

Supporting Document Q5

**Scoping of Potential Cumulative Effects
(SENES, 2007)**

Giant Mine Remediation Project

SCOPING OF POTENTIAL CUMULATIVE EFFECTS

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1.0 INTRODUCTION AND CONTEXT

This document provides a preliminary evaluation of potential cumulative effects associated with the Giant Mine Remediation Project. According to the Mackenzie Valley Environmental Impact Review Board (MVEIRB), cumulative effects are those impacts (biophysical, socio-cultural or economic) that result from the impacts of a proposed development in combination with other past, present or reasonably foreseeable future developments.

The Giant Mine is an abandoned “brownfield” site with extensive contamination and potential for significant adverse human health and environmental effects. The primary objective of the Giant Mine Remediation Project is to reduce the probability and magnitude of those potential adverse effects. Left unmitigated, the potential risks associated with the mine are significant. Specifically, action is required to address the presence of an estimated 237,000 tonnes of arsenic trioxide dust stored in 14 underground vaults. If no action is taken, the arsenic trioxide will eventually dissolve, contaminating both groundwater and surface water. Given the proximity of the Giant Mine to Great Slave Lake and the City of Yellowknife, this constitutes a major risk to various components of the surrounding environment, including human health.

The proposed strategy for the management of arsenic trioxide dust stored in underground vaults is described in detail in the Giant Mine Remediation Plan. The Remediation Plan also identifies approaches to address other sources of arsenic present throughout the Giant site. These include tailings and waste rock used to backfill underground workings, tailings deposited in surface impoundments, other mine wastes disposed on surface and arsenic-contaminated building materials that often include asbestos. Following implementation of the remediation plan, arsenic loadings to the environment are anticipated to be 95% lower than the “do nothing” scenario.¹

While the remediation “Project” focuses on reducing arsenic releases to the environment, other environmental or human safety concerns will also be addressed. Examples include: soils contaminated with hydrocarbons, hazardous materials, surface infrastructure, mine openings to underground and open pits.

¹ Without management, the upper limit of arsenic releases has been estimated to increase by many thousands of kilograms per year (Final Report –Arsenic Trioxide Management Alternatives, December 2002). Following implementation of the Remediation Plan, total releases to Yellowknife Bay from the site and upstream sources are estimated to be 690 kg/year.

2.0 CUMULATIVE EFFECTS METHODOLOGY

The current evaluation follows general guidance provided in:

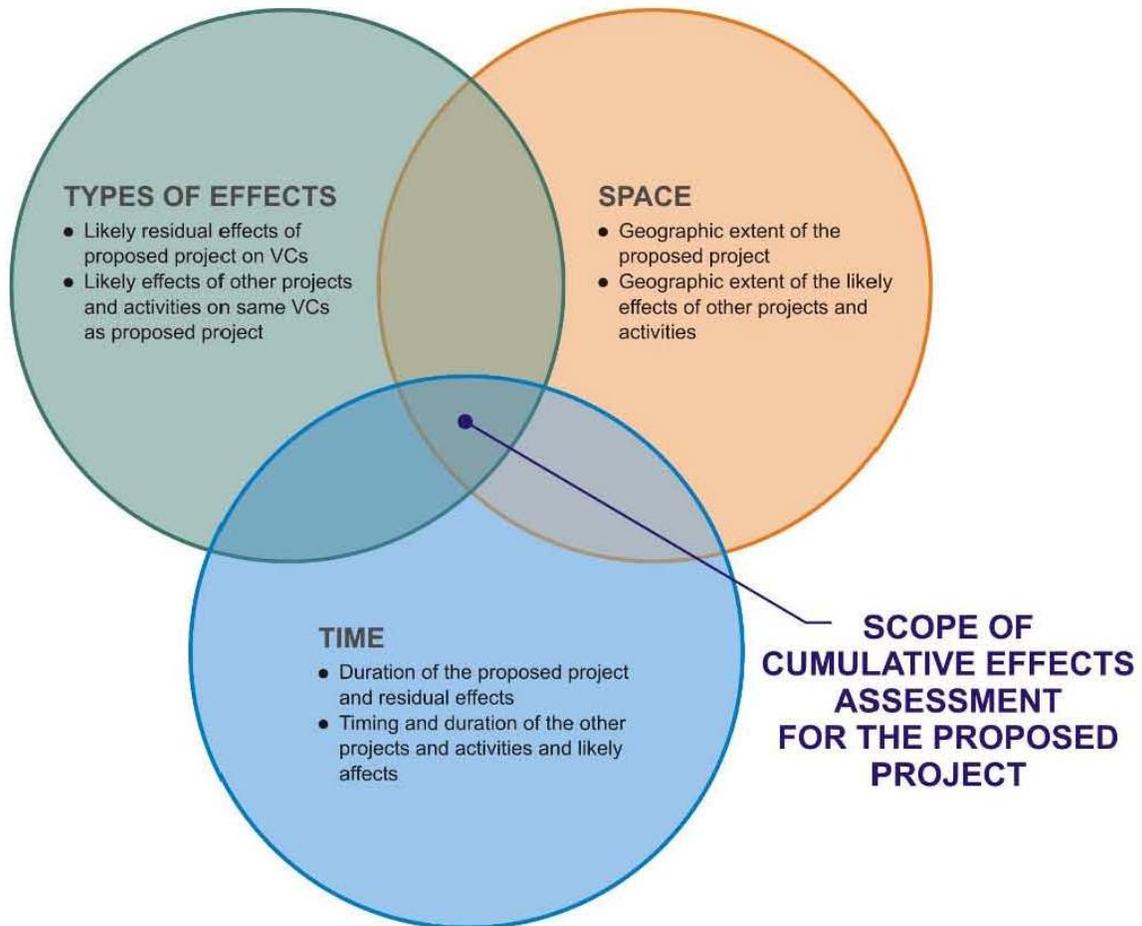
- MVEIRB's *Environmental Impact Assessment Guidelines* (2004); and
- The Canadian Environmental Assessment Agency's (CEAA) *Cumulative Effects Assessment Practitioners Guide* (1999).

Cumulative effects are typically evaluated as a component of Environmental Impact Assessment (EIA) processes. The EIA approach to evaluating cumulative effects is considered appropriate for the Giant Mine project and has been followed in the current evaluation. The approach identifies and assesses cumulative effects using the following functional steps:

- 1) Determine if the project under evaluation will result in adverse environmental effects that cannot be mitigated. The environmental impact matrix (a supporting document of the remediation plan) has been used to identify the residual effects. These "residual effects" constitute the "project-specific" effects that are advanced to the cumulative effects assessment.
- 2) Identify other projects or activities that could potentially interact with the residual effects from the proposed project.
- 3) Consider the likelihood for an interaction in terms of:
 - Similar effects from other projects and activities that might contribute to those caused by the proposed project;
 - The time over which these potential interactions coincide; and
 - The geographic area in which the effects occur.
- 4) For the effects indicated, determine the overall cumulative effect and its significance.

This concept is illustrated in Figure 1.

FIGURE 1
SCOPE OF CUMULATIVE EFFECTS ASSESSMENT



Note: VC = Valued Component

3.0 PROJECT-SPECIFIC EFFECTS

As noted above, the first step in a cumulative effects assessment is the identification of potential residual adverse effects associated with the project under evaluation. While the Giant Mine Remediation Project is expected to have a *significant positive effect* on the environment (i.e., by reducing the risk of uncontrolled releases of arsenic and other potential contaminants), some adverse effects may occur, particularly during implementation of the remediation plan. These adverse effects are anticipated to be minor in comparison to the Project benefits; in other words, the potential impacts associated with not implementing the project (which include large increases of arsenic loadings to the environment) are much greater than those associated with the project itself. Nonetheless, INAC will endeavour to ensure that impacts caused by the project are kept as low as reasonably achievable and within the requirements of existing and future permits.

A preliminary screening of potential project-specific *adverse* effects was performed based on the major activities associated with the Project. The temporal and spatial scope of each effect was subsequently determined using the following classifications:

Temporal Scope

- *Implementation Phase I (Year 1 to 10)* – Including all remedial works, construction of supporting infrastructure (e.g., freeze system and water treatment facilities), on-going treatment of mine water and active freezing of arsenic-trioxide vaults.
- *Monitoring and maintenance (Year 10 onward)* – Passive maintenance of the frozen arsenic-trioxide vaults and on-going treatment of mine water. Parts of the site will remain in institutional care until arsenic loading rates reach a level where active management is no longer required.
- *Modelling of future performance (Year 1 to + 50 years)* – Period used for modelling the passive freezing system to ensure that it is secure for this time.

Spatial Scope

- *Site Study Area* – Giant Mine lease area and the near-shore environment of Great Slave Lake.
- *Local Study Area* – Yellowknife, Dettah, N'dilo and Yellowknife Bay
- *Regional Study Area* – the Northwest Territories²

² The regional study area of the Northwest Territories was selected as the most relevant scale for the evaluation of potential socio-economic effects (e.g., employment/labour force).

For each potential effect, appropriate mitigation measures were selected and any residual effects (i.e., post-mitigation effects) were identified. Table 1 provides an overview of the anticipated residual effects, their temporal scope and spatial extent. All potential residual effects are included in the table, irrespective of their magnitude or probability.

It should be noted that none of the residual adverse effects are associated with arsenic. While some remedial works may cause minor and short-term increases in arsenic loadings (e.g., through erosion or dust suspension) total arsenic releases will be significantly reduced by the remediation project (i.e., through the freezing of arsenic trioxide vaults and on-going water treatment).

**TABLE 1
PROJECT-SPECIFIC RESIDUAL EFFECTS**

Environmental Category	Sub-Category	Residual Adverse Effect	Significance *	Primary Activities	Effect Boundaries**		Remedial Measures	Impact Matrix Reference
					Temporal	Spatial		
Atmospheric Environment	Air Quality	Dust emissions	1	Earth works, demolition and transportation	Implementation	Site/ local	<ul style="list-style-type: none"> Dust suppression with water Dust suppression with chemicals Wheel and undercarriage washing Haulage vehicle sealing/tarping Screening vegetation Drill cutting and sludge collection, removal and safe disposal 	Most activities on site will cause some dust
	Air Quality	Combustion Emissions	1	Operation of vehicles and equipment	Implementation, Monitoring and Maintenance	Site	<ul style="list-style-type: none"> Conversion of active refrigeration to passive thermosyphon system 	Most vehicular, lighting, pumping and active refrigeration activities
	Noise / vibration	Noise and vibrations	2	Operation of vehicles and equipment; blasting	Implementation, Monitoring and Maintenance	Site/ local	<ul style="list-style-type: none"> Sound proofing Screening vegetation 	Drill and install from-surface and from-underground freeze pipe casing (2-6 years)
Aquatic Environment	Surface Water Quality	Suspended solids and erosion	1	Earth works	Implementation	Site	<ul style="list-style-type: none"> Wash and waste water collection and treatment Settling pond and sediment control plan 	Most activities on site will cause some dust and suspended sediment
	Habitat	Disturbance of habitat	1	Stream and shoreline modifications	Implementation	Site	<ul style="list-style-type: none"> Wash and waste water collection and treatment Settling pond and sediment control plan 	Most activities on site will cause some local habitat disturbance
	Hydrology	Change in quantity/ response	1	Stream/drainage modifications	Implementation, Monitoring and Maintenance	Site	<ul style="list-style-type: none"> Settling pond and sediment control plan 	
	Hydrogeology	None identified	NA	NA	NA	NA	NA	NA

Giant Mine Remediation Project – Scoping of Potential Cumulative Effects

Environmental Category	Sub-Category	Residual Adverse Effect	Significance *	Primary Activities	Effect Boundaries**		Remedial Measures	Impact Matrix Reference
					Temporal	Spatial		
Terrestrial Environment	Habitat	None identified	NA	NA	NA	NA	NA	NA
	Soils and Terrain	Scarred and modified terrain	2	Earth moving Blasting Drilling			<ul style="list-style-type: none"> Screening vegetation Settling pond and sediment control plan Removal of roads to borrow sites and reshaping of borrow areas 	Build and use access roads to new borrow source and quarry areas) Open borrow source areas and extract material
Socio-Economic and Cultural Environment	Aboriginal Interests	None identified	NA	NA	NA	NA	NA	NA
	Land Use	None identified	NA	NA	NA	NA	NA	NA
	Built Environment	New quarries and thermosyphons construction	3	Construction and earth moving	Implementation	Site	<ul style="list-style-type: none"> Screening vegetation 	Drill and install from-surface freeze pipe casing (2-6 years)
	Population and Economic Base	None identified	NA	NA	NA	NA	NA	NA
	Archaeology / Historic interests	Brock pit has a quartz vein that could be used as educational asset. Potential loss of A Shaft as it is covered with asbestos containing material	3	Earth works	Implementation	Site	<ul style="list-style-type: none"> Decide if structures can be left in place that will allow vein to remain visible. Decide if structures are safe and if they can be stripped of hazardous material to leave a heritage asset Standard asbestos controls 	Brock & B4 Pits – backfill. A shaft (Heritage society would like to retain shaft, compressor house and museum)
Transportation	System disruption	1	Project Transportation	Implementation	Site and Local	<ul style="list-style-type: none"> Blasting mats Flight coordination to avoid blast periods Road closures during blast periods 	Activities involving use of public roads for haulage of material	

Giant Mine Remediation Project – Scoping of Potential Cumulative Effects

Environmental Category	Sub-Category	Residual Adverse Effect	Significance *	Primary Activities	Effect Boundaries**		Remedial Measures	Impact Matrix Reference
					Temporal	Spatial		
							<ul style="list-style-type: none"> • Dust suppression with water • Dust suppression with chemicals • Wheel and undercarriage washing • Haulage vehicle sealing/tarping 	

* The level of significance assigned to each residual effect is based on a preliminary qualitative evaluation for the purpose of scoping impacts. The following symbols and descriptions are used to qualify impacts.

1 Minor: Potential to change ecosystem or activity in a localised area for a short time, with good recovery potential. Similar scale of effect to existing natural variability. It is not generally possible to measure impacts in this range although it is recognised that activities are causing a disturbance.

2 Moderate: Potential to change ecosystem or activity for up to 2 years, with reasonable recovery potential. Impacts are measurable.

3 Major: Potential to change ecosystem or activity leading to medium or long term (+2 years) damage with low or no recovery potential. Impacts are measurable.

** In theory, some residual effects may extend beyond the stated spatial and temporal boundaries, however they are not anticipated to be measurable.

NA = Not Applicable

4.0 IDENTIFICATION OF OTHER PROJECTS AND ACTIVITIES

A key step in the assessment of cumulative effects involves the identification of other “past, current, certain or reasonably foreseeable projects or activities”. While past and current projects are relatively easy to identify and assess (their effects are evaluated through baseline studies) the selection of “certain” and “reasonably foreseeable” projects is typically more challenging. As a conservative approach, the current evaluation has assessed the full range of future potential projects, regardless of the degree to which they are considered reasonably foreseeable. Grouped by study area, these projects are summarized in Table 2.³

**TABLE 2
OTHER PROJECTS AND ACTIVITIES CONSIDERED IN THE
CUMULATIVE EFFECTS ASSESSMENT**

Project / Activity	Rationale
Site Study Area	
On-going industrial, residential and recreational use of Hwy 4	Hwy 4 currently bisects the site and serves as the primary access route to Dettah (summer), mining developments (winter) and recreational use of areas adjacent to the highway. Current use is reflected in baseline conditions (e.g., traffic volumes and dust emissions). Future use is not expected to change significantly.
Re-routing or upgrading of Hwy 4	Various re-routing alternatives are currently under evaluation. Effects are expected to be typical of road construction activities and similar to the major earth works at the Giant Mine.
Potential re-development of former Giant town site and adjacent areas	The City of Yellowknife is evaluating options for the future use of the Giant town site, for which the City now holds a lease. The NWT Mining Heritage Society is planning to build several structures and exhibits near and on the mine site. The Yellowknife Cruising Club is believed to be considering expansions.
Local Study Area	
On-going passive release of arsenic from the local study area	Arsenic trioxide dust (and other forms of arsenic) associated with historic mining operations have been deposited (primarily through aerial deposition) outside of the Site Study Area. Arsenic from these sources passively leaches into local water bodies. Loadings are reflected in baseline conditions.
Current community operations.	Communities in the local study area (Yellowknife, Dettah and N’ dilo) have effects on the environment. Examples include atmospheric emissions, water discharges to Great Slave Lake (stormwater and wastewater) and generation of solid waste. These effects are reflected in current baseline conditions.

³ To simplify the cumulative effects assessment, projects or activities that might occur in more than one study area have been assigned only in the area that is closest to the site. For example, resource harvesting occurs in both the local and regional study areas but has been assigned only to the local study area. Any potential cumulative effects beyond the location of “first occurrence” are expected to be less significant.

Project / Activity	Rationale
Future municipal development	The average annual growth rate for the City of Yellowknife has been under 1% for the last ten years and growth is expected to continue at a similar pace. Any incremental environmental effects associated with population increases are likely to be off-set by improvements in environmental performance.
Resource harvesting	Some resource harvesting occurs in the local study area (particularly fishing).
Solid waste landfill operation and expansion	The City of Yellowknife is evaluating options to expand the capacity of the municipal landfill.
Quarry operations	Quarrying currently occurs in the local study area (between the mine site and the landfill)
Transportation (air)	Air traffic in the vicinity of Yellowknife is extensive. Effects (primarily noise and combustion emissions) are reflected in current baselines. Significant increases in air transportation are not anticipated.
Decommissioning of Con Mine	Miramar is currently developing a remediation plan for the Con Mine. With the exception of arsenic-trioxide management, remedial activities are anticipated to be similar to those for the Giant Project.
Regional Study Area	
Hwy 4 extension	The territorial government and other parties are considering the extension of the “all weather” portion of Hwy 4 to facilitate access to mineral developments in the Slave Geological Province. Currently at a conceptual level.
Mineral/diamond exploration and mining	Bio-physical cumulative effects are unlikely (due to an absence of spatial overlap of effects). Socio-economic cumulative effects are possible.
Oil and gas exploration and development	

5.0 INTERACTION OF EFFECTS

As described previously, cumulative effects will occur only if the residual effects of the Giant Mine Remediation Project and those of other projects and activities meet each of the following conditions:

- a) The effects are similar in nature;
- b) They overlap spatially; and
- c) They overlap temporally.

Table 3 evaluates the extent to which the conditions have been met using the following symbols: similar effects (●), temporal overlap (✓) and spatial overlap (■). In situations where a potential cumulative effect has been identified (i.e., all three conditions have been met) the symbols have been highlighted in yellow for future discussion of significance in Section 6.0.

**TABLE 3
POTENTIAL INTERACTION OF PROJECT EFFECTS**

Other Projects and Activities (refer to Table 2)	Giant Remediation Project Residual Effects (refer to Table 1)						
	Dust Emissions	Combustion Emissions	Noise & Vibration	Suspended Solids & Erosion	Disturbance of Aquatic Habitat	Hydrology (quantity & response)	Transportation Disruptions
Site Study Area							
On-going industrial, residential and recreational use of Hwy 4		● √ ■	● √ ■				
Re-routing or upgrading of Hwy 4	● √ ■	● √ ■	● √ ■	● √ ■	● √ ■	● √ ■	● √ ■
Potential re-development of former Giant town-site and adjacent areas							
Local Study Area							
On-going passive release of arsenic from the local study area							
Current community operations.	● √	● √	● √	● √			● √
Future municipal development	● √	● √	● √	● √	● √	● √	● √
Resource harvesting							
Solid waste landfill operation and expansion				● √ ■			
Quarry operations	● √ ■	● √ ■	● √ ■	● √ ■			
Transportation (air)			● √ ■				
Decommissioning of Con Mine	● √	● √	● √	● √	● √	● √	● √
Regional Study Area							
Hwy 4 extension	● √	● √	● √	● √	● √	● √	● √
Mineral/diamond exploration and mining	● √	● √	● √	● √	● √	● √	● √
Oil and gas exploration and development	● √	● √	● √	● √	● √	● √	● √

Note: Projects were only evaluated for temporal and spatial overlap if they were determined to produce similar effects.

6.0 SIGNIFICANCE OF POTENTIAL CUMULATIVE EFFECTS

As indicated in Table 3, potential cumulative effects are associated primarily with other projects or activities located in the near vicinity of the Giant Mine site. For example, the majority of overlapping effects (11 of 15) are associated with the re-routing of Hwy 4 and on-going quarry operations. None of the potential cumulative effects are expected to extend beyond the implementation phase of the remediation project.

Each category of potential cumulative effect is discussed separately in the following subsections.

6.1 DUST

Additional projects and activities with the potential to result in cumulative dust effects are:

- Re-routing or upgrading of Hwy 4; and
- Quarry operations.

Historic overlap between mine operations and projects similar to those identified above has not resulted in dust concentrations above applicable criteria (GNWT Guidelines for Ambient Air Quality Standards). In the unlikely event that conventional dust management strategies are insufficient (e.g., watering and application of dust suppressants), a variety of additional mitigation measures are available (e.g., wind fencing). On this basis, cumulative effects involving dust are anticipated to remain below applicable criteria.

6.2 COMBUSTION EMISSIONS

Additional projects and activities with the potential to result in cumulative combustion emissions from vehicles or equipment include:

- On-going industrial, residential and recreational use of Hwy 4;
- Re-routing or upgrading of Hwy 4; and
- Quarry operations.

The zone of influence of combustion emissions from the Giant Remediation Project is expected to be limited to the near vicinity of the site. Consequently, only those emissions occurring on or adjacent to the site have a realistic potential of acting cumulatively with emissions from the Project. Given the fact that local ambient air quality monitoring has found that concentrations of atmospheric pollutants are generally very low, minor additions from the Project or adjacent areas to the existing local baseline are not expected to cause air quality concerns.

6.3 NOISE AND VIBRATION

Additional projects and activities with the potential to result in cumulative effects from noise or vibrations include:

- On-going industrial, residential and recreational use of Hwy 4;
- Re-routing or upgrading of Hwy 4;
- Quarry operations; and
- Air transportation.

Noise and vibrations during the implementation phase of the Giant Mine Remediation Project may act cumulatively with the projects and activities identified above. However, the magnitude of any cumulative effects is expected to be comparable to those experienced during the operational phase of the mine. Furthermore, there is a general absence of sensitive noise and vibration receptors in the vicinity of the Giant site (e.g., residential developments and terrestrial/avian species). Overall, any cumulative noise or vibration effects are expected to be minor.

6.4 SUSPENDED SOLIDS AND EROSION

Additional projects and activities with the potential to result in cumulative effects from suspended solids and erosion include:

- Re-routing or upgrading of Hwy 4;
- Solid waste landfill operation and expansion; and
- Quarry operations.

Potential cumulative erosion effects are associated only with overlaps that occur on the site itself and are considered insignificant in the context of the widespread surface modifications associated with the remediation project. In the case of cumulative effects involving suspended solids, such effects are limited to the watersheds draining through and from the mine site into the near-shore environment of Great Slave Lake. Assuming appropriate mitigation measures are implemented (e.g., use of silt curtains) cumulative effects involving suspended solids are expected to be localized and minor.

6.5 DISTURBANCE OF AQUATIC HABITAT

Additional projects and activities with the potential to result in cumulative disturbances to aquatic habitat are limited to:

- Re-routing or upgrading of Hwy 4.

Physical disturbances to aquatic habitat will occur only during the implementation phase. Spatially, areas of potential concern include Baker Creek (new alignment) and removal of standing water currently used by waterfowl (tailings ponds). Any effects to aquatic habitat will be fully offset by improved water quality and/or habitat creation (e.g., new fish habitat in Baker Creek). As such, no significant cumulative effects to aquatic habitat are anticipated.

6.6 HYDROLOGY

Additional projects and activities with the potential to result in cumulative effects to hydrology are limited to:

- Re-routing or upgrading of Hwy 4.

Site drainage patterns and imperviousness will be affected to varying degrees by the remediation Project and/or highway re-routing. All modifications to the hydrological regime are intentional and supportive of the overall remediation plan (e.g., capping of tailings areas and re-routing Baker Creek). Any cumulative effects will be minor and fully justifiable given the benefits associated with the Project.

6.7 TRANSPORTATION DISRUPTION

Additional projects and activities with the potential to result in cumulative traffic effects are limited to:

- Re-routing or upgrading of Hwy 4.

In scheduling the remediation project and any changes to Hwy 4, attention will be given to minimizing the collective effects of the two projects on traffic. Furthermore, based on recent activities on the site Giant site, traffic effects are expected to be relatively minor. Overall, no significant cumulative traffic effects are anticipated.

7.0 CONCLUSION OF THE CUMULATIVE EFFECTS SCOPING

The scoping of cumulative effects described in the previous sections suggests that no significant adverse cumulative effects are anticipated from the physical works and activities associated with the proposed project. Therefore, no mitigation measures beyond those identified for project-specific effects are warranted.