Visual Impact of Suncor Steepbank Mine Development

May, 1996

Prepared for:

Suncor Inc.

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952-2307

This report is one of a series of reports prepared for Suncor Inc. Oil Sands Group for the Environmental Impact Assessment for the development and operation of the Steepbank Mine, north of Fort McMurray, Alberta. These reports provided information and analysis in support of Suncor's application to the Alberta Energy Utilities Board and Alberta Environmental Protection to develop and operate the Steepbank Mine, and associated reclamation of the current mine (Lease 86/17) with Consolidated Tailings technology.

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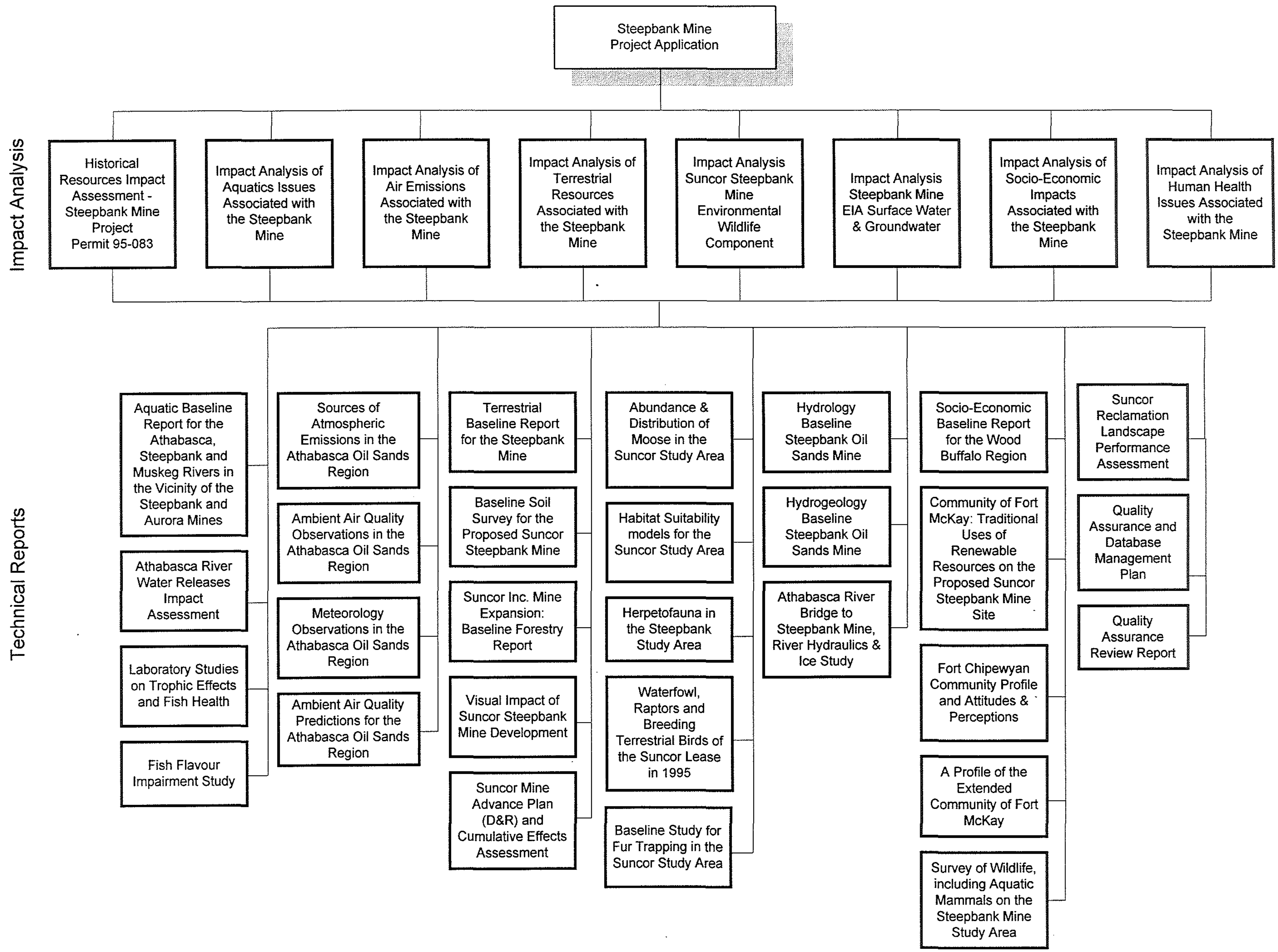

Reports Prepared for the Steepbank Mine Environmental Assessment

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ACKNOWLEDGEMENTS

This analysis of the visual impact of the Suncor Steepbank Mine development is based on work provided by Dr. Richard M. Levy.

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1.0 INTRODUCTION

1.1 Background

Many factors contribute to how an observer's response responds to changes in the environment. In evaluating the visual impact of a potential project, both perceptual and cultural issues must be considered. For example, the reaction to the appearance of an older neighborhood can vary greatly within a community. For many, our historic districts are visually charming and interesting, while for others it they are symbols of urban decline and decay. In addition, traditions, myths, and local history may affect the appreciation of a natural landscape by pre-charging the experience for the observer. From the onset of a study one must acknowledge that responses to a visual representation of a landscape will depend on the demographic, social, cultural and economic composition of the group. A society's aesthetic sensibilities can change over time, affecting the appreciation of art, architecture, landscapes, and even industrial products. What is considered to be "in style" is a transient cultural event. For example, a smokestacks can be either a symbol of progress or a source of visual pollution. When conducting a visual impact assessment, issues of aesthetics must be acknowledged as having an impact on measures of preference.

1.2 Visual Perception

Visual impact assessments begin by defining the study area or viewshed affected by a proposed development. Delineation of the viewshed begins by considering that portion of the landscape which can be observed from a single point, such as a scenic rest stop, or along a curved line, such as from a portion of a highway. In constructing a reference frame for a visual impact assessment, the limits of human vision must be taken into account. A 2.5 degree cone of vision describes the main focus of most humans even though our peripheral vision is approximately 180 degrees. We may be able to perceive an object which is a few centimeters in diameter from a distance of 300 meters in a single instance. However, we can focus on multiple objects if they are only in very close proximity.

The ability to discern a single object within the landscape will also be greatly affected by the interaction of color, texture and reflectivity of the object within its surroundings. Because of these factors, lighting and atmospheric conditions will have a significant impact on our ability to differentiate individual objects. Under bright daylight we can see 40 times better than at dusk. In natural surroundings, there is also a psychological factor, which determines whether the object appears out of place. We expect to see barns when traveling along a country road in a rural farm district. However, when we encounter an industrial structure of similar size in the same setting which differs in color and architectural detail, our attention is immediately drawn to it. The same building placed back in its industrial setting will go completely unnoticed as it merges with the visual patterns of its surroundings.

The relative motion of the observer also places constraints on the viewer's perception of a landscape. A sense of tunnel vision is created as we increase our speed along a path. Our stationary peripheral vision of 180 degrees will decrease to 100 degrees if we increase the speed of the observer to about 40 Kph, or the speed of a small motorboat. At 100 Kph, the speed of a car on the highway, our vision is restricted to a cone of 40 degrees. Similarly, the focal point of our eye becomes more distant as we increase our speed. At 50 Kph our the eye will focus at a point about 180 meters ahead, while at speeds of 100 Kph this distance increases to about 500 meters. A single view does not recreate the conditions of viewing a landscape from a moving vehicle. Though providing a better representation of an actual scene, even animation sequences will suffer from the limitations of image size and presentation format.

2.0 METHODS

2.1 Viewshed Selection

In this study it has been assumed that the views of greatest concern are those observed by boaters traveling along the river. Key views seriously affected by development from the neighboring highway or scenic stops have not been identified. Because views of the site will not be of major concern during the intemperate months of late fall, winter and early spring, a model has been created which shows the site with trees in total foliage. Lighting conditions used in modeling the site simulate a partly sunny afternoon in late summer-early fall. The overriding concern in building the model has been to simulate conditions experienced from the viewpoint of a recreational boater. This viewpoint has been created for the three phases of mine development: the current 1995 situation, the operations phase, and following mine closure.

2.2 Data Sources

The topographical data used in building the model was supplied by Golder Associates. A series of meshes was created from the point data to simulate the topography for each phase: 1995, operations and closure. Textures added to these surfaces were made from photographic and video images of the surroundings. The textures used for object details, such as groves of trees, were also taken from photographic and video images. In modeling the construction phase it was assumed that the exposed surface of the dykes are of overburden material. Later during the restoration, these slopes would be planted with natural vegetation including pine, spruce and aspen

2.3 Issue Selection

Evaluating the severity and degree of concern of the proposed development may require further research in order to identify the specific preferences of the stakeholders in the community. For this section of the report, four key issues have e been identified. Each of these issues will be treated as a sub-hypothesis. There may be additional concerns, which may be discovered as discussions with key informants continue. Views from the river will be affected by:

- the impact of the proposed dykes and other earthworks created during the mining process,
- roads and areas reserved for mining equipment,
- industrial buildings and mining conveyance equipment,
- bridge location and design.

2.4 Baseline Conditions

The area under review includes a river basin bordered by an escarpment to the east. The escarpment rises gradual to about 50 m above the Athabasca River. The area to the east is largely undeveloped and is covered primarily with Aspen. Pockets of Jack Pine, White Spruce and Bog Willow can be seen from the river. On the western side of the Athabasca River are located Suncor's existing mining facilities. This area to the west is occupied by industrial works including a processing facility, electric generation plan and service roads. The site is marked by smokestacks, some with heights of over 100 m. Several large ponds have also been created along the edge of the river to retain affluent from the mining operations. Tar Island Dyke, an embankment constructed during the early development of Suncor's operations, is located just south of the plant facilities. The sides of the embankment still retain visible remnants of the lifts used to create this earthwork. The slopes are covered largely by grass with some sporadic patches of small trees and shrubs. The study site viewshed along the river is moderately low quality given the current level of industrial development located within close proximity. South of the site, the river is spanned by several bridges. The spans of these bridges upstream from the site have been designed to maintain navigation.

3.0 IMPACT ANALYSIS

3.1 Impact Analysis Criteria

For the purposes of this study the impact criteria have been defined as follows:

3.1.1 Direction

Positive + A favorable effect

Negative - An unfavorable effect

3.1.2 Severity

In defining the severity of the visual impact caused by changes to the river valley, consideration should be given to the potential impact on views in the foreground, middleground and background. Development which affects the foreground of a view will generally have considerably more impact than do those in the background. If the texture, color and form of an object differs from those of the surroundings, it will attract the attention of the viewer. The introduction of objects and landform which are not normally found in the landscape will make a greater impression on the observer. The severity of the impact has been ranked as low, medium and high based on expert opinion. Arriving at the specific levels of concern associated with these measures would be possible through the use of surveys and interviews with stakeholders and members of the community. The categories of concern are:

> Low (L) - Defined as changes to the environment which will not change the general impression of an area. Changes to the views may either go unnoticed by a local observer or be insignificant. The color, texture, mass and form of the proposed development does not differ from its surroundings. Typically, a low rating will be assigned when there is an affect only on the background of a view. In this case the color, texture and form of landforms and objects introduced into the environment will not vary from those already present in the landscape.

Moderate (M) - Defined as changes to the environment which may be noted by an observer but be considered either innocuous or insignificant given existing surrounding conditions. The color, texture and form of the proposed development will contrast from their surroundings. Typically, a moderate rating will be assigned when the affect is either in the middleground or background. The color, texture and form of landforms and objects introduced into the environment may differ from those already present, contributing to an observer's recognition that the environment has been altered.

High (H) - Defined as changes to the environment which an observer may consider as having made a substantial impact on the surroundings. The color, texture, mass and shape of the proposed development differs substantially from the surroundings. Typically, a high rating will be assigned when their affect is either on the foreground or middleground. The color, texture and shape of landforms and objects introduced into the environment will differ substantially from those already present contributing to an observer's recognition that the environment has been altered significantly.

3.1.3 Duration

A short term impact (S) is an impact which is limited to duration of the action causing the effect.

A medium term impact (M) extends for less than 30 years beyond the completion of the activity causing the effect.

A long-term impact (L) extends more than 30 years beyond the completion of the activity causing the effect.

3.1.4 Geographic extent

Local: The impact occurs on the Suncor Lease 86/17 and the Steepbank Mine.

Regional: The impact of Suncor's activities are within the context of all activities cumulative within the region.

3.1.5 Degree of Concern

Low: Any impact that is restricted to the local area is either low in extent or is a moderate impact or short duration.

Moderate: Any moderate impact that does not extent beyond the regional area and is not of long term duration.

High: A moderate or high impact that extends beyond the regional area, or is of long term duration.

3.2 Key Hypothesis: Visual integrity of the Athabasca River valley will be affected by the development, operation and reclamation of the Steepbank Mine and Lease 86/17.

An assessment of the visual integrity of the Athabasca River Valley can be examined by looking at the project components which may alter the visual landscape of the study area. These components are examined under the following sub-hypothesis:

1. The impact of the proposed dykes and earthworks.
2. The impact of the proposed roads, barge loading points and areas reserved for mining.
3. The impact of the proposed bridge.

Each sub-hypothesis is examined by first describing the impact, then identifying potential mitigation measures and finally classifying the degree of impact.

Photographs were used to create computer images of selected views from along the Athabasca River Valley. These images were then used to superimpose development components onto the landscape to compare "before and after" conditions. An example of this technique is shown in Figure 1.

It must be acknowledged from the onset of this study that responses to a visual representation of a landscape will depend on the demographic, social, cultural and economic composition of the group. The testing of mitigation efforts is possible by relying on surveys and interviews with stakeholders and members of the Fort McMurray community.

3.2.1 Sub-hypothesis: Impact of the proposed dykes and other earthworks

- **Impact Description**

  Dykes at a distance of 350m - 1200 m from the water's edge will create a wall-like berm in view from a boat travelling along the river. During the construction and opeartion phase this berm will be partially screened by the existing treed buffers. In the late fall, winter and early spring, the proposed dyke will have a stronger presence. However, fewer boat travellers will be expected during the colder months. Therefore, the visual impact of the dyke may be considered less important during these seasons. The choice of materials used to construct the dyke will influence the visual prominence of the dyke prior to reclamation. Materials that differ substantially in color and texture from the surface of the surrounding hillsides will be more noticeable, especially at close range. Furthermore, given that the berm has a uniform cross-section and fixed elevation along its top, it will be easily discernable even at a distance of several thousand meters (Figure 2).

- **Impact Mitigation**

During the period of reclamation and recovery, images have been created of the site which suggest possible strategies for minimizing the impact of the proposed development. The primary concern focuses on the landforms created during the construction period. Attention is directed to possible actions which could be taken to present a more favorable impression of any built form. For the purposes of this study the following have been assumed:

- Develop a planting scheme which will give a texture and color to the slopes to blend with the adjacent areas.

- Avoid a single profile for the dyke. If possible, the addition of small hills on top of the dyke and some contouring along the dyke slopes could help camouflage its man-made quality by mimicking glacial formations found in the area.

- **Impact Classification**

The classification of impacts for the dykes and earthworks is summarized in Figure 3. The severity of visual impact is rated as “moderate” during the construction and operational phases, decreasing to “low” following mine closure.

3.2.2 Sub-hypothesis: Impact of the proposed roads, barge loading points and areas reserved for mining operations.

- **Impact Description**

Several major roads, building sites and staging areas have been planned for the development. In creating these roads and staging areas, part of the buffer between the river and the dyke will be removed. It is planned that a minimum of 30 m will be needed to create the proposed roadways. In areas where the installation of road will require substantial grading, further removal of trees is inevitable. This will also be the case for areas reserved a staging areas for barges, as well as heavy equipment. Where the roadways are in close proximity to the river, dust may be visible from truck movement during the dry periods of the year.

- **Impact Mitigation**

The following has been proposed as mitigation measures to lessen the impact of the proposed roads, barge loading points and areas reserved for mining operations:

- Preserve as much of the treed area as buffers around dykes, embankments and building sites.
- Re-plant areas using native trees and plants after the area is no longer an active mine site.
- Maintain dust control measures on roads where truck movement may create visible dust plumes.

- **Impact classification**

The classification of impacts for the roads, barge loading points and areas reserved for mining operations is summarized in Figure 3. Moderate visual impacts are anticipated for the construction and operational periods.

3.2.3 Sub-hypothesis: Impact of the buildings and mining equipment

- **Impact Description**

Several buildings and structures have been planned for the operations connected with Lease 86/17 and Steepbank Mine Site. Many of these buildings will be temporary. Several of these sites will be hidden from view by treed buffers. Many of the structures including the mine conveyance equipment, shovels and trucks will be difficult to hide. However, their lack of permanence will make their impact of short duration. Maintaining buffered areas will reduce the impact of equipment and structures on views from the river. Lower profile structure will have less impact than those several stories high. Buildings with unbroken facades and flat roofs will also be more easily recognizable as industrial structures then those which have articulated facades and pitched roofs. Bright colors for the buildings and conveyance equipment will make them more noticeable at greater distances. High intensity lighting will only make these structures more prominent (Figures 4).

- **Impact Mitigation**

The following has been proposed as mitigation measures to lessen the impact of proposed buildings and placement of mining transport equipment:

- Avoid locating buildings and structures outside of buffered areas or in areas close to the river.
- Preserve as much of the treed buffers around buildings and other structures.
- Re-plant areas surrounding buildings and other structures with native plants and trees after the area has been decommissioned.

- Use muted colors for buildings and structures. Bright colors, especially those which differ in hue and value from the surroundings will be more easily noticeable.

- Lighting should be designed to focus only on the work areas.

- If possible maintain low profiles for building forms. Articulated facades and varied roof lines are more easily hidden than buildings with continuous facades.

- Berms may be used to partially screen building and other structures which are prominent in the landscape.

- **Impact Classification**

The classification of impacts for buildings and mining equipment is summarized in Figure 3. For both the construction and operation period, the impacts are considered moderate.

3.2.4 Sub-hypothesis: Impact of the proposed bridge

- **Impact Description**

A concrete and steel girder bridge has been planned for the river adjacent to the existing development. Given the loadings from passing trucks and slurry-pipes the bridge will be of substantial dimensions. The bridge also requires sufficient clearance for river traffic. Abutments planned for the bridge will be covered with rip-rap and will create an imposing presence. To protect the bridge piers from ice flows, additional structures may be necessary (Figure 5).

- **Impact Mitigation**

The following has been proposed as mitigation measures to lessen the impact of the proposed bridge and abutments:

- Preserve as much of the treed buffers as possible near the river bank next the bridge abutment.

- Re-plant areas near the bridge using native trees and plants.

- If possible use muted colors for the bridge span. Bright colors, especially those which differ in hue and value from the surroundings will be more easily noticeable.

- Lighting should be designed to focus only on the work areas.

- Survey existing bridge forms in use upstream of the location. It may be possible to identify structural forms which are viewed favorably by the community. Since this bridge will be seen primarily at a distance, the addition of architectural detailing should be avoided in favor of creating a design which has an elegant profile.

- Ice protection may be built into the existing pier form, creating a more elegant appearance.

- **Impact Classification**

The classification of impacts for the bridge is summarized in Figure 3. The construction and operation of the bridge is considered a "moderate" impact of long-term duration.

3.5 Summary

A summary of the overall impacts is presented in Figure 6. For both the construction and operational periods, the impacts are moderate and long-term (greater than 30 years) in duration. Following reclamation, visual impacts are considered "low" and of moderate duration.

4.0 RESIDUAL IMPACTS AND NET BENEFITS SUMMARY

The proposed development will transform the physical form of the landscape. This fact cannot be disputed. The introduction of dykes to the area will not go unnoticed given their presence on the horizon as one approaches the site by boat in either direction. However the impacts are primarily local. The extent of the duration may be long term depending on the success or the restoration plans. If replanting and landscaping of the dykes is successful, the duration of the impact may be considered of moderate duration. Considerable attention should be given to creating forms which can blend in with their surroundings. The use of native plants during restoration and the design of a dyke structure suggestive of glacial forms can contribute greatly to a view which will not be disturbing to the local population.

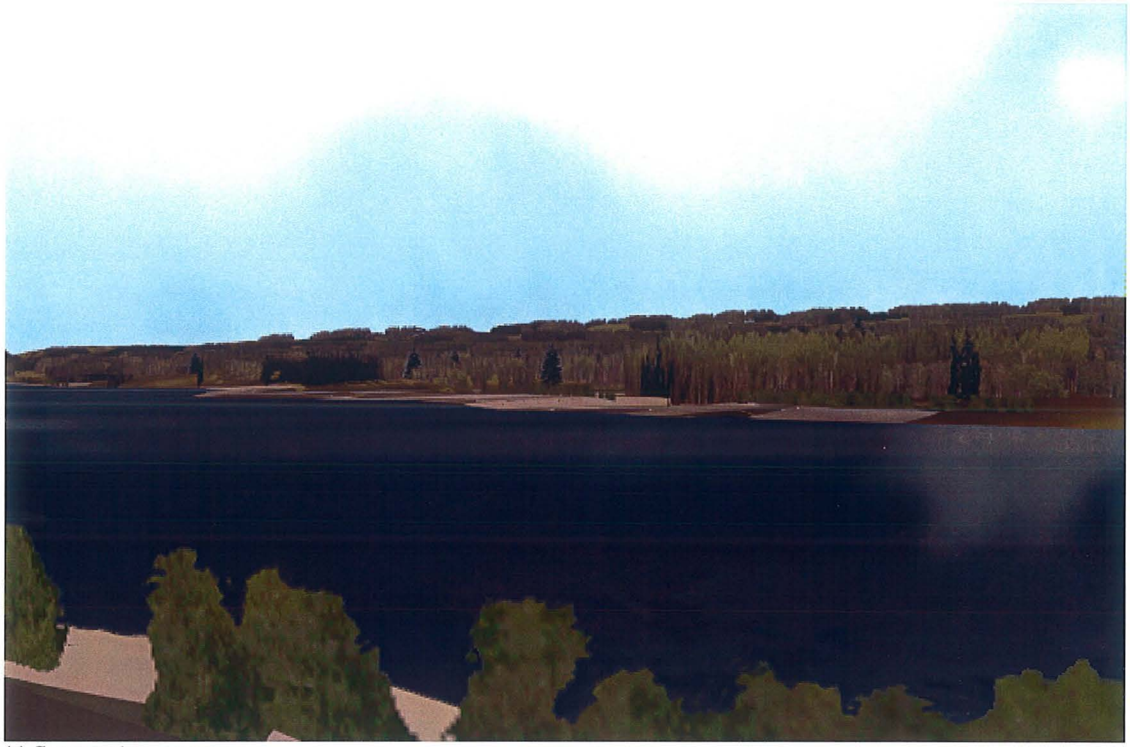
Structures and buildings of lasting duration should be designed to consider local preferences. Duration of these built forms will be either of moderate or long term. Careful consideration should be given to the design of any permanent structure such as bridges and buildings. Designs should focus on profile of the form, color and texture of the materials, rather than on the addition of architectural detail which will not be seen except at close range. Maintaining treed buffers will substantial soften the views of buildings and roads. Roads which are in view of the river can be partially hidden through the addition of berms planted with natural materials. During the operation phase of the mine, attention should be given to reducing the effects of light and dust pollution. Lighting should be designed to focus on work activity and shielded to reduce light pollution. The maintenance of dust control measures for roads will alleviate dust pollution.

The construction of a new bridge will provide a link between the existing and future development. A bridge, besides offering a needed transportation connection can heighten the visual experience of a landscape by providing a sense of scale and by offering a landmark for river boaters. Since this bridge will be seen primarily at a distance, a profile which is elegant will help improve the appearance of this feature. Surveys and focus groups may help identify specific design issues of color and form and assist in the creation of a bridge which will be viewed favorably by the community.

FIGURES

Figure 1

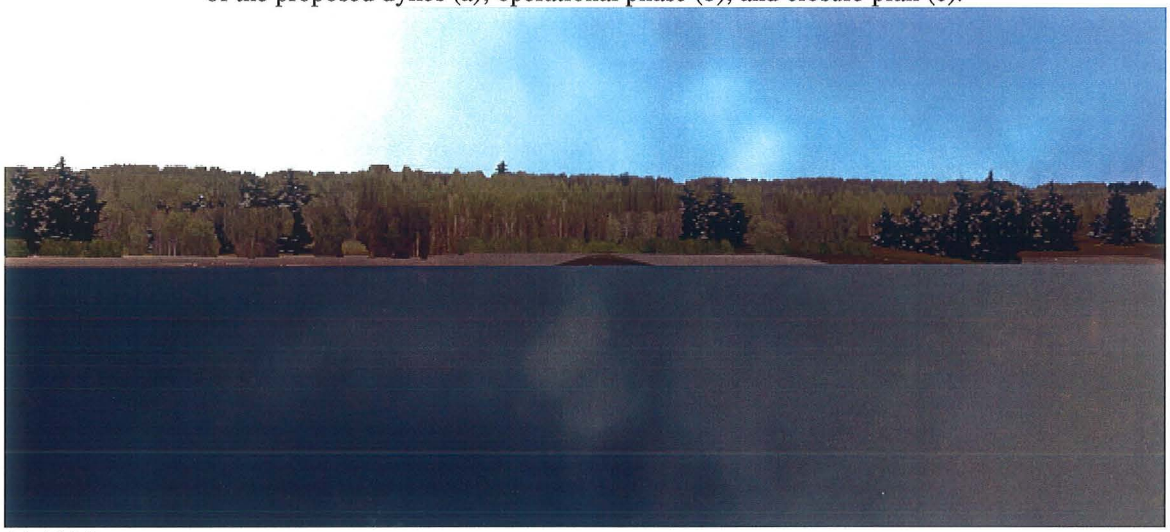
Comparison of a photographic image with an image created from the computer model. The computer image (a) was created from approximately the same viewpoint as that used in the photograph (b)



(a) Computer image *W88.TIFF*

(b) Photograph *P88.TIF*

Figure 2
Computer generated image showing a view of the site prior to the development (1995) of the proposed dykes (a); operational phase (b); and closure plan (c).



(a) 1995 *V95A0009.TIF*

(b) Operational phase *V09A009.TIF*

(c) Closure *V15A0009.TIF*

Figure 3a: IMPACT HYPOTHESIS CLASSIFICATION - PROJECT COMPONENTS

Dykes and Earthworks

1997-2000

Geographical Extent

	Local	Regional	Beyond
Direction	-	-	na
Severity	M	L	na
Duration	L	L	na

2000-2020

Geographical Extent

	Local	Regional	Beyond
Direction	-	-	na
Severity	M	L	na
Duration	L	L	na

2020-

Geographical Extent

	Local	Regional	Beyond
Direction	-	-	na
Severity	L	L	na
Duration	M	L	na

Roads, Barge Loading Points and Mining Operations

1997-2000

Geographical Extent

	Local	Regional	Beyond
Direction	-	na	na
Severity	M	na	na
Duration	L	na	na

2000-2020

Geographical Extent

	Local	Regional	Beyond
Direction	-	na	na
Severity	M	na	na
Duration	M	na	na

2020-

Geographical Extent

	Local	Regional	Beyond
Direction	-	na	na
Severity	L	na	na
Duration	S	na	na

Figure 3b: IMPACT HYPOTHESIS CLASSIFICATION - PROJECT COMPONENTS

Buildings and Mining Equipment

1997-2000 Geographical Extent

	Local	Regional	Beyond
Direction	-	na	na
Severity	M	na	na
Duration	S	na	na

2000-2020 Geographical Extent

	Local	Regional	Beyond
Direction	-	na	na
Severity	M	na	na
Duration	S	na	na

2020- Geographical Extent

	Local	Regional	Beyond
Direction	-	na	na
Severity	L	na	na
Duration	S	na	na

Bridge and Abutment

1997-2000 Geographical Extent

	Local	Regional	Beyond
Direction	-	na	na
Severity	M	L	na
Duration	L	L	na

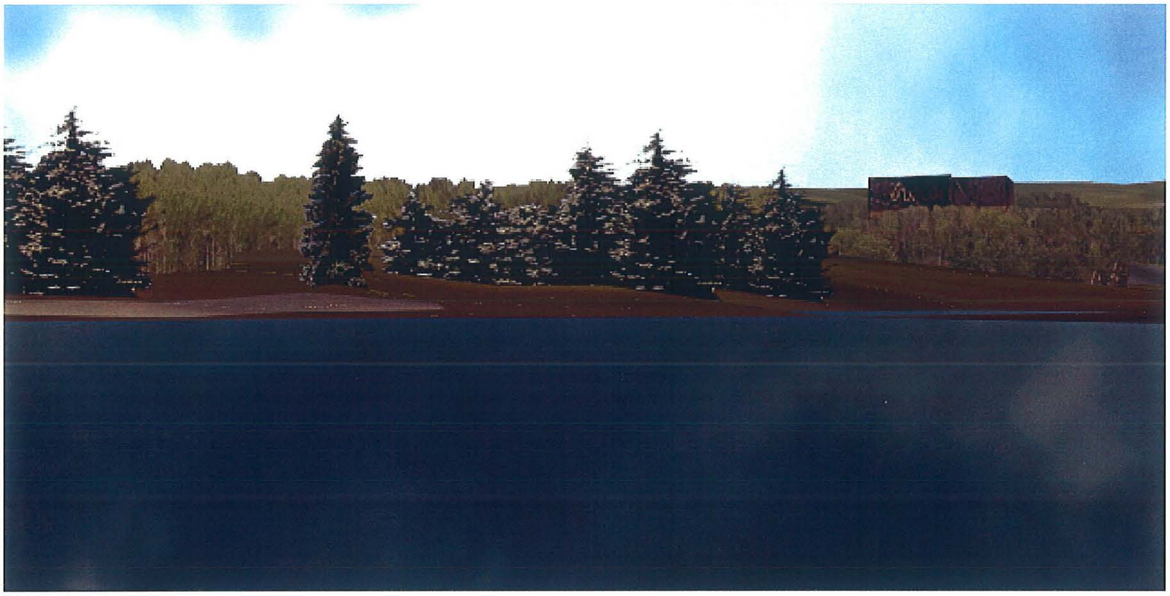
2000-2020 Geographical Extent

	Local	Regional	Beyond
Direction	-	na	na
Severity	M	L	na
Duration	L	L	na

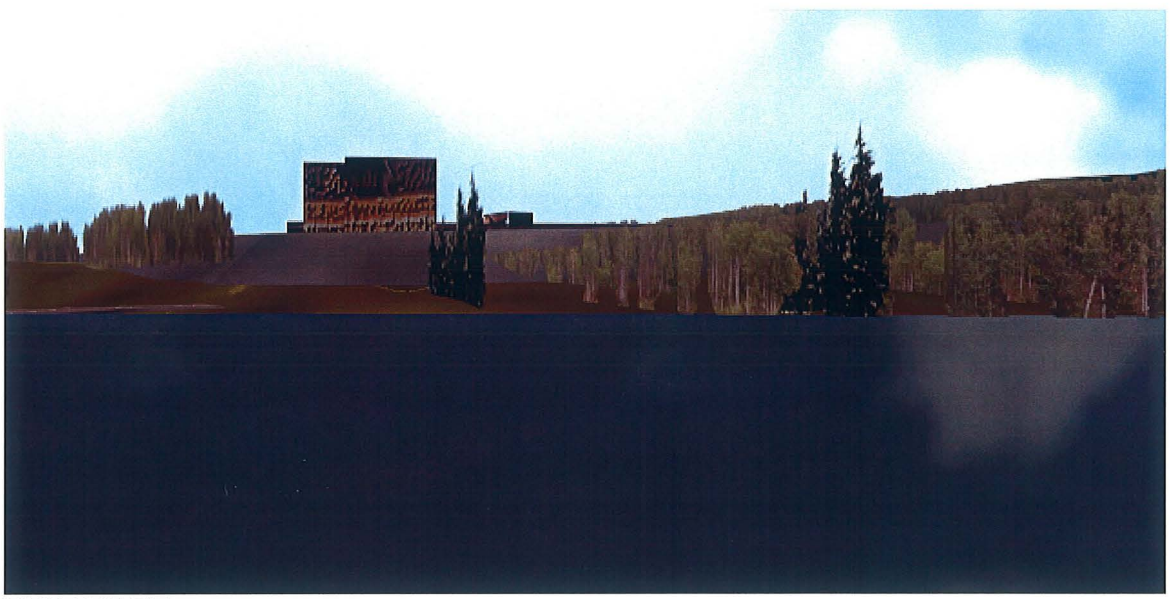
2020- Geographical Extent

	Local	Regional	Beyond
Direction	-	na	na
Severity	M	L	na
Duration	L	L	na

Figure 4
Computer generated image showing a view of the proposed structures
during the mine operational phase

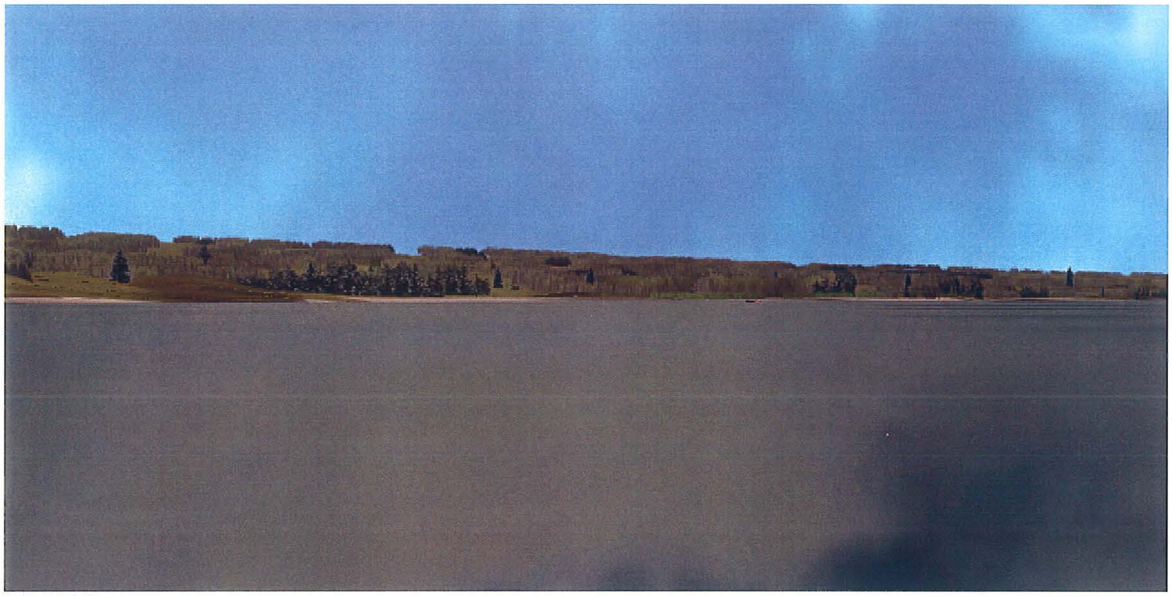


V15A0006.TIF

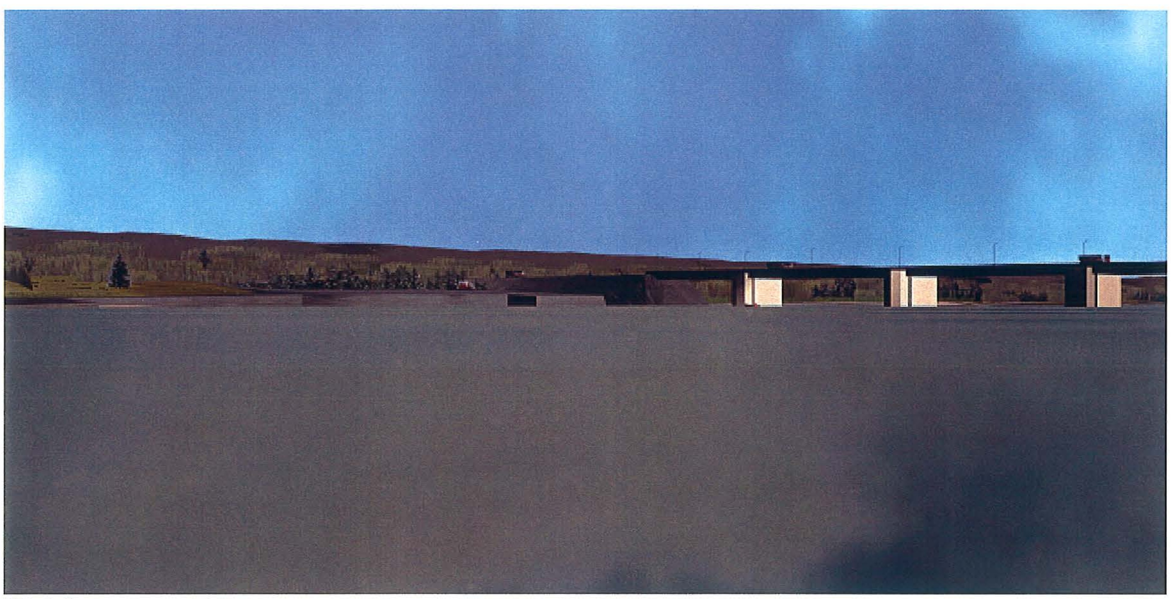


V15A0007.TIF

Figure 5
Computer generated image showing a view of the site prior to construction of the proposed bridge (1995), and bridge after construction



(a) 1995 *V95A0002.TIF*



(b) After construction *V09A002.TIF*

Figure 6: IMPACT HYPOTHESIS CLASSIFICATION - OVERALL DEGREE OF CONCERN

Overall

1997-2000

Geographical Extent

	Local	Regional	Beyond
Direction	-	-	na
Severity	M	L	na
Duration	L	L	na

2000-2020

Geographical Extent

	Local	Regional	Beyond
Direction	-	-	na
Severity	M	L	na
Duration	L	L	na

2020-

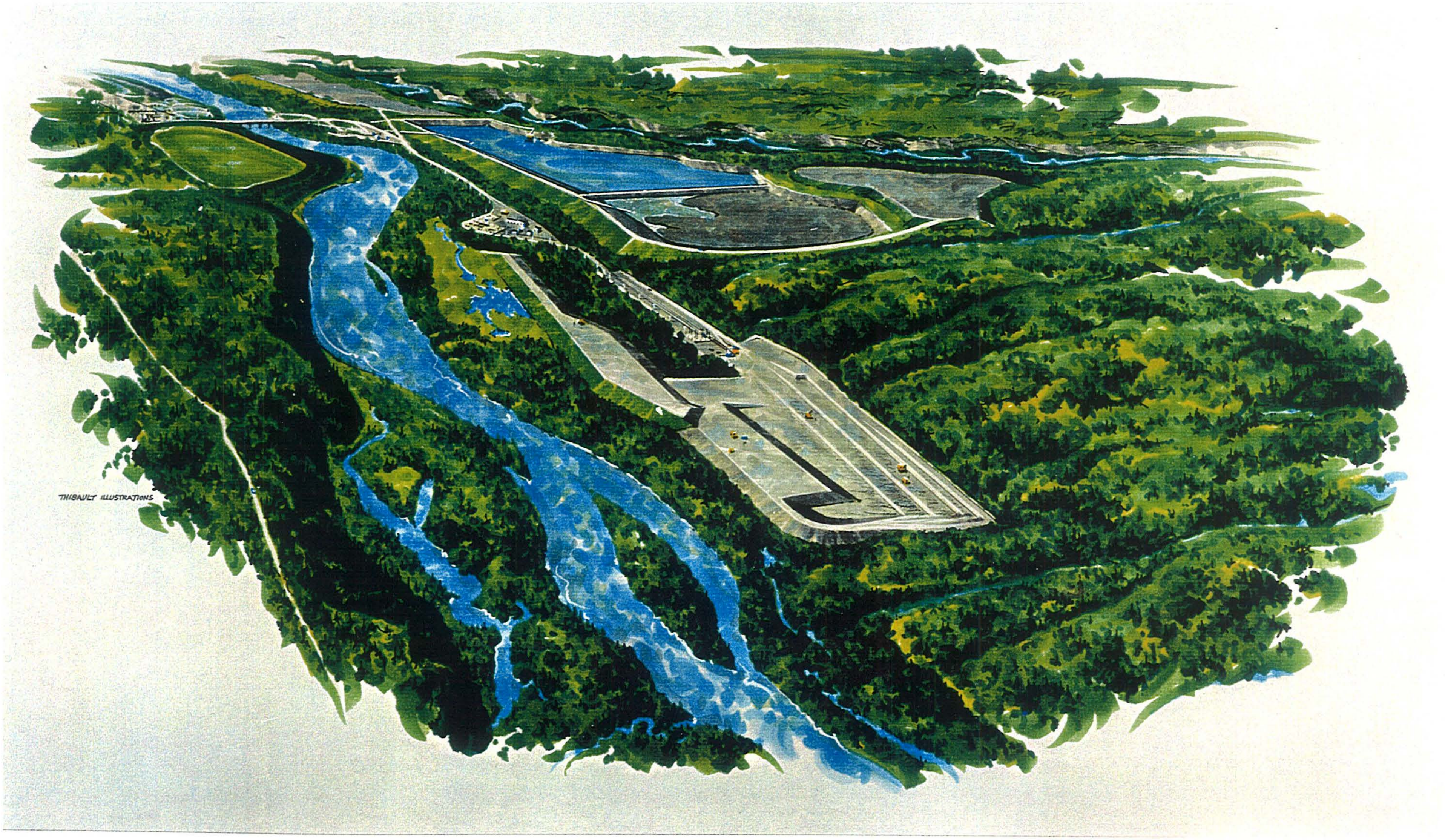
Geographical Extent

	Local	Regional	Beyond
Direction	-	-	na
Severity	L	L	na
Duration	M	L	na

APPENDICES

APPENDIX

ARTIST'S RENDERING OF STEEPBANK MINE DEVELOPMENT


THIBAULT ILLUSTRATIONS