural wildlife habitat and rare plant species. However, no rare plant species were found during the assessment.

The tree and shrub communities will be impacted. These communities not only provide slope stability and erosion protection, but offer cover for wildlife movements, and a source of grazing and browse for wildlife. Areas cleared during construction in and adjacent to the right-of-way (RoW) should be revegetated with compatible plant species where possible.

Landfill construction will produce disturbed ground surface upon which weeds can become established. To reduce the potential for establishment of weeds within the RoW, an aggressive revegetation program using native seed sources and stock will be initiated following clean-up. This will help ensure that desirable species are quickly established and have a competitive edge over weed species.

Since the Project area is adjacent the existing Cache Creek Landfill, there is low probability for rare plants. Therefore, impacts to vegetation are not anticipated to affect a population or a specific group of individuals beyond their natural limits of variation. Therefore, there are no perceived measurable effects on the integrity of the vegetation communities and population as a whole and the impacts to vegetation from development of the landfill are considered to be low.

Recommended mitigation measures to reduce these potential impacts to an acceptable level are described below:

- Construction Stage
  - All contractors and subcontractors shall ensure that all construction equipment on the job site is clean (free of weeds and weed seeds) and in good working order (no oil or hydraulic fluid leaks)
  - All contractors and subcontractors shall check for, and physically remove, obvious accumulations of weeds and other types of vegetation from their equipment prior to moving onto the RoW, to minimize the spread of weeds
  - All construction and operational activities associated with the Project shall be confined to the surveyed and marked RoW and temporary workspaces, and designated access roads
  - The RoW, extra workspaces and any environmentally sensitive sites shall be clearly flagged and identified prior to construction activities
  - Install erosion and sediment control measures where necessary to avoid loss of slope stability and maintain erosion control (e.g. silt fence, matting, re-vegetation)

  - Minimize disturbance of natural drainage channels during grading and do not block channels with graded material
  - All trees shall be felled onto the RoW during salvage operations. No trees shall be felled off the RoW. Leaners or felled trees that inadvertently fall into adjacent undisturbed vegetation shall be relocated onto the RoW for disposal
  - If there is evidence of excessive weed development on the RoW after construction, necessary control measures (e.g. tilling or mowing) will be undertaken; the method of control selected shall accommodate site conditions and regulatory recommendations
  - No spraying shall occur on areas where spray can drift onto native grasslands, wooded or shrub areas, or riparian habitats

- Operational Stage

  - No additional loss of vegetation will be required during the operational phase of the landfill site; all traffic will utilize established access roads, and the landfill site will be clearly marked off and cleared prior to operation; with no vehicles or traffic permitted to travel off the RoWs, and the area cleared prior to operation, no additional impacts to vegetation are expected
  - Monitor for the establishment and or introduction of weed species; if weeds establish, they will be removed by mowing, other mechanical methods, or any other means as approved by the MoE

- Closure Stage

  - To reduce the potential for weeds to establish within the RoW, an aggressive revegetation program using native seed sources and stock will be initiated following clean-up, this will help ensure that desirable species are quickly established and have a competitive edge over weed species
  - Only certified Canada #1 weed free seed shall be used during reclamation phases, and, if possible seeding shall occur when the potential for seed germination is high (that is, spring)
  - All disturbed areas shall be seeded with appropriate and MoE-approved seed mixes
  - All shrub and tree plantings will be conducted with the same species found in the adjacent areas and documented during the environmental assessment.
  - Any choice of fertilizer will be cleared with the MoE before being applied.
  - Any established weed species on-site will be removed using mechanical means or any other means approved by the MoE
  - Sediment and Erosion control measures will be installed where necessary (exposed slopes and cleared areas)

If the mitigation measures outlined above are followed, Project-related impacts resulting from clearing and loss of habitat are expected to be low in magnitude, local in extent, and of medium-term duration.

The potential residual impacts to plant communities as a result of Project activities are expected to be low, assuming detailed restoration plans are provided and adhered to. Table 7-8 provides a summary of the potential residual effects.

7.1.4.2 Wildlife

Vegetation clearing within the Project area will lead to loss of habitat for the bunchgrass area, and the adjacent ponderosa pine area. Clearing of the bunchgrass area will result in an anticipated predator shift in the direction of the Douglas-Fir habitat on the western edge of the Project. This will potentially result in a displacement of the small passerine species that inhibit this area; however the relatively dense forest habitat will likely be a mitigating factor.

Wildlife will be subject to sensory disturbance from an increase in noise and traffic resulting from landfill construction. Construction during the summer months may affect most wildlife species during the sensitive reproductive period (that is, May, June), while winter construction will affect wildlife during the late winter period (that is, January to early April).

Wildlife occurring in the area will likely be exposed to an increased risk of mortality due to construction and operations equipment. Since no special status wildlife were found within the Project area during the environmental surveys, impacts to wildlife are not anticipated to affect a population or a specific group of individuals beyond their natural limits of variation. Therefore, there will be no measurable effect on the integrity of the populations as a whole, and the impacts are considered to be insignificant.

Wildlife movement throughout the Project area will also be affected by the construction and operation of the landfill. Due to the localized nature of the landfill, animals that are displaced from the centers of activity will be able to move away from the zone of disturbance without being forced into lower quality habitats.

The following mitigations will reduce impacts to wildlife:

- Construction
  - Vegetation will be cleared outside of the bird breeding season, or nest surveys will be completed to avoid the potential for nest abandonment
  - To the extent possible, construction will occur outside of the summer months to minimize sensory disturbance during the reproductive season. If construction occurs within these months it will take place during daylight hours to allow animals to travel within the construction areas during their nocturnal activities
- Operations
  - Speed limits of vehicles will be in place and operations of the main unlit areas will be conducted in the daylight hours to reduce collision potential; all incidents will be reported
- Closure
  - Reseed area during reclamation to encourage regrowth of wildlife habitat

TABLE 7-8
Projected Impacts on Terrestrial Plant and Wildlife Resources

Construction (C) /Operation (O)	Project Activity	Summary of Effect	Probability of Occurrence	Spatial Extent	Frequency	Reversibility	Duration	Monitoring/Mitigation	Residual Effect
C	Tree Clearing	Loss of Habitat, including potential nesting sites for birds	High	Low	Medium	Non-reversible	Long-term	Vegetation clearing will be conducted outside of the breeding bird season, or nest surveys will be completed to avoid the potential for nest abandonment.	Low
C	Tree clearing	Loss of vegetation cover	High	Low	Medium	Reversible	Long-term	Reseeding or restoration plan.	Low
C	Tree clearing	Loss of habitat	High	Low	Medium	Reversible	Long-term	Small impacted area with no sensitive areas or rare wildlife or plant species identified.	Low
C	Tree clearing	Loss of rare plants	Low	Low	Low	Reversible	Long-term	Rare plant assessment conducted and none found.	Low
C	Grading/site preparation	Introduction of weed species	Low	Low	Low	Reversible	Short-term	Ensure equipment on-site is weed free. Monitor for establishment of weed species. Remove weed species with mowing or other mechanical means.	Low
C	Site Construction	Sensory Disturbance from Construction	High	Low	Medium	Reversible	Short-term	Most construction will occur outside of the summer months to minimize sensory disturbance during the reproductive season, and if construction occurs within these months it will take place during daylight hours to allow animals to travel within the construction areas during their nocturnal activities.	Low
C	Grading/site preparation	Loss of slope stability and erosion protection	Low	Low	Low	Reversible	Short-term	Erosion control measures, such as silt fence will be installed where necessary. Exposed slopes will be revegetated if possible or protected with matting.	Low

TABLE 7-8
Projected Impacts on Terrestrial Plant and Wildlife Resources

Construction (C) /Operation (O)	Project Activity	Summary of Effect	Probability of Occurrence	Spatial Extent	Frequency	Reversibility	Duration	Monitoring/Mitigation	Residual Effect
C & O	Site Construction and Operation	Wildlife Mortalities	Med	Low	Medium	Non-reversible	Short-term	Incident reporting, speed limits, working in daylight hours.	Low
O	Operations/ vehicle traffic	Establishment/ Introduction of weed species	Low	Low	Low	Reversible	Short-term	Monitor for establishment of weed species. Mechanical removal of weeds.	Low
CL	Site clean-up and reclamation	Establishment of weeds	Low	Low	Low	Reversible	Short-term	Aggressive re-vegetation to allow for native species to establish and out compete non-native species.	Low
CL	Site clean-up and reclamation	Unsuccessful reclamation	Med	Low	Medium	Reversible	Long-term	Reclaim site with same topsoil found in area and to an acceptable depth. Reseed area during reclamation to encourage regrowth of wildlife habitat. Implementation of a detailed restoration plan.	Low

7.2 Socioeconomic

7.2.1 Socioeconomic Impacts

This section addresses the Project's potential for socioeconomic impacts on the communities of Cache Creek and Ashcroft, and on the Bonaparte and Ashcroft First Nations, located within the study area. Implications for the tourist, recreation, mining, agricultural, and other sectors of the local economy were considered within the socioeconomic study area. Transportation issues were also considered for the Trans-Canada Highway, Highway 97, and Highway 97C.

Project activities that may impact socioeconomic conditions include:

- Construction activities associated with the extension of the existing landfill cell
- Installation and operation of new landfill gas capture and renewable or sustainable energy generation technologies
- General operational activities associated with the landfill and energy production
- Impacts related to the activity of closing/reclamation of the existing and proposed extension landfill

The proposed Project is expected to enhance positive socioeconomic impacts and mitigate (avoid or minimize) negative socioeconomic impacts. This may include, but not be limited to:

- The location and siting of the landfill extension to mitigate visual and other negative aesthetic impacts of the Project; since the Project site is within the official municipal boundary of Cache Creek, this includes potential impacts on local tourism and commercial or residential areas due to the Project
- The presence of odour, dust, and windblown debris will be managed using an operations plan prepared during the Operational Phase to help minimize the negative aesthetic impacts of the Project, and potential negative impacts on air quality and adjacent land uses
- Hiring locally will help to enhance the positive economic impacts of the Project
- The future potential to generate sustainable energy from landfill gases to minimize or offset greenhouse gas emissions from the construction and operation of the Project

7.2.1.1 Local and Regional Economic Impacts

The communities of Cache Creek and Ashcroft have both benefited from the Landfill Operation which has contributed in excess of $1.2 million in annual revenues to the communities at large. As noted in Chapter 6 of this report, this project is supported by benefit sharing agreements between Belkorp Environmental Services, and the Bonaparte and Ashcroft Indian Bands. These agreements were negotiated prior to the initiation of the environmental assessment and provide revenues, capacity building opportunities, and support cultural programs.

The Cache Creek landfill provides steady employment opportunities with approximately 120 direct positions. The proposed Landfill extension will provide an additional 20 to 30 year lifespan to the current landfill operation and subsequently continue to significantly contribute to the local economies of Cache Creek and Ashcroft, provide opportunities for First Nations people, as well as contributing revenues and taxes into local and regional government services. Closure of the current landfill operation would be damaging to the local economy. The proposed landfill extension is therefore expected to have a sustaining positive impact on the local and regional economies.

The estimated capital & operating costs for the Extension are between $20 – 30 million, and $7 – 10 million, respectfully.

7.2.1.2 Economic Sectors

Economic sectors including mining, forestry, agriculture, film, and manufacturing are not expected to be affected by the proposed Project. There will continue to be beneficial impacts on value added operations related to the forestry sector in the region stemming from wood chip backhaul agreements, as well as other transportation partnerships.

7.2.1.3 Tourism and Recreation

Visibility of the landfill is not expected to affect tourism and recreational values as the site is not visible from the Trans-Canada Highway or any areas designated for recreational use. It is possible that intermittent construction traffic, emissions and noise may have short-term impacts related to traffic in the peak tourist season in the vicinity of the Project. Other factors such as emissions and noise are likely to be limited due to the location of the site, but would still require management. The area of the proposed expansion site includes ATV and four-wheel-drive trails which may be used recreationally or for access to range or grazing areas; these may be affected by changes in the boundary of the landfill operation.

7.2.1.4 Public Safety

Public safety could potentially be impacted by increased construction traffic during the development of the landfill extension. Effects may include dust generated from earth moving or grading activities, which, amplified by high winds, may reduce driver vision on the Trans-Canada Highway. These effects may also impact the airfield located to the south of the proposed extension area perimeter. Proper signage and traffic management, and dust control measures, will reduce the potential for collisions with construction and hauling vehicles as well as visibility impacts on and off-site.

7.2.1.5 Labour Supply and Local Employment

It is expected that the labour force required for the specialized construction or closure activities will be drawn from the local labour pool (including First Nations) or will come from the region or elsewhere in the Province, including the Lower Mainland. During the operational period it is anticipated that the Project will positively affect local trucking and support businesses (welding, maintenance, and equipment supply), local services, and administrative workforce. There is a potential for additional jobs and training, which will reinforce current labour support for the operation.

7.2.1.6 Government Revenues/Taxation

The Project is expected to continue to generate annual revenue for the Thompson Nicola Regional District (TNRD), as well as the municipalities of Cache Creek and Ashcroft. The Project will also provide revenue benefits to local First Nations. From a Provincial and Federal taxation perspective, the 120 jobs generate $2 – 3 million in revenue. The Federal and Provincial taxes paid by supporting businesses are also significant.

7.2.1.7 Local Infrastructure and Public Services

A small positive impact on the local population is expected, primarily attributable to a labour force increase over the long-term. It is expected that the capacity of the existing infrastructure and services would accommodate any potential increase in demand during the operational phase.

7.2.1.8 Housing and Property Values

The proposed Project will likely positively impact the local housing and property values by continuing current employment and economic contribution to the communities. Demand for property may also increase if additional labour is retained during the operational stage. Temporary accommodations may also be required during construction and closure stages, but this need may be met by local hotels and motels in the area. Since the operation is not immediately adjacent to any current residential or commercial properties, (with the exception of properties located across the Trans-Canada Highway that are associated, partnered with or of a similar use as the operation) it is expected that there would be no impact on the housing and property market in the study area communities.

7.2.1.9 Transportation

As noted in Section 6.2.2.5, the volume of landfill trucks represents approximately 2 percent of all vehicles on Highway 1, 7 percent of the heavy vehicles, 9 percent of the trailer trucks, and 22 percent of the train trucks.

A key issue in considering the impact of this is the back haul operation. Over the last 20 years of operation at the Cache Creek Landfill, head hauls of refuse have been matched more than 95 percent of the time with the back haul of products requiring transportation to the lower mainland. Given the products would travel by truck irrespective of refuse moving northbound into the interior, there is no incremental truck traffic unless there is no back haul.

The landfill extension would also operate with a back haul. Therefore, the extension is expected to have a minor impact on the transportation corridor. In addition to the low impact on traffic volume, all trailers are sealed (water tight) and tarped to ensure no liquid or litter escape during transport.

As noted previously, there is potential for traffic patterns to be affected during the construction and closure of the proposed Project; however, this is expected to be low and manageable through the use of appropriate mitigating measures. It is anticipated that there will be only a minor increase in vehicle trips (including trucks, maintenance and employee traffic). Impacts to the vehicular accident rate and pedestrian safety are expected to be minor.

7.2.1.10 Public Health Services

There are no Project-generated impacts expected to affect the provision of public health services within the study area.

7.2.1.11 Socio-Economic Mitigation Measures

In general, the Project is not expected to have significant impacts on the socioeconomic study area. This is primarily due to the fact that the proposed Project is an extension of the current landfill, which has been in operation for over two decades. It is anticipated that the Project will have generally positive socioeconomic impacts on the area. Any other identified impacts are expected to be low and manageable through application of appropriate mitigation measures. These are described as follows:

- Construction Stage
  - All contractors shall prepare and implement a Construction Management Plan that will include Noise, Emissions and Dust Control, Traffic Monitoring and Management policies and actions
  - Prepare and Implement a Communications plan to outline proposed activities, schedule key milestones and liaise with appropriate stakeholders
  - Monitor and report construction activities on a regular basis and manage non-compliance immediately
  - Provide ongoing awareness, training and education to construction workforce
  - Coordinate with authorities having jurisdiction and advise of vehicle movement to and from the site during construction and commissioning period
  - Operate within normal working hours, advise community of expected above normal noise or traffic activities
  - Provide temporary or permanent fencing, signage, and public advisory notices
  - Where possible, maintain and protect natural tree or vegetation stands to screen Project activities and to maintain visual quality of long distance views into the Project

- Operational Stage
  - Prepare and implement an operational management plan (OMP) that will include noise, emissions and dust control, traffic, and litter monitoring and management policies and actions
  - Work with authorities to determine potential areas of risk on highway and through communities; manage driver training and awareness as well as public education on waste transportation routes; implement appropriate traffic controls as required
  - Prepare and implement an operational communications plan (OCP) to outline proposed activities, schedule key milestones and liaise with appropriate stakeholders
  - Monitor and report construction activities on a regular basis and manage non-compliance immediately
  - Provide ongoing awareness, training and education to operational workforce and associated operators

  - Work with a Landfill Advisory Committee, comprised of representatives from the Bonaparte and Ashcroft Indian Bands and the Villages of Cache Creek and Ashcroft, on all operational matters

- Closure Stage
  - Prepare and implement a closure management plan that will include noise, emissions and dust control, traffic monitoring and management policies and actions
  - Prepare and implement a communications plan to outline proposed closure activities, schedule key milestones and liaise with appropriate stakeholders
  - Monitor and report construction activities on a regular basis and manage non-compliance immediately
  - Provide ongoing awareness, training and education to construction workforce.
  - Coordinate with authorities having jurisdiction and advise of vehicle movement to and from site during the construction and commissioning periods
  - Operate within normal working hours, advise community of expected above normal noise or traffic activities
  - Provide temporary or permanent fencing, signage and public advisories.
  - Work with the Bonaparte and Ashcroft Indian Bands and other stakeholders affected by the closure of the operation to identify alternate uses for the property
  - Working with local municipalities and other stakeholders, identify economic support strategies and actions to minimize impacts of landfill closure on employment, local services, and economy

TABLE 7-9
Projected Impacts on Socioeconomic Resources

Construction (C)/ Operation (O)	Project Activity	Summary of Effect	Probability of Occurrence	Spatial Extent	Frequency	Duration	Reversibility	Monitoring / Mitigation	Residual Effect
C	Landfill extension clearing, grading, and general construction activities	Visual impact due to changes of existing landscape from Trans-Canada Highway. Views impacted looking uphill to Project site.	High	Low	Medium	Short-term	Reversible	Erosion Sediment Control Plan (ESCP) to be implemented to manage all construction activities including temporary or permanent natural or man made screening of facilities.	Low
		Current land use of the site includes ATV trails, grazing, and other recreational activities. An existing forestry road will need to be moved to the south of the proposed extension.	High	Low	Medium	Short-term	Reversible	Relocate the Forest Service Road (FSR) in consultation with appropriate authorities. Consult with affected stakeholders to determine alternate ATV/4 Wheel Drive routes. Determine boundaries for grazing or other recreational activities. Provide fencing, signage and monitoring for safety of recreational users near Project boundaries.	
	Equipment and vehicle mobilization for construction startup	Potential impacts on traffic flow and safety from heavy earth moving vehicles and equipment delivered to site.	High	Low	Medium	Short-term	Reversible	Implement traffic management plan and schedule, and advise affected stakeholders.	Low
		Impact on tourism values - perception of area going to, or from, the Village of Cache Creek.	Low	Low	Medium	Short-term	Reversible	Implement Communications Plan with affected stakeholders as required to manage impacts and advise of ongoing activities and schedule.	Low
	Equipment Operation during Landfill Extension Construction Period	Noise from construction equipment (earth-moving vehicles, generators and pumps for groundwater) to adjacent properties or other receptors.	High	Low	Medium	Short-term	Reversible	Construction Management Plan (CMP) to be implemented to manage all construction activities – hours of operation.	Low
		Potential impact of odour from construction vehicle emissions.	High	Low	Medium	Short-term	Reversible	Implement no-idling policy on site and no engine braking within community.	Low
		Day to day impacts on local and regional traffic flows.	Low	Low	Medium	Short-term	Reversible	Construction Management Plan (CMP) to be implemented to manage all construction activities.	Low

TABLE 7-9
Projected Impacts on Socioeconomic Resources

Construction (C)/ Operation (O)	Project Activity	Summary of Effect	Probability of Occurrence	Spatial Extent	Frequency	Duration	Reversibility	Monitoring / Mitigation	Residual Effect
		Potential for dust generation and/ or spillage of soils and gravel on highway at site entry	High	Low	Medium	Short-term	Reversible	Construction Management Plan (CMP) to be implemented to manage all construction activities.	Low
		Potential for dust generation affecting adjacent airfield	Low	Low	Medium	Short-term	Reversible	Construction Management Plan (CMP) to be implemented to manage all construction activities. Work with aviation authorities and airfield stakeholders to manage safety and visibility of runway during daylight hours. (Airfield not currently operational during nighttime)	Low
	Installation of LFG beneficial recovery equipment and structures	Emissions from combustion. Perceived impacts to air quality.	Low	Low	Medium	Short-term	Reversible	Implement Commissioning Plan to manage startup and testing schedule	Low
C	Utility connection to beneficial LFG recovery equipment	Installation of utility connections to site to from existing BC Hydro RoW to the east of the site, across the Trans-Canada Highway. May disrupt power supply during connection. Traffic impacts due to construction activities.	Low	Low	Medium	Short-term	Reversible	Construction Management Plan (CMP) to be implemented to manage all construction activities. Advise appropriate stakeholders of schedule and potential disruptions to utilities.	Low
Operations	Wind blown litter/debris on boundaries of landfill, and debris or litter from waste trucks arriving and departing from operation	Visual quality Impact from Trans-Canada Highway	Low	Low	Continuous	Medium-term	Reversible	Implement waste materials management best practices such as soil covering each day, and regular litter monitoring on boundaries.	Low
		Visual quality impact on transportation routes to and from landfill site	Low	High	High	Long-term	Reversible	Implement waste materials management practices for waste trucks using mandatory covering and or wash down as appropriate.	Low

TABLE 7-9
Projected Impacts on Socioeconomic Resources

Construction (C)/ Operation (O)	Project Activity	Summary of Effect	Probability of Occurrence	Spatial Extent	Frequency	Duration	Reversibility	Monitoring / Mitigation	Residual Effect
		Impact on tourism and recreation, affecting perception, activities, or opportunities during tourist season due to wind blown litter and waste within vicinity of operation	Low	Medium	Medium	Long-term	Reversible	Implement waste materials management practices such as soil covering each day.	Low
		Potential for wind blown litter migration affecting adjacent airfield operation	Low	Low	Medium	Long-term	Reversible	Implement waste materials management practices such as soil covering each day.	
	Landfill Odour	Impacts on adjacent properties or receptors	High	Low	High	Long-term	Reversible	Read in conjunction with air quality section. Odours will be monitored on an ongoing basis, with specific attention paid to any complaints received. When warranted, a commercially available odour control substance will be applied to refuse on the operating face to control odours from migrating off-site. Odour issues will also be integrated with the organics management plan.	Low
	Landfill Equipment operation – graders, bulldozers, and unloading	Noise impacts on adjacent properties or receptors during operational hours	High	Low	Medium	Long-term	Reversible	Manage all on site activities generating noise through hours of operation, regular maintenance and sound controls for stationary noise sources. Limit idling to reduce engine noise.	Low
		Emissions from equipment operation	High	Low	Medium	Long-term	Reversible	Enforce no idling policy or no engine braking through community.	Low
	Energy generation from LFG	Emissions from combustion. Perceived impacts to air quality from flaring	Low	Low	Medium	Medium-term	Reversible	Implement LFG management plan for monitoring. Maintain facility to maximum efficiency, liaise and educate adjacent land owners, community and municipality to advise on flaring activity.	Low
	General landfill	Demands for additional public infrastructure -	No negative impact					Current access routes to be maintained.	No impact expected

TABLE 7-9
Projected Impacts on Socioeconomic Resources

Construction (C)/ Operation (O)	Project Activity	Summary of Effect	Probability of Occurrence	Spatial Extent	Frequency	Duration	Reversibility	Monitoring / Mitigation	Residual Effect
	operations	highway access to and from site	expected						
		Impacts on housing/property values due to potential development opportunities near Boston Flats area - as per Ashcroft –Cache Creek Fringe land use plan	Low	Low	High	Long-term	Reversible	Continue consultation with TNRD on current land uses to the south of the current Cache Creek municipal boundary adjacent to the proposed landfill extension.	Low
		Impacts on housing/ property values proximity to landfill operation	Low	Low	High	Long-term	Reversible	Landfill has been in operation since 1989. Past research has indicated that the landfill aided to the general market value of the properties as an economic catalyst for the community – mitigation will include continued management of transportation routes to and from the facility, as well as odour, dust and noise mitigation.	Low
		Impacts on public health services	No negative impact expected					Continued operation of the landfill facility as well as potential increase in personnel would help maintain community stability and demand for services.	Low
		Impacts of waste transportation on public safety	Low	Low	High	Long-term	Reversible	Work with Authorities to determine potential areas of risk on highway and through communities. Manage driver training and awareness as well as public education on waste transportation routes. Implement appropriate traffic controls as required.	Low
		Local and regional economy	High	Medium	High	Long-term	Reversible	Continued operation of the landfill facility as well as potential increase in personnel would help maintain community economic stability.	Positive
		Government revenue/taxation	High	Medium	High	Long-term	Reversible	Continued operation of the landfill facility as well as potential increase in personnel would help	Positive

TABLE 7-9
Projected Impacts on Socioeconomic Resources

Construction (C)/ Operation (O)	Project Activity	Summary of Effect	Probability of Occurrence	Spatial Extent	Frequency	Duration	Reversibility	Monitoring / Mitigation	Residual Effect
								maintain revenues to Cache Creek and Ashcroft, First Nations Communities, and maintain tax base.	
		Labour supply and local employment opportunities – increased demand for labour from local, regional workforce	High	High	High	Long-term	Reversible	Continued operation of the landfill will provide opportunities to target additional labour from local communities, as well as from the lower mainland and regional area. Training for waste management technology (LFG capture) potentially exists, as does short-term employment for construction.	Positive
		Impacts on land uses	Low	Medium	High	Long-term	Reversible	Continue to consult with TNRD and local private land owners in Boston Flats area to determine impacts or opportunities.	Low
		Impacts on other economic sectors – wood processing – forestry value added	High	Medium	High	Long-term	Reversible	Continued operation of the landfill will provide economic and business opportunities to existing wood chip processors across from current facility as well as trucking and maintenance support.	Positive
Closure + Post Closure PC	Decommissioning activities Landfill capping of Final Phase - grading and general landscape reclamation/ construction activities.	Visual impact due to changes of existing landscape from Trans-Canada Highway. Views impacted looking uphill to landfill.	High	Low	Medium	Short-term	Reversible	Implement closure and post closure plan and provide continuous monitoring, and reporting on a prescribed basis.	Low
	Equipment and vehicle mobilization for decommissioning startup.	Potential Impacts on traffic flow and safety from heavy earth moving vehicles and equipment delivered to site	High	Low	Medium	Short-term	Reversible	Closure Plan (CP) to be implemented to manage all construction activities – hours of operation.	low
		Impact on tourism values -	Low	Low	Medium	Short-term	Reversible	Closure Plan (CP) to be	low

TABLE 7-9
Projected Impacts on Socioeconomic Resources

Construction (C)/ Operation (O)	Project Activity	Summary of Effect	Probability of Occurrence	Spatial Extent	Frequency	Duration	Reversibility	Monitoring / Mitigation	Residual Effect
		perception of site undergoing decommissioning						implemented to manage all construction activities. Provide temporary screening. Implement landscape reclamation plan.	
		Noise from construction equipment (earth moving vehicles, generators and pumps for groundwater) to adjacent properties or other receptors.	High	Low	Medium	Short-term	Reversible	Closure Plan (CP) to be implemented to manage all construction activities.	Low
		Potential impact of odour from construction vehicle emissions	High	Low	Medium	Short-term	Reversible	Implement no - idling policy on-site and no engine braking within community.	Low
		Day-to-day impacts on local and regional traffic flows	Low	Low	Medium	Short-term	Reversible	Closure Plan (CP) to be implemented to manage all construction activities.	Low
		Potential for dust generation and/ or spillage of soils and gravel on highway at site entry	High	Low	Medium	Short-term	Reversible	Closure Plan (CP) to be implemented to manage all construction activities.	Low
		Potential for dust generation form decommissioning activities affecting adjacent airfield	Low	Low	Medium	Short-term	Reversible	Closure Plan (CP) to be implemented to manage all construction activities. Work with aviation authorities and airfield stakeholders to manage safety and visibility of runway during daylight hours. (Airfield not currently operational during nighttime)	Low
	Decommission-ing of LFG beneficial recovery equipment and structures	Loss of renewable energy source	Low	Medium	High	Long-term	Reversible	Implement decommissioning plan for facility – identify alternate sources for renewable energy production.	Low
	Utility Disconnection	Impacts of utility disconnection. Potential power and traffic disruption.	Low	Low	Medium	Short-term	Reversible	Closure Plan (CP) to be implemented to manage all construction activities. Advise appropriate stakeholders of	Low

TABLE 7-9
Projected Impacts on Socioeconomic Resources

Construction (C)/ Operation (O)	Project Activity	Summary of Effect	Probability of Occurrence	Spatial Extent	Frequency	Duration	Reversibility	Monitoring / Mitigation	Residual Effect
								schedule and potential disruptions to utility.	
		Impacts on housing/property values due to closure	Low	Low	High	Long-term	Reversible	Consult with community and municipality on decommissioning of facility.	High without alternate equivalent economic opportunities to support market in area.
		Local and regional economy loss of local income and spending	Low	Medium	High	Long-term	Reversible	Consult with community and municipality on decommissioning of facility.	High without alternate equivalent economic opportunities to support market in area.
		Government revenue/ taxation – loss of revenues and taxation base	High	Medium	High	Long-term	Reversible	Consult with community and municipality on decommissioning of facility.	Medium – High
		Labour supply and local employment loss – no demand for labour from local, regional workforce, may force relocation to better job markets	High	High	High	Long-term	Reversible	Consult with community and municipality on decommissioning of facility. During operations, provide training and education opportunities to personnel to maintain skill levels.	Medium - High
		Impacts on land uses – land may become available over long-term for other development or recreational opportunities	Low	Medium	High	Long-term	Reversible	Consult with community and municipality on decommissioning of facility. Work with community planners to identify long-term opportunities.	Low
		Impacts on other economic sectors – wood processing – forestry value added	High	Medium	High	Long-term	Reversible	Work with other sectors to identify other partnerships or business opportunities.	Low

7.3 Cultural Heritage Resources

7.3.1 Identification of Culturally Important Plants

Plants of ethnobotanical importance were identified as part of the rare plant surveys. This was done to collect baseline information and to ensure that culturally important plants within the Project site were not rare, and could be found in other areas around the Project site.

7.3.2 Proposed Mitigation for Archaeological Resources and Values

The Archaeological Impact Assessment (AIA) conducted by Terra Archaeology Limited was comprehensive in nature and was completed with First Nations participation and input. This section summarizes the results of the Archaeological Impact Assessment (AIA) conducted for the proposed extension of the Cache Creek Landfill. A comprehensive interim report has been produced which provides details of each archaeological site identified.

During the field work, which was conducted over a 16 day period in August 2008, a total of 1790 shovel tests were excavated. Eighteen archaeological sites were identified within the 46 ha landfill extension area. The sites are lithic scatters consisting of both surface and subsurface cultural material of varying density. Lithic scatters are presumed to predate 1846, and are automatically protected under the *Heritage Conservation Act* of British Columbia. Subsurface cultural deposits were found to be relatively shallow, concentrated within the first 5 cm below the surface. A faunal remains component was identified at only one site (EeRi-178). No archaeological surface features were identified within the proposed development area.

As complete site avoidance is not feasible, mitigation has been recommended for three of the sites identified: EeRh-277, EeRh-283 and EeRi-178. Any ground-disturbing activities within the established boundaries of an archaeological site will be conducted under the authority of a site alteration permit pursuant to S.12 of the *Heritage Conservation Act*. Further archaeological work in the form of systematic data recovery (excavation) is recommended for these three sites:

1. Site EeRh-277 is a relatively light lithic scatter located on a small defined landform. The site contains surface (including one diagnostic projectile point) and intact subsurface cultural deposits. As intensive surface collection was conducted during the AIA, this data recovery can be limited to systematic archaeological excavation. Based on the limited cultural returns, in order to adequately mitigate this site it is recommended that 3 1 m x 1 m units be excavated within the defined site area.

2. Site EeRh-283 contains surface and intact subsurface cultural deposits including very high artifact density in one portion of the site; therefore, site avoidance or further archaeological work is recommended. If avoidance is not feasible, mitigation in the form of systematic data recovery is recommended prior to any ground-altering activity within the site area. This data recovery should incorporate intensive surface artifact collection and systematic archaeological excavation within the established area of increased artifact density. In order to adequately mitigate this site, it is recommended that 15 1 m x 1 m units be excavated within the area of increased artifact density.

3. Site EeRi-178 contains surface and intact subsurface cultural deposits including very high artifact density in one portion of the site; therefore, site avoidance or further archaeological work is recommended. If avoidance is not feasible, mitigation in the form of systematic data recovery is recommended prior to any ground-altering activity within the site area. This data recovery should incorporate intensive surface artifact collection and systematic archaeological excavation within the established area of increased artifact density. In order to adequately mitigate this site, it is recommended that 16 1 m x 1 m units be excavated within the area of increased artifact density.

No further archaeological work is recommended for the remaining 15 sites. All of the artifacts identified at these sites were collected, and the amount of additional information likely to be obtained through systematic data recovery at these sites is considered to be limited due to one or more of the following: low artifact density, absent or negligible subsurface components, and/or lack of diagnostic or otherwise archaeologically significant artifacts.

7.4 Summary of Mitigation Requirements

Summaries of impacts and mitigation requirements can be found in Tables 7-1 and 7-6 through 7-10. While the potential exists for some Project activities to have moderate or high impacts on environmental resources, all project activities are expected to have a low residual effect as a result of mitigation measure implementation. Key proposed mitigations include (but are not limited to):

- Erosion and sediment control, including proper topsoil management and handling, will reduce impacts to soils, protect atmospheric resources through dust control, and protect aquatic resources through runoff management
- Leachate management will include a double liner and leak detection system to ensure leachate does not enter the watershed
- Timing of construction activities and traffic management is expected to reduce impacts to vegetation and wildlife, and improve safety for residents and tourists
- Reclamation plans should include an accelerated revegetation program to ensure no loss of vegetation, provide more wildlife habitat, and ensure no further soil erosion

Many of these mitigations are already in place with the existing landfill, and CH2M HILL concludes that potential additional impacts as a result of activities associated with the proposed landfill extension will not be significant.

Socioeconomic effects are also expected to be low throughout Project construction and operation, with positive effects as a result of income generation and an increase in tax revenue for the area. The Project is also expected to create jobs and keep the populations of Cache Creek and Ashcroft stable. The closure of the existing landfill is expected to have a high residual impact, but construction of the proposed landfill extension will delay this and allow for time to transition to a post-closure economic plan.

7.5 Summary of Commitments

TABLE 7-10
Impact Type and Required Action

Impact Type	Construction (C)/ Operation (O)/ Closure (CL)	Required Action	Timing	Responsible Party
Aquatic	CL	A conceptual closure plan for the landfill and other onsite facilities will be detailed in a separate report and will detail a surface water drainage management plan	Plan completed by 2010	Wastech plus –Design Engineer
Atmospheric	O	Enhance the LFG monitoring program and maintain the maximum efficiency of the LFG collection system.	Ongoing	Wastech - Operations
Atmospheric	O	Monitoring odour on an ongoing basis, with specific attention paid to any complaints received. When warranted, a commercially available odour control substance will be applied to refuse on the operating face to control odours from migrating off-site.	Ongoing	Wastech - Operations
Atmospheric	O	Spreading and compacting the refuse as soon as it is tipped, placing cover over the waste.	Ongoing	Wastech - Operations
Atmospheric	C, O	Use of an on-site water truck to water-down access roads and other materials on an as-required basis.	Ongoing	Wastech - Operations
Community	C, O	Advise appropriate stakeholders of schedule and potential disruptions to utilities.	Before construction starts	Wastech/Village of Cache Creek – Stakeholder Relations
Community	CL	Consult with community and municipality on decommissioning of facility.	post closure period	Wastech/Village of Cache Creek – Stakeholder Relations
Community	C	Continue consultation with TNRD on current land uses to the south of the current Cache Creek municipal boundary adjacent to the proposed landfill extension.	Before construction starts	Wastech/Village of Cache Creek – Stakeholder Relations
Community	C	Continue to consult with TNRD and local private land owners in Boston Flats area to determine impacts or opportunities.	Before construction starts	Wastech/Village of Cache Creek – Stakeholder Relations

TABLE 7-10
Impact Type and Required Action

Impact Type	Construction (C)/ Operation (O)/ Closure (CL)	Required Action	Timing	Responsible Party
Community	C, O, CL	Conceptual design and a physical model of a Cattle Easement for facilitating grazing of cattle to the north of the extension area have been developed. Ashcroft Ranch staff will be consulted at the detailed design and construction phase to ensure that the easement meets specific requirements (e.g. grades, funneling, etc.)	Design 2009/2010, Construction 2010	Wastech/ Design Engineer
Community	O	Training for waste management technology (LFG capture) potentially exists, as does short-term employment for construction.	Ongoing as needed	Wastech – Operations, Design Engineer
Community	C,O	Current access routes to be maintained.	Design phase 2009	Wastech – Operations, Design Engineer
Community	O	During operations, provide training and education opportunities to personnel to maintain skill levels.	Ongoing as needed	Wastech – Operations
Community	C,O	Construction Management Plan to be implemented to manage all construction activities. Work with aviation authorities and airfield stakeholders to manage safety and visibility of runway during daylight hours. (Airfield not currently operational during nighttime)	Construction Management Plan developed Before construction starts	Wastech – Operations, Design Engineer
Community	CL	Implement closure and post closure plan and provide continuous monitoring, and reporting on a prescribed basis.	Closure period	Wastech/Village of Cache Creek – Stakeholder Relations
Community	C	Implement Commissioning Plan to manage startup and testing schedule	Before construction starts	Wastech – Stakeholder Relations
Community	C,O	Implement Communications Plan with affected stakeholders as required to manage impacts and advise of ongoing activities and schedule.	Before construction starts, Ongoing	Wastech/Village of Cache Creek – Stakeholder Relations
Community	CL	Implement decommissioning plan for facility – identify alternate sources for renewable energy production.	Closure period	Wastech – Operation
Community	CL	Implement landscape reclamation plan.	Closure period	Wastech – Operation

TABLE 7-10
Impact Type and Required Action

Impact Type	Construction (C)/ Operation (O)/ Closure (CL)	Required Action	Timing	Responsible Party
Community	O	Implement LFG management plan for monitoring. Maintain facility to maximum efficiency, liaise and educate adjacent land owners, community and municipality to advise on flaring activity.	Before construction starts; Ongoing	Wastech – Stakeholder Relations; Operations, Design
Community	O	Implement no-idling policy on site and no engine braking within community.	Ongoing	Wastech – Operations
Community	C, O	Implement traffic management plan and schedule, and advise affected stakeholders.	Before construction starts	Wastech/Village of Cache Creek – Stakeholder Relations, Design
Community	O	Implement waste materials management best practices such as soil covering each day, and regular litter monitoring on boundaries.	Ongoing	Wastech – Operations
Community	C, O	Manage all on site activities generating noise through hours of operation, regular maintenance and sound controls for stationary noise sources. Limit idling to reduce engine noise.	Ongoing	Wastech – Operations
Community	C	Provide temporary screening from the Trans-Canada Highway as required.	Before construction starts	Wastech – Construction
Community	O	Relocate FSR in consultation with appropriate authorities. Consult with affected stakeholders to determine alternate ATV/4 Wheel Drive routes. Determine boundaries for grazing or other recreational activities. Provide fencing, signage and monitoring for safety of recreational users near Project boundaries.	Consultation in 2009; Ongoing management	Wastech/Village of Cache Creek – Stakeholder Relations; Operations
Community	O	Work with Authorities to determine potential areas of risk on highway and through communities. Manage driver training and awareness as well as public education on waste transportation routes. Implement appropriate traffic controls as required.	Management plan to be completed before construction starts	Wastech/Village of Cache Creek – Stakeholder Relations, Design, Operations
Community	O	Work with aviation authorities and airfield stakeholders to manage safety and visibility of runway during daylight hours. (Airfield not currently operational during nighttime)	Ongoing	Wastech – Design Engineer, Operations
Community	O	Work with other sectors to identify other partnerships or business opportunities.	Ongoing	Wastech – Management

TABLE 7-10
Impact Type and Required Action

Impact Type	Construction (C)/ Operation (O)/ Closure (CL)	Required Action	Timing	Responsible Party
General	C, O	Landfill will be constructed in phases to limit spatial extent of operations	Before construction starts, Ongoing	Wastech – Construction, Operations, Design Engineer
Hydrological	C, CL	Drainage will be managed during operation with a constructed drainage ditch. Drainage will be re-established as part of the closure plan.	Before construction starts, As part of closure plan	Wastech – Construction, Operations
Hydrological	O	Leachate management system includes a double liner with a leak detection system which will remain in operation as long as needed following landfill closure.	Ongoing	Wastech – Design, Operations
Hydrological	O	Storm water will be directed around landfill into constructed drainage ditch; environmental management system and surface water control will manage storm water	Before construction starts, Ongoing	Wastech – Design Engineer, Operations
Soil	C,O	Erosion control measures, such as silt fence will be installed where necessary.	Before construction starts, Ongoing	Wastech – Construction, Operations
Soil	C	ESCP plan to be implemented to manage all construction activities including temporary or permanent natural or man made screening of facilities.	ESCP developed prior to construction ; monitoring ongoing	Wastech – Construction
Soil	C, O	Landfill will be constructed in phases to minimize the area exposed.	Before construction starts, Ongoing	Wastech – Construction, Operations
Soil	CL	Reclaim site with same topsoil found in area and to an acceptable depth.	Closure period	Wastech - Operations
Soil	CL	Salvaging and replacing topsoil in disturbed areas following closure will restore land to pre disturbance condition.	Closure period	Wastech - Operations
Soil	C, O	Spill response will be managed with the ERP for the site and the use of clean up materials and techniques	Before construction starts, Ongoing	Wastech – Construction, Operations

TABLE 7-10
Impact Type and Required Action

Impact Type	Construction (C)/ Operation (O)/ Closure (CL)	Required Action	Timing	Responsible Party
Soil	O	Stockpiles should be seeded if left for long periods of time.	Ongoing	Wastech – Operations
Vegetation	CL	Aggressive re-vegetation to allow for native species to establish and out compete non-native species.	Closure period	Wastech - Operations
Vegetation	O	Dust suppressants, such as magnesium chloride, will also be used on an as-required basis.	Ongoing	Wastech - Operations
Vegetation	C, O	Ensure equipment on-site is weed free.	Before construction starts, Ongoing	Wastech – Construction, Operations
Vegetation	C, O	Exposed slopes will be revegetated if possible or protected with matting.	Before construction starts, Ongoing	Wastech – Construction, Operations
Vegetation	O	Mechanical removal of weeds.	Before construction starts	Wastech - Construction
Vegetation	O, CL	Monitor for establishment of weed species	Ongoing	Wastech - Operations
Vegetation	CL	Reseeding or restoration plan.	Plan completed prior to construction	Wastech – Design Engineer
Vegetation	C	Vegetation clearing should be conducted outside of the breeding bird season, or nest surveys should be completed to avoid the potential for nest abandonment.	Before construction starts	Wastech - Construction
Wildlife	C	To the extent possible, construction should occur outside of the summer months to minimize sensory disturbance during the reproductive season, and if construction occurs within these months it should take place during daylight hours to allow animals to travel within the construction areas during their nocturnal activities.	Ongoing	Wastech – Construction, Operations
Wildlife	C, O	Incident reporting, speed limits, working in daylight hours	Ongoing	Wastech - Operations
Wildlife	CL	Reseed area during reclamation to encourage regrowth of wildlife habitat.	Ongoing	Wastech - Operations