

## **4 EVALUATION OF SITE OPTIONS**

A comparison of the sites was completed to determine the best location for the multiplex from a biophysical, land use and alternate energy resource perspective.

This section compares the potential positive and negative environmental impacts of the proposed development options on each physical and biophysical component. Each option was evaluated by team members, in their area of expertise (i.e. wildlife, vegetation, soils, hydrology, human use and alternate energy), to identify which option posed the least environmental impact. The team then worked collaboratively to determine net positive or negative impacts of each development option. Based on this comparative analysis an overall consensus was reached as to which site would be the most suitable for development of the proposed multiplex. Section 4.7 provides a summary of the negative and positive impacts of each option in a comparative matrix.

The potential options for the multiplex development are: Option 1: demolition of the existing recreation centre and replacement with a new multiplex with an expanded footprint, leaving Elkwoods natural; and Option 2: construction of the multiplex on the Elkwoods site and reclamation of the existing recreation centre site.

### **4.1 Wildlife**

#### **4.1.1 Option 1: Further development of existing recreation centre site**

The greatest impacts to wildlife resources resulting from redevelopment of the existing recreation centre site are an incremental disruption to the Fenland-Indian Grounds wildlife corridor, potential disturbance to sensitive aquatic species in creeks, and the loss of previously thinned old white spruce habitat.

Redevelopment of the existing recreation centre will result in some loss of habitat both through direct loss due to facility expansion and indirect habitat loss due to increased vehicular and human noise disturbance. As a result of this habitat loss, the existing Fenland-Indian Grounds wildlife corridor will be impacted. However, careful placement of facilities can result in the maintenance of a functional wildlife corridor of at least 450 m between facilities and the TransCanada Highway.

Similarly, the existing recreation centre site provides habitat for the bull trout, which is provincially listed as “sensitive”. Bull trout, brook trout and mountain whitefish are known to inhabit Forty Mile Creek, while brook trout have been observed in sections of Whiskey Creek on the subject property. A 30 m protective vegetated buffer around these waterways will minimize impacts to these species and in many areas enhance existing fisheries habitat conditions by decreasing potential for sediment and other contaminants reaching the streams and limiting human and sensory disturbance of aquatic wildlife. Undisturbed riparian areas within the 30 m buffer will also serve to support a high number of wildlife species (including potentially sensitive amphibians) and plant species not found in the predominant upland forests that surround Banff.

The redevelopment of the existing recreation centre will also result in the loss of a portion of old white spruce forest. These forests are important as they support a number of sensitive bird species (e.g. Black-backed woodpecker and brown creeper), they also provide cover for wildlife species utilizing the Fenland-Indian Grounds wildlife corridor. However, most if not all, of the old spruce forest likely to be removed during redevelopment at the existing recreation centre site has been previously thinned to reduce the local fire hazard and has been otherwise impacted by clearing for a power line ROW and existing recreation centre operations. As such, the impact of clearing old spruce forest at the existing recreation centre will be somewhat reduced.

Furthermore, under this scenario, the following characteristics will be retained by not developing the Elkwoods site: the integrity of existing east-west wildlife corridor movement through its southern pinch point, older more intact white spruce forests and small wetlands with high habitat value for birds and small mammals which are located on the Elkwoods site.

#### **4.1.2 Option 2: Development of Elkwoods site and reclamation of existing recreation centre site**

By comparison, the greatest impacts to wildlife likely resulting from development of the Elkwoods site include: a major constriction of Fenlands-Indian Grounds east-west wildlife corridor, a possible increase in vehicular traffic crossing the Fenlands-Indian Grounds wildlife corridor, the loss of old-growth spruce habitat and an increase in availability of palatable forage for ungulates close to the townsite.

Development of the Elkwoods site would virtually terminate any wildlife movement between Elkwoods and the industrial compound. As shown in Figure 4, this would force all wildlife to utilize the already drastically under-sized 160 m wide section of the Fenlands-Indian Grounds wildlife corridor north of the compound. BCEAG guidelines recommend a width of 500 m for a corridor with the physical attributes of the Fenland- Indian Grounds wildlife corridor. The size and location of the Elkwoods site is such that any development on this site would serve to further compromise wildlife use in this portion of the corridor.

There is the possibility that development of the Elkwoods site would result in an increase in the number of vehicles crossing the Fenlands-Indian Grounds wildlife corridor. This could occur if, in an attempt to avoid downtown traffic congestion, residents take Norquay Rd to the TransCanada Highway, and turn off onto Compound Rd. to access the Elkwoods site. This would result in multiplex users crossing the wildlife corridor twice, instead of not crossing it at all if they had accessed the site through town or if they had to access the existing recreation centre site. If many recreation site visitors undertake this activity, the increased traffic flows could adversely impact wildlife use of the Fenlands-Indian Grounds wildlife corridor.

Just as at the existing recreation centre, development of the Elkwoods site would also result in the removal of old white spruce forest. However, unlike the existing recreation centre, the white spruce forest at the Elkwoods site contains more and older white spruce, has greater snag densities, has not been previously thinned, and has been less impacted by previous land use activities. As such, removal of this old white spruce forest will have a greater impact on sensitive bird species dependent upon old forests (e.g. Black-backed woodpecker and brown creeper), and wildlife species that require dense cover to utilize this portion of the Fenland-Indian Grounds wildlife corridor (i.e. wolves and cougars).

Finally removal of much of the dense coniferous forest cover that dominates the Elkwoods site will open up the site and allow for the growth of more plentiful and palatable ungulate forage plants. This in turn has the potential to directly increase the number of elk and deer in close proximity to the town and thereby human/elk and possibly human/predator encounters.

Under this scenario, the existing recreation centre would also be completely reclaimed. Reclamation of the site would ultimately be aimed at restoration of native plant species (forbs, shrubs, trees) that are not palatable to ungulates, and do not provide berry sources for bears. However restoration projects are typically complex, expensive, long-term in duration and vary widely in success of intended outcomes. Initial reclamation activities would likely involve a long period of time where seeded grasses and intensive weed control measures dominate. Eventually reclamation would lead to the transplanting of native grass, shrubs and possibly tree species. As a result of this grass dominated system, a similar undesirable increase in elk and deer in close proximity to the town, as predicted at the Elkwoods site, could also be expected. However, the closing and reclamation of the existing recreation centre would also result in less disruption of aquatic habitat through a decrease in human activity near watercourses. This in turn would be expected to result in a gradual establishment of denser vegetation and thereby benefit sensitive aquatic species.

## **4.2 Vegetation**

### **4.2.1 Option 1: Further development of existing recreation centre site**

The special vegetation resources at the existing recreation centre site consist of a rare aster species found in two locations in riparian areas along the creeks. The integrity of the habitat for this species is moderate to high and if the proposed multiplex is constructed on this site the plant populations could be adequately protected by maintaining an undisturbed buffer of 30 m around all riparian areas on this site (as recommended to protect wildlife habitat and water resources). The undisturbed riparian areas support a high number of plant species not found in the predominant upland forests that surround Banff.

The sand dune located to the east of the current recreation centre has been heavily impacted by human use and clearing for the power line which runs down the length of it. The vegetation is a mixture of native plants, seeded grasses and other non-native plants and has overall low integrity from a vegetation perspective. There are no old-growth spruce on the existing recreation centre site.

A large portion of the vegetation at the existing recreation centre site has been disturbed as a result of clearing for the power line ROWs and recreation centre operations as well as recent forest thinning work. Adjacent railway operations also have created permanent areas that support only non-native plants. The disturbed areas generally have a high percent cover of non-native species including noxious weeds that are difficult to control such as Canada thistle, toadflax and perennial sow-thistle. Development of the multiplex on this site would result in a relatively small incremental disturbance to the vegetation on a site that has been subject to significant previous disturbance.

#### **4.2.2 Option 2: Development of Elkwoods site and reclamation of existing recreation centre site**

Overall the Elkwoods site has higher integrity with respect to vegetation than the existing recreation centre site. There are fewer disturbances on this site and therefore less area affected by non-native plants than the existing recreation centre. The wetlands on the Elkwoods site are smaller in number and extent but are relatively undisturbed and have high integrity. The special resources on this site are patches of old-growth white spruce which are rare in floodplain spruce forests in the montane. Old-growth spruce trees greater than 300 years old like that on Elkwoods are very rare and considered of high ecological importance for wildlife habitat.

The power line ROW on the Elkwoods site is heavily infested with non-native plants including Canada thistle and oxeye daisy. Clearing of this site for a large development would result in the spread of these weeds throughout the site in any areas that did not have facilities (i.e. any cleared areas without buildings or pavement).

If the existing recreation centre site was successfully reclaimed as part of this option, the resulting vegetation communities on the site would add to existing habitat in the Vermilion Lakes wetland complex. The health of the rare aster population on this site would be improved by the reduction in non-native species and improved integrity of the riparian zone along 40 Mile Creek where one sub-population is located.

However, as apparent by the invasive non-native species along the powerline ROWs and other previously disturbed areas, the environment is very sensitive to anthropogenic disturbance. Decommissioning and reclamation of the existing site would be very difficult due to the high presence of non-native species and high compaction of the soils under buildings and paved areas. Soils in heavily compacted areas would need to be amended with preferably sterile organic materials (e.g. peat moss) for many years to improve the soil quality to allow for even moderate plant growth. To be successful, reclamation with native species would likely involve long periods of fallow with seeded grasses that would help to improve organic content of soils over time and would “occupy” the site quickly to reduce the amount of ground available for colonization by aggressive weed species like Canada thistle. Intensive weed control measures would have to be employed for many consecutive years during this phase of reclamation to create conducive conditions for eventual transplanting of native species. This process is likely to take 10-20 years to get the non-native plants controlled and to establish native forbs, shrubs and trees. It would take many decades more to restore a mature forest on the site. These measures would be very costly and time-consuming to create what would likely amount to more undesirable ungulate habitat close to Banff for many decades.

### **4.3 Geology and Soils**

Based on the distribution and structural characteristics of the soils, as well as expected potential mitigations for the removal, storage and restoration of the soils, the differences between the two sites are negligible with respect to soils and determining the best location for the proposed multiplex. Due to similarity in the geology and soil types in project areas, construction impacts and maintaining soil quality for reclamation would be the same for either site. This conclusion is based on the assumption that further impacts to the sand dune at the existing recreation centre site can be avoided during construction and future operations.

### **4.3.1 Option 1: Further development of existing recreation centre site**

The previously disturbed sections of the existing recreation centre have already had soil stripping and replacement. Therefore there is potential for previous admixing and loss of soil productivity. New soil clearing in areas where the soil has been previously disturbed (i.e. areas around the developed parts of the site) would have less of an impact compared to clearing areas where the soil has not been previously disturbed. There is potential for further disturbance of the eolian deposit (sand dune) on the site if the multiplex is located on this site. However, the redevelopment of the existing recreation centre site may provide an opportunity to remediate potential subsurface contamination from past railway land uses.

The clearing of any areas near Whiskey Creek and 40 Mile Creek on the existing site have potential for erosion and sedimentation into the creeks.

### **4.3.2 Option 2: Development of Elkwoods site and reclamation of existing recreation centre site**

Clearing of the Elkwoods site will impact soils due to potential admixing and loss of soil quality. Most areas of the Elkwoods site have not been disturbed; any soil disturbance will negatively impact soil quality and reclamation potential. During clearing and construction there is also potential for erosion and sedimentation into infiltration areas and wetlands on the site.

The existing disturbances on the existing recreation centre site have negatively impacted soil availability and quality. This will make reclamation difficult at this site as there are areas with no topsoil and hard compaction under the buildings and paved areas.

## **4.4 Hydrology**

### **4.4.1 Option 1: Further development of existing recreation centre site**

Potential negative environmental impacts related to hydrology of constructing the new multiplex on the existing recreation centre site include water quality impacts and loss of vegetated land cover important for buffering the adjacent creeks from pollutants.

Hydrologic alterations within a landscape occur whenever land is developed. Stormwater is generated as a result of land use changes from natural vegetated land cover to hard, non-absorbent surfaces (e.g. buildings, parking lots, roads). Construction of the new multiplex will create stormwater. Since stormwater contains contaminants such as hydrocarbons and heavy metals derived from vehicle exhaust, brakes and leaked fluids, as well as nutrients, pesticides and bacteria from urban land uses, it is an environmental concern for aquatic systems. If stormwater is allowed to flow over large paved surfaces on warm days, its temperature increases. If this warmed contaminated water is not diverted to storm sewers or swales and/or if vegetated buffers do not exist, it enters waterbodies where it alters aquatic environments. The result of temperature increases can be immediate fish kills in receiving streams, or chronic, long-term impairment of fish and other aquatic species. Eroded material in stormwater creates turbidity, or dirty water, that can irritate fish gills and make it difficult for fish to find their food. Eroded sediments can cover spawning beds, smothering fish eggs and young that reside in the gravel and possibly blocking access to spawning areas for the next generation. Since Forty Mile Creek and Whiskey

Creek are fish bearing, the impacts of stormwater from the new multiplex could negatively impact fish populations.

The decrease in infiltration (due to replacement of soil and naturally vegetated areas with hard, non-absorbent surfaces such as pavement and roofs) may also have impacts on aquatic habitat because it reduces the slow, constant groundwater supply that keeps creeks flowing in dry weather. This may lead to water levels that are inadequate to provide fish with access to their spawning areas.

However, constructing the new multiplex on the existing recreation centre site would result in less absorbent vegetated surfaces being converted to hard, non-absorbent surfaces compared to Option 2 (if the footprint of the existing recreation centre and parking lot are used). Under this scenario, most if not all area currently covered by paved and roofed surfaces would become new paved and roofed surfaces in the multiplex design resulting in less negative impact to the overall hydrologic regime of the site because the net amount of vegetated land cover lost would be less in comparison to Option 2.

If the new multiplex was developed in the northeastern portion of the existing recreation centre site or close to (within 30m) Forty Mile or Whiskey Creek the ecological integrity of the creeks would likely be significantly compromised due to rapid changes to land cover and resulting disruptions to the local and regional hydrological regime. Developing the new multiplex in the northeastern portion of the existing recreation centre site would result in the conversion of 100% pervious vegetated land cover to impervious (hard, non-absorbent) land cover. This would result in a major hydrological shift – in particular a dramatic increase in stormwater. Development within riparian areas would fragment and destroy vegetated buffers. Lack of vegetated buffers along the stream banks would allow excess stormwater to directly enter the creeks. This would result in both acute and cumulative impacts to aquatic species.

Regardless of the location of the new multiplex on the existing recreation centre site additional stormwater runoff as a result of the construction of the new multiplex will inevitably enter Forty Mile and Whiskey Creeks. After Forty Mile Creek exits the site it flows westward into the eastern edge of the Vermilion Lakes Wetlands complex. The proximity of the site to this natural wetland area could be considered a positive environmental linkage. This large wetland network provides natural water quality and quantity mitigation services such as water retention and storage, and absorption of excess nutrients and pollutants.

There would be no negative environmental impacts related to hydrology on the Elkwoods site if this site is left in a natural state. Leaving Elkwoods in a natural state maintains the vegetated environment that provides on-site absorption and infiltration processes, preserves the wetland complexes critical for nutrient uptake and flood mitigation, and preserves natural soil conditions that have capacity to circulate and filter subsurface water.

These processes are integral for maintaining the hydrological balance of a watershed. Small rainfall events typically account for 75% of the annual rainfall volume (BC MLWA, 2002). Because the majority of rain falls in small amounts, soil and vegetation are generally able to absorb and infiltrate it as it falls – this is why infiltration and evapotranspiration are maximized and surface runoff is minimized in a forested environment. In natural conditions, vegetated surface soil layers are highly permeable. As surface plants die and decompose, they provide a

layer of organic matter which is stirred and mixed into the soil by earthworms and microbes. This soil ecosystem provides high infiltration rates and a basis for subsurface flow. Trees contribute to the soil ecosystem in two ways: the root zone creates a permeable environment; and the buildup of forest litter creates an absorbent layer. In an urban situation, preservation and to a certain extent restoration of soil, vegetation and trees can help to recharge subsurface flow, protect groundwater and minimize runoff (BC MLWA, 2002). Leaving Elkwoods in natural state would preserve these characteristics on the site.

#### **4.4.2 Option 2: Development of Elkwoods site and reclamation of existing recreation centre site**

Potential negative environmental impacts related to hydrology of constructing the new multiplex on the Elkwoods site include water quality and quantity impacts and loss of prime pervious landscape important for the regional hydrologic regime.

Rapidly altering natural land cover in a landscape that has developed over a long period of time can negatively affect the hydrological balance on-site and downstream. Since the Elkwoods site is currently 100% pervious, construction of the new multiplex at that site would drastically change the land cover regardless of its location on the site. The natural capacity of the site to absorb and infiltrate precipitation and subsurface water will be eliminated - leading to a sharp increase in runoff. This could result in downstream water quality degradation and flooding. Since the natural drainage direction from the Elkwoods site is to the west into a commercial/residential neighbourhood, the consequences of a sharp increase in stormwater runoff could lead to downstream flooding and eventually costly stormwater infrastructure upgrades and/or other quantity-related mitigation measures. Stormwater from this site will eventually make its way to the existing recreation centre site through the Town of Banff's stormsewers. This could lead to cumulative impacts to the water quality and quantity of Whiskey Creek over time since natural nutrient uptake and filtering of sediments will be limited in the urban stormwater system before the stormwater reaches existing recreation centre site. These impacts have already been observed south of the railway where blue-green algae have begun to proliferate in Whiskey Creek. Eventually, these effects could impact fish populations within Forty Mile and Whiskey Creek.

To a certain degree, reclamation of the existing recreation centre site would improve the local hydrological regime. The conversion of hard, non-absorbent surfaces (current existing recreation centre, tennis courts, parking lot etc) to vegetated land cover and the protection of Forty Mile Creek and Whiskey Creek through the reclamation and restoration of riparian habitat would reduce surface runoff, improving infiltration and evapotranspiration. However, infiltration rates of newly reclaimed soils are typically an order of magnitude lower than adjacent, undisturbed soil, but generally increase slowly over time. The magnitude of increase is dependent on soil characteristics and vegetation. Due to the type of land cover disturbance (extensive pavement) and the age of structure, compaction of subsurface soils has likely taken place over time. As a result, restoring the natural hydrological conditions in this area through reclamation could take anywhere from 25 to 100 years.

In addition, reclamation activities would need to be strictly monitored by an environmental site inspector to ensure that excavation practices and heavy equipment are not contaminating Forty Mile Creek and Whiskey Creek. Improper practices could impact aquatic systems and fish populations.

## **4.5 Land Use**

### **4.5.1 Option 1: Further development of existing recreation centre site**

There were two eolian deposits observed at the existing recreation centre site east of the recreation centre. Both landforms are relatively rare in Banff National Park (EBA, 2007). These land forms have historical significance, therefore it is recommended that these landforms not be altered or disturbed if this site was to be developed. The value of the deposit is in its stratification. The development of the existing recreation centre could potentially cause further disturbance of these eolian deposits. If the archaeologically significant dune was to be further impacted during the construction of the multiplex a complete investigation to determine archaeological significance and mitigate impacts would need to be completed (Langemann, pers.comm. 2007).

The existing recreation centre potentially has contamination to the south end of the site on the CP Rail land; there is no information available to verify this. If there is contamination, the further development of the existing recreation centre could provide an opportunity to remediate the potentially contaminated areas.

### **4.5.2 Option 2: Development of Elkwoods site and reclamation of existing recreation centre site**

There are no historically significant sites on the Elkwoods site. There is also no documentation or visual evidence of contamination on the Elkwoods site.

The reclamation of the existing recreation centre would provide an opportunity for the protection of the historical dune.

## **4.6 Environmental Technology Potential**

### **4.6.1 Geothermal**

The geothermal potential for each site is similar due to similar depth to the frost-free soil layer. Tree removal would be required on the Elkwoods site to access areas of the site to drill a suitable number of boreholes. Pump-testing containment would be difficult on a treed site during drilling, potentially causing sedimentation into natural infiltration areas. Therefore the previously cleared areas at the existing recreation centre would be more suitable for initial pump-testing and containment of drilling fluids (cuttings and water based fluids). This impact would be the same on each site if the Elkwoods site is cleared prior to drilling boreholes and pump-testing.

### **4.6.2 Solar**

Both the Elkwoods and the existing recreation centre sites could effectively use solar installations to meet a portion of the proposed multiplex's energy requirements. Viable installations would include solar thermal to assist with the heating water. In addition photovoltaic solar panels could be installed to generate a portion of the electricity. It should be noted that though both sites could successfully use solar power the solar viability at the Elkwoods site is dependent on the building location. If the building(s) are to be located at the eastern edge of the

proposed site then Tunnel mountain will impact the morning solar gain. The months impacted would include: November, December, January and February. The fact that more of the day's solar energy occurs in the morning then in the afternoon during these months compounds the impact.

The existing recreation centre site has excellent solar availability as shown by the solar pathfinder readings taken on the southeast and southwest corners of the existing recreation centre site. Effectively all of the day's sun throughout the year is available at this site.

#### **4.6.3 Wind**

Due to the low average wind speed in the Banff area wind is not recommended as a source of alternate energy.

## 4.7 Comparative Matrix of Option 1 and Option 2

This section provides a summary of the net negative and positive impacts of the development of the multiplex on each site.

**Table 8.** Net environmental impact comparison for Option 1 and Option 2

Environmental Elements	OPTION 1				OPTION 2			
	Development of the existing recreation centre site		Elkwoods Natural		Development of the Elkwoods site		Existing recreation centre reclaimed	
	+/- <sup>a</sup>	Impact	+/-	Impact	+/-	Impact	+/-	Impact
<b>Wildlife</b>	-	Incremental disruption to Fenland-Indian Grounds wildlife corridor	+++	Preserve integrity of existing east-west wildlife corridor through this pinch-point area	---	Major constriction of Fenlands-Indian Grounds east-west wildlife corridor	++	Improved width of wildlife corridor near existing recreation centre
	-	Increased disturbance to aquatic species in creeks (minimized through buffer retention)	++	Preserve old spruce forests and small wetlands with high habitat value for birds and small mammals	-	Possible increased vehicular traffic crossing wildlife corridor	-	Moderate term increase in ungulate use of area due to reclamation activities
	-	Loss of old spruce habitat (previously thinned)			-	Increased availability of palatable forage for ungulates close to Banff	+	Decrease in disturbance to aquatic species and vegetation.
	--	Potential impact to aquatic species in creeks			--	Loss of old-growth spruce habitat		
<b>Vegetation</b>	-	Loss of vegetated areas with medium-low integrity and high cover of non-native plants	++	Preserve patches of old-growth white spruce (considered rare in montane)	---	Loss of old-growth spruce forest	+	Increased integrity of riparian vegetation
	--	Possible loss or degradation of habitat for rare plant species located on this site			--	Spread of non-native plants within site	+	Slow revegetation with native plant communities (given current high cover of non-native species in adjacent areas)

Environmental Elements	OPTION 1				OPTION 2			
	Development of the existing recreation centre site		Elkwoods Natural		Development of the Elkwoods site		Existing recreation centre reclaimed	
	+/- <sup>a</sup>	Impact	+/-	Impact	+/-	Impact	+/-	Impact
<b>Soils</b>	-	Soils have already been compacted on the existing recreation centre	++	Preserve undisturbed soils	-	Potential for erosion and sedimentation into infiltration areas on the site	+	Soil has been impacted in disturbed areas (i.e. compaction, admixing, loss of topsoil) making reclamation difficult
	-	Potential for erosion and sedimentation into the creeks						
<b>Hydrology</b>	--	Conversion of vegetated pervious surface to hard impervious surface (less than option 2)	++	Maintain critical vegetated pervious environment	---	Major shift in hydrologic regime	++	Reclamation of riparian zones adjacent to Forty Mile Creek and Whiskey Creek near existing recreation centre
			+++	Preserve wetland complexes critical for nutrient uptake and flood mitigation	---	Conversion of vegetated pervious surface to hard impervious surface	++	Increase pervious cover
			+	Preserve natural soil conditions that have capacity to circulate and filter subsurface water	-	Increased stormwater runoff, decreased on-site storage capacity, erosion	+	Reduction in stormwater runoff
					-	Inundation of downstream stormsewers	+	Increased on-site absorption and infiltration
					-	Possible accumulation of nuisance water on private property and public spaces downstream	-	Hydrologic capacity of reclaimed soil not as strong as natural soil

Environmental Elements	OPTION 1				OPTION 2			
	Development of the existing recreation centre site		Elkwoods Natural		Development of the Elkwoods site		Existing recreation centre reclaimed	
	+/- <sup>a</sup>	Impact	+/-	Impact	+/-	Impact	+/-	Impact
<b>Land Use</b>	-	Dune disturbed during construction			+	No historical land use disturbance.	+	Protection of historical site.
	++	Remediation of potentially contaminated areas on current CP Rail land						
<b>Alternative Energy</b>	+	Excellent solar availability, all of the day's sun throughout the year is available at this site			-	Tunnel mountain will impact development of the eastern edge of the proposed site, for the months of November to February. More solar energy occurring in the morning during these months compounds the impact		
<b>Net Environmental Rating</b>	This option would produce net negative environmental impacts. However, the net impacts would likely be less than those associated with Option 2. If the recommendations outlined in section 6 were incorporated into development and planning the net negative impacts could be offset – making this option environmentally neutral.				This option would produce net negative environmental impacts. Even with strict mitigation measures this option would likely result in net negative environmental impacts.			

<sup>a</sup> A measure of the relative environmental impacts: - - - large negative, - - medium negative, - small negative, +++ large positive, ++ medium positive, + small positive

## **5 RECOMMENDATIONS TO MINIMIZE NET ENVIRONMENTAL IMPACT**

### **5.1 Option 1: Further development of existing recreation centre**

This option could have potential negative effects on wildlife, vegetation, and hydrological resources on this site. As such, the following is a list of recommendations to minimize the potential negative environmental impacts and suggestions to off-set the negative impacts of developing the existing recreation centre site.

- Limit major development (i.e. buildings and parking lots) to the southwest corner of the site and eastward along the railway tracks. This will help maintain as wide a wildlife corridor to the north as possible, limit disturbance to Forty Mile Creek and Whiskey Creek and utilize areas that are largely previously disturbed or of limited habitat quality. For the same reasons it is recommend not to develop on the north side of Forty Mile Creek or in the northeast corner of the site.
- In accordance with general best management practices maintain a 30 m development buffer for roads, buildings and parking lots from Forty Mile Creek and Whiskey Creek and ensure that these buffers are vegetated with trees and shrubs. This will help eliminate nutrient loading, sedimentation, erosion and disturbances (i.e. construction, visitor related use) to aquatic environments and sensitive riparian vegetation. This will prevent disturbance of existing rare plant habitat. It will also serve as a barrier to reduce the effects of noise, light, etc. on wildlife within the Fenland-Indian Grounds corridor.
- Develop walking trails in areas adjacent to CP Rail land adjacent to the existing recreation centre site, to minimize human use in the Fenland-Indian Grounds wildlife corridor.
- Do not develop an off-leash dog park as part of the recreation facility. Off-leash dogs have been identified as having the single greatest potential impact on wildlife usage of corridors and habitat areas (BCEAG 1999b). If still deemed necessary, it is recommended that the off-leash dog park be located in another area of town.
- Consider using the redevelopment opportunity to incorporate a wildlife under/overpass of Norquay Rd. into the multiplex project design. Construction of the multiplex will further impinge upon wildlife movement ability. A wildlife crossing structure would assist in providing quick and relatively undisturbed movement through the Fenland-Indian Grounds wildlife corridor.
- Consider off-site wildlife corridor enhancement such as decommissioning of the access road (Compound Rd.) from the TransCanada Highway to the industrial compound turnoff, and increasing vegetation cover density within the corridor east of Compound Rd.
- Do not develop in the disturbed area directly north of the existing recreation centre (former septic field, current outdoor ice rink) in order to protect the water quality of Forty Mile Creek and Whiskey Creek. Restore natural conditions along

- the banks of the creek and on adjacent uplands especially adjacent to the existing recreation centre and parking lot. Attempt to reduce cover of non-native species in this area and restore native plants through native sod transplants or seeding of native species to protect the rare plants found in this area and restore integrity of the riparian zone along Forty Mile Creek.
- Fence off northern portion of the sand dune to allow the vegetation to recover and to protect sensitive archeological resources contained in this dune. Provide interpretive display about the nature and significance of this unique feature as well as the aboriginal artifacts buried in the dune. This could be the focal point of the design plan for the multiplex, with an historical theme throughout the facility. This is an opportunity to educate the public on historical use in the area.
  - Utilize existing disturbed areas under the east-west power line for development of accessory facilities such as the skateboard park and additional parking lots. These areas are already disturbed and have a high cover of non-native plants, utilizing these areas will minimize further disturbance to native vegetation communities on the site.
  - Actively control and reduce populations of non-native plants on this site using an integrated weed control program to limit further spread of these weeds into riparian areas and thinned areas.
  - Avoid development near the wetland areas in the south east portion of the site. These areas provide beneficial hydrological functions such as filtration and assimilation of nutrients and pollutants from the stormwater outfall upstream.
  - Engage in a process to restore the upper reaches of Whiskey Creek on the Elkwoods site. This project could be considered a method of off-setting potential impacts to regional hydrology caused by development activities on the existing recreation centre site. It also poises the Town of Banff as an environmental steward and could be implemented as a joint Parks Canada, Town of Banff and CP Rail project (Pacas, pers. comm. 2007).
  - Ensure post-construction hydrological conditions are equal to or better than preconstruction hydrological conditions. Currently 18% of the existing recreation centre site is covered by hard, non-absorbent surfaces. The remaining 82% of the site is covered by vegetated, absorbent surfaces. Given that the new multiplex most likely will have to occupy a larger footprint than the existing recreation centre (to meet the growing needs of the community) the amount of hard, non-absorbent surface cover will also increase. In other words, developing solely within the existing recreation centre footprint is unlikely. A suggested mitigation measure is to incorporate on-site integrated stormwater management source controls such as low impact development practices, structural best management practices and traditional stormponds to minimize negative changes to the hydrological regime on the site. This would involve utilizing various on-site stormwater practices such as absorbent landscaping, green roofs, grassed swales, infiltration ponds, capture and reuse of precipitation, and pervious paving to reduce stormwater runoff so that it is equivalent to preconstruction hydrological conditions (or runoff based on 18% impervious land cover).

- Investigate the potential to install a stormwater retention pond adjacent to the existing parking lot (former septic field, current outdoor ice rink) as a means to mitigate the impacts of stormwater on the adjacent creeks and to integrate stormwater management with the natural and built environment on-site. This will help mitigate negative impacts (erosion, sedimentation, water quality degradation) caused by stormwater runoff into Forty Mile Creek and Whiskey Creek.

## **5.2 Option 2: Development of Elkwoods site and reclamation of existing recreation centre**

This option could have potential significant negative effects on wildlife, vegetation and hydrological resources on this site. As such, the following is a list of recommendations identified to mitigate the potential negative environmental impacts and suggestions to off-set the negative impacts of developing the Elkwoods site.

- With regard to wildlife, any development of the Elkwoods site will dramatically compromise wildlife movement through the southern pinch point of the Fenland-Indian Grounds wildlife corridor. An absolute minimum 200 m corridor is recommended to demonstrate a very liberal building footprint remaining once all mitigation options are implemented.
- Develop walking trails along Banff Ave. only to minimize human use in the Fenland-Indian Grounds wildlife corridor. Minimize human access to CP Rail tracks north of Elkwoods, as this would be the main entry point for wildlife traversing the site.
- Do not develop an off-leash dog park as part of the recreation facility. Off-leash dogs have been identified as having the single greatest potential impact on wildlife usage of corridors and habitat areas (BCEAG 1999b). It is recommended that the off-leash dog park be located in another area of town.
- Development of this site would make off-site wildlife corridor enhancement imperative. Consider decommissioning of the access road (Compound Rd.) from the TransCanada Highway to the industrial compound turnoff, and increasing cover density within the corridor east of Compound Rd.
- Maintain a 30 m development buffer for roads, buildings and parking lots from permanent and ephemeral portions of Whiskey Creek and ensure that these buffers are vegetated with trees and shrubs. This will help eliminate potential contamination (i.e. surface erosion, parking lot runoff) and disturbance (i.e. construction, visitor related use) of ephemeral areas and sensitive riparian vegetation.
- Maintain a buffer around the old-growth patches on the Elkwoods and do not put any trails or other development in this area to preserve the ecological integrity of these patches.
- Revegetate reclaimed recreation centre site with quick-growing agronomic grasses to slow down the invasion of the reclaimed areas with hard to control invasive non-native plants like Canada thistle that are established in adjacent areas.

- Enhance the soil in the reclaimed areas by adding sterile organic amendments to build up and regenerate the soil (i.e. peat moss, straw) so transplanted native plants will have a better chance of survival.
- Employ yearly integrated weed control measures to reduce the population of non-native plants on the reclaimed areas at the existing recreation centre site. After weed populations are reduced (after 5-10 years), plant native forbs, shrubs and trees on the reclaimed areas.
- Ensure post-construction hydrological conditions mimic preconstruction hydrological conditions as much as possible. Currently 100% of Elkwoods site is pervious. It is recommended that on-site integrated stormwater management source controls such as low impact development practices, structural best management practices and traditional stormponds be employed to attempt to maintain the hydrologic capacity of the site and minimize downstream impacts. This would involve utilizing various on-site stormwater best management practices such as absorbent landscaping, green roofs, stormwater capture and reuse, and porous pavement to reduce stormwater runoff so that it is equivalent to preconstruction hydrological conditions (or to 100% pervious cover).
- Avoid development near the wetland areas in the south west portion of the site. These areas provide beneficial hydrological functions such as filtration and assimilation of nutrients and pollutants from the stormwater runoff. In the model class screening report for the Town of Banff and surrounding areas completed by Highwood (2003), Whiskey Creek and associated springs and wetlands were listed as sites potentially sensitive to disturbance. The screening report recommends that these sensitivities be included in future development plans.
- Avoid development in and adjacent to the dried Whiskey Creek bed. Although this channel has not experienced surface flow in several years, it may serve as an important natural attenuation feature during 1:100 year storm events.
- Reclaim the existing recreation centre site so that the area currently occupied by the existing recreation centre (including parking lot, access roads, and skateboard park/tennis court), which accounts for 18% of the site, is converted to a pervious vegetated surface that mimics, as much as possible, the natural hydrological balance of a natural forest landscape (40% evapotranspiration, 10% runoff, 50% infiltration).
- The buffers and measures required to mitigate the negative environmental impacts on the Elkwoods site are likely mutually exclusive and if implemented would result in very little if any developable land on this site.

## **6 CONCLUSIONS**

Based on the comparative analysis of net positive and negative environmental impacts, Option 1 - redevelopment of the existing recreation centre site is the recommended option for development of the proposed multiplex. Overall Option 1 was determined to have a lower net negative impact on wildlife, vegetation, soils, and hydrology.

For wildlife, it would be preferable to utilize the existing recreation centre site over the Elkwoods site in the interest of minimizing the net negative impacts of this project to wildlife habitat and existing wildlife corridors. The existing recreation centre site is also the best site for the proposed multiplex to minimize the total area of natural undisturbed vegetation communities that will be affected as a result of this development. Opportunities also exist to reduce the overall presence of non-native plants at the existing recreation centre site as part of the redevelopment of this site. From a hydrological perspective, the net negative impact of developing the multiplex on the existing recreation centre site is less than that of developing the Elkwoods site.

These conclusions are based on a thorough evaluation of the current environmental conditions and ecological values of the two sites as well as input from key Parks Canada biologists and specialists and Town of Banff officials.

Developing the proposed multiplex on the existing recreation centre site will still result in negative environmental impacts, as most, if not all, major developments do in a national park setting. However, most of these impacts can be feasibly mitigated by employing comprehensive mitigation measures and using state-of-the-art technology in order to make the development environmentally neutral. It is also a more attractive option for pursuing alternate energy technologies. If the recommendations put forth for minimizing the negative environmental impacts of further developing the existing recreation centre are employed, this option will best fulfill the Town of Banff's commitment to the principle of No Net Negative Environmental Impact during the development and operation of this new facility.

## 7 REFERENCES

- Agriculture and Agri-Food Canada. 1998. Publication 1646: The Canadian System of Soil Classification.
- Alberta Environment, Groundwater Information Centre. Accessed August 2, 2007. [http://www.telusgeomatics.com/tgpub/ag\\_water/](http://www.telusgeomatics.com/tgpub/ag_water/).
- Alberta Sustainable Resource Development. 2005. The General Status of Alberta Wild Species. Retrieved August 7, 2007, from <http://www.srd.gov.ab.ca/fishwildlife/wildspecies/index.htm>
- Banff Recreation Centre Redevelopment, Press Release, 2006.
- Banff-Bow Valley Study. 1996. Banff-Bow Valley: At the Crossroads. Technical report to the Banff-Bow Valley Task Force. Prep. For the Honourable Sheila Copps, Minister of Canadian Heritage, Ottawa, ON.
- Bartlett, M. 2004. Research and monitoring of Banff-Mount Norquay water withdrawals on bull trout (*Salvelinus confluentus*) populations within Forty Mile Creek, April 2004. Parks Canada, Aquatics, Banff, AB.
- Baseline monitoring report for the aquatic resources of Whiskey Creek, 2002. An ecological indicator for the Town of Banff's Environmental Management Project, Report 4 of 6. Highwood Environmental Management Ltd.
- Bow Corridor Ecosystem Advisory Group (BCEAG). 1999a. Wildlife Corridor and Habitat Patch Guidelines for the Bow Valley. Prepared for: Town of Canmore, Municipal District of Bighorn, Banff National Park and the Government of Alberta. Pp. 34 including appendices.
- Bow Corridor Ecosystem Advisory Group (BCEAG). 1999b. Guidelines for Human Use Within Wildlife Corridor and Habitat Patch Guidelines for the Bow Valley (Banff National Park to Seebe) Prepared for: Town of Canmore, Municipal District of Bighorn, Banff National Park and the Government of Alberta. Pp. 21 including appendices.
- British Columbia Ministry of Water, Land and Air Protection (BC MWLA). 2002. A Guidebook for British Columbia Stormwater Planning. Government of British Columbia.
- Clarke, S. 2003. Electricity Generation Using Small Wind Turbines at Your Home or Farm. <http://www.omafra.gov.on.ca/english/engineer/facts/03-047.htm#availability>
- Coen, G.M. and Holland, W.D.; Editors. 1982. Ecological (Biophysical) Land Classification of Banff and Jasper National Parks, Map Supplement 2-1 Banff National Park NTS 82-O/3,4. Prepared for: Environment Canada.
- Cowardin, L. M., V. Carter, F. C. Golet, E. T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C. Jamestown, ND: Northern Prairie Wildlife Research Centre. (Version 04DEC1998). <http://www.npwrc.usgs.gov/resource/wetlands/classwet/index.htm>

- EBA Engineering Consultants Ltd. 2007a. Phase I Environmental Site Assessment existing recreation centre Site (East of Mount Norquay Road) and Banff Avenue Site (Portion of SW 01-026-12 W5M) Banff Multi-Purpose Sites Town of Banff and Banff National Park, Alberta. C22100057.001. Prepared for: GEC Architecture.
- EBA Engineering Consultants Ltd. 2007b. Preliminary Biophysical Environmental Values Assessment existing recreation centre Site (East of Mount Norquay Road) and Banff Avenue Site (Portion of SW 01-026-12 W5M) Banff Multi-Purpose Sites Town of Banff and Banff National Park, Alberta. C22100057.0025. Prepared for: GEC Architecture.
- Environment Canada. 1991. Historical streamflow summary. Inland Waters Directorate, Water Resources Branch, Water Survey of Canada.
- Environment Canada. 2007. Canadian Climate Data, the Town of Banff. [http://www.climate.weatheroffice.ec.gc.ca/climateData/dailydata\\_e.html](http://www.climate.weatheroffice.ec.gc.ca/climateData/dailydata_e.html)
- FISRWG. 1998. Stream Corridor Restoration: Principles, Processes, and Practices. By the Federal Interagency Stream Restoration Working Group (FISRWG) (15 Federal agencies of the US gov't). GPO Item No. 0120-A; SuDocs No. A 57.6/2:EN 3/PT.653. ISBN-0-934213-59-3. [http://www.nrcs.usda.gov/technical/stream\\_restoration/newtofc.htm](http://www.nrcs.usda.gov/technical/stream_restoration/newtofc.htm)
- Geological Survey of Canada. 1972. Map 1342A, Surficial Geology of Banff Area West of Fifth Meridian, Sheet 2. Prepared for the Department of Energy Mines and Resources.
- Gunson, K. 2003. Field Summary for the 2003 Banff-Bow Valley Amphibian Survey, and Recommendations for Long-term Monitoring. Prepared for: Banff National Park. Pp. 43 plus appendices.
- Highwood Environmental Management Ltd. (Highwood). 2002. Baseline monitoring report for the aquatic resources of Whiskey Creek. An ecological indicator for the Town of Banff's Environmental Management Project, Report 4 of 6.
- Highwood Environmental Management Ltd. (Highwood). 2003. Revised model class screening report for routine projects within the Town of Banff and proximate outlying areas. Prepared for Parks Canada.
- Highwood Environmental Management Ltd., 2001. Comprehensive Study Report for the Decommissioning of the Airstrip in Banff National Park.
- Holroyd, G.L. and K.J. Van Tighem. 1983. Ecological (Biophysical) Land Classification of Banff and Jasper National Parks. Vol. III: The Wildlife Inventory. Environment Canada, Canadian Wildlife Service report to Parks Canada. Pp. 444.
- Hydrogeological Map of the Calgary-Golden Area, Alberta, NTS 82N – NTS 82O, Map 116. Alberta Energy and Utilities Board, Alberta Geological Survey. 1978.
- Joint Research Centre. 2007. Photovoltaic Geographical Information System (PVGIS) Geographical Assessment of Solar Resource and Performance of Photovoltaic Technology. <http://re.jrc.ec.eu.int/pvgis/index.htm>

- Kortello, A., S. Hamm, J. Whittington and T. Hewitt. 2007. Wildlife Corridors Around Developed Areas in Banff National Park: Progress Report Winter 2006/07. Prepared for Banff National Park. Pp. 51 plus appendices
- Kwasniak, A. 2002. Alberta's Wetlands: A Law and Policy Guide. Environmental Law Centre and Ducks Unlimited Canada for the North American Waterfowl Management Plan. Edmonton, AB.  
[http://www.edmonton.ca/Environment/Office\\_of\\_Natural\\_Areas/External%20Resources/Alberta\\_Wetlands\\_Guide.pdf](http://www.edmonton.ca/Environment/Office_of_Natural_Areas/External%20Resources/Alberta_Wetlands_Guide.pdf)
- McIvor, D, and M. McIvor. 1999. Bird Monitoring in the Bow Valley Banff National Park 1998. Prepared for: Banff National Park. Pp. 79 including appendices.
- McIvor, D, and M. McIvor. 2006. Amphibian Surveys in Banff National Park and Adjacent Areas 2005. Prepared for: Banff National Park. Pp. 43.
- NRCan. 2007 Photovoltaic potential and solar resource maps of Canada URL.  
<https://glfc.cfsnet.nfis.org/mapserver/pv/municip.php?n=580&NEK=e>
- Ozoray, G.F. and Barnes, R. 1978. Hydrogeology of the Calgary-Golden Area, Alberta. Alberta Research Council, Report 77-2.
- Parks Canada. 2005. Lands Adjacent to the Town of Banff External Advisory Committee, Final Report, May 2005. Banff National Park.  
[http://www.pc.gc.ca/pn-np/ab/banff/plan/plan5c\\_E.asp](http://www.pc.gc.ca/pn-np/ab/banff/plan/plan5c_E.asp)
- Parks Canada. 2006. Summary of Public Comment. Banff National Park.  
[http://www.pc.gc.ca/pn-np/ab/banff/plan/plan5c2a\\_E.asp](http://www.pc.gc.ca/pn-np/ab/banff/plan/plan5c2a_E.asp)
- Pedocan Land Evaluation Ltd. 1993. Soil Series Information for Reclamation Planning in Alberta, Volume I. Alberta Conservation and Reclamation Council. Edmonton, Alberta.
- Phase II Environmental Site Assessment Banff Recreation Centre 100 Mt. Norquay Road, AMEC Earth and Environmental, 2006.
- Poll, G. 2005. Field Summary for the 2005 Bow-Valley Amphibian Survey. Prepared for Banff National Park. Pp. 49.
- Post, J. R. and F. D. Johnston. 2002. Status of the Bull Trout (*Salvelinus confluentus*) in Alberta. Alberta Sustainable Resource Development, Fish and Wildlife Division, and Alberta Conservation Association, Wildlife Status Report No. 39, Edmonton, AB. 40 pp.
- Prather, C.M. et al. 2001. Assessment of emergent and submersed vegetation in the Vermilion Wetlands: diversity and community structure final report. Creek Ecological Ltd. and Lobstick River Enterprises. Prepared for Banff National Park Warden Service, Banff, AB.
- Research and monitoring of Banff-Mount Norquay water withdrawals on bull trout (*Salvelinus confluentus*) populations within Forty Mile Creek, April 2004. Parks Canada, Aquatics.
- Rosgen, D.L. and H.L. Silvey. 1996. Applied River Morphology. Wildland Hydrology Books, Fort Collins, CO.

- Sentar Consultants Ltd. 1992. Ecological Review, Inventory and Analysis of the Vermilion Lakes Wetland Area.
- Stantec Consulting Ltd. (Stantec). 2005. Alberta Environment Water for Life – Aquatic Ecosystems, Review of Issues and Monitoring Techniques. Edmonton, AB. <http://environment.gov.ab.ca/info/library/7701.pdf>
- The Town of Banff 2005 Parking Facilities Plan, Swanson Transportation Consultants Ltd, 2005.
- Town of Banff. 2002. Town of Banff State of Our Environment Report.
- Trutta Environments and Management (Trutta). 2004. 1993 Fishery Investigations in the Upper Bow River System, Banff National Park, August 2004. Cochrane, AB.
- Weather Underground. 2007. History for Banff Airport, Alberta. <http://www.wunderground.com/history/station/71122/2007/1/1/MonthlyHistory.html>
- Wendeborn, Frances Colleen. 2001. A study of potential road salt contamination of highway-adjacent wetlands in the Banff area. University of Calgary. 62 p.
- Whittington, J. 2007. A Summary of Ecological Trends in the Bow Valley. Prepared by Banff National Park. Pp. 8.
- Wright, G.N., McMechan, M.E., Potter, D.E.G. 1994. Structure and Architecture of the Western Canadian Sedimentary Basin. In “Geological Atlas of the Western Canadian Sedimentary Basin”, Mossop, G.P., Shetsen, I., comps. Alberta Research Council and Canadian Society of Petroleum Geologists.

## **7.1 Personal Communications**

- Brewster, Mary. Manager of Community Services, The Town of Banff. Personal Communication. July, 2007.
- Ezzat, Ahmed. Environmental Staff Consultant, CP Rail Real Estate West. Personal Communication. September 28, 2007.
- Kalviaenn, Dave. Town of Banff Engineering. October 15, 2007.
- Langemann, Gwyn. Cultural Resource Services, Government of Canada. Personal Communication. August 24, 2007.
- Pacas, Charlie. Aquatic Specialist, Banff Field Unit, Banff National Park, Banff, AB. Personal communication. September 21, 2007.
- Pengelly, Ian. Vegetation and Fire Specialist, Banff National Park, Banff, AB. Personal Communication. September, 2007.
- White, Cliff. Wildlife Biologist for Banff National Park. Personal Communication, August 22, 2007.