EXECUTIVE SUMMARY

Local governments are becoming aware of the finite and nonrenewable nature of aggregate supply. Increasingly, cities and towns in North America are facing shortages of construction aggregate. With accelerated urban growth, the situation is intensified. This pressure on the resource is compounded by the sterilization of potential reserves by urbanization, legislative requirements, environmental protection measures, and neighborhood concerns of dust, noise, and landscape aesthetics.

In order to effectively plan for and manage the resource, the Regional District of the Central Okanagan, in conjunction with the municipalities of Kelowna, Lake Country and Peachland, under the auspices of the Central Okanagan Growth Management Strategy, have commissioned EBA Engineering Consultants Ltd. (EBA) to produce the following Aggregate Supply and Demand Study. The study involves an inventory and assessment of aggregate supply and demand projections over a 20 year planning horizon. The objective of the study is to develop a comprehensive management strategy for the industry within the Central Okanagan in order to make efficient use of the resource, minimize land use conflicts, and avoid the sterilization of the resource due to urbanization. The project has included an extensive consultation program with representatives from the aggregate industry, provincial agencies, and the public.

The inventory portion of this study included the refinement of existing aggregate potential mapping, surveying aggregate producers in the area, and data collection from published resources. The assessment portion was developed based on information collected during the inventory stage, as well as projected growth data, industry capacities, demand levels, and current permitting policy. The strategy was developed based on tools available for local governments under the *Municipal Act (1996)* and guidelines developed by the Ministry of Municipal Affairs (MMA) and the Ministry of Energy and Mines (MEM).

INVENTORY

Through the producers' surveys and information obtained from the Ministry of Transportation and Highways (MOTH), the following reserves under permit are estimated:

Total Estimated Aggregate Supply
- 35.5 million tonnes - Industry
- 3.5 million tonnes – MOTH

Total Estimated Quarried Rock Supply
- 59 million tonnes – Industry

EBA refined existing aggregate potential maps produced by the MEM (Bobrowsky, 1998). Mapping divided landforms into Class I, Class II and Class III potential aggregate supplies. EBA also mapped potential sources of bedrock suitable for quarried material based on existing geology maps. The aggregate potential mapping identified areas of existing urban development and the Agricultural Land Reserve (**ALR**), for the purposes of land planning. The current policy of the Agricultural Land Commission (**ALC**) regarding aggregate extraction on ALR land is that, if there is a possibility to improve the agricultural value of the land through aggregate extraction, the use may be permitted. The following primary potential area, and the corresponding urban development and ALR area throughout the Regional District of Central Okanagan has been identified:

- Class I Gross Area * = 182 sq. km.
- ALR / Urban Area = 121.8 sq. km
- Net Class I Area = 60.2 sq. km.

* Total within a marketable trucking area.

ASSESSMENT

Based on published data, a figure of 15 metric tonnes of aggregate per person per year has been used in this study for the purposes of anticipating aggregate demand. Using a 2.25 % growth rate and a current estimated population of 150,000, the population in 20 years will be approximately 245,000 in the Central Okanagan. At this rate, aggregate consumption will average of 2.9 million tonnes per year for a total amount of 59 million tonnes over 20 years. This results in an anticipated shortfall of 20 million tonnes of sand and gravel, not including quarried rock supply. This shortfall can be reduced somewhat by increasing the amount of recycled products and promoting total resource utilization. Another potential source of aggregate is crushed quarried material. However, 95% of the current aggregate used for road construction, asphalt, concrete, and structural fill comes from natural sand and gravel deposits. Only 5% originates from quarried rock. It is estimated that using crushed quarried material has 25 to 30 percent greater production costs than natural sand and gravel sources (Hora, 1995). To avoid this increase in production costs, additional sand and gravel reserves will need to be established and permits approved.

The assessment portion of the study included an analysis of transportation considerations, economic climate and the effects of urbanization. Transportation costs figure prominently in the overall cost of aggregate. Transportation costs can increase the cost of aggregate from 40 to 100%. The producer surveys suggest that, within the Central Okanagan, an average of 12 km from origin to market is the distance for which it is economical to supply aggregate. Survey results in the lower mainland have revealed that the maximum competitive distance for trucking aggregate is 50 km one way, while the maximum competitive distance for barging is 150 km (Hora, 1995).

Costs for sand and gravel products rise with increased urbanization. Vancouver area consumers pay approximately 85% more for their aggregate products than consumers in the Okanagan. Proximity to market and the potential effects of increased sterilization of supplies are considerations for managing the resource within the Regional District over the next 20 years.

Further assessment was undertaken for each deposit area, including: planning considerations such as proximity to market; future land use designations according to current Official Community Plans (**OCPs**); and Rural Land Use Bylaws (**RLUBs**), neighbourhood issues; Land and Resource Management Plans (**LRMPs**); and environmental considerations. Some areas identified as Class I potential for aggregate are currently in the planning process for other land uses, such as residential and industrial. These considerations, as well as deposits constrained by environmental and land use plans, further reduce the potential resource area available for aggregate extraction.

STRATEGY

Recommendations for aggregate management planning and a policy strategy were developed to:

- ensure a level playing field between producers in the region;
- maximize the efficient use of the aggregate resource;
- minimize land use conflicts;
- minimize neighborhood conflicts;
- minimize environmental impacts; and
- streamline the permit process between agencies with overlapping jurisdictions.

Elements of the strategy include the development of:

- an Aggregate Working Group to coordinate regional policy development;
- a regional *Soil Removal and Deposit Bylaw* (**SRDB**);
- an Implementation Agreement with relevant provincial agencies regarding aggregate policy and process;
- a review by the Inter-government Agency Committee (IAC) regarding the permit review process and corresponding legislation; and
- policy amendments to OCPs and zoning bylaws within the region.

SOIL REMOVAL AND DEPOSIT BYLAW

The study includes a draft Soil Removal and Deposit Bylaw. Some of the key elements of the bylaw include:

- a 'Soil Removal' area;
- requirements for a public hearing for an amendment to the 'Soil Removal' area;
- buffer requirements;

- maximum levels for total suspended sediment in surface water runoff;
- hours of operation;
- references to applicable noise abatement bylaws;
- fees for permitting;
- identification of truck routes for aggregate hauling;
- fines for offences; and
- security for reclamation.

VOLUME BASED FEES

The draft bylaw did not include volume-based fees although this is an option for consideration. According to *A Guide to the Development of Soil Removal and Deposit Bylaws (MEM, 1998)*, municipalities have the authority to charge a volume-based fee for infrastructure maintenance, while regional districts do not. This is due to the fact that municipalities are responsible for their own road maintenance. The advantages and disadvantages of volume-based fees are discussed below.

ADVANTAGES:

1. For the City of Kelowna, and the Districts of Peachland and Lake Country, volume based fees would represent additional revenue with which infrastructure upgrades (e.g. roads and bridges) could be made.

DISADVANTAGES:

1. Municipalities have the authority to charge volume based fees for infrastructure maintenance while regional districts do not *(MEM et al., 1998)*. The implementation of a volume-based fee could create an unequal economic playing field between producers in the region.
2. Volume-based fees would likely result in price increases for aggregate products. Considering that approximately 60 to 70 percent of aggregate is used for road construction and maintenance, local governments would likely see increased costs for their public works operations.
3. Collecting and processing of fees would result in additional administration costs to municipalities, including staff time and potential legal challenge.
4. Systems for collecting fees need to rely either on the goodwill of industry to disclose accurate quantities or systems of monitoring such as air photo calculation.

ALTERNATIVES TO VOLUME BASED FEES

Other local governments have utilized different tools for reclaiming funds for infrastructure upkeep. These include the utilization of the funds within security bonds in the event that the aggregate operation neglects to maintain the adjacent roads adequately. There may be scope to utilize monies collected for local truck permits under the commercial vehicle licensing program for infrastructure upgrades.

CONCLUSION

The inventory results of this study indicate a shortage of approximately 20 million tonnes of aggregate based on current permitted supply. This, in conjunction with increasing demands on the land base in the Central Okanagan, establish the need for a comprehensive long term management strategy for aggregate production. This should include land use policies that reserve aggregate deposits for the use by future generations. In addition, the permitting process should be well defined and coordinated between agencies with overlapping jurisdictions.

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1.0 INTRODUCTION

In order to effectively plan for and manage the resource, the Regional District of the Central Okanagan, in conjunction with the municipalities of Kelowna, Lake Country and Peachland, under the auspices of the Central Okanagan Growth Management Strategy, have commissioned EBA Engineering Consultants Ltd. (EBA) to produce the following Aggregate Supply and Demand Study. The following section describes what aggregate is and outlines the purpose of the study, the Central Okanagan Growth Management Strategy, and the scope of work.

1.1 What is 'Aggregate'?

'Aggregate' is the term commonly used for the sand and gravel used to build our cities. Aggregate is the main component in construction materials such as concrete, asphalt, and cement blocks. As such, it forms the foundation of our infrastructure as we know it. Sidewalks, roads, buildings and bridges are largely composed of aggregate.

1.2 Purpose of the Study

The identification of sand and gravel deposits is one of the key components of a community plan as described by the Municipal Act (R.S.B.C., 1996). Aggregate is a non-renewable resource. Planning for aggregate is becoming increasingly important as urbanization grows up around existing extraction operations and demand grows. Pressures on locating supplies of the resource is compounded by the sterilization of reserves by urbanization, legislative requirements, environmental protection measures, and neighborhood concerns of dust, noise and landscape aesthetics. These factors establish the need for long term planning for aggregate extraction.

The objectives of the management strategy are to:

- maximize the efficient use of the resource;
- reduce land use conflicts;
- minimize environmental impacts;
- streamline the permit process between all government agencies with overlapping jurisdictions;
- reduce the burden on infrastructure; and
- maintain a level playing field among producers in the Central Okanagan.

1.3 Central Okanagan Growth Management Strategy

The Central Okanagan Growth Management Strategy is based on a committee of local government representatives coming together to address regional issues in partnership. Aggregate extraction is a regional issue, and, as such, it is appropriate to plan for and manage it on a regional scale.

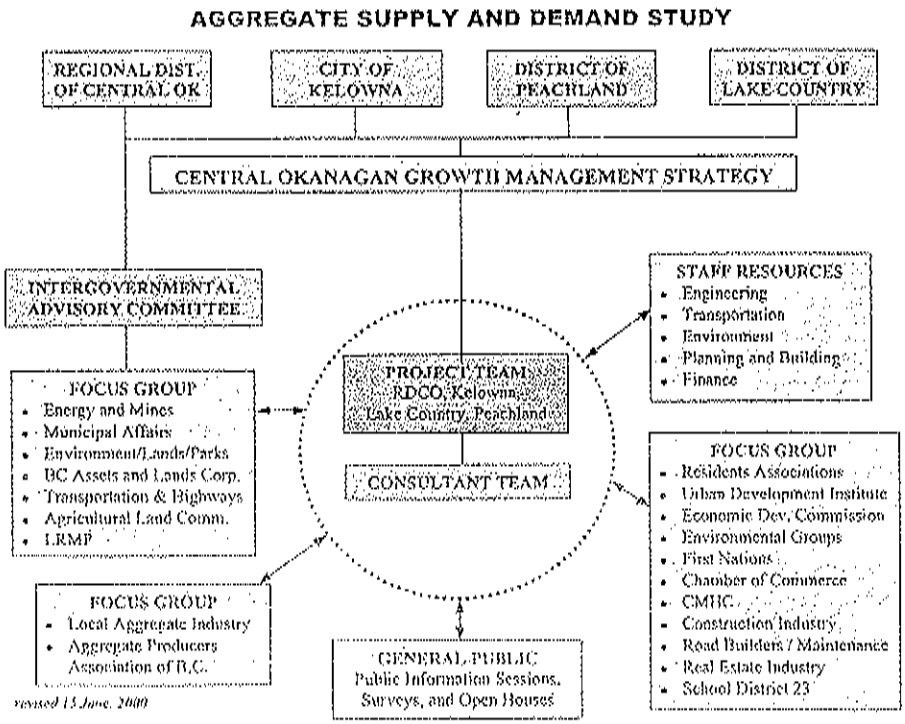

Figure 1: Project Organizational Chart (City of Kelowna, 1999)

1.4 Scope of the Study

The study involves an inventory and assessment of aggregate supply and demand projections over a 20 year planning horizon. The objective of the study is to develop a comprehensive management strategy for the industry within the Central Okanagan in order to make efficient use of the resource, minimize land use conflicts, and avoid the sterilization of the resource due to urbanization. The study includes:

- an Inventory of the current and future supply and demand of aggregate;
- an Assessment of the industry, land use and environmental issues, and the current regulatory framework with respect to aggregate extraction; and
- a Strategy for the management of aggregate resources in the Central Okanagan.

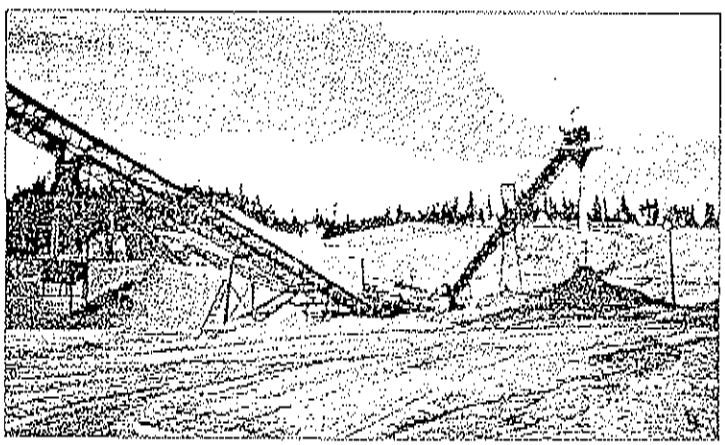

Photo 1: Aggregate Pit and Processing Equipment

2.0 STUDY AREA

The Study Area boundaries are those of the Regional District of the Central Okanagan (**the District**). Aggregate supply and demand has been assessed both on a District wide scale and also for each Official Community Plan area. (See Section 10.0)

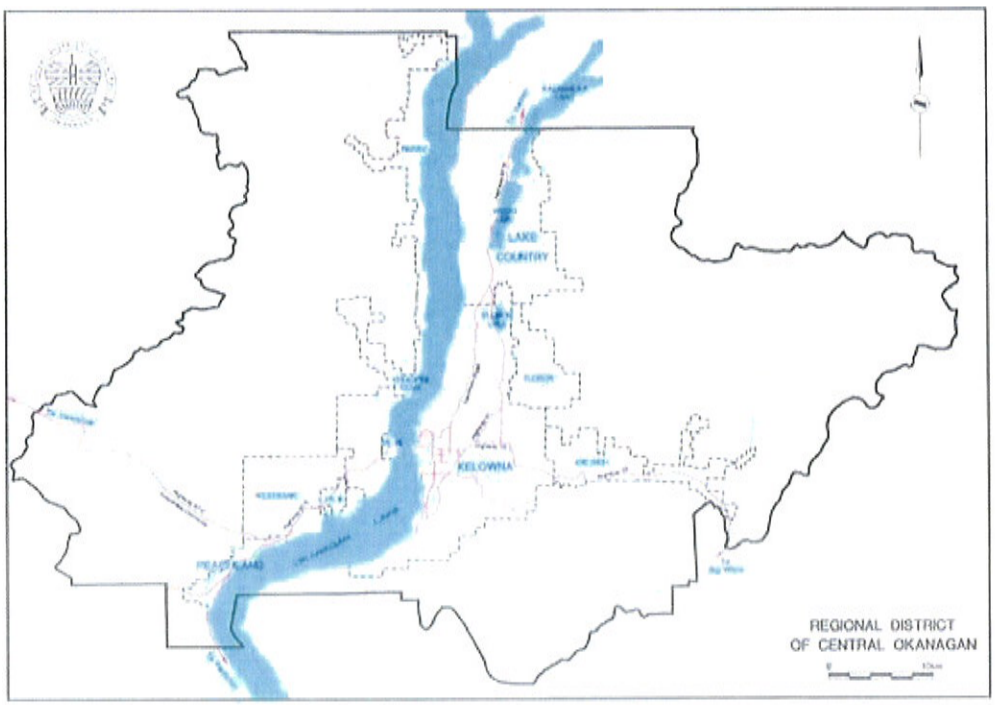

Figure 2: Study Area (RDCO, 1999)

3.0 AGGREGATE DEFINED

The following section describes aggregate, and how and where it occurs in the landscape. It also describes bedrock as a source of aggregate.

3.1 Commodity Description and Use

For the purposes of this study, aggregate resources include sand, gravel and bedrock deposits that are mined for use in construction materials such as concrete, asphalt, decorator rock and brick. Aggregate is also used for structural fill, sub-base material for roads and sidewalks, railway ballast and drain rock. Natural sand and gravel deposits are the primary sources of aggregate. Bedrock is also quarried and crushed for use as aggregate. Each use has particular specifications with regard to grain size, particle shape and physical properties to ensure quality requirements are met. To meet these specifications, gravel deposits and rock are often washed, screened and crushed in order to achieve the desired physical and mechanical properties. (See Appendix C for an overview of aggregate processing).

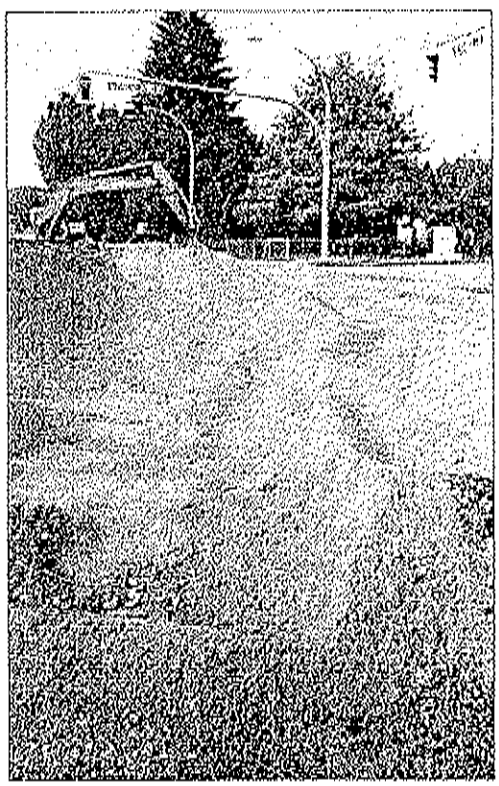

Photo 2: Aggregate Use for Infrastructure

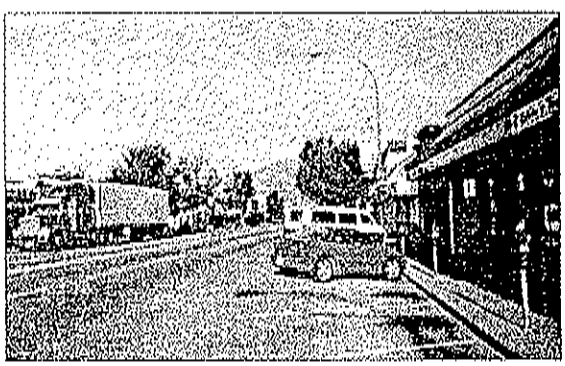

Photo 3: Asphalt and Concrete in the Community

3.2 Sand and Gravel Versus Quarried Bedrock

In terms of geological deposits, aggregate is mined from two sources:

- sand and gravel deposits; and
- bedrock.

The term 'natural aggregate' is used for those sand and gravel deposits that occur in the landscape. The following is a description in generalized terms of how sand and gravel is deposited through the process of water erosion and deposition. This process takes tens of thousands of years.

Modern and glacial rivers deposit boulders, gravels, sands and silts. Rocks carried into streams are split and eventually rounded as they are move down the channel, producing particles of different shape and size. The particles in the channel are laid down based on the gradient, hence velocity of the stream and the weight of the material. Boulders and cobbles are deposited higher in the watershed where the stream has great velocity and power. Sands and gravels are deposited further down in the watershed where the stream has a moderate velocity. Silts and fine sands are deposited even lower in the watershed, at the delta, where the stream is slow and meandering. Clays are waterborne until the water is very still. Therefore, clay deposits occur at the bottom of modern lakes, or in locations where glacial lakes once stood.

Photo 4: Cobbles in a Riverbed

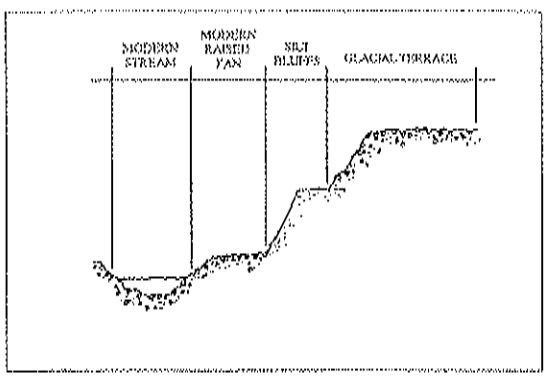

Figure 3: Cross Section of Gravel Deposits in the Landscape

3.3 Where in the Landscape are Sand and Gravel Deposits Found?

Sand and gravel deposits that are suitable for aggregate are found in specific locations in the landscape. These include terraces and fans that have been laid down by glacial rivers, terraces of modern (post-glacial) rivers, the riverbeds of modern rivers or streams, and deltas of modern streams that reach out into lakes. The sketches below illustrate graphically where sands and gravels are typically found in the landscape.

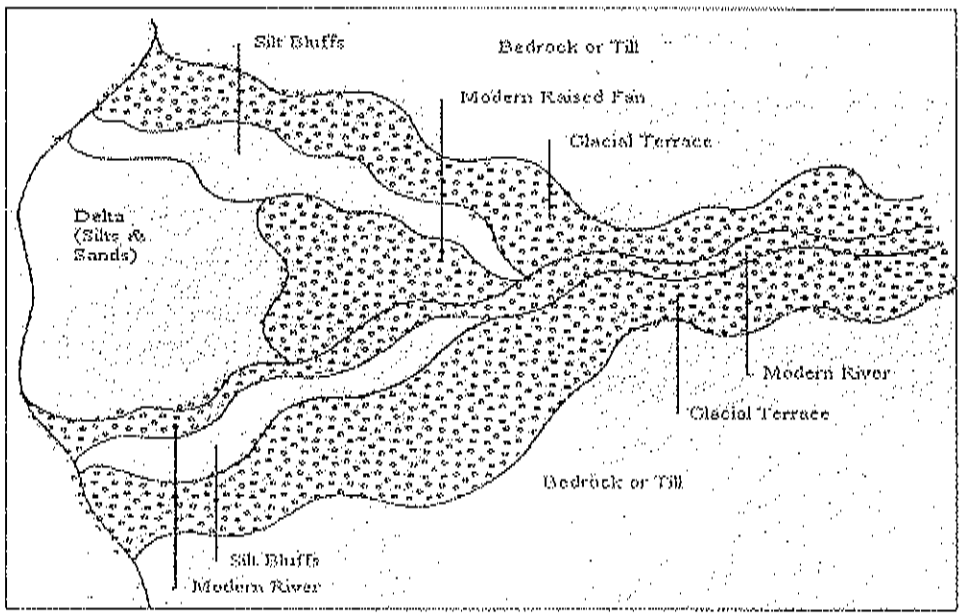

Figure 4: Sand and Gravel Deposits in a Large Valley

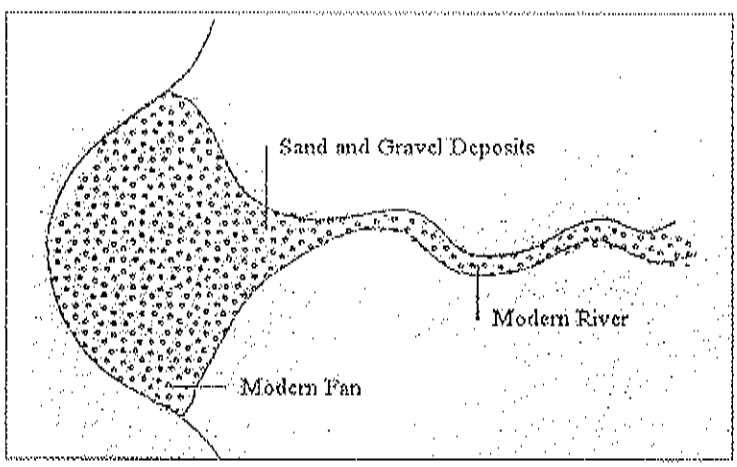

Figure 5: Sand and Gravel Deposits in a Small Valley

Particles of different materials have different applications for construction. Sands and gravels are used for structural fill, asphalt and concrete. Clay is used to make brick. The locations where these materials have been deposited dictates where they can be mined. Like oil, natural aggregate is non-renewable and only occurs in specific locations based on geological processes.

> 'Because sand, gravel and stone deposits are created over very long periods of time by geological and other natural forces, they are considered a non-renewable resource. Like other non-renewable resources, it is important that they be managed wisely.'
>
> *p. 6 Reclamation and Environmental Protection Handbook for Sand, Gravel and Quarry Operations in British Columbia* (MEM, 1995).

3.4 Bedrock for Aggregate Use

Bedrock is another potential source of aggregate. While sand and gravel deposits can be excavated directly out of the bank, bedrock requires blasting prior to processing. The blasted rock is then crushed for use as aggregate.

4.0 METHODOLOGY

The study was conducted in three consecutive stages: Inventory, Assessment, and Strategy. Consultation was conducted throughout all stages of the study.

4.1 Inventory

Information regarding the potential supply of aggregate was collected through the:

- refinement of existing aggregate potential mapping; and the
- collection of raw volume data from aggregate suppliers and MOTH.

4.2 Base Aggregate Potential Mapping

In 1996, the B.C. Ministry of Energy and Mines (MEM) conducted broad scale aggregate potential mapping in the Central Interior of B.C. from Salmon Arm to Osoyoos (P. Bobrowsky et. al., 1998). The mapping evaluated the valley for aggregate potential based on a number of criteria, including soil and landform type, the presence of existing pits, and available data on the thickness of deposits.

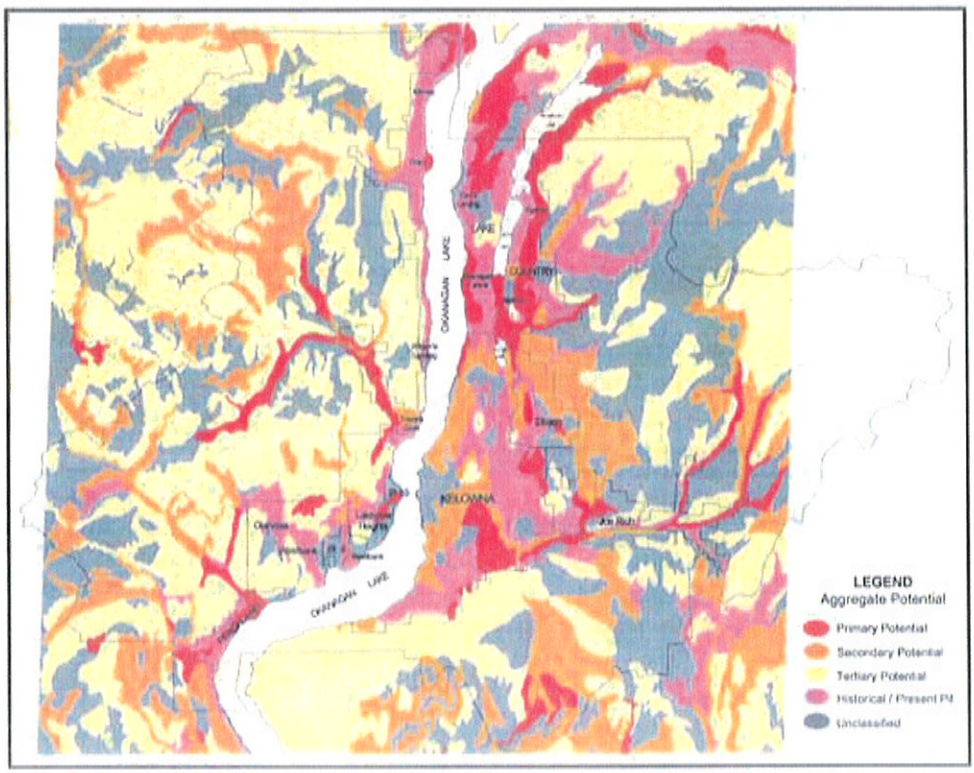

Figure 6: MEM Aggregate Potential Mapping for the Central Okanagan (MEM, 1998)

Five categories of aggregate potential were identified:

- Primary potential;
- Secondary potential;
- Tertiary potential;
- Historical units; and
- Unclassified.

EBA further refined the MEM mapping, focusing on the primary and historical areas. Air photo interpretation was used to complete the mapping. For the lands within the City of Kelowna boundary, 1996 photos at 1:15,000 scale were used. For the remainder of the District, the interpretation was completed using 1:20,000 scale photos from 1974.

EBA divided the primary and historical areas into polygons. ***A polygon is a shape on a map with a certain colour that shares a physical characteristic with other shapes of the same colour.*** Each resulting polygon was given a new classification based on the surficial geology of the polygon, or unit. (Refer to Appendix B for further information regarding the origin and characteristics of surficial materials). EBA classified the base mapping by landform unit as follows:

- Class I – Glaciofluvial Deposits, Fluvial Terraces and Fluvial Fans;
- Class II – Flood Plains, Till, Colluvium, and Thin Glaciofluvial Deposits; and
- Class III – Bedrock, Thin Colluvium and Till, Lacustrine and Glaciolacustrine Deposits.

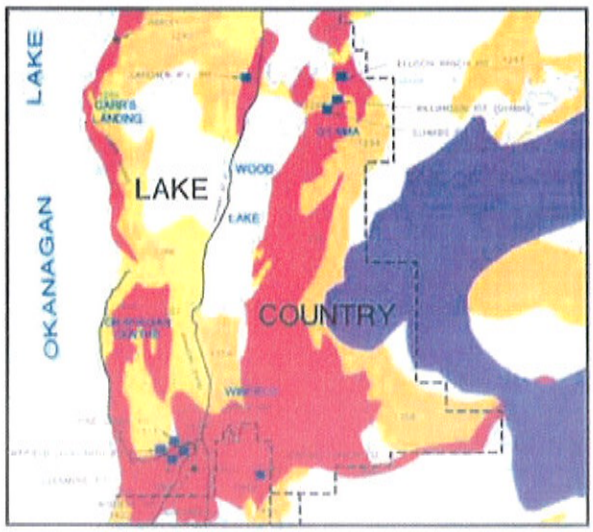

Figure 7: Example of Refined Aggregate Potential Mapping

In addition to aggregate potential mapping, the Agricultural Land Reserve (**ALR**) for the Central Okanagan was mapped using current digital information (RDCO, 1999). Lands sterilized by urban development were mapped by air photo interpretation (City of Kelowna, 1996; and RDCO 1974). The 1974 photos were used because they represent the set with the most complete coverage of the District.

A resultant net aggregate potential map was prepared that removed the lands of urban development and the ALR from the Class I and Class II potential areas. Remaining aggregate deposits were compared with locations of projected growth. Growth projections were derived from current Official Community Plans within the study area.

4.2.1 Geology Mapping to Identify Quarried Aggregate Potential

Certain types of bedrock have potential for aggregate production. Therefore, bedrock was mapped in terms of its potential for aggregate and other products such as dimension stone and landscape rock. Bedrock groups were mapped using existing geological mapping (W. M. Mathews, 1987; B.N. Church, 1981; Jones, 1959; Templeman-Kluit, 1989). (See Map 4.)

4.2.2 Limitations of Mapping Methodology

The methodology used for mapping identifies polygons in which aggregate deposits are likely to be found based on soil types and landform characteristics. The methodology was designed to identify areas within the Study Area that have high aggregate potential in order to plan adequately for future extraction. However, it is important to note that, due to the limitations of the methods used, precise estimates of depth, quality, volume, or economic viability for a specific deposit are not revealed by this study. Further site specific field investigation is required to attain this level of inventory and assessment.

4.2.3 Aggregate Producer Surveys

In addition to the aggregate potential mapping, surveys were conducted with aggregate producers in the region to assess current levels of production and supply under permit. A copy of the survey distributed to the aggregate producers is included in Appendix D. Information was gathered on the following:

- aggregate market use;
- annual volume of aggregate;
- annual volume of quarried rock;
- annual volume of recycled aggregate;
- aggregate composition;
- percentage waste;
- estimated reserve;
- estimated remaining life of pit;
- transportation routes;
- current aggregate prices; and
- reclamation plans.

Photo 5: Sand and Gravel Pit

Of thirty-one (31) aggregate and rock quarry operations in the District, EBA received 17 completed surveys. It is estimated that, in terms of volume, the survey respondents represent approximately 70% of the reserve under permit. Based on survey results and an understanding of landform and current production levels, volumes for the remaining pits were extrapolated.

The Ministry of Transportation and Highways also provided information regarding aggregate reserve under their jurisdiction.

4.3 Assessment

Using information collected through mapping, producer surveys, published documentation, and projected growth data, demand levels were calculated. Current and projected levels of recycling aggregate products were assessed. Impacts of aggregate extraction on infrastructure were analyzed using a generic example and empirical data from the City of Kelowna Pavement Management System (D. Carate, pers. comm., 2000). Environmental and visual impacts were assessed based on currently accepted principles of land management set forth by BC Environment and the Ministry of Forests.

A review of current policy and legislation affecting the industry was conducted, including a review of the Ministry of Energy and Mines process for permitting aggregate extraction operations and quarries.

4.4 Strategy

Recommendations for aggregate management and policy were developed. A Soil Removal and Deposit Bylaw was prepared for the District. This was based on the model bylaw produced by the Ministry of Energy and Mines (MEM, 1998), with reference to similar bylaws in the province. (Refer to Appendix G for bylaw).

4.5 Consultation

Consultation with the public, interest groups such as the Aggregate Producer's Association, and government agencies, was done throughout the course of the study. The consultation process is noted below.

Information Bulletin / Issue Questionnaire circulated to Stakeholder Groups and Agencies	January, 1999
Inter-governmental Advisory Committee (IAC) Meeting	February 04, 1999
Meeting with Technical Staff and Agencies # 1	February 11, 1999
Meeting with Aggregate Producer Representatives	February 23, 1999
Aggregate Producer Questionnaire	February, 1999
Public Information Meeting	February 25, 1999
Aggregate Producer & Agencies Workshop	April 7, 1999
Meeting with Technical Staff and Agencies # 2	June 17, 1999
Presentation to Aggregate Producer's Association	June 21,1999
Meeting with Project Team	August 25, 1999
Meeting with Project Team and Agencies # 3	January 12, 2000
Aggregate Newsletter	March, 2000
Open House 1, 2 and 3	March 28 - 30, 2000

Table 1: Consultation Process

The draft report and bylaw were circulated to the following for comment:

- Ministry of Energy and Mines;
- Ministry of Municipal Affairs;
- District of Lake Country;
- City of Kelowna;
- District of Peachland; and the
- Regional District of the Central Okanagan.

The following agencies were contacted for information and comment:

- Ministry of Transportation and Highways;
- Ministry of Environment, Lands and Parks;
- Agricultural Land Commission; and the
- Forest Land Commission.

5.0 INVENTORY

The inventory includes aggregate potential mapping and information gathered from producer's surveys.

5.1 Inventory – Mapping

EBA refined the mapping done by the MEM (P. Bobrowsky, 1998). EBA focused on areas identified by MEM as having high aggregate potential and those that had a history of aggregate or mining activity. EBA further refined the designations of these areas as being Class I, II or III. Class I is considered the best for aggregate production, Class II moderate, and Class III poor. Generally speaking, it is only economically feasible to produce aggregate in Class I areas. Bedrock as a potential aggregate source was mapped separately. (See Section 5.3 for a description of bedrock mapping.)

EBA mapping refined the aggregate potential resources by area in the Central Okanagan. Map 1 outlines the total area of refined aggregate potential. Map 2 identifies areas of urban development and the ALR. Map 3 identifies the net aggregate potential of the three classes outside the urban areas and ALR. Calculations based on this mapping resulted in the following areas of aggregate potential. Note that the figures represent area calculations only, and do not indicate the volume or quality of aggregate.

Class I Potential

- Gross Area * = 182 sq. km.
- ALR / Urban Area = 121.8 sq. km.
- Net Class I Area = 60.2 sq. km.

Class II Potential

- Gross Area * = 86 sq. km.
- ALR / Urban Area = 40 sq. km.
- Net Class I Area = 46 sq. km.

* Total within a marketable trucking area.

The following chart illustrates Class I and Class II deposits of natural sand and gravel for each municipality by area.

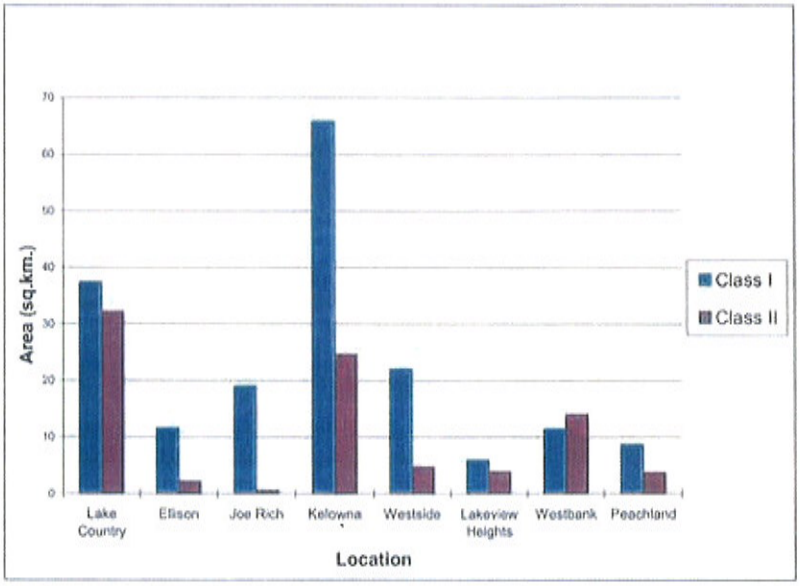

Chart 1: Gross Aggregate Potential by Location

The above chart illustrates Class I and Class II sand and gravel distribution by area.

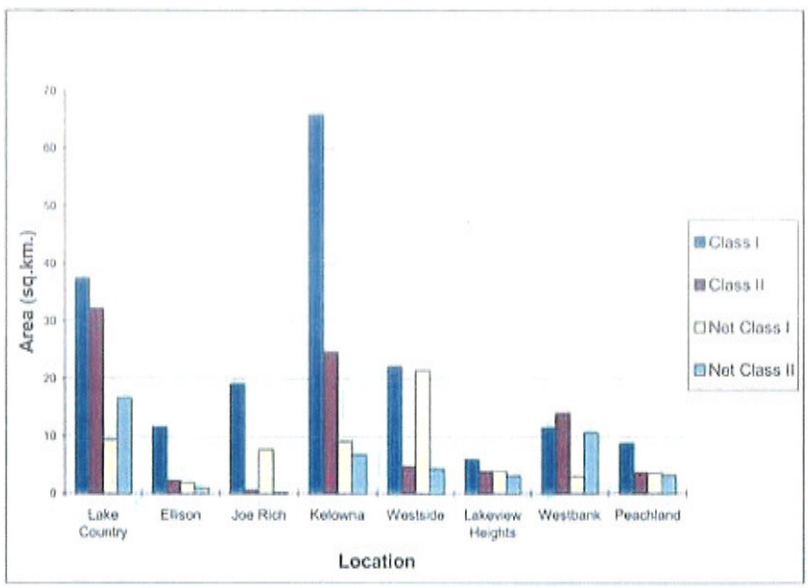

Chart 2: Aggregate Potential by Location Net of ALR and Urban Areas

The above chart illustrates gross Class I and Class II aggregate potentials for each location, and also the net area of each type once the ALR and urban areas are removed.

5.2 Inventory - Producer's Surveys

Results from the producer's surveys (June, 1999) revealed the following estimated volumes in reserve:

Total Estimated Aggregate Supply under permit

- 35.5 million tonnes - Industry
- 3.5 million tonnes – MOTH

Total Estimated Rock Supply under permit

- 59 million tonnes – Industry

5.3 Bedrock

In consideration that bedrock may be crushed for use as aggregate, bedrock mapping was completed that identified rock groups and their potential for aggregate use. (See Map 4.)

The rock groups that have high potential for aggregate use are:

- Paleozoic - Monashee Gneiss (upper plateaus east of Okanagan Lake);
- Mesozoic - Nelson Plutonic Granodiorite and Granite (Trepanier Creek and Ellison);
- Cenozoic - Okanagan Gneiss (upper plateaus east of Okanagan Lake); and
- Plateau Basalt (upper elevations of the District.)

The rock groups that have moderate potential for aggregate use are:

- Mesozoic Intrusives - (Lake Country and east of Okanagan Lake).

The rock groups that have low potential for aggregate use are:

- Mesozoic – Pyritic Slate, Phyllite & Argillite;
- Cenozoic – Trepanier Rhyolite (Trepanier Creek); and
- Cenozoic – Volcanic Rocks (e.g. Mount Boucherie, Dilworth Mountain, Black Mountain).

6.0 RESOURCE

In order to assess the state of the resource within the Central Okanagan, supply figures gathered from the inventory were brought together with demand projections. In addition, other aspects of the industry that affect supply were assessed. This includes a discussion of specification requirements, recycling, the use of quarried bedrock, sand and gravel quality, waste utilization and alternative sources such as dredging watercourses. This section also includes a discussion on the mining of rock for landscape and other uses.

6.1 Supply

As noted in Section 5.1, the results from the producer's surveys revealed the following estimated volumes are in reserve:

Total Estimated Aggregate Supply under permit

- 35.5 million tonnes - Industry
- 3.5 million tonnes – MOTH

Total Estimated Rock Supply under permit

- 59 million tonnes – Industry

These numbers will be matched to the projected demand in the sections below to assess the supply relative to the demand over the next 20 years.

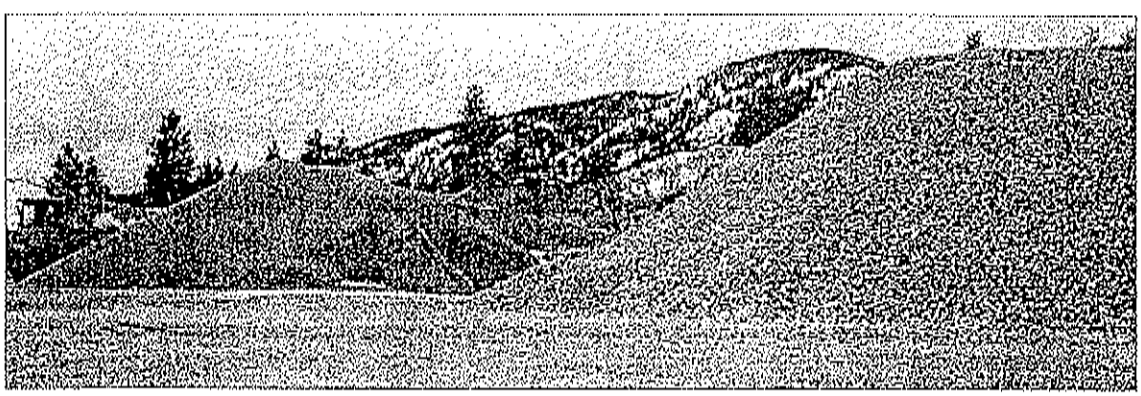

Photo 6: Stockpiles of Crushed Rock and Sand

6.2 Demand

Demand figures were based on calculations using consumption figures based on published literature and projected growth rates and estimates from OCPs within the District. In addition, several different rates were assessed to accommodate potential fluctuations in growth patterns. The demand assessment also includes an analysis of where the centers of demand are likely to occur.

6.2.1 Projected Demand of Aggregate

Estimates of consumption of aggregate products in North America range from nine tonnes (Langer, 1995) to 17 tonnes (USGS, 1999) per person per year. Between 1984 and 1994, the total quantity of aggregates shipped in Canada was estimated at 300 million tonnes annually. Production within BC is approximated at 50 million tonnes annually (Matysek *et al.*, 1995). The annual per capita consumption average in Canada is 14 tonnes (Langer, 1995). Consumption tends to be greater in areas with an expanding infrastructure system, and lower in established communities.

Based on consumption averages in British Columbia, and in consideration that the Central Okanagan is growing in terms of infrastructure, a figure of 15 tonnes per person per year has been used to calculate demand in this study. Figures of 12 and 17 tonnes per person were also used to accommodate potential differences in consumption rates.

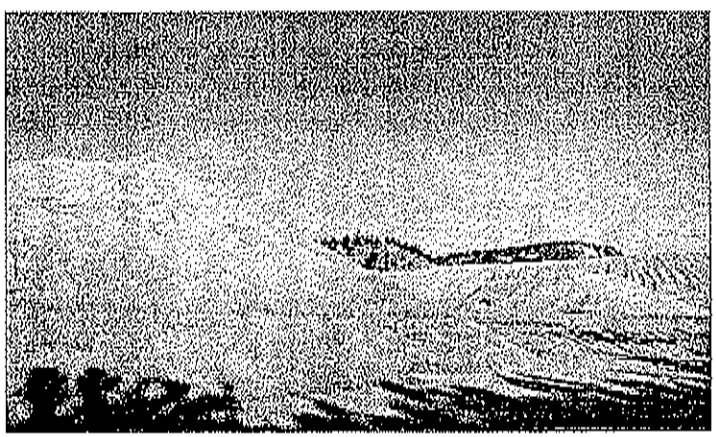

Photo 7: Aggregate Stock piles

Growth rates of 1.5%, 2.5% and 3.5% were assessed to accommodate potential fluctuations in population growth.

By considering projections of growth in population and building units, several scenarios for aggregate demand over the next 20 years were developed.

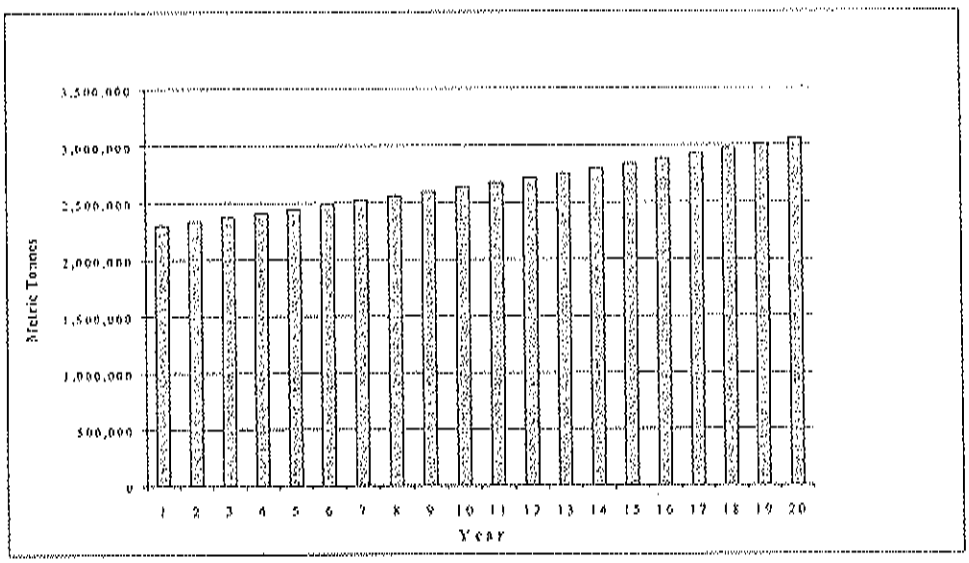

Chart 3: Demand of Aggregate to 2020 at a 1.5% Growth Rate

Using a 1.5 % compound growth rate and a current population of 150,000, the population in 20 years will be approximately 204,000 in the Central Okanagan. At this rate, we will consume an average of 2.65 million tonnes per year and require a total of 53 million tonnes over 20 years.

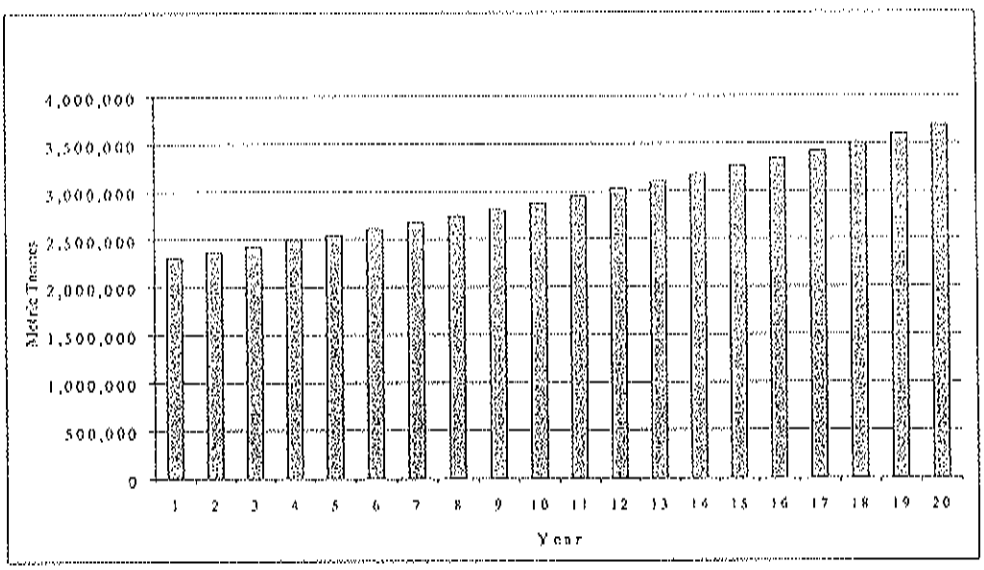

Chart 4: Demand of Aggregate to 2020 at a 2.5% Growth Rate

Using a 2.5 % compound growth rate, the population in 20 years will be approximately 245,000 in the Central Okanagan. At this rate, we will consume an average of 2.9 million tonnes per year and require a total of 59 million tonnes over 20 years.

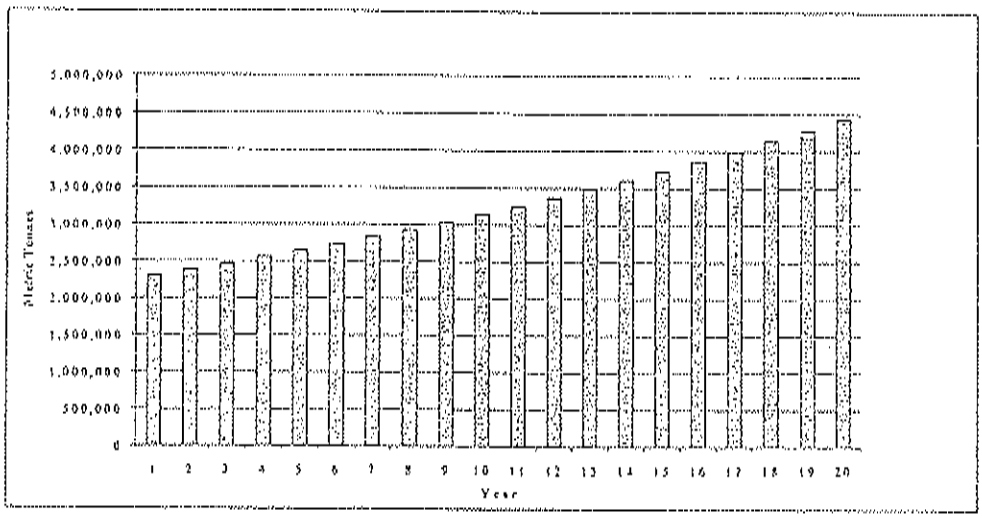

Chart 5: Demand of Aggregate to 2020 at a 3.5% Growth Rate

Using a 3.5% compound growth rate and a current estimated population of 150,000, the population in 20 years will be approximately 270,000 in the Central Okanagan. At this rate we will consume an average of 3.2 million tonnes of aggregate per year and require a total amount of 65 million tonnes over 20 years.

	Growth Rate per Annum		
Consumption (per person per annum)	1.5%	2.5%	3.5%
12 Tonnes	2017	2016	2015
15 Tonnes	2014	2013	2012
17 Tonnes	2013	2012	2011
Year of Exhaustion of Permitted Supply			

Table 2: Projections of Permitted Supply at Current Consumption Rates.

The above table outlines the estimated year of exhaustion of supplies currently under permit, as of July, 1999. This includes sand and gravel deposits only, and does not include the use of quarried rock for aggregate use. The producer surveys indicate that only 5% of aggregate consumption is currently supplied from quarried rock sources.
As outlined in Section 5.2, the Central Okanagan has an estimated 39 million tonnes of sand and gravel reserve including private industry and MOTH pits. At all of the projected growth rates, there is a potential shortfall of aggregate supply. At a growth rate of 1.5%, a shortfall of 14 million tonnes is projected. A growth rate of 2.5% would result in a shortfall of 20 million tonnes. At an estimated growth rate of 3.5%, the projected shortfall would be 26 million tonnes.

As sand and gravel resources currently permitted do not meet anticipated demand, either more extraction areas will need to be permitted, or the reliance on quarried rock sources will increase. The US Geological Survey estimates the production costs for quarried crush material are 25 to 30 percent higher than natural sand and gravel deposits (Zora, 1995). Therefore, reliance on quarried crushed rock for aggregate requirements would lead to increased construction costs.

6.2.2 Growth Centres

Using the number of additional single family units, multi-family units, and commercial space projected in current OCPs, the primary markets for aggregate products can be identified. As illustrated in the following chart, the central growth areas for single family dwellings should occur in southwest Mission, Lakeview Heights, Black Mountain, Westbank and Glenmore. The greatest number of multi-family dwellings will occur in Central Kelowna, the Mission, Rutland and Glenmore. The greatest increase in commercial space is anticipated to occur in Kelowna.

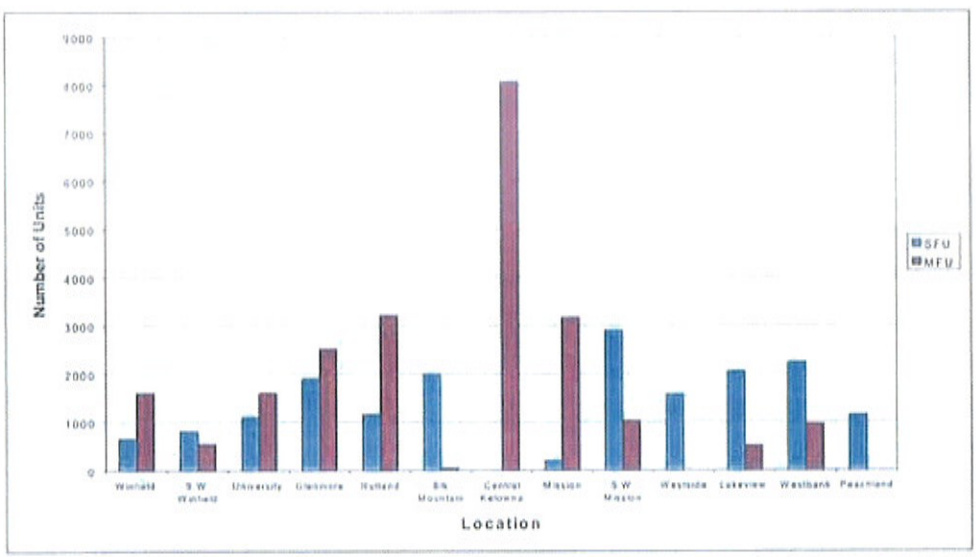

Chart 6: Projections of Housing Construction to 2020 (Source: current OCPs))

It is estimated that approximately 300 metric tonnes of aggregate is required to build an average 150 sq. m. (1615 sq. ft.) new home, taking into consideration its proportional share of schools, roads churches, and shopping centers (Langer, 1995). Using this number, and an estimated 120 metric tonnes per multi-family unit, we can estimate the demand of aggregate for new construction. Below is a chart of projected demand by area for new construction only.

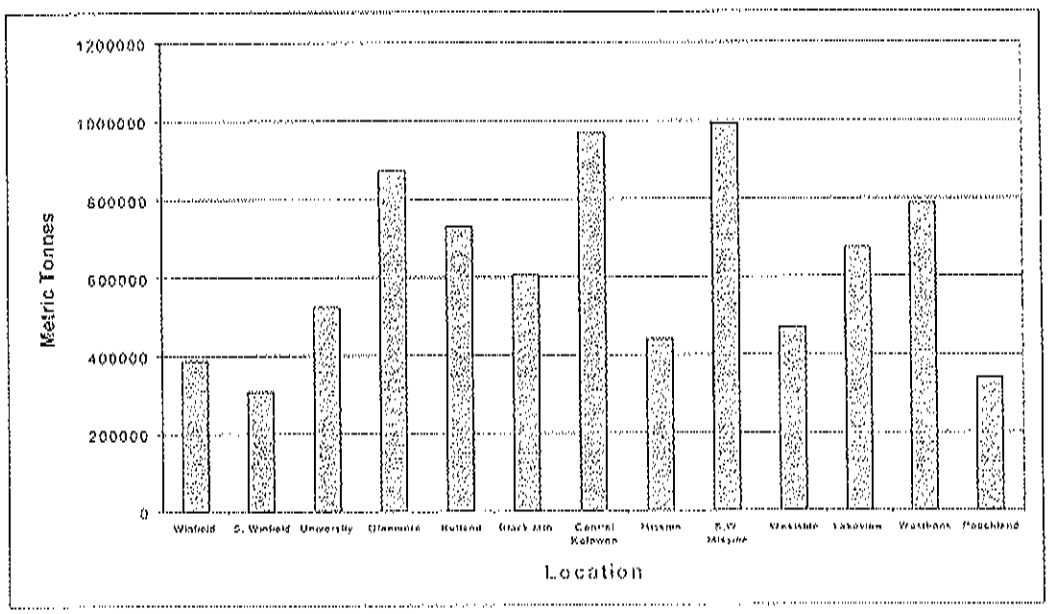

Chart 7: Aggregate Demand for New Construction to 2020

6.2.3 Aggregate Use in the Community

Aggregate products combined represent the largest non-fuel commodities produced in North America by weight (Poulin, 1995). In Western Canada, the use of sand and gravel products is broken down in the following manner, based on 1993 figures (Irvine *et. al.*, 1995):

- Road bed and surfacing (60%);
- Concrete aggregate (13%);
- Asphalt aggregate (7%);
- Fill material (6%); and
- Miscellaneous uses such as railway ballast, ice control, mortar sand, & backfill (14%).

Based on the above figures, road construction and maintenance accounts for approximately 70% or more of sand and gravel use. In 1998, the City of Kelowna utilized approximately 103,000 tonnes of aggregate materials for in-house road construction and maintenance. This figure represents approximately 5 % of the annual consumption in the District, and is relatively small with respect to the total figure. However this does not include figures for road construction that has been done by contractors.

	Per Annum (2.9 Million Tonnes per Annum)	20 Years (59 Million Tonnes)
Road Beds	1,740,000	35,400,000
Asphalt	203,000	4,130,000
Concrete	377,000	7,670,000
Fill Material	174,000	3,540,000
Miscellaneous	406,000	8,260,000

Table 3: Projected Demand Based on a 2.5% Population Growth

The above chart outlines the relative proportion of aggregate required within the Central Okanagan over the next 20 years for different applications. The projections are based on a growth rate of 2.5%.

Results from the producer surveys indicate that natural sands and gravels (including pit run, washed and screened products) together comprise almost 60% of aggregates sold in the Central Okanagan. Crushed rock comprises 35%, and topsoil and other miscellaneous products 5% of the total aggregate sold.

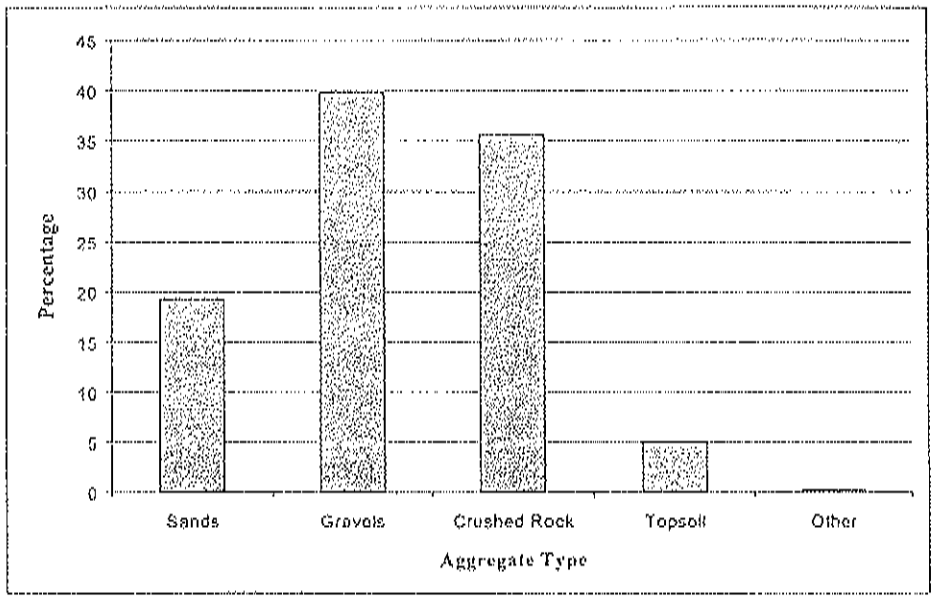

Chart 8: Relative Proportions of Products Sold

6.2.4 Resource Utilization

In addition to the base inventory, other factors affecting supply were assessed. This includes a discussion of specification requirements, recycling, the use of quarried bedrock, waste utilization and alternative sources such as dredging of watercourses.

6.2.4.1 Specification Requirements

The current reserve of natural aggregate, based on existing permits, is apparently insufficient for the 20-year horizon indicated by the producer survey and projected demand figures. The life of the reserves is, to some extent, dependent upon the particle size distribution within each operating pit. It is not uncommon to find an excess of fines or sand fraction and insufficient coarse material for producing the required crushed aggregate for asphalt or concrete. The operator is often faced with having to tailor his production to satisfy markets that may result in overproduction of waste or fine sands. Sands and fines may be used in some cases for backfill and landscaping applications such as for golf courses.

Some discussion regarding the use of higher quality (cost) road bed base material for highway construction is warranted. Higher quality materials, those with a high fracture content, normally allow a reduction in the total thickness of the pavement structure. The use of higher quality material can reduce the cost of the project, by reducing the overall quantity of aggregate required and subsequent hauling costs. The net consumption of the resource would be reduced in this case, and if applied systematically, would extend the life of some aggregate supply operations.

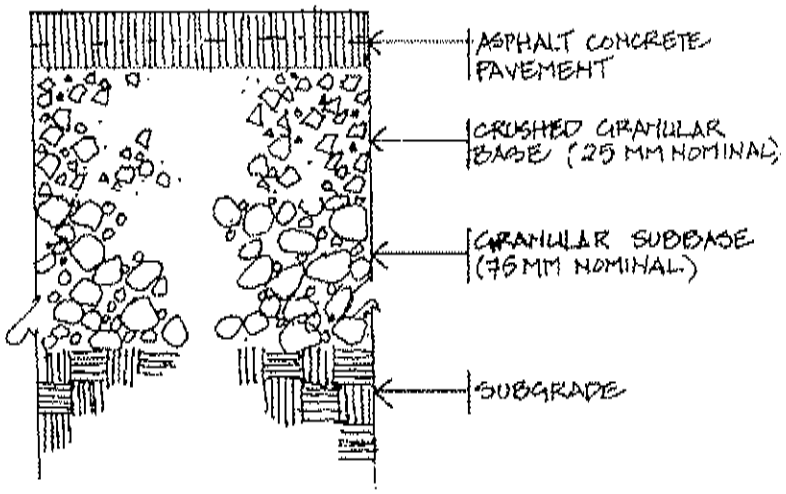

Figure 8: Illustration of a Flexible Pavement Structure

6.2.4.2 Recycling

There has been a sustained effort to recycle asphalt and concrete for paving and concrete applications. This could add a small amount of reserve to the conventional reserve. Within British Columbia, motivation to improve recycling efforts has come from the provincial goal of reducing solid waste being deposited in landfills by 50% per capita (of 1991 levels) by the year 2000 (Consedine, 1995).

Benefits to the encouragement of aggregate recycling include:

- improved resource recovery;
- reduced reliance on existing reserves;
- reduced pressure on landfill requirements; and
- reduced potential site contamination.

Local recycling operations have resulted in an annual reduction of more than 37,000 tonnes of waste aggregate deposited at the City of Kelowna landfill (Consedine, 1995). Following a 1993 ban by the RDCO and the City of Kelowna on the disposal of asphalt (Swanson, 1996), no significant quantities have been accepted at the City of Kelowna landfill between 1998-99. The city landfill did accept approximately 1,166 tonnes of concrete in 1998 and approximately 2,000 tonnes in 1999 (A. Newcombe, pers. comm., 1999). The Regional District and the City of Kelowna charge $150/tonne for the disposal of concrete or asphalt at their landfills. The Districts of Lake Country and Peachland do not operate landfills, but use those operated by the City and Regional District. Local producers accept both asphalt and concrete at their pits at a cost ranging from $2.00 to $20.00 per tonne. Disposal of concrete and asphalt is permitted on private sites that do not provide recycling services. This represents a loss of aggregate resource and possible site contamination concerns. The quantity of this loss is not known.

Based on producer's surveys, the volume of aggregate presently derived from recycled products is relatively low, approximately 8% of the total annual aggregate supplied. Producers believe this could be substantially increased. The current volume of recycled aggregate product (1998) includes:

- asphalt: 161,300 tonne; and
- concrete: 155,400 tonne.

The recycled aggregate products are available in a variety of sizes and can be used for:

- road sub-base material;
- structural fill;
- embankment fill (highways);
- ditch lining;
- landscaping;
- drainage; and
- sport field applications.

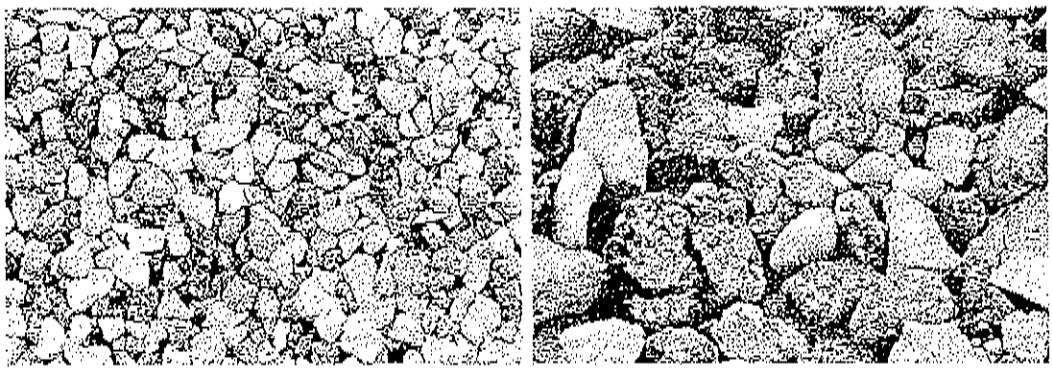

Photo 8: Recycled Asphalt after Primary / Secondary Processing

The construction industry has been innovative in developing ways to use salvaged materials in new construction. Portable crushers used to recycle asphalt and concrete products are available locally. Hot, in-place asphalt recycling machines pull up, grind, heat and re-apply the asphalt all in one application. This technique of road surfacing is only suitable for certain applications.

Other jurisdictions have had success with recycling initiatives. Recycling materials from demolished buildings was implemented in Port Coquitlam, where the concrete from three warehouses was recycled and reused on site for road base and fill material. Cost savings were realized by reducing the quantity of imported material and trucking costs required (Swanson, 1996). The City of Edmonton's recycling program led to reduced concrete and asphalt disposal over a 15-year period. This allowed the city to extend the life of its landfill for one year. In 1995, Edmonton produced and used 180,000 tonnes of recycled material at a cost of $5.65 per tonne (Swanson, 1995).

The City of Regina has a program that utilizes recycled concrete and asphalt concrete (City of Regina, 1999). The crushed concrete is used for:

- base course for roads; and
- backfill for water and sewer trenches.

The asphalt concrete is used for:

- backfill for sewer trenches; and
- surface material in alleys and parking lots.

6.2.4.3 Quarried Bedrock

A potential source of aggregate to meet the requirements for the next 20 years is quarried bedrock. To identify this resource, mapping was completed that identified bedrock groups and their respective potential for aggregate use (See Map 4).

The rock groups that have high potential for aggregate use are:

- Paleozoic - Monashee Gneiss (upper plateaus east of Okanagan Lake);
- Mesozoic - Nelson Plutonic Granodiorite and Granite (Trepanier Creek and Ellison);
- Cenozoic - Okanagan Gneiss (upper plateaus east of Okanagan Lake); and
- Plateau Basalt (upper elevations of the Regional District).

There are cost and neighbourhood issues associated with the use of quarried bedrock for aggregate products, as compared to the use of natural gravel sources. The production costs of crushed quarried aggregate are estimated to be 25 to 30 percent higher than natural gravel deposits (Zora, 1995). In addition, the blasting associated with quarries may present additional noise concerns for neighbours.

6.2.4.4 Alternative Aggregate Sources - Dredging

A source of additional gravel may exist in the shelving extension of the fans beneath the surface of Okanagan Lake, formed by the larger creeks such as Mission Creek. However, underwater dredging has potential to trigger large scale underwater slumping. The steep profiles of the sides of the lake floor suggest that this potential may exist naturally since the Okanagan Valley is seismically active. Any change to the stability of the system could aggravate the natural risk. An underwater slump could produce catastrophic waves large enough to cause damage to lakefront property. In addition, environmental considerations such as the potential damage to lakeshore spawning habitat and siltation due to underwater excavation also pose a constraint to this form of aggregate extraction.

In consideration of the geophysical hazards and environmental concerns present, dredging is not considered a viable option for aggregate production in the Central Okanagan.

6.2.4.5 Quality of Sand and Gravel – Processing

In order to produce aggregates with acceptable physical parameters for construction specifications, such as size and shape, most natural deposits require some level of processing. For example, the granular composition of a product coming from a bank deposit may not be ideal for use in concrete, asphalt, or as structural fill.

Limitations to the utilization of aggregate in the Central Okanagan include:

- high percentage of silt in some deposits;
- high percentage of sand in some deposits; and the
- presence of volcanic particles in some deposits.

Primary processing operations used at both sand and gravel, and rock quarrying operations may include:

- washing;
- screening; and
- crushing.

The MEM regards this primary processing as integral part of gravel and quarry operations. This allows a pit run material to be upgraded into specific rock and aggregate sizes to meet market specifications. Some small operators may operate only screening equipment, offering a limited selection of products to the market. Larger operators generally wash, screen and crush the gravel in order to supply a broad range of products to the market.

6.2.4.6 Waste Utilization – Silts and Clays

The reclamation of aggregate extraction sites is affected by the need to reposition waste (typically clay fines) and overburden. Excess fine fraction material has potential for being used in the production of growing medium, an artificial soil, when mixed with saw dust and/or bio-solids from sewage plant operations. This growing medium can then be used in the closure of the pit operation to return the surface to a usable condition that supports plant growth. Heavy metal contamination, sometimes encountered with bio-solids, could be remediated with low cost, locally available zeolites. Bulk, crushed zeolites, quarried from some of the younger volcanic rocks between Kamloops and Vernon, can be used to absorb the heavy metals and release them sufficiently slowly to allow edible crops to be grown on the soil. Soil produced in this manner is an additional product for an aggregate operation and reduces the amount of waste to handle during the final reclamation of the pit.

6.2.4.7 Landscape Rock and Brick

A number of quarries are present in the Central Okanagan that supply products such as landscape rock, bentonite clays, zeolites, and dimension stone. The market conditions and permitting process for these products differs from that of aggregate products and operations. However, the neighbourhood concerns of noise, dust and traffic are similar to those of natural gravel extraction operations.

The materials mined from these quarries are used for a variety of purposes. Landscape rock, also called 'decorator rock', is used as mulch around shrubs and trees in lieu of grass or other herbaceous ground cover. Bentonite clays are used to make clay liners for sewage lagoons and detention ponds. Zeolites are absorbent minerals used for soil enhancement, oil spill kits and cat litter. Dimension stone is rock that is cut into blocks or slabs and used in architectural applications such as rock walls, exterior facing for buildings, or headstones. Quarries at KLO Creek and in the Mission area produce dimension stone. A quarry operation in Oyama produces "Oyama Shale" for landscape purposes.

The regulatory process for these products requires the operator to stake a mining claim prior to extraction. The criteria that determines if a mining claim needs to be staked or not is dependant on the intended use of the product, rather than physical characteristics of the rock. That is, if a quarry produces crushed stone for a construction purpose such as road base, concrete or asphalt production, a mining claim is not required. If the same rock is cut and used for dimension stone or landscape rock, then a mining claim is required. (See Section 9.1.2 for further information.)

The market for products such as landscape rock and dimension stone is primarily within the Central Okanagan. However, they may be shipped up to 450 km to market, according to our producer survey. The demand for these products is influenced by population growth, but is more sensitive to architectural trends than construction aggregate products. As such, it is more difficult to accurately assess the demand over 20 years. However, it is anticipated that these quarries have adequate reserves to supply requirements over the next 20 years.

Neighbourhood issues of noise from blasting and loading, dust, and traffic, apply to these quarry operations in a similar way to that of aggregate operations.

Presently there are no brick production facilities in the Central Okanagan. Should the market for brick arise, the best places for mining clays are the Glenmore Valley and the North Rutland area.

7.0 INDUSTRY

An analysis was prepared of the overall market framework in which the aggregate industry operates. This included an assessment with respect to transportation issues, infrastructure impacts, product use, and future trends for the industry. The analysis was based on discussions with local and provincial government representatives, published literature, and industry standard specifications.

7.1 Transportation

Transportation route information was taken from the producer surveys and local truck route maps. (See Map 3.) Aggregate is hauled from pit to market via local roads and designated truck routes. Transportation routes often go through residential areas. (See Section 10.0 for discussion on specific resource areas.) The responsibility for road maintenance varies within the District. The Ministry of Transportation and Highways (MOTH) maintains Highway 97 and all of the rural roads within the Regional District jurisdiction. MOTH requires all loads on provincial roads to be covered.

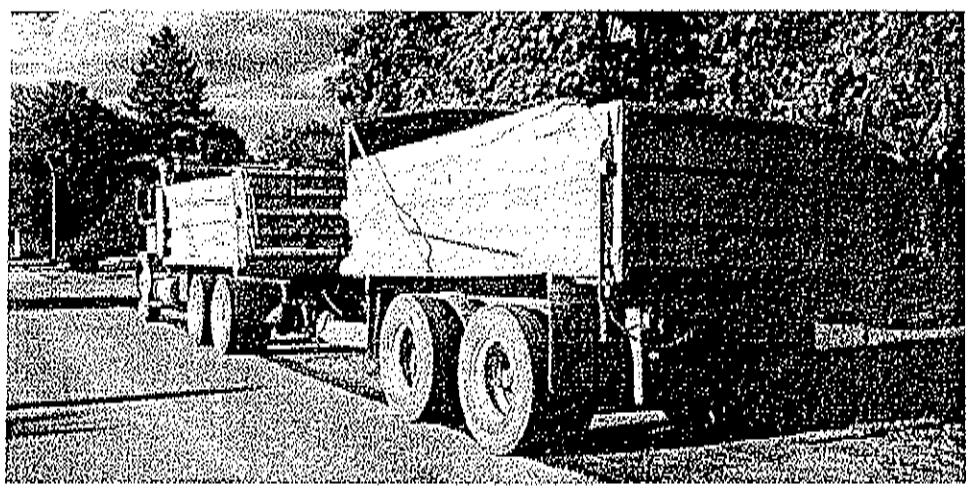

Photo 9: Aggregate Truck and Pup

The following table outlines the roads most commonly used for the transport of aggregate and the government responsible for maintenance. Note that the City of Kelowna assumes responsibility of all rural roads within City boundaries on May 9, 2001.

Area	Road	Jurisdiction
Regional District Wide	Highway 97	MOTH
	Highway 33	MOTH
	Highway 5-C	MOTH
Lake Country	Oyama Road	Lake Country
	Sawmill Road	Lake Country
	Okanagan Centre Road	Lake Country
	Beaver Lake Road	Lake Country
	Glenmore Road North	Lake Country
Ellison	Old Vernon Road	MOTH
Kelowna	Glenmore Road S. (to Scenic Road)	City of Kelowna
	Glenmore Road N. (past Scenic Road)	MOTH
	High Road	City of Kelowna
	Cawston Road	City of Kelowna
	Gordon Road	City of Kelowna
	Spall Road	City of Kelowna
	Springfield Road	City of Kelowna
	Benvoulin Road	City of Kelowna
	K.L.O. Road	City of Kelowna
	Lakeshore Road N. (to Renwick Court)	City of Kelowna
	Lakeshore Road S. (past Renwick Court)	MOTH
	McCulloch Road	MOTH
	Stewart Road West	MOTH
	Stewart Road East	MOTH
	Chute Lake Road N. (to Kettle Valley)	City of Kelowna
	Chute Lake Road S. (past Kettle Valley)	MOTH
Westside	Westside Road	MOTH
Lakeview Heights	Boucherie Road	MOTH
	Westlake Road	MOTH
Westbank	Shannon Lake Road	MOTH
	Elliot Road	MOTH
	Gellatly Road	MOTH
	Glenrosa Road	MOTH
Peachland	Trepanier Bench Road	District of Peachland
	Princeton Avenue	District of Peachland

Table 4: Common Aggregate Haul Routes Within The Central Okanagan

7.2 Infrastructure Impacts

As part of the assessment an evaluation of impacts to infrastructure systems, such as road pavements, was undertaken. The following section illustrates the behavior of pavement structures using empirical data from the City of Kelowna Pavement Management System (D. Carate, pers. comm., 2000). In addition, a hypothetical scenario was developed using industry standards to illustrate the potential impacts resulting from hauling aggregate.

Photo 10: Road Resurfacing in Conjunction with Sewer Upgrade

The behavior of asphalt pavement infrastructure is dependent upon:

- the quality of the initial design and construction including surface drainage;
- climatic conditions;
- adequacy of the supporting embankment; and
- traffic.

On the premise that the first three factors have been competently addressed during the design and construction phase, the service life of a pavement structure is predominantly influenced thereafter by the traffic that utilizes the pavement. For the following discussion, it is presumed that normal maintenance practices will exist throughout the service life of the pavement.

Passenger cars, light duty pick-up trucks and vans cause relatively minor distress to competent pavements. Heavy trucks and buses do influence pavement performance. Deterioration curves illustrate the impacts of traffic on roads. Many rural road pavements were placed to eliminate dust and to fulfill commitments made by elected representatives. The following chart illustrates the deterioration of a local rural road under current traffic conditions. This example is taken from the City of Kelowna's Infrastructure Management System for Casorso Road (D. Carate, pers. comm., 2000).

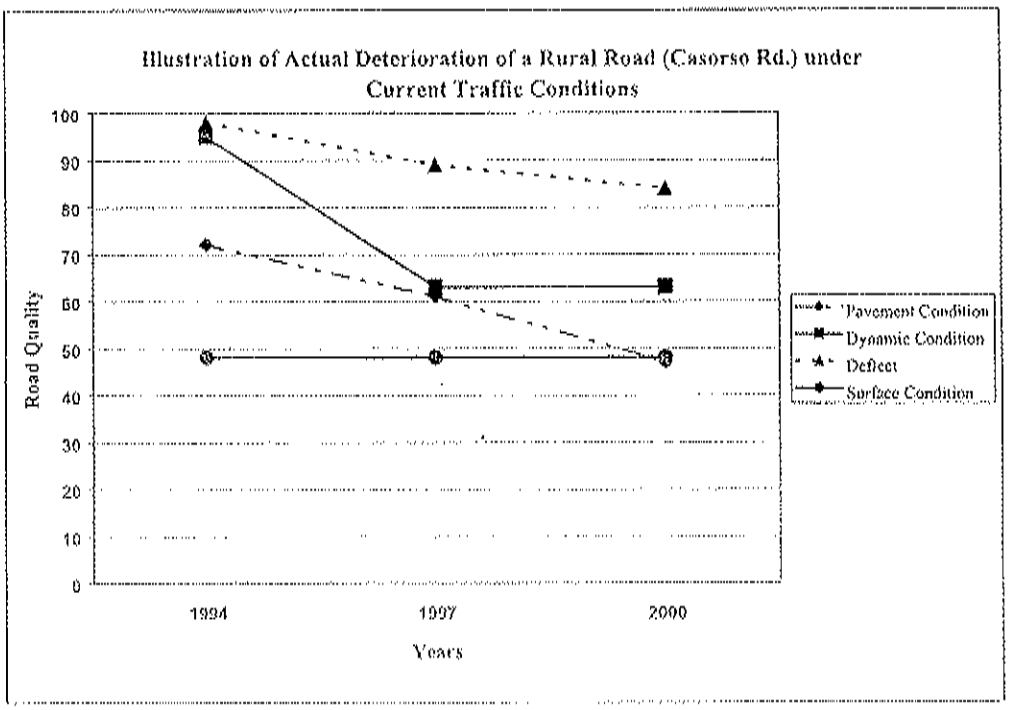

Chart 9: Deterioration Curve of Rural Road (Casorso Rd.) under Current Traffic Conditions (D. Carate, 2000)

Fortunately, asphalt paving technologists have developed design methods to accommodate heavy truck traffic. However, the available design methods require that a reasonably accurate prediction be made of the volume of heavy trucks to be accommodated in the design period. The following chart illustrates the deterioration of a well designed arterial road with that of a rural road over the same time frame. This is based on current traffic volumes with an assumed 2% increase of volume per year (D.Carate, pers. comm., 2000).

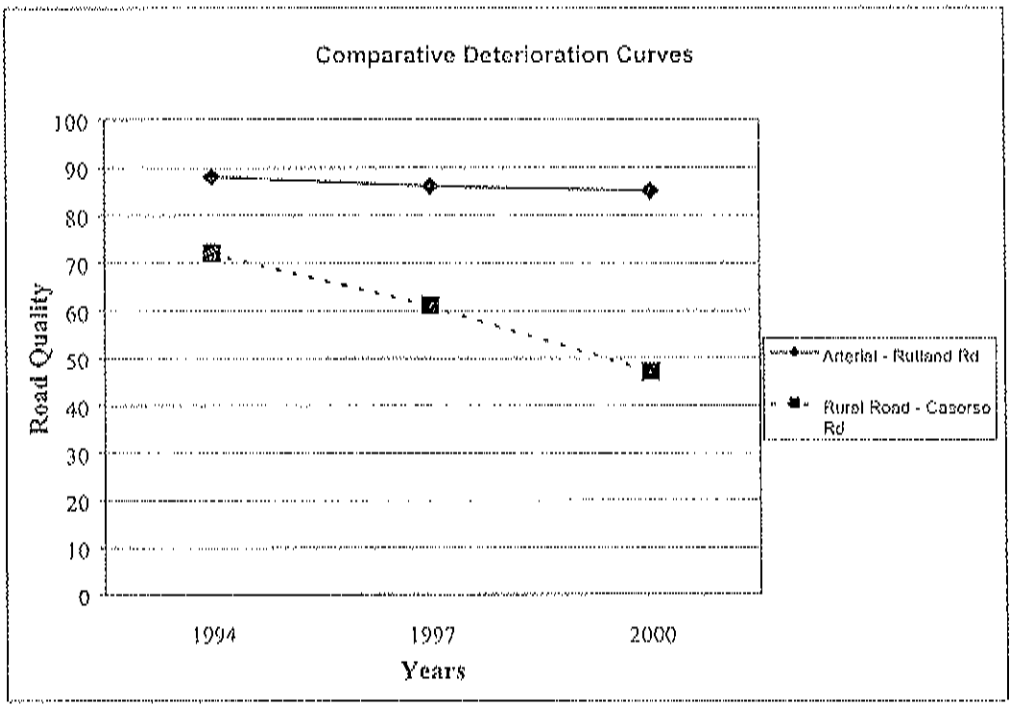

Chart 10: Comparative Deterioration Curves

Another related pavement issue is that, if highway pavements are not adequately designed and constructed in the first instance, then optimum value is not obtained from the aggregate resource. Waste occurs through premature reconstruction. It would be an advantage to the aggregate operation for the roads to be upgraded prior to, or in the initial stages of the life of a pit or quarry. By upgrading the road prior to hauling, efficiencies with respect to time of travel and maintenance of vehicles would be realized to the operation.

Pavement design engineers have developed the term "equivalent single axle load" (ESAL) as a means of standardizing truck or tractor-trailer configurations for traffic estimating purposes. Some highway agencies maintain very detailed records of axle loads/configurations through data collected at their weigh scale sites. Other agencies, including those in British Columbia, appear to have less detailed information. By definition, one ESAL is 18,000 lb (8167 kg) on a single axle with dual tires, or 32,000 lb (14,500 kg) on a tandem-dual configured axle. In British Columbia, a maximum of 37,500 lb (17,000 kg) is permitted on a tandem axle.

The physical result of overloading a truck is increased wear and tear on the pavement structure. This increases exponentially as the overload increases. As a result of overloading, the number of ESALs generated increases. Using the 'fourth power' rule developed by technologists, the allowable axle load in British Columbia produces $(17{,}000 / 14{,}500)^4$ kg , or 1.9 ESALs. Therefore, a legally loaded tandem axle truck, typical of the type used for hauling granular

products, produces approximately 2.5 ESALs, when the steering axle is included. If the tandem axle was overloaded by 1000 kg, the corresponding ESALs produced increases to $(18,000 / 14,500)^4$ kg, or 2.9 ESALs, including the steering axle. This represents a 26% increase of equivalent single axle load. The importance of policing truck haul operators is demonstrated by these statistics.

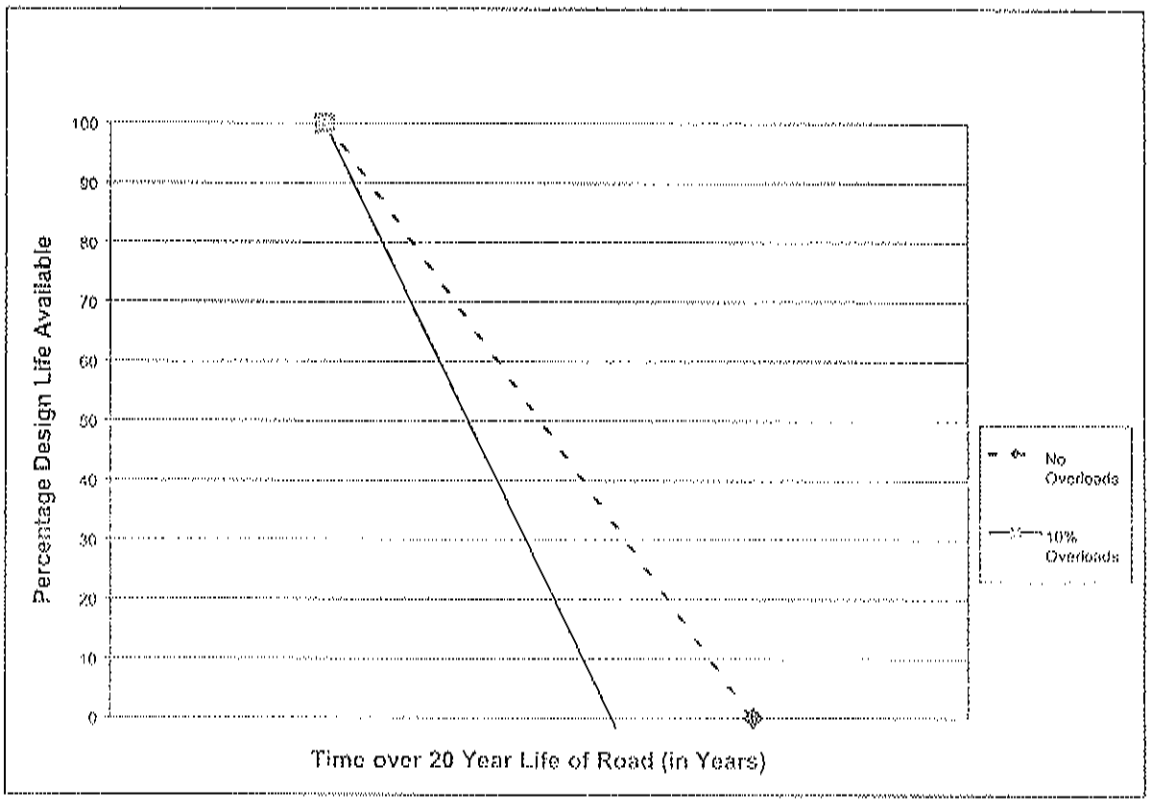

Chart 11: Impact of Overloading on Rural Roads

The illustration in Chart 11 demonstrates how approximately 25 percent of the original design life of a pavement structure can be lost by permitting trucks to operate with 10 percent overload of the gross vehicle weight. The example is based on a pavement design life of 20 years, an original design number of 300,000 ESALs, and an equivalent number of tandem trucks at legal limit of 125,000. The number of ESALs produced by the overloading is 362,000.

Of significance to the current study is the impact that a long term, continuous hauling operation from an aggregate or quarry source would have on an existing pavement structure. For the purposes of this assessment, the effect of hauling 1,000,000 tonnes of aggregate over three different pavement structures was analyzed. Using a conversion factor of 1.6 tonnes = 1 cubic metre, this would equal approximately 625,000 cubic metres of material, requiring approximately 87,000 trucks. It is projected that approximately 225,000 ESALs would be generated in this manner. The question becomes: if the subject pavement had been designed for a twenty year initial service life (*ie.* before planned rehabilitation was necessary) but had not been designed to accommodate a gravel hauling operation - how significantly is the pavement's service life jeopardized by that operation?

Pavement design methodology published by the American Association of State Highway and Transportation Officials (AASHTO) has been used for the following analysis. Road type pavement structure specifications are taken from the Ministry of Transportation and Highways *Pavement Design Standards -- Technical Circular T – 9/95.* (See Appendix E.) A subgrade of weak to average support quality has been used in the illustration that follows.

Pavement Layer	Type 'A'	Type 'B'	Type 'C'
Asphalt Pavement	100 mm	75 mm	50 mm
Crushed Gravel Base	300 mm	300 mm	225 mm
Granular Sub-base	300 mm	300 mm	0 mm
Allowable ESALs	5,000,000	2,800,000	60,000
Life Used by 1,000,000 tonnes	4.5%	8.0%	100% +*

* Terminal serviceability in approximately three years.

Table 5 : Example of the Effects of 1,000,000 Tonnes of Gravel Hauled Over Three Different Pavement Structures

Relatively minor damage results from the transport of granular materials when an arterial level pavement structure, Type A or Type B, exists. At the other extreme are rural roads originally paved to accommodate passenger vehicles and to eliminate dust. Very light pavement structures were constructed in some cases. These have little potential to survive a continued commercial hauling operation of any kind, as illustrated above.

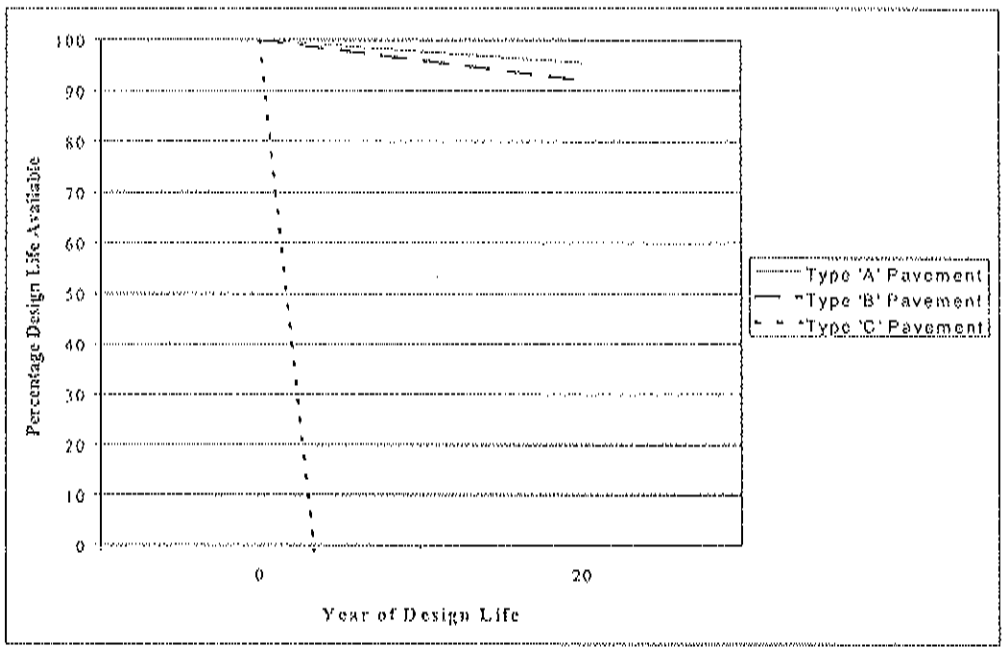

Chart 12: Life Consumed by 1,000,000 Tonnes Aggregate Hauled Over 3 Different Pavement Structures

The foregoing commentary is generalized to illustrate the issues of concern with regard to truck haul. Factors such as surface drainage, roadway cross section and truck speed have influence on pavement performance, but cannot be precisely factored into such an example.

An assessment of the current structural quality of haul roads, correlated with the anticipated loads over time, would be beneficial for inclusion in an infrastructure master plan for the region.

7.3 Economic Framework

The economic assessment was developed from data collected from the producer's surveys, current price lists, and published data. Within the Central Okanagan, the aggregate industry generates revenues of between $12 and $20 million annually. Hauling costs are estimated to add an additional $5 million to this number.

Transportation represents a large portion of the cost of aggregate products. As such, sand and gravel operations are generally located near the market centers. Data from the producer surveys suggest that, within the Central Okanagan, an average of 12 km from origin to market is the distance for which it is economical to supply aggregate. This compares with a figure of 50 km from origin to market in the lower mainland (Hora, 1995). Transportation can increase the cost of aggregate anywhere from 40 to 100%. Within the Okanagan, transportation costs are between 25 - 40% of the total cost of aggregate. In the Lower Mainland, transportation costs can increase the cost of aggregate by 100%.

In British Columbia, the transport of aggregate by rail is considered prohibitive due to handling costs (Karrow, 1998). However, as the density of urbanization increases and supplies deplete, aggregate transport by rail becomes more economical, as seen in the Western United States (Holmes, 1998).

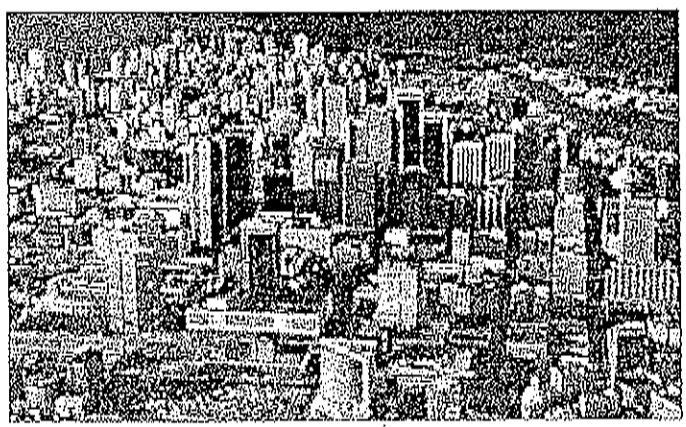

Photo 11: Urban Core, Vancouver

Costs for sand and gravel products rise with increased urbanization. Vancouver area consumers pay approximately 85% more for their aggregate products than consumers in the Okanagan. The difference is partly due to increased transportation costs, as the reserves are pushed further away due to resource depletion and sterilization. Survey results in the lower mainland have revealed that the maximum competitive distance for trucking aggregate is 50 km, while the maximum competitive distance for barging is 150 km (Hora, 1995). The cost difference is also due to the trend within larger centers to have fewer, larger gravel extraction operations, rather than the many smaller pits that is common in the Interior. As the number of operations decreases, the lack of competition can cause prices to rise.

The Lower Mainland requires 20 – 24 million tonnes of aggregate annually for construction, with some estimates as high as 30 million tonnes. This figure includes fill and backfill material. The material is brought in from the following locations:

- Coastal pits on tidewater – 8 million tonnes / year
- North side of the Fraser River – 4 million tonnes / year
- Matsqui / Abbotsford and Chilliwack – 4 million tonnes / year
- Fraser River – 4 million tonnes / year (incl. 3 million tonnes of dredged sand)
- Quarries on Texada – 1 million tonnes / year
- United States – 1 million tonnes / year

Costs of production varies between these sources. For example, aggregate from coastal pits incorporates the costs of barging anywhere from 50 to 150 km, as well as off-loading and hauling costs to market once on shore. Sources on the north side of the Fraser River have overburden ratios up to 4 times the amount of aggregate, and the costs of removing and relocating this waste is reflected in increased cost. Quarries have the additional costs of blasting and increased crushing as compared to natural aggregate sources (Irvine, 1995). The US Geological Survey has published data which suggests that the production costs of crushed quarried aggregate are 25 to 30 percent higher than naturally occurring gravel (Zora, 1995).

The following chart provides an illustration of comparative prices between the Okanagan, Port Coquitlam, and the Vancouver area. As indicated in the chart, prices for aggregate in the Okanagan are anywhere from $2.00 to $9.00 per tonne less expensive than their counterparts in the Lower Mainland. Prices in Vancouver are highest. Vancouver is a net importer of aggregate. Most of the aggregate for Vancouver is supplied by coastal pits such as that in Sechelt, or trucked in from adjacent municipalities. Additional costs reflect the cost of barging and off-loading, or trucking into the area and stockpiling for further delivery. For example, the price for pit run material in Vancouver is more than double the price of the same material in the Okanagan or Port Coquitlam. This price has already incorporated barging and / or hauling costs to a stockpile facility, but doesn't include the costs required for hauling it from the facility to the final site. Prices for washed and crushed material are significantly higher in Port Coquitlam than the Okanagan. This may reflect differences in the nature of the deposit. For example, the product may require more washing and / or crushing in Port Coquitlam than the Okanagan due to the original particle size, or the amount of overburden present.

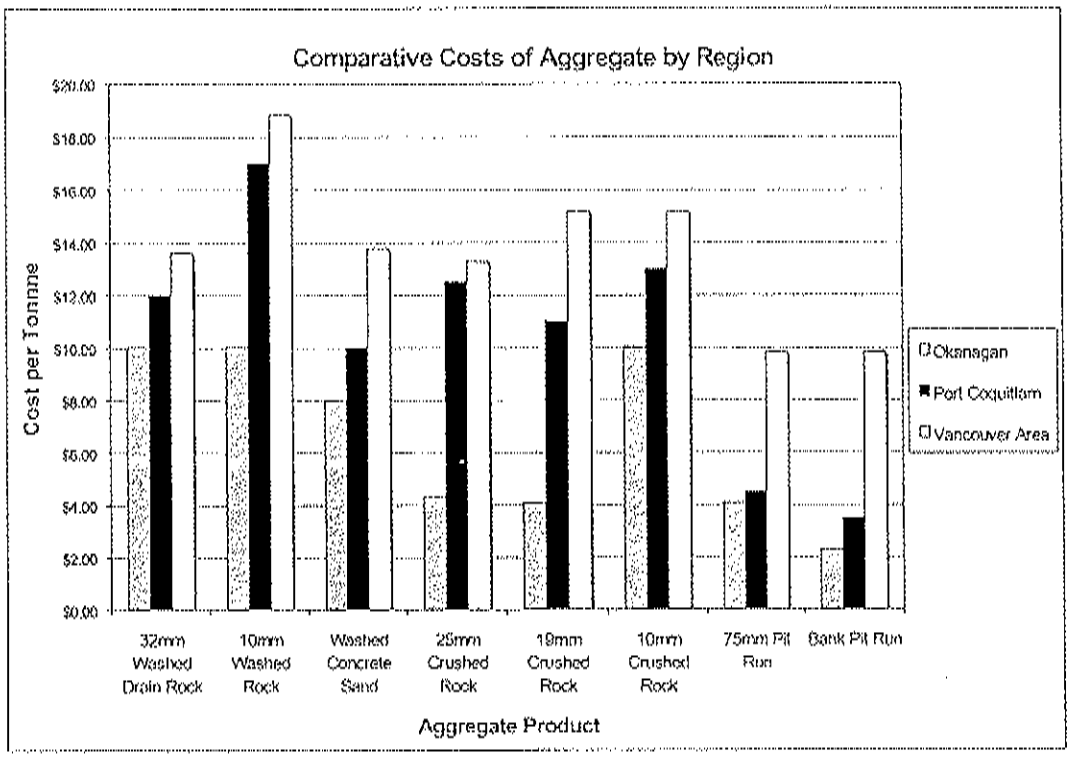

Chart 13: Comparative Costs of Aggregate by Region

7.4 Future Trends for the Industry

With increased urbanization, cities on the West Coast of North America are facing depletion of aggregate reserves within one or two decades (Holmes, 1998). The effects of resource depletion, sterilization of resource through land use conflict, and increased requirements regarding environmental protection and reclamation, have generated a number of industry trends to accommodate the shortages. These include:

- water transport through barging;
- rail transport from distant sources;
- consolidation of operations, with the larger operators buying smaller operations to achieve a greater economy of scale;
- permitting of smaller and / or lower quality resources which had previously been uneconomical to utilize;
- increase in product recycling;
- increasing quality through technology (e.g. impact crushers);

- increasing distance from supply to market; and an
- increasing reliance on quarried crush materials.

As cities grow and go farther afield for their aggregate requirements, the industry tends to become regional in scope rather than local. For example, cities of the West Coast States have started to import aggregate from British Columbia and Alaska (Holmes, 1998).

8.0 COMMUNITY

The extraction of aggregate effects the surrounding community. This section provides a discussion regarding the issues of public safety, radon, the environment, and neighbourhood issues such as dust, traffic and noise.

8.1 Public Safety

The injury risk to neighbouring populations is related to the potential for trespass in aggregate operations. Youth, in particular, are drawn to the open terrain and mounds of sands and gravels in pits. A number of accidents, and even deaths, have occurred in British Columbia as a result of trespassing. One such incident occurred in a Westside pit, when an All Terrain Vehicle driven by a youth overturned, and he was pinned and suffocated (Capital News, 1999).

Safety on all pits and mines is regulated by the Ministry of Energy and Mines through the *Mines Act* (RSBC, 1996) and the *Health, Safety and Reclamation Code for Mines in British Columbia* (Province of British Columbia, 1997). Permits include requirements for safety elements such as fencing, gates and signage. The MEM is the only legal authority to inspect for health and safety. Bylaw enforcement officers can only go onto the mine site with the consent of the Mine Manager appointed under the *Mines Act* (RSBC, 1996).

Aggregate corporations in the Lower Mainland have implemented public relations programs that incorporate site tours and public information sessions as part of their safety programs.

8.2 Radon

Interest has been generated regarding radon and its potential as a health concern. This section outlines what radon is, where it comes from, and how it relates to the aggregate industry.

Radon is a radioactive gas that is released from uranium as it decays. As radon decays, it emits alpha particles. Alpha particles are damaging if in contact with human tissue but are stopped by 2.5 cm of air or a piece of paper. That is, they are not a very strong form of radiation.

Generally speaking, all waters draining over the gneisses in the Central Okanagan have the potential to carry a very small amount of uranium. The most likely places to find uranium are in the gravels of depressions within old river channels. These may not correspond to today's river channels but may underlie some of the sand and gravel deposits that have potential for aggregate production, particularly in the Hydraulic Lake area.

Gravel deposits are not generally tested for radon at the time of extraction. Typical gravel deposits are so permeable that radon will easily pass through.

The risk of finding uranium mineralization in younger, recent outwash gravels, such as those near our urban centers, is minimal. The radon risk is similarly small. Normal gravels would not retain radon except in fractures in the pebbles in the minutest of amounts. It is anticipated that this would not cause any release of radon in measurable amounts, even when crushed.

Open pit extraction of gravel is unlikely to generate detectable amounts of radon in the working environment. However, there may be potential for radon to build up in structures over former gravel pits. The British Columbia Building Code sets standards for the provision of clean granular fill under slabs for buildings where radon has been detected (Province of BC, 1992).

8.3 Neighborhood Issues

The principal neighbourhood issues related to aggregate operations are noise, dust, traffic, and visual impact. This section addresses each of these issues in turn.

8.3.1 Noise

Noise concerns may arise within the area of an extraction pit. These concerns are generally accentuated if the pit is near a residential neighbourhood. Noise within the pit is created by the processing operations of loading, screening and crushing. The use of unmuffled bulldozers and other earth-moving equipment is a primary source of site noise. Some control of sound is possible by the use of mufflers and sound shielding. Truck traffic to and from the site is also a concern. This can also be mitigated with the use of muffled equipment. There is a cost associated with this equipment. Another method to reduce sound is the use of berms and landforms to interrupt the travel of sound. This method of sound control is best implemented at the site design stage, and may be used for visual impact reduction as well as sound control. Noise control bylaws are in place in each of the local jurisdictions. (See Section 9.9.6)

8.3.2 Vibration

Vibration resulting from aggregate extraction operations may be a concern to neighbours. Generally complaints result from the annoyance of such vibrations, rather than actual structural damage. Vibration may be caused by heavy trucks or machinery, or blasting. The *Reclamation and Environmental Protection Handbook for Sand, Gravel and Quarry Operations in British Columbia* (MEM, 1995) outlines techniques for mitigating vibration. These include:

- pave and / or regularly grade roads that pass close to buildings on haul routes;
- minimize vehicle speeds along haul routes; and
- implement vibration reducing blasting methods.

8.3.3 Traffic

Traffic along local roads can be a concern to neighbours. Issues of traffic noise and perceived safety are a factor in this regard. Hours of operation are regulated by local noise control bylaws. Traffic safety is regulated by speed limit designation and licensing. Accommodation for truck routes and safe pedestrian passage should be made in regional traffic plans.

8.3.4 Visual Quality Impacts

Aggregate operations can have a significant impact on the visual quality of the neighbourhood and overall landscape of the community. While visual quality is a subjective concept, there are generally accepted principles that guide visual quality assessments. It is generally accepted that the removal of vegetation and natural landscape features, obstruction of views due to stockpiles, and the presence of machinery present impacts to visual quality. Impacts can be separated into those that effect the immediate neighbourhood, and those landscape level visual impacts visible from across the valley or across town. Aggregate operations on middle or upper level slopes are susceptible to the latter form of visual impact.

Neighbourhood impacts may be mitigated with vegetation buffers and berms at the perimeter of the pit. Impacts of a landscape nature need to be addressed on a landscape level. This includes visual impact mitigation planning at the initial stages of the operation. Grading considerations, phasing, and site lines to major population centers, in addition to perimeter landscaping, vegetation retention and berms need to be addressed in order to mitigate landscape level visual impacts. A visual quality analysis of the site at the planning stage can assist in impact mitigation planning.

8.4 Environment

A number of environmental issues are associated with the planning, operation, and reclamation of an aggregate pit. These include potential impacts to:

- wildlife habitat;
- rare and endangered plants and / or ecosystems;
- fish habitat and water quality;
- visual quality (described separately above);
- noise (described separately above).
- slope stability and geophysical hazards;
- air quality; and
- potential site contamination.

A general discussion regarding potential environmental impacts is included in this section. A detailed discussion regarding the regulation of environmental legislation is included in Section 9.0.

8.4.1 Impacts to Wildlife Habitat

A number of impacts to wildlife habitat may be associated with the operation of an aggregate pit. Potential impacts include:

- removal of vegetation that provides food, and thermal, protective, or reproductive cover;
- noise, especially during nesting periods;
- interruption of wildlife corridors; and
- removal or disturbance of physical habitat features such as rocky bluffs or water bodies.

The *Reclamation and Environmental Protection Handbook for Sand, Gravel and Quarry Operations in British Columbia* (MEM, 1995) outlines techniques to minimize for impacts to wildlife. For example:

- minimize the area of disturbance at any one time;
- reclaim disturbed areas as soon as possible;
- maintain a buffer zone of undisturbed vegetation around the operation;
- for areas near winter habitat, schedule operations between spring and fall where possible;
- restrict public access; and
- require / request employees not to fish or hunt in the vicinity of the operation.

8.4.2 Rare and Endangered Plants and / or Ecosystems

The Central Okanagan is home to a very specialized group of ecosystems, many of which are considered rare within British Columbia and Canada. The Conservation Data Centre (CDC) is a branch of the Ministry of Environment, Lands and Parks that assesses and tracks rare plants, animals, and ecosystems. A system of classifying ecosystems within British Columbia has been developed called the Biogeoclimatic Ecosystem Classification (BEC) system. The following biogeoclimatic zones are present within the Central Okanagan:

- Ponderosa Pine;
- Interior Douglas-fir;
- Interior Cedar – Hemlock;
- Montane Spruce;
- Engelmann Spruce – Subalpine-fir; and
- Alpine Tundra.

The BEC system further classifies these zones into specific plant associations. The CDC gives these plant associations ratings based on rarity. A red listing indicates the plant association is extinct or endangered. A blue listing indicates the plant association is threatened, or at risk of becoming endangered. Many of the plant associations in the Central Okanagan are red or blue listed. For example, within the Ponderosa Pine zone, of 9 plant associations, 3 are red listed and 4 are blue listed. Within the Interior Douglas-fir zone, of 9 plant associations, 4 are blue listed. A plant association should be in good condition in order to be considered listed.

A number of impacts may be associated with the operation of an aggregate pit with respect to rare and endangered plants and ecosystems. Potential impacts include the:

- removal of rare and endangered plants and / or ecosystems; and
- fragmentation of adjacent rare ecosystems.

A permit application referral to MELP may result in the requirement to conduct a Rare and Endangered Plant and Wildlife Species Survey prior to approval. Should rare species be found on the site, accommodations to avoid or mitigate impacts may be required.

8.4.3 Fish Habitat and Water Quality

The lakes within the Central Okanagan and their associated streams are home to many indigenous fish species. Among these are:

- kokanee;
- rainbow trout;
- brook trout;
- red-sided shiner;
- northern pike minnows;
- yellow perch; and
- peamouth chub.

A number of impacts may be associated with the operation of an aggregate pit with respect to fish habitat and water quality. Potential impacts include the:

- disturbance of riparian vegetation that protects the stream; and
- deposition of sediments and other contaminants into the stream that affect water quality.

Aggregate operations must adhere to the requirements of the federal *Fisheries Act*, and associated guidelines as outlined in the *Land Development Guidelines for the Protection of Aquatic Habitat* (B. Chilibeck, 1992). The *Reclamation and Environmental Protection Handbook for Sand, Gravel and Quarry Operations in British Columbia* (MEM, 1995) states:

'The width of the leave strip that is necessary to protect a stream or water body will vary with the terrain and vegetation type. The Department of Fisheries and Oceans suggests that 30 metres from the high water mark is a minimum width for fish bearing streams and streams that flow to fish bearing watercourses. Wider leave strips may be necessary in areas where

- the high water mark is not clearly defined;
- the channel is unstable;
- the watercourse is in a ravine; or
- the surrounding land uses have the potential for severe impacts.'

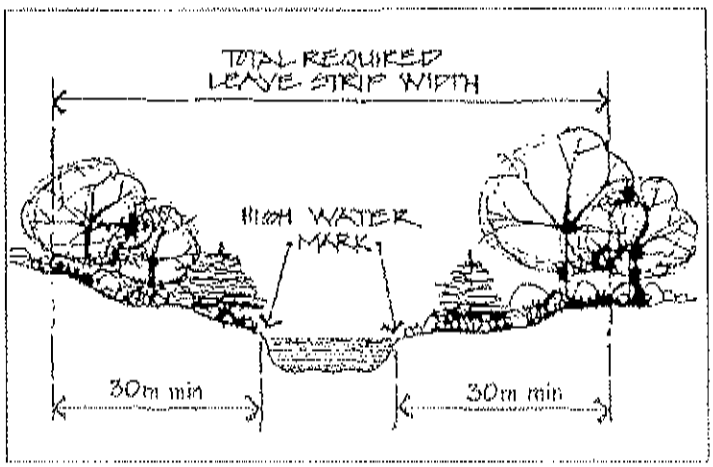

Figure 9: Setback From a Fish Bearing Stream (MEM, 1995).

8.4.4 Slope Stability and Geophysical Hazards

An aggregate or quarry operation has potential to influence slope stability and geophysical hazards, or even create a geophysical hazard. The operation is responsible, according to the provisions under the *Mines Act*, to plan and operate the pit in a safe and responsible manner. This includes providing accommodation for slope stability and geophysical hazards.

8.4.5 Air Quality

A number of impacts may be associated with the operation of an aggregate pit with respect to air quality. Potential impacts include the disturbances associated with excessive dust. The control of dust is regulated under the *Health, Safety and Reclamation Code for Mines in British Columbia* (Province of BC, 1997). Section 6.5.1 of this Code outlines the use of water sprays and personal protective equipment for sites to control dust.

Dust control is relatively easily provided in the operating pit by sprinkling haul routes. At times the stockpiles are also wetted. Wet processing reduces much of the potential for dust production around the plant. Dry processing requires dust extraction and collection systems to keep ambient dust levels low enough to meet work place requirements. Lowering the height which the gravel is dropped to the stockpile or truck also reduces dust. In large operations, planting vegetation or installing mulches on unused phases of the operation contributes greatly to dust control.

8.4.6 Potential Site Contamination

A number of impacts may be associated with the operation of an aggregate pit or quarry with respect to site contamination. Potential sources of contamination include:

- hydrocarbons such as fuel, hydraulic fluid and lubricants;
- chemicals stored on site;
- contaminated backfill; and
- fertilizers and pesticides used for reclamation.

Methods to reduce the potential of spilling and leaking of contaminants are outlined in the *Reclamation and Environmental Protection Handbook for Sand, Gravel and Quarry Operations in British Columbia* (MEM, 1995).

9.0 REGULATORY FRAMEWORK

Within the province of British Columbia, the extraction and deposit of aggregates is regulated by a number of legislative policies administered by various government agencies. The primarily regulatory bodies include local governments and the following provincial agencies:

- Ministry of Energy and Mines;
- Ministry of Transportation and Highways;
- Ministry of Environment, Lands and Parks;
- Land Reserve Commission; and
- Ministry of Municipal Affairs.

9.1 Ministry of Energy and Mines

Sand and gravel operations and rock quarries must be permitted by the Ministry of Energy and Mines under the requirements outlined in the *Mines Act* (RSBC 1996) and the *Mineral Tenure Act* (RSBC 1996). A mine permit is required for both sand and gravel operations and rock quarries whether on private or Crown Land. A mine permit is not required for operations on First Nations land, as this is federal government jurisdiction.

Applications are subjected to a 30 day, inter-agency review process and proposals deemed to be sensitive are referred to the local Regional Mine Development Review Committee (RMDRC). The RMDRC is comprised of representatives of both federal and provincial government agencies whose interests may be affected by the proposed mine. Local government and First Nations may also be invited to participate as members of the RMDRC. Usually, draft copies of the *Mines Act* permit are circulated to the RMDRC members as an opportunity for final comments subsequent to the Committee's review. New guidelines require that all applications on Crown Land be referred to local First Nation groups (Adams *et al.*, 1999).

In general, the steps outlined below are required as part of the permitting process:

9.1.1 Sand and Gravel Operation

The following requirements are part of the permit process for a sand and gravel operation:

- a lease title under the Lands Act from BC Assets and Land Corporation;
- a permit application to the Ministry of Energy & Mines (MEM);
- referrals coordinated by MEM (at MEM discretion);
- advertising the proposed operation in the local newspaper and the *BC Gazette* (at MEM discretion);
- a reclamation and safety plan; and
- inspection by MEM.

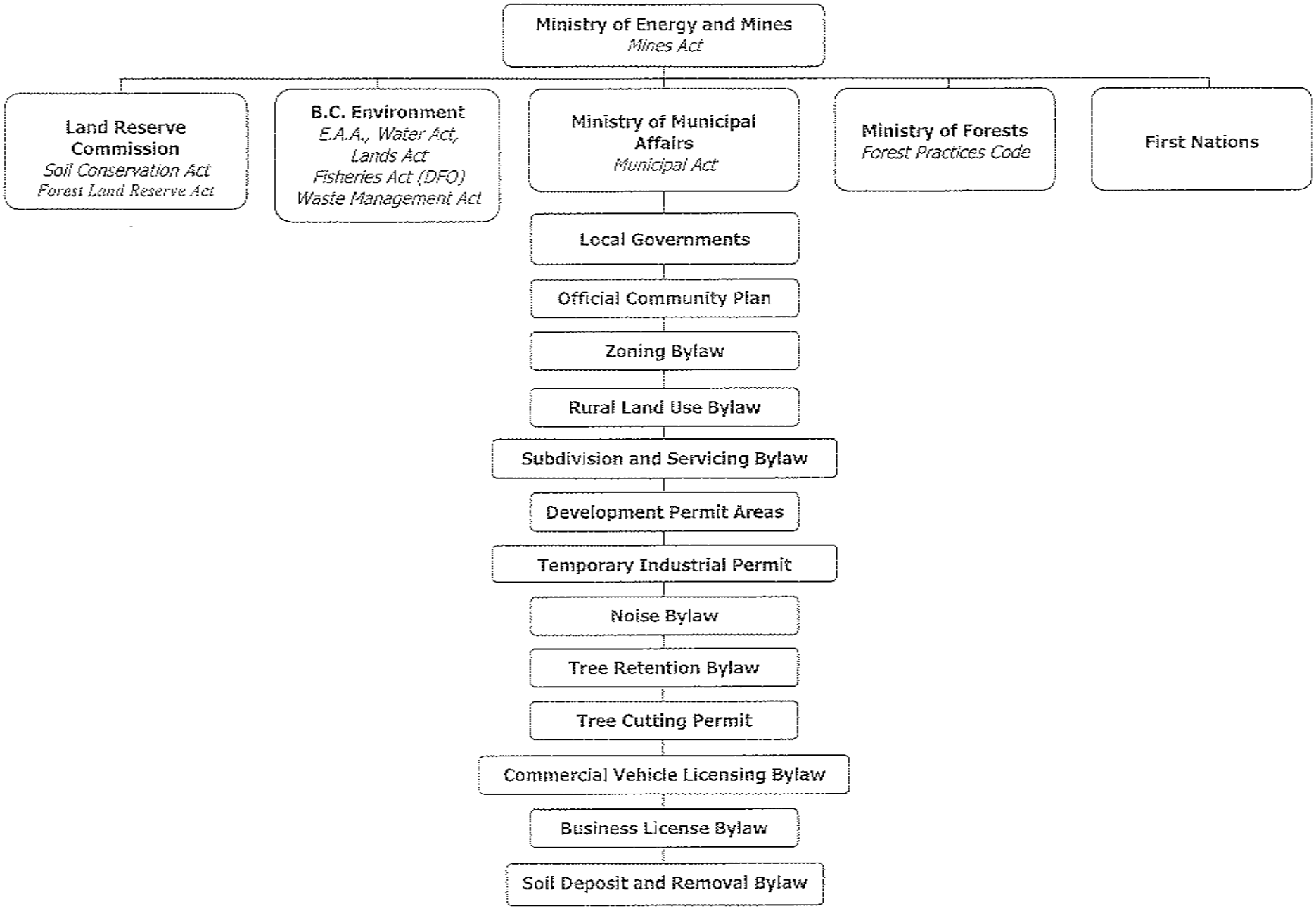
Ministry of Energy and Mines
Mines Act
Land Reserve Commission
Soil Conservation Act
Forest Land Reserve Act
B.C. Environment
E.A.A., Water Act,
Lands Act
Fisheries Act (DFO)
Waste Management Act
Ministry of Municipal Affairs
Municipal Act
Ministry of Forests
Forest Practices Code
First Nations
Local Governments
Official Community Plan
Zoning Bylaw
Rural Land Use Bylaw
Subdivision and Servicing Bylaw
Development Permit Areas
Temporary Industrial Permit
Noise Bylaw
Tree Retention Bylaw
Tree Cutting Permit
Commercial Vehicle Licensing Bylaw
Business License Bylaw
Soil Deposit and Removal Bylaw

Figure 10

9.1.2 Rock Quarry Operation

A quarry permit is required if the operation supplies non-structural construction materials, for example, rock used for facing stone, rock walls or landscaping. A quarry permit has the following requirements:

- a lease title under the *Land Act* from BC Assets and Land Corporation;
- a claim must be staked under the *Mineral Tenure Act*;
- a Free Miner's Certificate must be attained in order to stake a claim;
- taxing of profits under the *BC Mining Tax Act*;
- permit application to the MEM;
- referrals coordinated by MEM (at MEM discretion);
- advertising the proposed operation in the local newspaper and the *BC Gazette* (at MEM discretion);
- a reclamation and safety plan; and
- inspection by MEM.

9.1.3 Mine Standards

A *Mines Act* permit applicant is required to include detailed projections of mine site reclamation costs, including consideration of long term monitoring, mitigation of environmental impacts and ongoing maintenance. Standards for health, safety and reclamation are established and compliance is required as a condition of every *Mines Act* permit. Site specific conditions may warrant the inclusion of additional permit clauses where appropriate. It is the Ministry's policy to hold security for mine reclamation which reflects costs to decommission and close the site.

Depending on the scale of the project, costs of reclamation may play a key role in determining the economic feasibility of the mining project. In an effort to achieve consistency in the preparation of reclamation cost projections, the Ministry has developed a spreadsheet which may be utilized by *Mines Act* permit applicants.

9.1.4 Notice of Application

Mines Act permit applicants may be required to publish a 'notice of filing' in the *B.C. Gazette* and in local newspapers. This requirement is at the discretion of the Regional Manager and is often required when the application is for a new mine or for a substantive modification to an existing mine plan or reclamation program. When advertising is required, a minimum of two copies of the permit application must be made available for viewing at the local public library for the duration of the application review process.

9.1.5 Air Quality

The control of dust is required for a *Mines Act* permit as outlined under Section 6.5.1 of the *Health, Safety and Reclamation Code for Mines in British Columbia* (Province of British Columbia, 1997). It specifies that dust be controlled on the site with the use of water sprays and protective equipment for workers where required.

9.1.6 Health and Safety

All health and safety issues on the mine site are regulated and inspected for compliance by the MEM. The MEM has a Memorandum of Understanding (**MOU**) with the Workers Compensation Board of British Columbia that they will be responsible for all health and safety issues on mine sites under their jurisdiction.

9.1.7 Reclamation

Reclamation for aggregate extraction operations is regulated by the *Mines Act* (1996), and requirements are outlined in Section 10 of the *Health, Safety and Reclamation Code for Mines in British Columbia* (Province of British Columbia, 1997). Reclamation guidelines are also outlined in the *Reclamation and Environmental Protection Handbook for Sand, Gravel and Quarry Operations in British Columbia* (MEM, 1995).

Under the *Mines Act (1996)*, the Chief Inspector may require that a security be provided to the Ministry of Mines for reclamation works and the protection of watercourses and cultural heritage resources.

Reclamation standards as outlined in the above guidelines specify that the land of the aggregate operation is reclaimed appropriately to the approved recommended land use. The recommended land use can be any of the following:

- agriculture;
- forestry;
- wildlife habitat;
- fish habitat;
- recreation;
- residential
- commercial; or
- industrial.

Generally reclamation includes the restoration and stabilization of all watercourses, removal of buildings, restoring a vegetative cover, preservation and restoration of topsoil, and returning the land to a safe and stable gradient. The owner may also be responsible for a monitoring program to ensure that the reclamation is successful such as the intended land use, water quality, productivity, and site stability.

Reclamation standards are most stringent for lands within the Agricultural Land Reserve (ALR). The Land Reserve Commission (LRC) requires that the land be reclaimed such that the agricultural capability is equally or more productive than it was prior to extraction. The LRC will require a security to ensure this reclamation takes place. Often the MEM will waive their requirement for security should that of the LRC exceed their requirements.

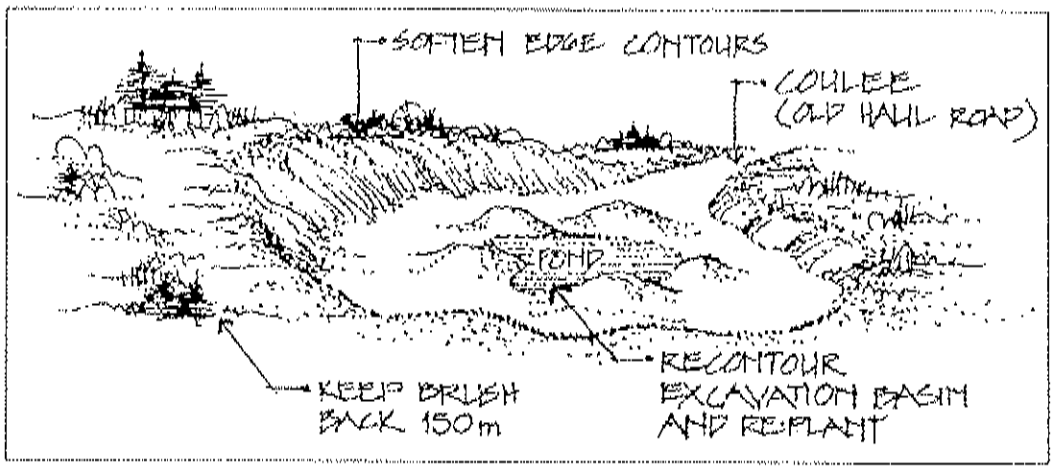

Figure 11: Illustration of Reclamation for Wildlife Habitat (MEM, 1995)

A local government, as part of a Soil Removal and Deposit Bylaw as allowed under the Municipal Act (1996), may also require reclamation plans and standards. (See Section 9.9.11.)

9.2 Ministry of Transportation and Highways

The Ministry of Transportation and Highways (MOTH) are a large consumer of aggregate resources. As such, it develops and operates a large proportion of pits within the province. It cooperates with the Ministry of Energy and Mines in the development of standards such as those for reclamation (MEM, 1995).

It is MOTH policy to have a 30 – 50 year supply of gravel in reserve. MOTH maintains all the major highways in the province and all the roads in the RDCO, and all roads with rural designation. The City of Kelowna will assume responsibility for all rural roads within the municipality boundaries on May 9, 2001. MOTH requires that all loads on provincial roads be covered.

In some cases MOTH's maintenance requirements supercede the tenants of local policy. For example, MOTH requires that all work on Highway 97 within the City of Kelowna be conducted at night, which contravenes the City's noise control bylaw. Night work is done in order to minimize the impact on traffic congestion.

9.3 Ministry of Environment, Lands and Parks

The Ministry of Environment, Lands and Parks (MELP) administers provincial environmental legislation, and some federal legislation on behalf of federal agencies. (See Section 9.4.2.) A permit application under the *Mines Act* generally includes referral to this agency to ensure adherence to environmental policy. Local concerns of MELP (L. Shimmin, pers. comm., 1999) include:

- aquifer recharge;
- water flow and proximity to watercourses;
- wildlife corridors from summer range to winter range; and
- rare and endangered ecosystems (*e.g.* grasslands and wetlands).

Provincial environmental legislation for consideration in the permitting and operation of aggregate operations includes:

- *Environmental Assessment Act (EAA)*;
- *Waste Management Act*;
- *Water Act*; and
- *Lands Act*.

9.3.1 Environmental Assessment Act

The *Environmental Assessment Act* (RSBC, 1996) outlines requirements for environmental assessments and associated public consultation procedures. It sets the threshold criteria limits for projects that are subject to the *Act*. Currently projects with the following production levels are subject to the *Act* (G. McKillop, 2000):

- Sand and Gravel Pits
  - new pits with > 500,000 tonnes per year, or > 1,000,000 tonnes every 4 years; or;
  - reviewable scale for existing mines - an expansion of >35% of disturbed area.
- Mineral Mines (applicable to rock quarries)
  - new mines with > 75,000 tonnes per year;
  - reviewable scale for existing mines - an expansion of >35% of disturbed area; or
  - reviewable scale for existing mines - an expansion of > 250 ha increased area of disturbance.
- Construction Stone & Mineral Quarries

- new mines with > 250,000 tonnes per year; or
- reviewable scale for existing mines - an expansion of >35% of disturbed area.

9.3.2 Water Act

The *Water Act (Water Regulation) B. C. Reg. 414/98* provides regulation of the use and flow of water in British Columbia. The *Water Act* prohibits unregulated use or restriction of water in the province. The right to use and store water is provided by a water license.

9.3.3 Land Act

The *Land Act* administers the tenure of aggregate resources on Crown Land. The BC Assets and Land Corporation must grant a Crown Lease or a License of Occupation, or secure other forms of tenure, for aggregate or mineral extraction on Crown Land.

9.4 Environment Canada

Environment Canada administers federal environmental legislation. A permit application under the *Mines Act* may include referral to this agency to ensure adherence to federal environmental policy. Federal environmental legislation for consideration in the permitting and operation of aggregate operations includes:

- *Canadian Environmental Assessment Act* (*CEAA*);
- *Fisheries Act*;
- *Migratory Birds Convention Act*; and
- *Wildlife Act*.

9.4.1 Canadian Environmental Assessment Act

Projects that meet or exceed threshold criteria of the *CEAA* must obtain a Project Approval Certificate prior to issuance of a *Mines Act* permit. Should an environmental assessment be required under *CEAA*, the application is subject to review by relevant federal ministries and interest groups. For example, the application may be sent to such agencies as Environment Canada, Health Canada, Transport Canada and local First Nation groups.

Currently projects with the following production levels are subject to the *CEAA:*

- Mineral Mines
  - new mines with > 3,000 tonnes per day;
  - existing mines with proposed increases of > 50% or > 1,500 tonnes per day; or
  - existing mines that would increase production to > 3,000 tonnes per day.

If a project triggers reviews under both the *CEAA* and the *EAA*, a single review is carried out under the provincial legislation with appropriate federal participation.

9.4.2 Fisheries Act

The Fisheries Act administers and regulates activities in and adjacent fish bearing streams. The Department of Fisheries and Oceans (**DFO**), in conjunction with MELP, has published the *Land Development Guidelines for the Protection of Aquatic Habitat* (Chillibeck, 1993). This publication has become the standard for development guidelines for the protection of fish bearing streams. It includes standards for erosion control, stream setbacks, work windows for in-stream activity, and culvert specifications. Within the Central Okanagan, Ministry of Environment, Lands and Parks personnel administer *Fisheries Act* policies on behalf of DFO.

9.4.3 Migratory Birds Convention Act

The Migratory Bird Act is federal legislation that protects migratory birds and their nests.

9.4.4 Wildlife Act

Wildlife Act protects raptor's nests, birds, eggs, and other bird nests that are occupied.

9.5 Land Reserve Commission

As of April 1st, 2000, the Agricultural Land Commission and the Forest Land Commission became integrated into one administrative body. The Agricultural Land Reserve and the Forest Land Reserve will remain as separate entities. The *Agricultural Land Commission Act*, *Soil Conservation Act*, and the *Forest Land Reserve Act*, will remain as separate legislation. No change with respect to policy objectives or permitting requirements for aggregate pits or quarries on ALR or FLR will occur as a result of this amalgamation (G. Bednard, pers. comm., Jan. 2000).

The *Agricultural Land Commission Act* came into effect in British Columbia in December 1972. In the 1970s, approximately 5 % of the land base in B.C., or 4.7 million hectares, was regulated by the LRC.

The Land Reserve Commission (**LRC**) administers legislation that regulates activities within the Agricultural Land Reserve and the Forest Land Reserve. This legislation includes the:

- *The Agricultural Land Commission Act;*
- *The Forest Land Reserve;* and
- *The Soil Conservation Act.*

Through the implementation of the *Soil Conservation Act (SCA)* and its regulations, orders and policies, the LRC pursues its mandate to sustain the quality of agricultural soils in the province of B.C.

Soil Conservation Act Permit Process

Should a permit application be submitted to the MEM that is within the ALR, a permit is required under the *Soil Conservation Act*. The *Soil Conservation Act* prohibits the removal of soil and placement of fill on land in the ALR unless the LRC has approved the action in writing, and the Local Authority where the land is situated has issued a permit. Furthermore, the removal of soil and/or placement of fill must be carried out in accordance with the regulations, terms and conditions of the permit.

An application under the *Soil Conservation Act* is initiated through the Local Authority with a fee payable to the local government. The Local Authority is responsible to ensure that the application is complete and may refer the application to its Board or Council and various committees for comment. Although not required under the SCA, the Local Authority may make a recommendation on the application. Once the local review is complete, the application is forwarded to the LRC.

LRC staff prepare the application for review by the Commission and may refer the application to various agencies for comments. Upon completion of their review, the Commission may approve the application in which case the Local Authority is advised in writing and any conditions are described in the notification. A copy of the Commission's letter is sent to the applicant. If the application is refused, the applicant is notified in writing by the Commission directly and a copy of the letter is sent to the Local Authority.

Once the applicant has received approval from the LRC, it is still necessary to obtain a permit from the Local Authority. The Local Authority may approve issuance of a permit subject to any of their own conditions and all conditions specified by the LRC or, may refuse to issue a permit.

If the Local Authority refuses to issue a permit, the application ends. The *Soil Conservation Act* does not include procedures for appeal or reconsideration of an application. If new information becomes available to the applicant or a refusal decision was based on information which was in error or was false, the Commission will reconsider an application. The request for reconsideration and the reasons must be submitted to the Commission in writing. Remedies of the *Judicial Review Procedures Act* apply to all applications.

9.5.1 Reclamation for Agricultural Reserve Land

The LRC has indicated that it will consider the removal of aggregate within the ALR on the condition that the removal will improve the land for the purposes of agriculture.

'Resource extraction is ordinarily a permitted temporary use within the Agricultural Land Reserve, provided that the extraction operation will not reduce the agricultural capability of the soils and / or the agricultural potential of the site. In principle, land capability for agriculture following reclamation must be better than that which existed prior to reclamation.'

(p. 83, Reclamation and Environmental Protection Handbook for Sand, Gravel and Quarry Operations in British Columbia, MEM, 1995).

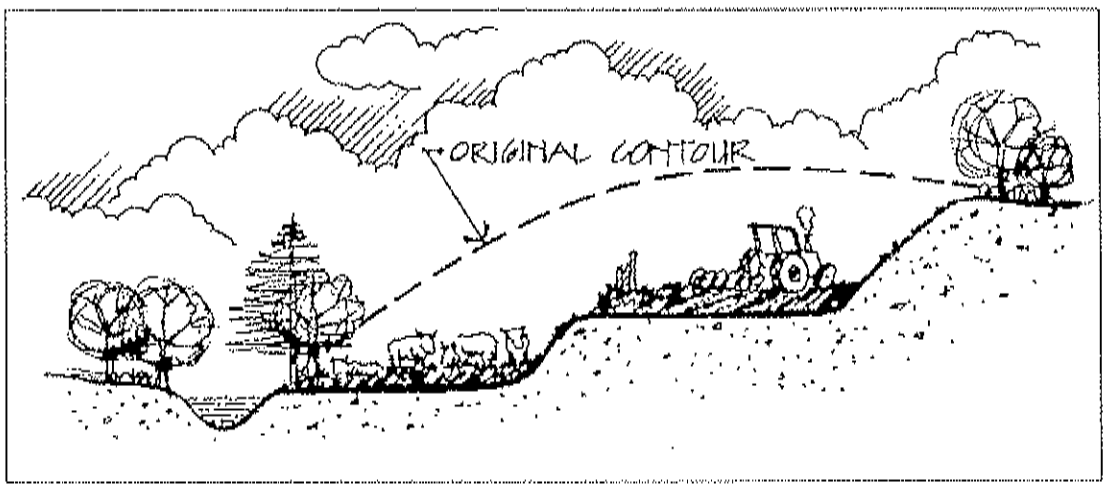

Figure 12: Agriculture Land Reclaimed for Agriculture After Temporary Aggregate Extraction (MEM, 1995)

In the Fraser Valley, good results have been achieved through the reclamation of agricultural land after aggregate extraction. In some cases, the soil capability rating of the land has gone from a rating of 5 to a rating of 1 (1 being prime agricultural land) (T. Pellett, pers. comm., 2000). The process of reclamation for agriculture generally includes:

- proper stockpiling of topsoil;
- reclaiming to a level gradient; and
- restoring topsoil.

Specific locations in the Central Okanagan where aggregate extraction has the potential to improve the agricultural capability of the land include areas at Frost Road and along Joe Rich Road east of the City of Kelowna boundary (T. Pellett, pers. comm., 2000).

9.5.2 Forest Land Reserve

The Land Reserve Commission also administers the *Forest Land Reserve Act*. The mandate of the FLR is to reserve the land for timber production. Should a permit application occur on Forest Land Reserve (FLR), the application will be referred to the LRC. Permits are not required within the FLR if the sand or gravel is being used to maintain forestry roads within the FLR area.

The criterion for approval for aggregate extraction within the FLR is that the land will be reclaimed for forestry. The LRC will take sufficient security to ensure reclamation for forestry is attained. This may exceed the requirements for MEM security. The release of the security requires that the stand has achieved free growing status, according to local Ministry of Forests' standards (G. Bednard, pers. comm., 2000).

Within the Regional District, approximately 789 hectares is currently within the FLR. This is comprised entirely of private land. The Land and Resource Management Plan (LRMP) proposes to include all Crown land currently used for forestry in the FLR upon its adoption (G. Bednard, pers. comm., 2000).

9.6 Ministry of Municipal Affairs

The Ministry of Municipal Affairs administers the *Municipal Act* and the development of policies under this act. It works with municipalities and regional districts to develop policy for local governments at the provincial level. The *Municipal Act* (1996) has a number of policy tools available to manage aggregate resources within its communities. These are described in the following section.

9.7 Local Government

A local government may utilize the following policy tools available through the *Municipal Act* (1996) to manage aggregate resources within its communities:

- Official Community Plan;
- Zoning Bylaw;
- Rural Land Use Bylaw;
- Subdivision and Servicing Bylaw;
- Development Permit Areas;
- Temporary Industrial Permit;
- Noise Bylaw;
- Tree Retention Bylaw; and
- Soil Removal and Deposit Bylaw.

9.7.1 Official Community Plan

A local government may, according to Section 875 of the *Municipal Act*, adopt an Official Community Plan (**OCP**) to guide future development within the community. The OCP must outline the approximate locations of sand and gravel resources within the municipality. The OCP may identify a special land use designation for the future extraction of aggregate. This designation would provide for the protection of the resource and accommodate compatible adjacent land use designations.

9.7.2 Zoning Bylaw

Section 903 of the *Municipal Act* enables a local government, by bylaw, to divide the municipality or the Regional District into zones. A zone specifies regulations regarding land use, siting and dimensions of structures within that zone.

In the *Municipal Act*, "land" is defined such that it excludes mines or minerals which are on land which is either privately owned or under jurisdiction of the Crown.

> '"land" includes the surface of water but does not include improvements, mines or minerals belonging to the Crown, or mines or minerals for which title in fee simple has been registered in the land title office but for the purposes of assessment and taxation, 'land' has the same meaning as in the *Assessment Act*;' (BC Reg. 317 /95).

Therefore, the activities involving mining aggregates cannot be regulated by "land use" bylaws such as a Zoning Bylaw. The zoning bylaw can, however, regulate 'the use of land, buildings and structures' (RSBC, 1991). This includes permanent platforms for screening or crushing equipment.

Zoning is used to designate the location of permanent platforms or structures for processing operations (*e.g.* screening, crushing, and washing). Thus, the activities of extraction itself, for example excavating and processing with mobile equipment, is not controlled by zoning or through land use designation (OCP).

9.7.3 Rural Land Use Bylaw

Section 886 of the *Municipal Act* enables a regional board to adopt a Rural Land Use Bylaw (RLUB) for a specifically designated area outside a municipality. The RLUB must include a general statement of the board's planning objectives for the area, and also indicate provisions that indicate and regulate the location and type of land use, density, conservation areas, hazardous and environmental areas, road systems, servicing standards and siting of buildings and structures.

9.7.4 Subdivision and Servicing Bylaws

Section 903 enables a local government to adopt a bylaw that regulates and prescribes minimum standards for highways in connection with the subdivision of land. It may specify requirements for other infrastructure such as sidewalks, boulevards, crossings, and water and sewage systems.

To some degree a Subdivision and Servicing Bylaw influences what aggregate products are in demand within a region. The bylaw specifies aggregate parameters, including the size, fracture content, and percentage of recycled material permissible.

9.7.5 Development Permit Areas

The Development Permit system is another mechanism which local governments may utilize to regulate aggregate extraction activities. Section 879 of the *Municipal Act* enables a local government (Regional District or Municipal) to utilize their Official Community Plan to designate areas for one or more of the following:

(a) protection of the natural environment, its ecosystems and biological diversity;
(b) protection of development from hazardous conditions;
(c) protection of farming;
(d) revitalization of an area in which a commercial use is permitted; and
(e) establishment of objectives and the provision of guidelines for the form and character of commercial, industrial or multi-family residential development.

Should a local government choose to utilize this mechanism as a means to manage aggregate removal and deposit activities, then the OCP must:

(a) describe the special conditions or objectives which justify the designation; and,
(b) specify the guidelines by which the special conditions or objectives are to be addressed.

If a community has identified areas which are deemed to warrant special consideration for reasons related to items (a) to (e) noted above, then these areas may be designated as Development Permit areas in their OCP. With such designations, several restrictions apply unless the land owner first obtains a Development Permit which must be approved by the local Council or Regional Board.

According to Section 920.1.c of the *Municipal Act*, land designated under Section 879 must not be altered prior to the receipt of a valid development permit. For example, until the land owner obtains a Development Permit, land within the designated area must not be subdivided, and buildings or other structures must not be constructed or altered.

Where an area has been designated as a Development Permit area, a DP may be required in conjunction with a provincial Mines Permit. The result is that more stringent requirements apply to mines within a DP area. However, the *Mines Act* does not require that MEM address land use designation or zoning in its permit process. An interpretation is therefore required with respect to which legislation prevails in the case that a mine permit application occurs within a Development Permit Area.

Currently the City of Kelowna, District of Peachland, and the Westbank, Westside, Lakeview, Ellison, and Lake Country OCPS have Development Permit Areas for Environmentally Sensitive or Hazardous Areas. The Joe Rich Rural Land Use Bylaw has floodplain restrictions.

9.7.6 Temporary Industrial Permit

Temporary Industrial Permits allow a temporary change in zoning for an industrial use. They are available for a 2-year period and require approval by Council. A public hearing is required prior to Council approval. A 2-year non-renewable extension is allowed.

The use of a Temporary Industrial Permit for aggregate extraction is problematic because of the limited time frame they are available for and the additional administration and public consultation required. Extraction for temporary use is better managed by the SRDB through the issuance of a Short Term Permit. (See Appendix G.)

9.7.7 Noise Bylaw

Section 724 enables a council to regulate noise within the community, for protection from disturbance. A Noise Bylaw may restrict activities such as construction procedures to certain times of the day.

The creation of noise due to construction and trucking activities is prohibited between the following times by local government bylaw in the Central Okanagan as outlined in the following table.

	Monday to Friday	*Saturday*	*Sunday*	*Other Holidays*
Lake Country	2200 -0700 hours	2200 -0700 hours	2200 -0700 hours	2200 -0700 hours
Kelowna	2200 -0700 hours	2200 -0700 hours	2200 -0700 hours	2200 -0700 hours
Peachland	2100 -0700 hours	2100 -1000 hours	1800 -1000 hours	1800 -1000 hours
Regional District	2200 -0700 hours	2200 -0700 hours	2200 -0700 hours	2200 -0700 hours

Table 6: Noise Bylaw Hours Prohibited For Construction Activities

9.7.8 Tree Retention Bylaw

Section 708 of the *Municipal Act (RSBC 1996)* empowers a council to regulate, by bylaw, the cutting and removal of trees. The bylaw may:

- restrict the removal of trees;
- require a permit for the removal of trees; and
- require trees to be replaced if trees are removed.

A bylaw under Section 708 may require that a permit be obtained prior to the cutting and removal of trees and may establish fees for the permit. Permit applicants may be required to provide plans identifying the trees proposed to be cut or removed, trees to be retained and trees to be provided as replacements.

There is the potential for a tree protection bylaw to overlap with mine reclamation requirements of the Ministry of Energy and Mines. Inter-jurisdictional conflict may arise if one level of government sets a more stringent standard.

Currently the City of Kelowna has a Tree Protection Bylaw.

9.7.9 Tree Cutting Permit

A Regional Board may not adopt a tree retention bylaw under Section 708. However, Section 923 of the *Municipal Act* empowers a Regional Board to designate tree cutting permit areas, and require a tree cutting permit for removal of trees in these areas. However, this may be done only in areas where the removal of trees may cause the land to be vulnerable to erosion or flooding (RSBC, 1996).

9.7.10 Transportation of Goods Bylaw

Under section 680 of the *Municipal Act*, a municipal council may, by bylaw, regulate the following activities:

- delivery of sand and gravel;
- inspections of haul trucks;
- covering of loads; and
- measurement and display of the delivery vehicle's capacity and owner's name.

9.7.11 Commercial Vehicle Licensing Bylaw

A council may, according to Section 672 of the *Municipal Act*, adopt a bylaw that requires the licensing of vehicles used for commercial use and charge a fee for the license (RSBC, 1996). The Union of British Columbia Municipalities (**UBCM**) manages the commercial vehicle license program. The intent of the license is to offset the expenses related to the use of local government roads and highways resulting from commercial traffic. A Regional District may not implement a commercial vehicle licensing bylaw.

The City of Kelowna and the District of Peachland require commercial vehicles to be licensed, while the District of Lake Country does not. In the City of Kelowna, commercial vehicle licenses range in cost from $25.00 to $40.00 per truck, for vehicles over 20,000 kg. In the District of Peachland, a commercial vehicle license is $40.00 per truck over 20,001 kg.

9.7.12 Business License Bylaw

A council may, under Section 653 of the *Municipal Act*, adopt a bylaw that requires owners and operators of businesses to hold a valid business license (RSBC, 1996). The bylaw may specify a fee for the license, and may have a price structure that charges different businesses different rates.

Business license rates in the District are as outlined in the chart below.

Lake Country	$50 for any business
Kelowna	$207.94 for a Sand and Gravel Pit or Quarry $125.00 for a Contractor – 1st license $ 34.22 for a Contractor – 2nd license
Peachland	$112.00 for any business
Regional District of Central Okanagan	$ 75.00 for any business

Table 7: Business License Rates

9.7.13 Soil Removal and Deposit Bylaw

Under the *Municipal Act* a municipality (Section. 723) or regional district (Section. 799) may, by bylaw, regulate the removal and deposit of sand, gravel and other soil on any land within the local government's jurisdiction. Such a bylaw may make different regulations and prohibitions for different areas. An objective of this provision is to reduce potential conflicts by improving coordination, cooperation and communication between stakeholders.

Should the bylaw have potential to restrict the extraction of aggregate or minerals, it requires approval by both MEM and the Ministry of Municipal Affairs. If the bylaw makes reference to the quality of soil or material or to contamination, that provision has no effect until approved by both the Minister of Municipal Affairs and MELP.

The bylaw may include a range of options such as:

- Designated areas for extraction;
- Permit Application Process;
- Requirements for Short Term Permits;
- Requirements for Plans and Specifications;
- Requirements for Reclamation Standards;
- Requirements for the Protection of Aquatic Habitat;
- Operations Procedures including hours of operation, noise levels, berming and visual buffers;
- Permit Fees;
- Volume Based Fees for Removal;
- Volume Based Fees for Deposit;
- Penalties for Offences;
- Security Deposits for Reclamation;
- Qualified Professional Assurance;
- Annual reports for volumes excavated and remaining life expectancy for each phase;
- Requirements for Liability Insurance; and
- Public hearing requirements.

Under the bylaw, fees may be imposed in order to obtain a permit and/or to engage in the removal or deposit of soils. The level of the fees may vary according to the quantity of soil removed or deposited and may be different for different areas of the municipality or regional district.

9.8 Land and Resource Management Plan

The Okanagan Shuswap Land and Resource Management Plan (LRMP) is a comprehensive strategy for Crown Land within the Okanagan Shuswap. The plan includes all of the Crown Land within this jurisdiction, including its aquatic land of lakes and rivers. The mandate of the Okanagan Shuswap LRMP is:

> *'to produce a strategic land and resource management plan that will sustain the ecological, social and economic well-being of the plan area (LRMP, 1999).'*

The LRMP has areas designated as potential parks and protected areas. Some of these areas contain primary potential sand and gravel deposits, or suitable bedrock for quarried material.

The Land and Resource Management Plan has the following areas currently under review for Protected Area Status:

- Kalamalka Lake Park Extension
- Chapperon / Shorts Creek Addition
- Trepanier Creek
- Mission Creek (upper reaches)
- Myra Canyon / Bellevue Addition

The LRMP proposes that all Crown Lands used for forestry be included in the *Forest Land Reserve* upon its adoption.

9.9 Sand and Gravel and Mineral Extraction on First Nations Lands

Sand and gravel and mining operations on Indian Reserve Lands are the jurisdiction of the federal government and, as such, provincial legislation does not apply. Therefore, MEM does not permit or inspect sand and gravel or mining operations on Indian Reserve Lands unless invited (Adams, 1999). While potential for aggregate extraction exists on First Nation Lands, the notion of subsurface rights remains a point of negotiation as part of the treaty process.

10.0 RESOURCE AREAS

The assessment stage includes a review and analysis of the presence of aggregate resource in the context of extraction constraints and planning considerations. These considerations include: presence of resource, proximity to market, committed or conflicting land uses, neighbourhood issues such as dust, noise and traffic, ground water limitations, visual impacts, environmental, and ALR considerations.

10.1 Assessment of Aggregate Potential in the Central Okanagan by Area

The inventory information gathered through the mapping refinement and the aggregate producer surveys were further reviewed in consideration of existing and potential resource extraction constraints. The presence of resource in the ground does not necessarily mean that it is readily available for production. A distinction must be made, therefore, between resource, and reserve. For the purposes of this study, resource will mean aggregate potential without consideration of extraction constraints. Reserve will indicate the amount of resource that is currently under permit.

The following section will review the aggregate resource of each municipality or OCP area with consideration of the following opportunities and constraints. The discussion will focus on Class I deposits of aggregate as defined by EBA mapping. Considerations in the discussion include:

- Future land use designations
- Proximity to market
- Resource sterilization due to existing land development
- Committed or conflicting land uses
- Agricultural Land Reserve
- Neighbourhood issues
- Visual Impact
- Environmental Considerations

10.1.1 Future Land Use Designations

Areas of Class I aggregate resource were assessed with respect to the future land use designation as outlined in the current OCP of the respective area. This was done to further identify land use opportunities and constraints for specific aggregate potential areas.

10.1.2 Proximity to Market

Based on information gathered from our producer's survey, it was determined that the average distance of aggregate hauled from source to market is 12 km. The average maximum distance to market for sand and gravel products is 31 km. The maximum hauling distance for sand and gravel products noted was 150 km, and the maximum distance for quarried products (including specialty products) noted was 450 km. For the purposes of this study, the average distance of supply to the first significant growth center will be assessed in terms of trucking distance.

10.1.3 Resource Sterilization Due to Land Development

Current urban development was determined by air photo interpretation. Lands with structures or hard surfacing were considered sterilized for the purposes of aggregate extraction.

10.1.4 Agricultural Land Reserve

Current policy of the Land Reserve Commission (formerly the Agricultural Land Commission) regarding aggregate extraction on ALR land is that, if there is a possibility to improve the agricultural value of the land through aggregate extraction, the use may be permitted. This would be subject to approval of the application by the LRC. As conditions would need to be met prior to gravel extraction, the presence of aggregate resource in the ALR is considered to be a constraint to aggregate production, while not negating the possibility entirely.

10.1.5 Neighbourhood Issues

Each area of Class I aggregate resource was assessed relative to existing or potential neighbourhood issues, including noise, dust, visual impact, and traffic. For the purposes of this analysis, adjacent land uses such as residential areas and schools are considered to have a high sensitivity, whereas industrial and agricultural uses have low sensitivity.

10.1.6 Visual Impact

Visual impact sensitivity has been taken from the principles developed by the Ministry of Forests (RIC, 1997), and modified to suit the parameters of this study. Visual impact criteria such as slope, internal versus external views, exposure to areas of dense population and busy traffic corridors are considered. Generally, a site is considered to have high visual sensitivity if it is present on steep slopes and facing a populated area, major road or waterway. A site is considered to have low visual sensitivity if the slopes are moderate, and visual impacts are limited to rural roadways and neighbouring sites.

10.1.7 Environmental Considerations

Environmental considerations in planning for aggregate extraction include the proximity of the site to a fish-bearing stream, slope, and presence of rare and endangered ecosystems and / or wildlife species. The proximity to fish-bearing streams and slope considerations has been included in the following analysis. Rare ecosystems and wildlife issues should be assessed on a site-specific basis.

10.2 Assessment by Resource Area

10.2.1 Lake Country

Based on the mapping inventory, Lake Country has 37.4 sq. km. of Class I potential aggregate. Current developed areas and ALR cover approximately 28.0 sq. km., with a large portion of this occurring in the ALR.

10.2.1.1 Carr's Landing

Areas of Class I potential aggregate resource in the Carr's Landing area have a future land use designation of Rural Intensive or Large Holdings. Lake Country has amended its OCP to include the west half of section 27 (Pollards Pond) as part of the Urban Containment Area. Its proximity to aggregate in the Carr's Landing area may make this resource useable in the 20 year horizon of this study (M. Reiley, pers. comm., 1999). The District of Lake Country currently has OCP amendment applications for a proposed development within Carr's Landing of 150 acres. This property is in the vicinity of Class I, II and III potential aggregate (M. Reiley, pers. comm., 1999).

10.2.1.2 Okanagan Centre

In the Okanagan Centre area, areas of Class I potential aggregate resource generally have a future land use designation of Low Density Residential Rural, Rural Intensive, or Comprehensive Mixed Density Residential.

10.2.1.3 Oyama

Class I potential areas of aggregate in Oyama have a future land use designation of Large Holdings. A Class I potential aggregate area occurs as a raised delta north of Sawmill Road. This area coincides with a current OCP amendment application (M. Reiley, pers. comm., 1999). A school site exists on Oyama Road, which has raised concerns regarding truck traffic.

10.2.1.4 Winfield Town Centre

A band of Class I potential resource occurs at the east side of the Winfield Town Centre area. The current future land use designation for this area is Low Density Urban Residential and Comprehensive Mixed Density Residential.

10.2.1.5 Vernon Creek

A corridor of Class I potential aggregate is present along Vernon Creek and its associated glaciofluvial fan. The designated future land use for the fan area is Industrial, while that of the creek corridor is Large Holdings. Considerations for aggregate extraction planning include environmental considerations for the creek such as setback area and slope stability.

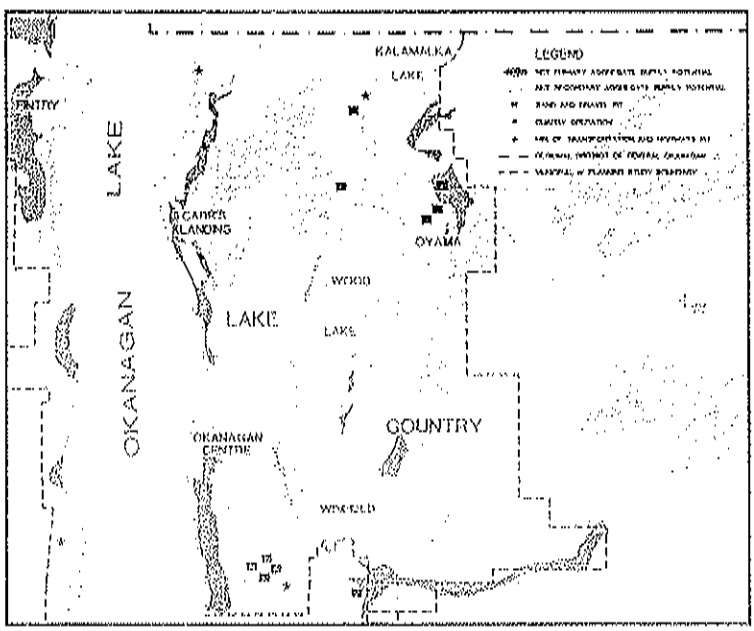

Figure 13: Aggregate Resources in Lake Country

10.2.2 Ellison

Ellison has 11.6 sq. km.. of Class I aggregate potential based on the refined mapping. The area net of existing urban development and ALR lands is 1.9 sq. km. The remaining Class I potential area lies north of Old Vernon Road. The designated future land use for this area is Rural (30 ha) Holdings.

The slope of the land is approximately 12%, and not considered to hold significant neighbourhood conflicts. It is approximately 6 to 10 km away from a major market that is within the distance considered economically feasible. Environmental considerations are those generally expected for an aggregate site. The site is considered to have a moderate visual sensitivity.

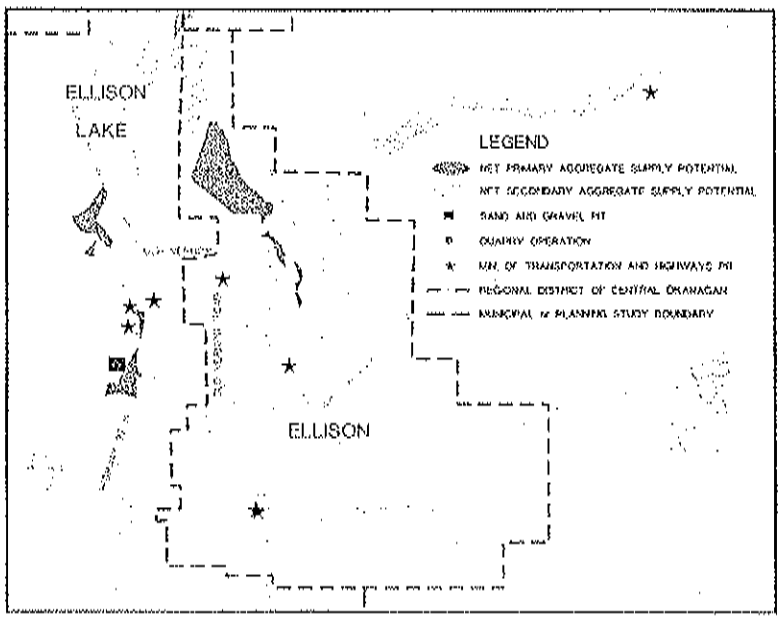

Figure 14: Aggregate Resources in Ellison

10.2.3 Joe Rich Area

The Joe Rich Area has been mapped with a gross Class I aggregate potential of 19.0 sq. km. Its Class I potential area net of urban development and ALR is 7.6 sq. km. Greater than 50% of this area lies beyond 12 km from market in the Belgo, Mission, and Joe Rich Creek Corridors. However, there are already several MOTH pits in this area.

10.2.3.1 Daves Creek

A glaciofluvial outwash deposit occurs east of Daves Creek. The future designated land use for this area is Rural (4 ha) Holdings. While appropriate creek setbacks and water runoff controls would be required for an aggregate operation in this area, other environmental or visual impact considerations are not considered to be significant.

10.2.3.2 Mission Creek

A Class I aggregate deposit has been identified along Mission Creek at the west end of the Joe Rich OCP Area. This area has a future land use designation of Large Holdings (30 ha). Aggregate resource extraction would need to address environmental considerations such as watercourse protection measures.

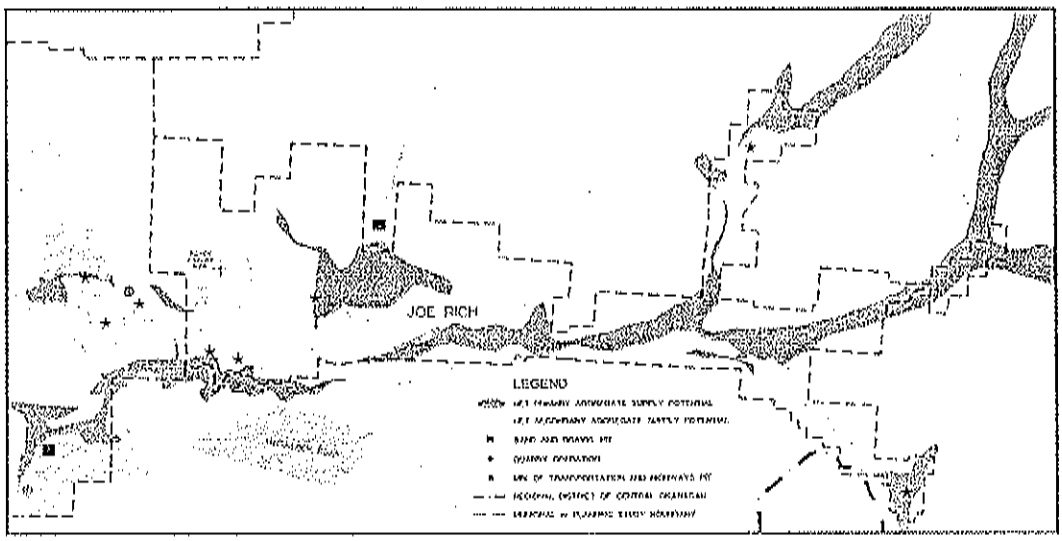

Figure 15: Aggregate Resources in the Joe Rich Area

10.2.4 Kelowna

The estimated gross Class I potential area within the City of Kelowna is 65.9 sq. km. Class I potential area net of ALR and urban development within Kelowna is 9.1 sq. km. Future land use designations for the remaining area according to the current OCP (June 1995) vary.

10.2.4.1 Black Mountain

An area of Class I potential aggregate resource has been mapped on the south side of Black Mountain along Highway 33. This area has a future land use designation for Single and Two Family Residential development, and occurs within Area Structure Plan #10. Visual impact and neighbourhood issues with respect to adjacent residential developments would need to be addressed in the planning and operation of aggregate pits in this area.

10.2.4.2 Mission and KLO Creeks

A Class I aggregate deposit has been identified in the Mission and KLO Creek corridors east of Gallagher's Canyon. This area has been identified in the current OCP as Major Park / Open Space. The area lies within the Development Permit Area for Natural & Hazardous Conditions. Steep slopes pose a constraint to aggregate extraction within the creek ravine. However, deposits on higher benches in this area may present good aggregate potential with fewer environmental or geotechnical constraints.

10.2.4.3 Southwest Mission

An area identified as a Class I aggregate source has been identified in the Southwest Mission area. The area has a future land use designations of Single and Two Family Residential, Park / Open Space, and Future Urban Reserve.

Some of the area lies within the Development Permit Area for Natural & Hazardous Conditions. Bellevue, Rembler, Lebanon, and Bertram Creeks run through this area. Appropriate creek setbacks and watercourse / fish protection measures would need to be considered in the planning and operation of aggregate extraction pits in this area.

The area lies 2 – 10 km from growth centers. A number of residential areas exist in the area and would need to be considered in the planning and operation aspects of gravel extraction. A school zone is present along Lakeshore Road, by which trucks need to pass to access major arterial roads.

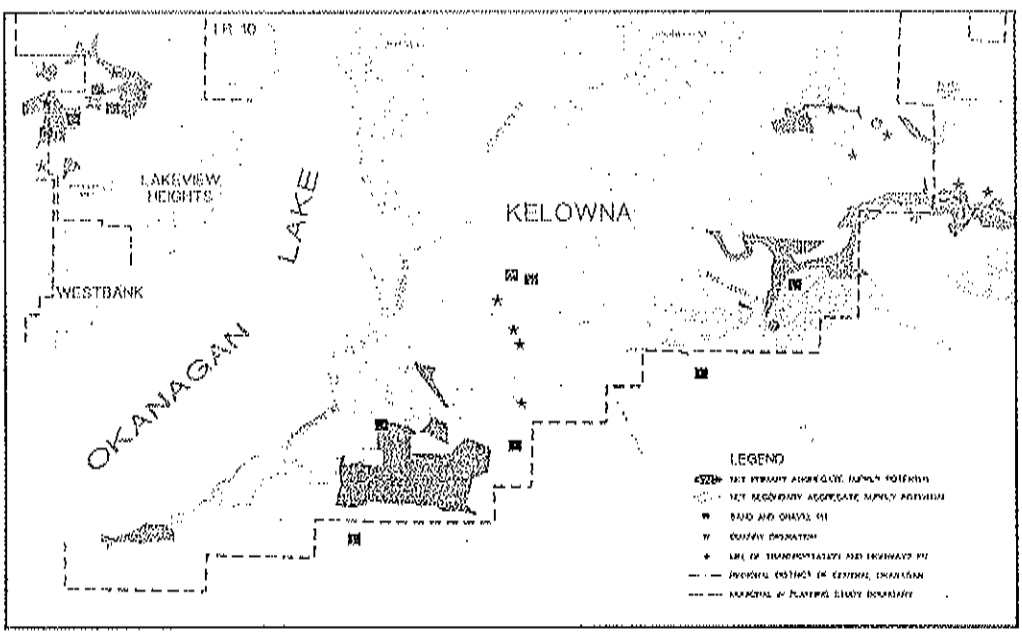

Figure 16: Aggregate Resources in Kelowna

10.2.5 Westside

There is an estimated 22.1 sq. km. of Class I aggregate potential within the Westside OCP Area. Potential area net of urban development areas and ALR for the Westside is 3.9 sq. km.

10.2.5.1 Fintry / Killiney

Over 50% of this area lies in the Fintry / Killiney Area, which exceeds the 12 km distance to market estimated to be economically feasible for aggregate extraction sites. However, the majority of the deposits lies within 1 to 2 km from the shoreline of Okanagan Lake. There may be potential, therefore, for transporting aggregate via barge to growth centers. While it is not anticipated that this would be economically viable in the 20 year planning horizon, consideration should be given for this option in the long term.

According to the current Westside OCP, (1998), future land use designations for Class I potential areas include Large Holdings, Rural Residential, and Parks and Recreation. Shorts and Whiteman Creeks run through the area, as well as a number of smaller creek systems.

Currently the LRMP has listed a large portion of the land adjacent the OCP Area as the proposed Chapperon-Shorts Protected Area. This area is west of the OCP area along Shorts Creek. This designation lies outside the Official Community Plan Boundaries and essentially does not effect the Class I aggregate potential area noted. Environmental aspects including wildlife corridors and visual impact planning should take the proposed protected area into consideration.

The areas of aggregate which parallel Okanagan Lake have slopes of 25% and greater. Visual impact planning would be required for extraction sites in this area.

10.2.5.2 Traders Cove

An area of Class I potential aggregate resource has been mapped in the Traders Cove / Lambly Creek area. The area has future land use designations of Large Holdings, Parks and Recreation, and Agriculture. The area is within the 12 km considered economically feasible for aggregate production. Environmental considerations regarding impacts to Lambly Creek would need to be addressed in the planning and operations of aggregate extraction sites. Internal views along the Lambly Creek Corridor have less visual sensitivity than slopes facing Okanagan Lake.

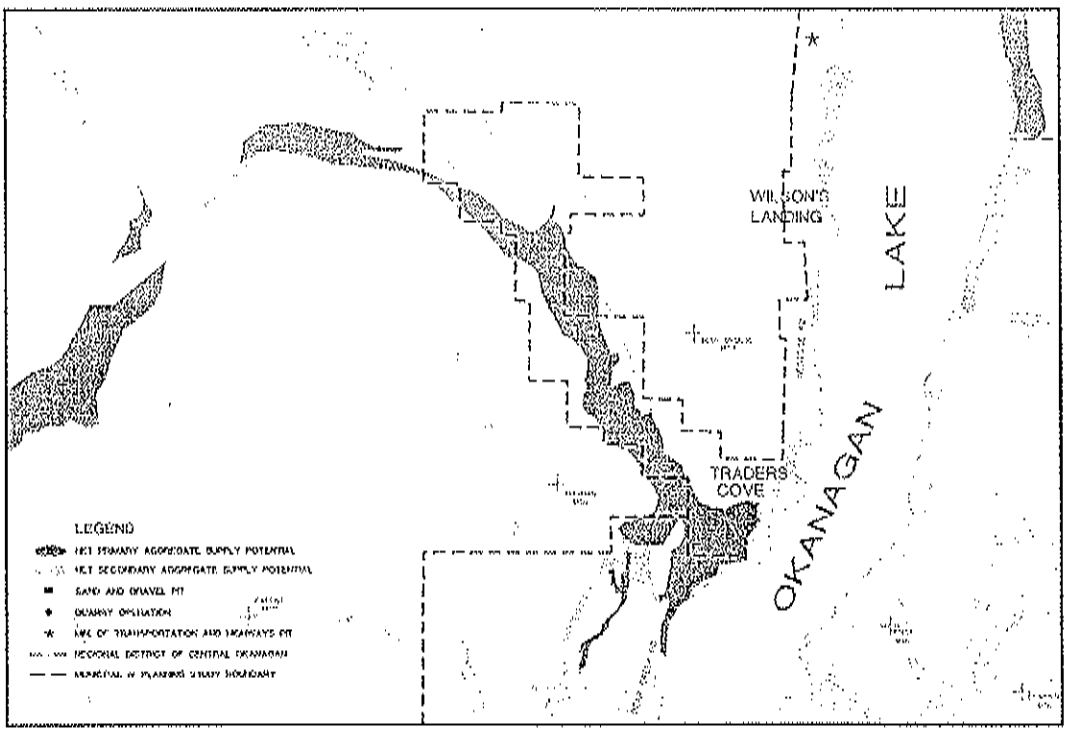

Figure 17: Aggregate Resources of the Westside

10.2.6 Lakeview Heights

There is an estimated 5.9 sq. km. of Class 1 potential aggregate supply within the Lakeview Heights OCP Area. Potential area net of urban development and ALR for Lakeview Heights is 3.9 sq. km.

Areas of Class 1 aggregate resource have been identified in the area of Westlake, McDougall, Dominion, and Bartley Roads. The designated future land uses for this area includes Industrial, Agricultural, and Low Density Residential. The area is located within 12 km of markets. Neighbourhood considerations are a factor at the northeast corner of the deposit.

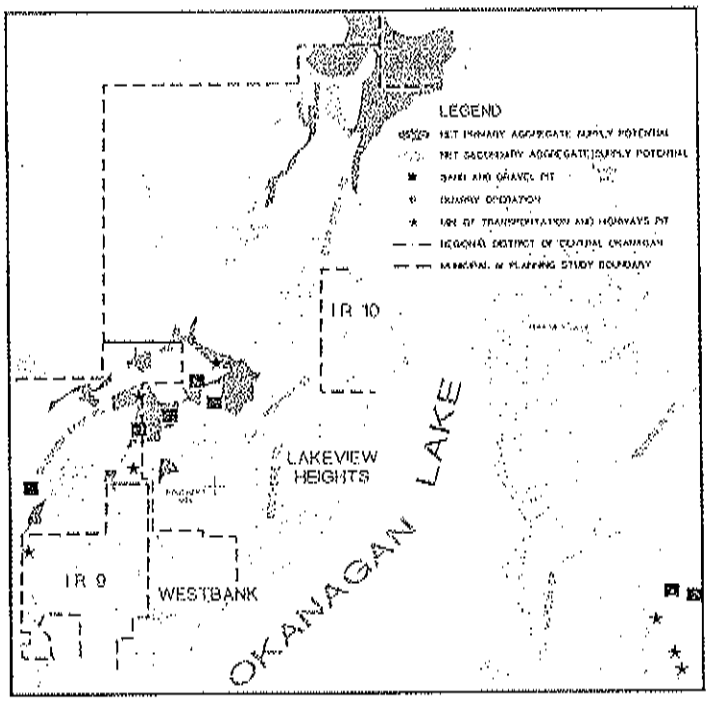

Figure 18: Aggregate Resources of Lakeview Heights

10.2.7 Westbank

An estimated 11.4 sq. km. of Class I aggregate potential has been mapped for the Westbank area. Of this, 2.9 sq. km. is outside ALR boundaries and current urban development.

10.2.7.1. Elliot and Shannon Lake Roads

In the area of Elliot and Shannon Lake Roads, lands with Class I aggregate deposits have a future land use designation of Low Density Residential. Planning for extraction in this area would need to take into consideration Smith Creek and nearby residential neighbourhoods. The majority of this deposit is not within a Environmentally Sensitive Area – Development Permit Area.

10.2.7.2 Powers Creek

An area of Class I potential aggregate has been identified along the glaciofluvial terrace of Powers Creek. The area has future land use designations of Major Open Space Conservation Areas and Parks, Mixed Density Residential, Low Density Residential, and Educational / Institutional. The majority of the area lies within Environmentally Sensitive Area – Development Permit Areas.

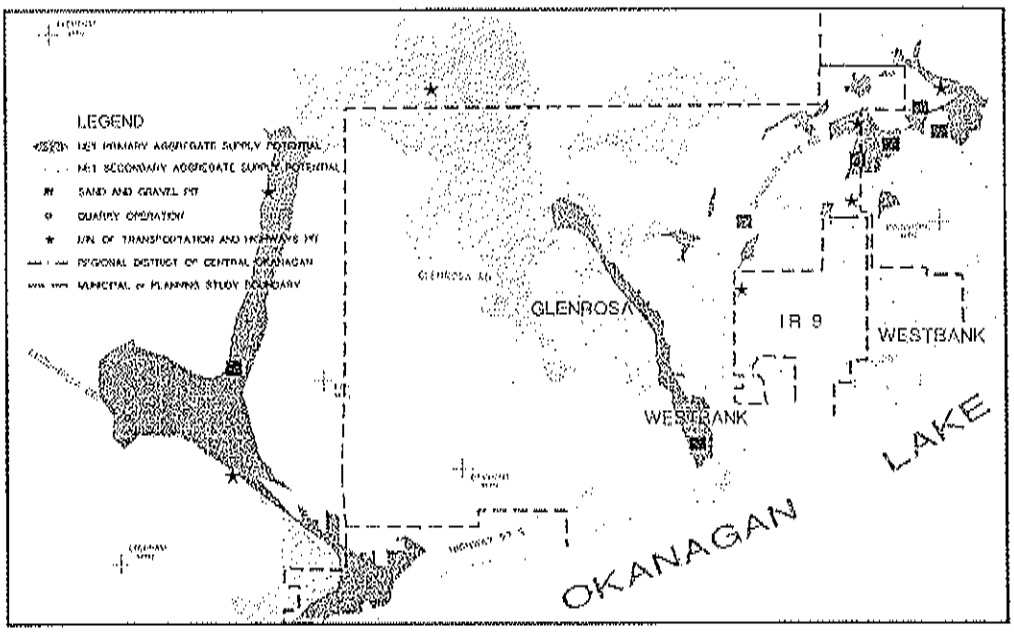

Figure 19: Aggregate Resources of Westbank

10.2.8 Peachland

An estimated 8.7 sq. km. of Class 1 aggregate resource has been mapped within the District of Peachland. The area net of urban development and ALR is 3.6 sq. km.

10.2.8.1 Trepanier Creek

A Class 1 aggregate deposit occurs along the Trepanier Creek outwash terrace. Designated future land uses for this area include Rural, Parks / Recreation / Natural Areas, and Low Density Residential. The area lies within the 12 km distance to a growth center.

Areas of steep slopes above Okanagan Lake are considered to have visual sensitivity considerations, while areas on the bench itself are considered to have visual impact only with adjacent roads and neighbours. Neighbourhood considerations for this area would include traffic issues along McKinnon and Trepanier Bench Roads. Environmental considerations include appropriate setbacks and watercourse protection measures for Trepanier Creek. The LRMP has proposed a protected area for the Trepanier area, but this occurs north of the Coquihalla Connector and is not adjacent the deposits in question.

10.2.8.2 Peachland (Deep) Creek

Class I potential aggregate areas lie along the outwash terraces and deposits along the Peachland (Deep) Creek corridor. Future land use designations for these deposits include primarily Rural and Industrial, with minor areas of Low Density Residential and Parks / Recreation / Natural Areas. The area is within 5 km of the Peachland market, but 16 km away from the next major growth center (Westbank). This area may be considered for aggregate extraction potential beyond the present 20 year planning horizon.

Areas of steep slopes above Okanagan Lake would be considered to have high visual sensitivity, while areas further up the bench away from the lake are considered to have only local visual impact considerations. Creek setbacks and watercourse environmental considerations regarding Peachland Creek would need to be incorporated into the planning and operation of aggregate extraction operations in this area. Neighbourhood issues would include traffic considerations through residential neighbourhoods along Princeton Avenue.

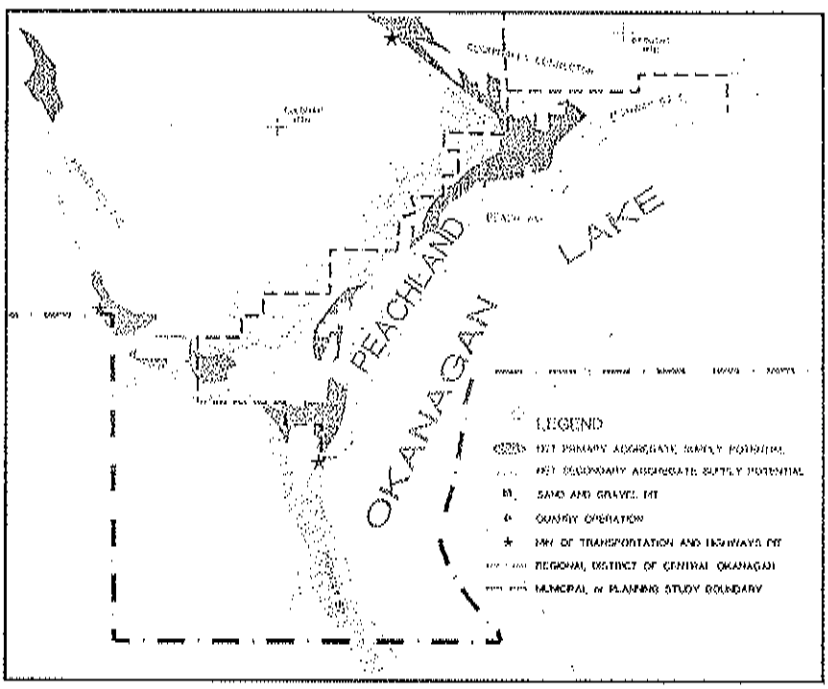

Figure 20: Aggregate Resources of Peachland

11.0 STRATEGY

The primary objective of the strategy is to develop an aggregate industry management system that meets the needs of consumers, producers, residents and regulators in an equitable and sustainable manner. The following section outlines recommendations for aggregate management.

11.1 Aggregate Management within the Central Okanagan

The aggregate management strategy and associated policy was designed to:

- ensure a level playing field between producers in the region;
- maximize the efficient use of the aggregate resource;
- minimize land use and neighborhood conflicts;
- minimize environmental impacts; and
- streamline the permit process between agencies with overlapping jurisdictions.

Implementation of the management plan will require involvement from local and provincial governments as well as industry representatives. Committees such as the Growth Management Strategy Steering Committee, the Growth Management Strategy Working Committee, and the Intergovernmental Advisory Committee will play important roles in the execution of the plan. Local government will need to apply the principles at the regional level to policies within their jurisdiction. Industry representatives and the public will provide consultation.

11.2 Growth Management Strategy

The Growth Management Program is led by the Regional board and includes a Growth Management Working Committee. The working Committee is comprised of local government staff. Together they establish policy for the Regional Growth Strategy as outlined by the *Municipal Act* (RSBC, 1996). The mandate of the Regional Growth Strategy is to ensure that development is 'socially, economically and environmentally healthy and that makes efficient use of public facilities and services, land and other resources' (RSBC, 1996). Five objectives for the management strategy to be completed under the Growth Management Strategy are noted below.

1. Establish an Aggregate Working Group to coordinate regional policy development as it pertains to aggregate extraction and deposit. The group should include aggregate industry representatives as well as local government engineering and planning staff. Its mandate will be to:

    - established extraction areas within the District, based on the aggregate potential maps generated by this study, for inclusion in the Soil Removal and Deposit Bylaw;

- co-ordinate revisions to OCPs within the District to provide consistency with the SRDB and other policies outlined in this strategy;
- develop a regional database for aggregate supply and consumption data;
- develop strategies to increase the use of recycled aggregate products, including a review of specifications and applications used in other communities;
- co-ordinate revisions to zoning bylaws within the District to provide consistency with the SRDB and other policies outlined in this strategy; and
- co-ordinate a public education program of the importance of aggregate and safety issues around extraction and deposit sites.

2. Adopt a Soil Removal and Deposit Bylaw for the District. The objectives of the bylaw will be to:

   - maintain a level playing field among producers in the region;
   - provide an alternative policy tool to the zoning bylaw for the management of aggregate within the region;
   - provide a review process that considers the interests of local government;
   - provide a mechanism to address impacts such as those to local infrastructure and the neighbourhood (*e.g.*, off-site dust, noise, visual and environmental impacts);
   - provide a mechanism to address long term reclamation issues as they affect the community (*e.g.*, reclamation phasing and landscape standards);
   - provide a mechanism to facilitate extraction in the short term in locations where the zoning does not support this activity, to allow for greater utilization of the resource (*e.g.*, for deposits that are threatened by sterilization due to the construction of roads, structures or utilities);
   - outline where public involvement is required in the review process; and
   - provide long term certainty to producers that their operation will not be threatened by local issues as long as a valid permit under the SRDB is held and the conditions outlined therein are met.

3. Establish an Implementation Agreement as permitted under Section 868 of the *Municipal Act* with relevant provincial agencies to coordinate the management strategy outlined in this report. The Implementation Agreement will:

- outline the permit process with agencies of overlapping jurisdictions;
- coordinate the process to address violations, such as the overloading of haul trucks;
- include a provision to enable local government to review annual reclamation reports submitted by producers to MEM;
- include a provision that requires both the MEM and local government (and LRC, if applicable) to sign off on the reclamation works prior to release of the security;
- delineate clearly those issues regulated under the SRDB Permit and those regulated under the Mines Permit; and
- outline mechanisms for mediation in the case of a dispute.

Figure 13 outlines the permit process when MEM is required to be involved (*e.g.*, for large extraction operations). Figure 14 outlines the permit process when it is likely MEM will not be involved (*e.g.*, deposit applications and some Short Term Permit applications). Figure 14 includes a referral to MEM if, through the permit process, it is deemed necessary.

The following table outlines the elements of the aggregate industry regulated by the Soil Removal and Deposit Bylaw and the Ministry of Energy and Mines Permit.

Local Government	Ministry of Energy and Mines
Off-site noise / noise attenuation	On-site noise attenuation for workers Off-site noise / noise attenuation (*e.g.* berms, equipment location)
Off-site dust	On-site dust
Off-site infrastructure impacts	n/a
Visual Impacts to Neighbourhood / Community	Visual Impacts to Neighbourhood / Community
Truck overloading – monitors local roads according to local bylaws	n/a
Valid permit waives zoning requirements	n/a
Requires reclamation plans in accordance with future land use	Requires reclamation plans in accordance with future land use
Requires a reclamation security – may waive security requirement if the security requirements of another agency exceeds local government requirements	Requires a reclamation security – may waive security requirement if the security requirements of another agency (e.g. ALC, FLC or local government) exceeds MEM requirements

Table 8: Local Government and MEM Jurisdiction

4. Consider resource needs for the administration of the bylaw provisions and permits.

5. Integrate transportation and land use planning with respect to aggregate haul, redirecting routes away from schools and residential areas where feasible.

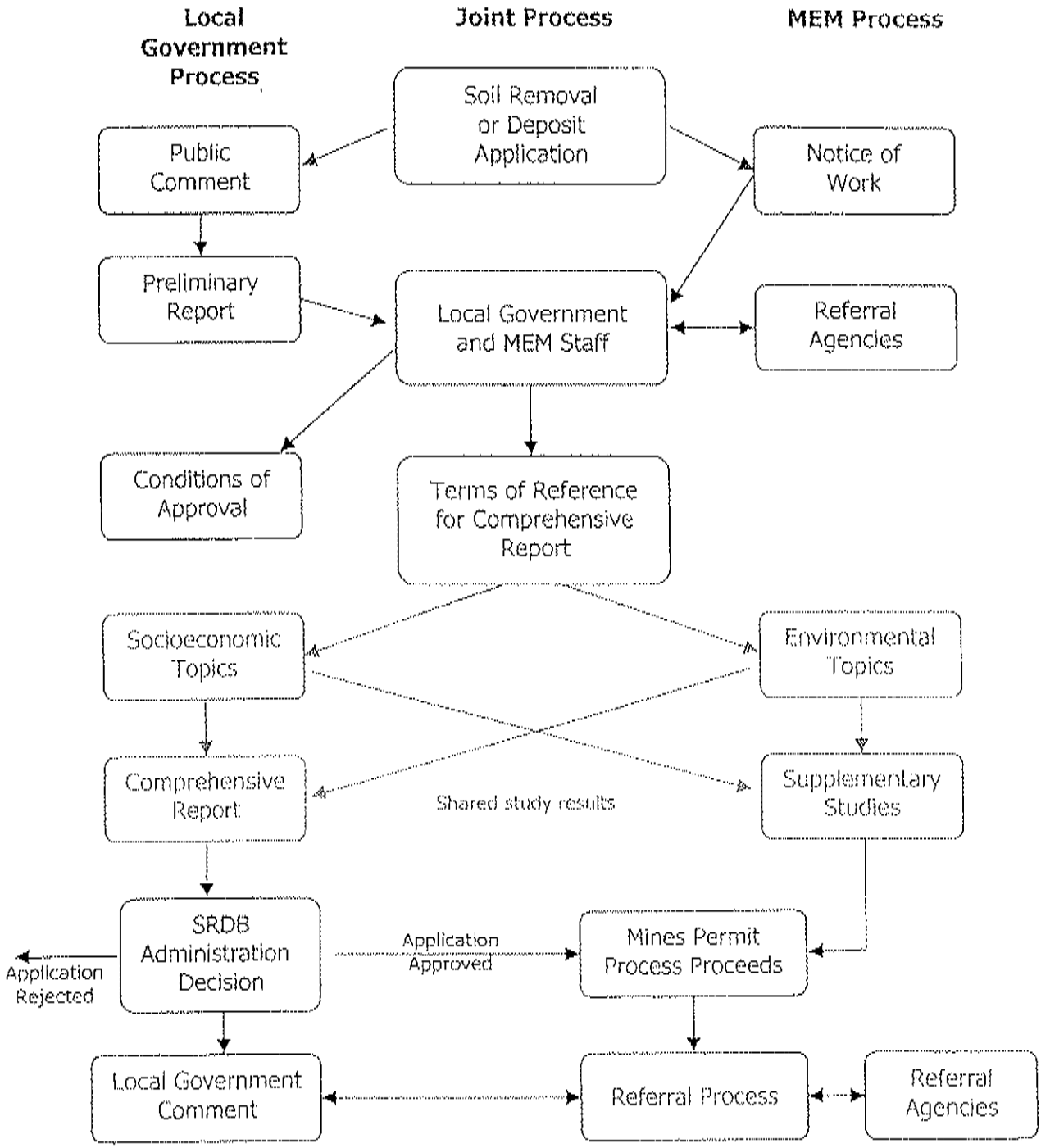

Figure 21: Coordinating the Soil Removal and Deposit Bylaw and Mines Act Permit Application Processes (RDN, 1999)

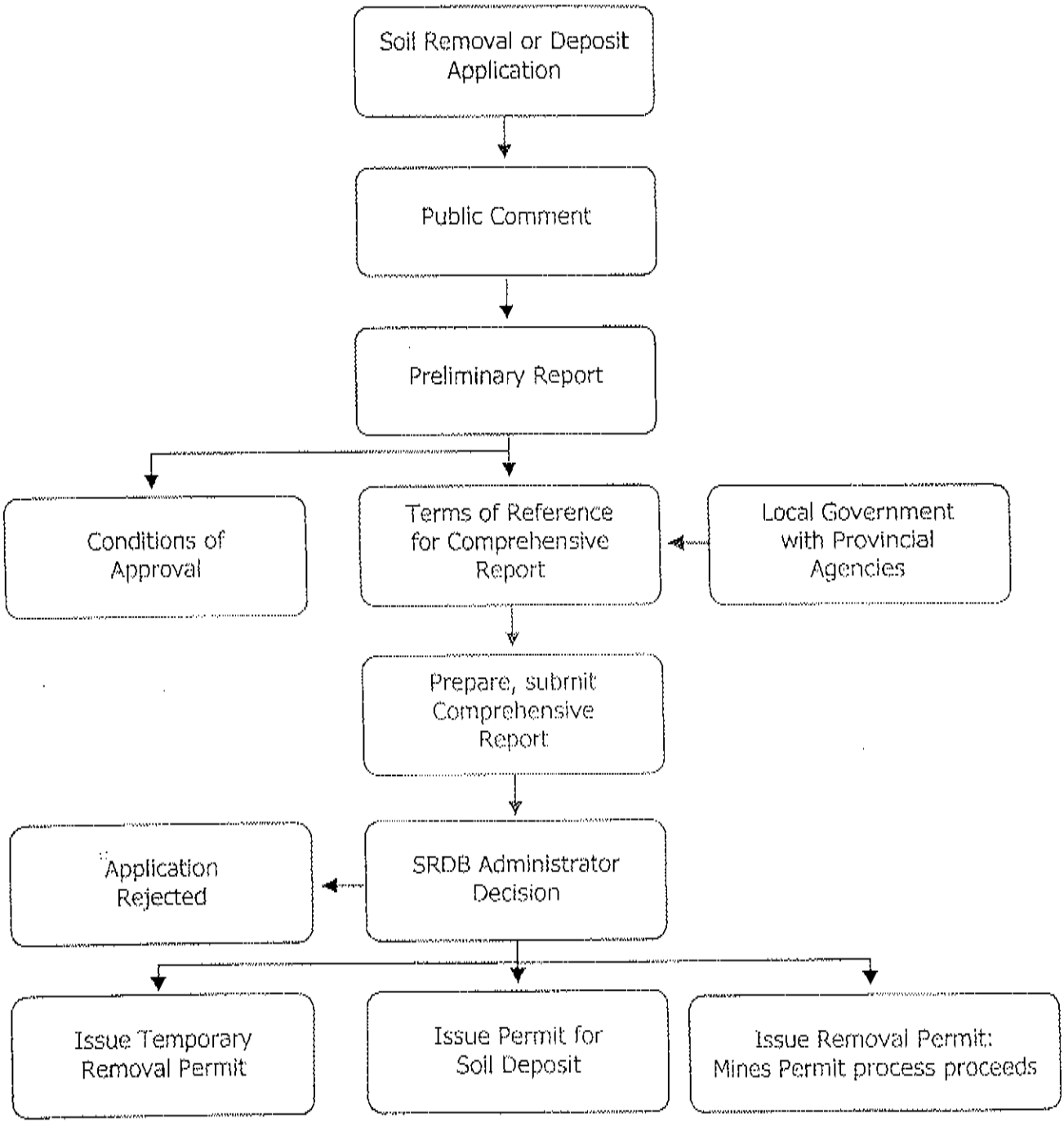

Figure 22: Soil Removal and Deposit Bylaw Application Process without Provincial Involvement (RDN, 1999)

11.3 Intergovernmental Advisory Committee

The Intergovernmental Advisory Committee (IAC) addresses issues that concern overlapping jurisdictions between levels of governments. The IAC would be an appropriate forum to review any legislative changes that may be required as a result of the strategy. For example, the option of changing the permit process to include the approval of a SRDB permit prior to a Mines Permit should be reviewed by the IAC. The permit process for an application under the *Soil Conservation Act* provides a model where the permit is first reviewed by the local government and then forwarded to the provincial agency. This model should be considered by the IAC for the aggregate industry.

11.4 Local Government

Local governments will need to ensure that community policy is consistent with the regional SRDB and management plan. This will include items as outlined below.

1. Review and amend OCP extraction policies to ensure that they are consistent with the SRDB and with other OCPs across the Regional District. Example wording in an OCP may be:

   'Extraction and processing of sand and gravel will be permitted in areas designated as Soil Removal Areas, subject to the issuance of a permit under the Soil Removal and Deposit Bylaw and required provincial permits' and

   "Temporary extraction and processing of sand and gravel may be permitted in the *(name of jurisdiction)* subject to the issuance of a Short Term Permit allowed under the Soil Removal and Deposit Bylaw and required provincial permits.'

2. Review and amend local zoning policy pertaining to aggregate extraction to ensure consistency with the SRDB. With respect to zoning, the SRDB would:

   - regulate long term aggregate extraction in lieu of zoning policy throughout the Regional District;
   - regulate the deposit of soil (in quantities exceeding a designated amount per year, e.g. 50 cubic metres); and
   - establish conditions for the issuance of Short Term Permits for aggregate extraction in all zones.

3. Participate on the Aggregate Working Group on behalf of their jurisdiction.

4. Implement a road radar management program to assess the current condition of aggregate haul roads for inclusion in Transportation and Infrastructure programs. Each haul route should be assigned an appropriate road type classification based on anticipated loading. The loading calculations should incorporate loads due to regular traffic, forestry and agriculture, as well as aggregate haul.

5. Instruct bylaw officers to pay particular attention to the overloading of vehicles, particularly during spring weight restrictions.

6. Review future land use designations within each OCP for areas designated as Class I aggregate potential. Consider redefining the future land use designation of these lands and those around them to facilitate the maximization of the aggregate resource. Consider including Class I potential aggregate resources which lie more than 12 km from an urban area for designation as future aggregate reserve zones, for development beyond the present 20 year planning horizon.

7. Implement policy that requires a former extraction site to be tested for the presence of radon gas prior to the construction of any inhabited spaces. If radon is detected, the BC Building Code regulations with respect to radon must be adhered to.

11.5 INDUSTRY

The participation of local industry in the development of aggregate policy is essential in ensuring the success of the management plan. There are a number of ways industry members can participate in this endeavour. These are outlined below.

1. Participate on the Aggregate Working Group on behalf of the industry.

2. Provide annual numbers of aggregate production and supply to local and provincial governments, such that overview demand and supply trends may be tracked and projections made.

3. Self-regulate to prevent the overloading of trucks, which can be detrimental to road pavement condition.

4. Help to promote the industry and provide public education on the importance of aggregate to the community.

5. Be a 'good neighbour'. Comply with hours of operation as defined by local bylaws and minimize truck traffic during peak traffic hours.

12.0 FINANCING STRATEGY

There are potential tools for financing the management strategy. Some of these tools are implemented currently by some of the local governments, others are not currently used. The following section reviews current revenues being generated to date and assesses potential sources as well as potential costs.

12.1 Revenues

Potential revenues generators with respect to the aggregate industry include business licenses, commercial vehicle licenses and, through a Soil Removal and Deposit Bylaw, permit fees, reclamation securities and volume based fees. These are discussed below.

12.1.1 Business Licenses

Business licenses for aggregate pits, quarries, and the related businesses for asphalt and concrete production are used by all four local governments in the Study Area. The current rates are noted below. Business license rates in the District are as outlined in the chart below.

Lake Country	$50 for any business
Kelowna	$207.94 for a Sand and Gravel Pit or Quarry $125.00 for a Contractor – 1st license $ 34.22 for a Contractor – 2nd license
Peachland	$112.00 for any business
Regional District of the Central Okanagan	$ 75.00 for any business

Table 9: Business License Rates

- *There is potential to increase revenues by increasing business license fees to reflect administration and enforcement.*
- *There is potential to standardize the fees across the District to establish an equal playing field with respect to business licenses for aggregate producers.*

12.1.2 Commercial Vehicle Licenses

Municipalities are able to charge fees for commercial vehicle licenses as regulated by the Municipal Act. Within the Central Okanagan, the City of Kelowna and the District of Peachland charge a fee for a commercial license per vehicle. Lake Country does not currently have a commercial vehicle license fee and the Regional District cannot impose a fee.

	Lake Country	Kelowna	Peachland	RDCO
Commercial Vehicle License Cost	Not used	$ 25 to 40 per truck	$40 per truck	N/A

Table 10: Commercial Vehicle License Rates

The revenues generated from the commercial vehicle licenses are submitted to the Union of British Columbia Municipalities minus an administration fee per license. They are pooled with other with the funds from other municipalities, and at the end of the year are returned to each municipality on a per capita basis. For example, the City of Kelowna receives approximately $48,000 per annum from this fund. Administration charges for this are approximately $15,000, leaving $33,000 that could potentially be identified specifically for infrastructure purposes, in addition for bylaw enforcement.

- *The District of Lake Country should consider implementing a commercial vehicle fee licensing program, with a portion of the funds being directed to infrastructure and maintenance.*

- *The municipalities within the District should consider applying the proceeds received from these fees, less administration charges, directly to infrastructure and maintenance.*

12.1.3 Soil Removal and Deposit Bylaw

A number of fees are permitted within a Soil Removal and Deposit Bylaw. These include a permit fee, a reclamation security, and volume based fees. (See the Executive Summary for a discussion on the advantages and disadvantages of volume based fees). In addition, a Soil Removal and Deposit Bylaw may impose fines for contravention of the bylaw.

Fees for existing soil removal and deposit permits vary by jurisdiction around the province. Some bylaws are for soil removal only, some bylaws are for soil deposit only. Other bylaws are for both soil removal and deposit. Therefore, the application of permit and volume based fees can vary greatly from jurisdiction to jurisdiction. In addition, while regional districts may charge a permit fee and require reclamation securities, they may not charge a volume based fee. The reason for this is that the intent of the volume based fee is to compensate for the impact of the aggregate haul over roadways. Since it is the Ministry of Transportation and Highways that builds and maintains roads within regional districts, they are not permitted to charge a volume based fee for road repair. The result is a potential to have great disparity with respect to fees between adjacent jurisdictions. It is the objective of this study to minimize disparity between the four local governments within the Central Okanagan.

A summary of the fees for existing Soil Removal and Deposit Bylaws is outlined below. Currently the District of Lake Country has a bylaw that regulates both soil removal and deposit (Soil Regulation Bylaw 95-015), while the City of Kelowna has two bylaws, one for soil removal (Soil Removal Bylaw No. 6933) and another for deposit (Soil Deposit Bylaw No. 8504).

	Lake Country	Kelowna	Peachland	RDCO
Permit Fee	Require business license - $ 50	Deposit – no fee Removal - $50	No existing bylaw	No existing bylaw
Volume Based Fee	no fee	Deposit – no fee Removal – no fee	No existing bylaw	No existing bylaw
Reclamation Security	no fee	Deposit – no fee Removal – no fee	No existing bylaw	No existing bylaw

Table 11: Summary of Existing Soil Removal and Deposit Fees in the Central Okanagan

The table below summarizes a range of fees charged for soil removal and deposit in British Columbia. As noted above, the objectives of the bylaws vary from jurisdiction to jurisdiction, and this is reflected in the fee variation. The date of adoption for the bylaws vary from 1961 to 1999. Bylaws from 12 different municipalities across the province were reviewed.

	Permit Fee	Volume Based Fee	Reclamation Security
Fee	Varies from $2.50 to $1,000.00 per permit	Varies from $0.26 / m^3 to $0.50 / m^3	Varies from $2000 / ha to $7000 / ha

Table 12: Summary of SRDB Fees from Across the Province

12.2 Expenses

The following table illustrates an estimate for the anticipated administration of a Soil Removal and Deposit Bylaw in the Central Okanagan, considering that there is currently approximately 25 aggregate pits and quarries within the district.

Administration	$10,000 per annum
Enforcement	$20,000 per annum
Pavement Management / Road Radar	$230 per lane km

Table 13: Summary of Potential Expenses Resulting from a SRDB

13.0 SUMMARY

The Aggregate Supply and Demand Study was undertaken to provide an inventory and assessment of aggregate resources within the Central Okanagan. Based on the assessment, a comprehensive management strategy for the industry was developed in order to make efficient use of the resource, minimize land use conflicts, streamline the permit process, and avoid the sterilization of the resource due to urbanization.

The inventory revealed a potential shortfall of 20 million tonnes over the 20 year study horizon, based on an assumed growth rate of 2.5%, a consumption rate of 15 tonnes per capita per year, and permitted supply figures from July, 1999. Providing for the projected demand requires either permitting additional sand and gravel sources or a relying more on quarried crushed rock. According to published literature, quarried rock has production costs 25 to 30 % greater than that for sand and gravel sources. Therefore, greater reliance on quarried crushed rock would result in increased costs.

Mapping was conducted to identify areas of aggregate potential. The aggregate potential mapping identified areas of existing urban development and Agricultural Land Reserve for the purposes of land planning. While aggregate extraction in the ALR is not prohibited, it does require the additional approval of the Agricultural Land Commission through a permit under the *Soil Conservation Act*. The ALC requires that the land be restored such that the overall agricultural capability of the site is increased. The following high (Class I) potential area, and the corresponding urban development and ALR has been identified:

- Total Class I Gross Area = 182 sq. km.
- ALR / Urban Area = 121.8 sq. km
- Net Class I Area = 60.2 sq. km.

13.1 Next Steps

Managing the resource requires an integrated working relationship between local, regional and provincial governments and the industry. In order to streamline the permitting process a strategy was developed to provide a predictable process and requirements for applicants. The strategy includes the development of:

- an Aggregate Working Group to coordinate regional policy development;
- a regional *Soil Deposit and Removal Bylaw*;
- an Implementation Agreement with relevant provincial agencies regarding aggregate policy and process;
- a review by the Inter-governmental Advisory Committee regarding the permit review process and corresponding legislation; and
- policy amendments to OCPs and zoning bylaws within the region.

With a cooperative effort to establish clear priorities for the long-term extraction and deposit of aggregate, the resource will remain available and affordable for future generations, while minimizing land use conflicts and contributing to the continued growth of our communities.

GLOSSARY AND ABBREVIATIONS

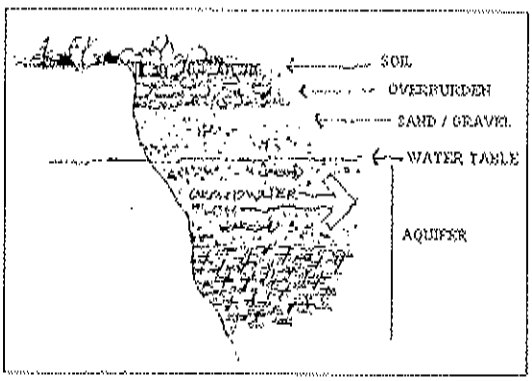

Figure : Gravel Deposit over Aquifer (MEM, 1995)

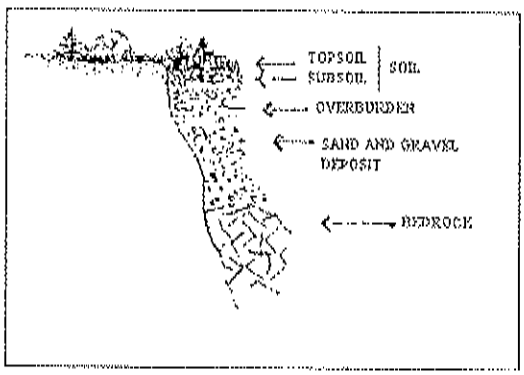

Figure : Gravel Deposit over Bedrock (MEM, 1995)

ALC. Agriculture Land Commission.

ALR. Agriculture Land Reserve.

aggregate. Sand, gravel, crushed stone and quarried rock.

aquifer. A geological formation that is made up of porous, permeable materials that are saturated with sufficient water to result in adequate flows of water into wells, boreholes and springs.

asphalt concrete. The material commonly used as asphalt top course for road structures.

bedrock. The solid rock that underlies the soil and overburden, or that is exposed at the surface.

bentonite clay. Clay used to make liners for sewage lagoons and detention ponds.

borrow pits. A pit containing resources of sand and gravel, are often excavated to provide low quality fill (e.g., overburden) for construction activities such as road building and landscaping.

Chief Inspector. The Chief Inspector of Mines appointed by the minister and includes a person designated by the chief inspector to act on behalf of the chief inspector.

clay and marl pits. A pit opened for special situations requiring such material. As clay can help reduce seepage, it is often used to line dugouts, water reservoirs, or ditches.

construction aggregate. Includes but is not limited to sand, gravel, crushed stone, quarry rock and similar materials used in the construction and maintenance of roads, bridges foundations and other civil and structural projects.

construction purpose. Includes, without limitation,

(a) the building or maintenance of a road, railway bed, runway, berm, dam, impoundment, breakwater, dike, levee, foundation, rock wall and other similar thing, and

(b) the providing of fill and riprap.

crushing. Crushing is a process whereby gravel or rock is broken down to improve its gradation, increase stability and/or maximize utilization of the resource.

CEAA. Canadian Environmental Assessment Act.

decorator rock. A rock classified by MEM as a mineral used for a ground cover in landscape applications.

dimension stone. A rock or stone product that is cut or split on 2 or more sides, and includes, without limitation, tiles, facing stone, crushed rock that is reconstituted into building stone, headstones, monuments, statues, ornamental furnishings and other similar components, but does not include crushed, cut or split rock that is used for a construction purpose.

District. In this study, the Regional District of the Central Okanagan.

District Inspector. A person appointed by the chief inspector as an inspector with responsibility for a designated area within British Columbia.

DFO. Department of Fisheries and Oceans.

EAA. Environmental Assessment Act of British Columbia.

ESAL. An ESAL is one 80 kN (18,000 lb) load applied by a single, dual tired axle. A tandem dual axle configuration, with a load of 32,000 lb similarly applies one ESAL. Loads applied to the pavement by any other axle and loading configuration can be assigned the appropriate ESAL value.

FLC. Forest Land Commission

FLR. Forest Land Reserve.

gravel. Unconsolidated materials that are made up of rock fragments 2 mm to 7.5 cm in diameter.

groundwater. Water that passes through or stands in the soil and underlying overburden or bedrock layers.

IAC. Intergovernmental Advisory Committee.

Inspector. A person appointed by the chief inspector as an inspector of mines.

LRC. As of April 1st, 2000, The Agricultural Land Commission and the Forest Land Commission became integrated into one administrative body.

LRMP. Land and Resource Management Plan.

MELP. Ministry of Environment, Lands and Parks.

MEM. Ministry of Energy and Mines.

mine. Includes:

(a) a place where mechanical disturbance of the ground or any excavation is made to explore for or to produce coal, mineral bearing substances, placer minerals, rock limestone, earth, clay, sand, or gravel,

(b) all cleared areas, machinery and equipment for use in servicing a mine or for use in connection with a mine and buildings other than bunk houses, cook houses, and related residential facilities,

(c) all activities including exploratory drilling, excavation, processing, concentrating, waste disposal, and site reclamation,

(d) closed and abandoned mines, and

(e) a place designated by the chief inspector as a mine.

mineral. An ore of metal, or a natural substance that can be mined, that is in the place or position in which it was originally formed or deposited or is in talus rock, and includes

(a) rock and other materials from mine tailings, dumps and previously mined deposits of minerals,

(b) dimension stone, and

(c) rock or a natural substance prescribed under section 2 (1) of the Mineral Tenure Act, but does not include

(d) coal, petroleum, natural gas, marl, earth, soil, peat, sand or gravel,

(e) rock or a natural substance that is used for a construction purpose on land that is not within a mineral title or group of mineral titles from which the rock or natural substance is mined,

(f) rock or a natural substance on private land that is used for a construction purpose, or

(g) rock or a natural substance prescribed under section 2 (2) of the Mineral Tenure Act.

mineral claim. A claim to the minerals within an area which has been located or acquired by a method set out in the regulations and includes a claim to minerals recorded under one of the former Acts;

MOTH. Ministry of Transportation and Highways.

MOU. Memorandum of Understanding.

natural aggregate. Sand and gravel deposits that occur in the landscape.

non-mineral materials. Sand, gravel, and rock products for a construction purpose.

OCP. Official Community Plan.

operation. As used in this report, an operation refers to all of the active work and processing areas within a site, including the pit or quarry area, stockpile and storage areas, haul roads, processing sites, weigh scales, etc.

overburden. The unconsolidated material between the soil layer (rooting zone) and the bedrock, excluding the economically valuable sand and gravel layers. Overburden is typically comprised of glacial till, and/or freshwater or marine sediments. Sand and gravel deposits are often sandwiched between layers of overburden. If overburden overlays a sand, gravel or stone deposit, it will need to be removed prior to extraction.

overlay. A layer of asphalt concrete laid over an existing pavement structure.

pavement structure. The entire structure forming a road including the subgrade, granular subbase, crushed granular base and asphalt concrete.

pit. For the purpose of this report, a pit is defined as a place designated by the Chief Inspector of Mines as a mine for the extraction and processing of sand and gravel.

polygon. A polygon is a shape on a map with a certain colour that shares a physical characteristic with other shapes of the same colour. For example, in this study, yellow shapes represent areas with Class III aggregate potential.

quarry. For the purpose of this report, a quarry is defined as a place designated by the Chief Inspector of Mines as a mine for the extraction and processing of non-mineral rock.

reserve. Sand and gravel or bedrock that is currently covered under a Mine Permit and is therefore available for production.

resource. Sand and gravel or bedrock that has potential for aggregate production and may or may not be available for production. A deposit may be defined as resource irrespective of extraction constraints such as sterilization by urban development.

rip rap. Rip rap is large diameter rock used to line creeks and lakes for protection against erosion.

RMDRC. Regional Mine Development Review Committee.

sand. Unconsolidated materials that are primarily made up of rock particles 0.06 mm to 5.0 mm in diameter.

SCA. Soil Conservation Act (of British Columbia).

screening. As many deposits contain mixtures of both sands and gravels, they are often screened to sort the different sizes of aggregates required for different construction purposes. Screening also provides a means of separating sand from the gravels, and removing waste materials such as silt.

site. For the purpose of this report, site refers to all of the disturbed and undisturbed land within the legal boundaries of a lease or property.

soil. The unconsolidated material on the immediate surface of the land that serves as a natural medium for the growth of plants.

SRDB. Soil Removal and Deposit Bylaw.

subsoil. The soil layer between the topsoil and the overburden. Subsoil layers may show differences in colour (often reddish brown or mottled), clay content, structure and chemistry (e.g., salinity, sodicity) compared to the topsoil and overburden. Subsoils typically contain some plant roots and are the maximum depth of rooting.

topsoil. The upper most soil layer that is commonly characterized by dark-coloured, organically-enriched materials. Topsoil layers can be very thin, but are commonly 10 to 30 cm deep. It normally includes the surface layer of plant litter. The majority of plant roots are located in the topsoil layer.

talus rock. A rock that occurs in fragments or particles lying on or above or adjacent to the place or position in which it was originally formed or deposited.

UBCM. The Union of BC Municipalities.

washing. Washing of gravel typically takes place when there is a requirement for clean construction materials that do not contain large quantities of non-granular materials (e.g., till) or fine granular material (e.g., sand). Finer gravels are commonly washed to remove sands and other material that accumulate during extraction and processing, or that were originally present. The outwash from the washing operation is often piped into ponds to separate fine, solid materials, and to allow recycling of the wash water. Depending on its characteristics, some finer material may be collected for further processing.

watertable. The upper surface or elevation of the groundwater that is within the aquifer that is closest to the ground surface.

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APPENDIX A

This report incorporates and is subject to these "General Conditions".

A.1 USE OF REPORT

This report pertains to a specific site, a specific development, and a specific scope of work. It is not applicable to any other sites, nor should it be relied upon for types of development other than those to which it refers. Any variation from the site or proposed development would necessitate a supplementary investigation and assessment.

This report and the assessments and recommendations contained in it are intended for the sole use of EBA's client. EBA does not accept any responsibility for the accuracy of any of the data, the analysis or the recommendations contained or referenced in the report when the report is used or relied upon by any party other than EBA's client unless otherwise authorized in writing by EBA. Any unauthorized use of the report is at the sole risk of the user.

A.2 LIMITATIONS OF REPORT

This report is based solely on the conditions which existed on site at the time of EBA's investigation. The client, and any other parties using this report with the express written consent of the client and EBA, acknowledge that conditions affecting the environmental assessment of the site can vary with time and that the conclusions and recommendations set out in this report are time sensitive.

The client, and any other party using this report with the express written consent of the client and EBA, also acknowledge that the conclusions and recommendations set out in this report are based on limited observations and testing on the subject site and that conditions may vary across the site which, in turn, could affect the conclusions and recommendations made.

The client acknowledges that EBA is neither qualified to, nor is it making, any recommendations with respect to the purchase, sale, investment or development of the property, the decisions on which are the sole responsibility of the client.

A.2.1 Information Provided to EBA by Others

During the performance of the work and the preparation of this report, EBA may have relied on information provided by persons other than the client. While EBA endeavours to verify the accuracy of such information when instructed to do so by the client, EBA accepts no responsibility for the accuracy or the reliability of such information which may affect the report.

A.3 LIMITATION OF LIABILITY

The client recognizes that property containing contaminants and hazardous wastes creates a high risk of claims brought by third parties arising out of the presence of those materials. In consideration of these risks, and in consideration of EBA providing the services requested, the client agrees that EBA's liability to the client, with respect to any issues relating to contaminants or other hazardous wastes located on the subject site shall be limited as follows:

(1) With respect to any claims brought against EBA by the client arising out of the provision or failure to provide services hereunder shall be limited to the amount of fees paid by the client to EBA under this Agreement, whether the action is based on breach of contract or tort;

(2) With respect to claims brought by third parties arising out of the presence of contaminants or hazardous wastes on the subject site, the client agrees to indemnify, defend and hold harmless EBA from and against any and all claim or claims, action or actions, demands, damages, penalties, fines, losses, costs and expenses of every nature and kind whatsoever, including solicitor-client costs, arising or alleged to arise either in whole or part out of services provided by EBA, whether the claim be brought against EBA for breach of contract or tort.

A.4 JOB SITE SAFETY

EBA is only responsible for the activities of its employees on the job site and is not responsible for the supervision of any other persons whatsoever. The presence of EBA personnel on site shall not be construed in any way to relieve the client or any other persons on site from their responsibility for job site safety.

A.5 DISCLOSURE OF INFORMATION BY CLIENT

The client agrees to fully cooperate with EBA with respect to the provision of all available information on the past, present, and proposed conditions on the site, including historical information respecting the use of the site. The client acknowledges that in order for EBA to properly provide the service, EBA is relying upon the full disclosure and accuracy of any such information.

A.6 STANDARD OF CARE

Services performed by EBA for this report have been conducted in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions in the jurisdiction in which the services are provided. Engineering judgement has been applied in developing the conclusions and/or recommendations provided in this report. No warranty or guarantee, express or implied, is made concerning the test results, comments, recommendations, or any other portion of this report.

A.7 EMERGENCY PROCEDURES

The client undertakes to inform EBA of all hazardous conditions, or possible hazardous conditions which are known to it. The client recognizes that the activities of EBA may uncover previously unknown hazardous materials or conditions and that such discovery may result in the necessity to undertake emergency procedures to protect EBA employees, other persons and the environment. These procedures may involve additional costs outside of any budgets previously agreed upon. The client agrees to pay EBA for any expenses incurred as a result of such discoveries and to compensate EBA through payment of additional fees and expenses for time spent by EBA to deal with the consequences of such discoveries.

A.8 NOTIFICATION OF AUTHORITIES

The client acknowledges that in certain instances the discovery of hazardous substances or conditions and materials may require that regulatory agencies and other persons be informed and the client agrees that notification to such bodies or persons as required may be done by EBA in its reasonably exercised discretion.

A.9 OWNERSHIP OF INSTRUMENTS OF SERVICE

The client acknowledges that all reports, plans, and data generated by EBA during the performance of the work and other documents prepared by EBA are considered its professional work product and shall remain the copyright property of EBA.

A.10 ALTERNATE REPORT FORMAT

Where EBA submits both electronic file and hard copy versions of reports, drawings and other project-related documents and deliverables (collectively termed EBA's instruments of professional service), the Client agrees that only the signed and sealed hard copy versions shall be considered final and legally binding. The hard copy versions submitted by EBA shall be the original documents for record and working purposes, and, in the event of a dispute or discrepancies, the hard copy versions shall govern over the electronic versions. Furthermore, the Client agrees and waives all future right of dispute that the original hard copy signed version archived by EBA shall be deemed to be the overall original for the Project.

The Client agrees that both electronic file and hard copy versions of EBA's instruments of professional service shall not, under any circumstances, no matter who owns or uses them, be altered by any party except EBA. The Client warrants that EBA's instruments of professional service will be used only and exactly as submitted by EBA.

The Client recognizes and agrees that electronic files submitted by EBA have been prepared and submitted using specific software and hardware systems. EBA makes no representation about the compatibility of these files with the Client's current or future software and hardware systems.

APPENDIX B

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1.0 ORIGIN AND DISTRIBUTION OF DEPOSITS

Understanding the underlying geology and nature of recent surficial materials is important to the location of aggregates useful for construction.

The following describes the origin of aggregate deposits in two sections. The first will deal with sand and gravel deposits which occur naturally in the landscape. The second will address bedrock deposits which have the greatest potential for quarried aggregate extraction. Deposits of specialty materials such as landscape rock and clays suitable for brick will also be covered.

1.1 Sand and Gravel verses Bedrock Sources of Aggregate

Aggregates are provided to us essentially in two kinds of geological deposits. The first come as sand and gravel deposits (known as *surficial materials*). The second is made available to use through bedrock deposits that are of suitable density and quality to provide quarried rock. The following sections will outline the origin of each type of deposit in turn.

1.2 Topography and Bedrock Geology of the Central Okanagan

The Central Okanagan is located at the eastern edge of the Thompson Plateau, a subdivision of the Interior Plateau Physiographic Region (Holland, 1976). The Thompson Plateau consists of a gently rolling upland surface of low relief. Elevations range from 342m at Okanagan Lake to 1600m in the upland regions. The rivers and streams of the area drain into Okanagan Lake that ultimately flows into the Columbia River system via Okanagan River.

The description of the bedrock geology for the study area is taken from Tempelman-Kluit (1989) and Jones (1958). The present physiography dates back four hundred million years when plate tectonics welded the former Pacific Ocean to the margin of the North American continent. This created ridges of metamorphic and plutonic bedrock orientated in a north-south direction. About 50 million years ago (early Tertiary), plate tectonics caused uplift of the area accompanied by extensive volcanism (extrusion of the Kamloops Group). A long period of relative stability followed, during which erosion and deposition formed a low-relief landscape with gentle slopes and low hills. During late Tertiary, the area was

subject to uplift again, followed by a renewed period of downcutting, with the stream valleys deeply incising into the old erosion surface.

2.0 BEDROCK SOURCES OF AGGREGATE

2.1 Paleozoic Metamorphic Rock

The crystalline gneisses and schists of the Shuswap and Okanagan Metamorphic Complex are probably the oldest rocks of the region. The metamorphic character of the rocks has made them appear to be more like typical Precambrian metamorphic rocks. These rocks are now classified as Carboniferous to Triassic in age and some discussion as to age still remains. The contact between the Shuswap and the Okanagan metamorphics is gradational and strikes approximately north-south near the confluence of Mission Creek and its tributary, Pearson Creek.

For the purposes of crushed stone aggregate, these rocks offer the largest areal extent of potential source rock. The more massive units, without strong foliation and only minor amounts of mica-filled partings, would be the best rock types.

2.2 Mesozoic Rocks

2.2.1 Upper Triassic or Lower Jurassic Rocks - Sedimentary

Upper Triassic or Lower Jurassic rocks, represented by rusty weathering, black pyritic slates , phyllites and argillites are mapped on the west side of Okanagan Lake around Wilson Landing and as a narrow band paralleling the lake shore on the east side of the lake north of Kelowna. The potential for acid rock drainage from these rock types would suggest poor potential for aggregate material.

2.2.2 Middle Jurassic Rocks – Nelson Plutonic Intrusives

In the Central Okanagan District, the rocks of the Middle Jurassic, being intrusive rocks rather than softer bearing sedimentary sequences, do have potential for crushed stone aggregate production. Granitic and granodioritic intrusive rocks extend across much of the west side of the area, including the upper reaches of Trepannier Creek and flanking the Coquihalla Connector. On the east side of the lake there is a smaller window of Nelson Plutonic rocks of Middle Jurassic age that extends roughly northwest-south east through the community of Ellison Lake. This is mapped as a massive granitic to granodioritic body.

These rocks should have potential for crushed stone aggregate where it is sufficiently unaltered and massive.

2.3 Tertiary Rocks

2.3.1 Tertiary Volcanic Rocks

Tertiary volcanics underlie much of the Westbank and Westside communities and are found capping many of the hills on the Okanagan Plateau to the east of Kelowna.

Generally these rocks are of low strength which indicate low potential for aggregate resource. The exception are the plateau basalts, discussed below.

2.3.2 Plateau Basalts

These rocks are Pleistocene in age (approximately 750,000 years before present). Lambly Creek Basalts occur along Lambly Creek and underlying Lakeview Heights on the west side of Okanagan Lake. They are rusty weathering basalts with some columnar jointing.

There is potential for rock in this unit which might be suitable for road sub-grade material.. The columnar forms may have greater value as landscaping rock.

3.0 GLACIAL HISTORY AND THE ORIGIN OF SURFICIAL DEPOSITS

At the beginning of the last major glacial episode (Fraser Glaciation), ice accumulated in the high mountains and then gradually spread to valleys and lowlands. About 14,500 years ago, when the Cordilleran Ice Sheet was thickest and most extensive at the climax of Fraser Glaciation, ice flowed generally southward across the study area (Fulton, 1965). The rounded ridge tops suggest that the entire area was completely overridden by ice at this time, depositing till at the base of the glacier.

Deglaciation occurred between about 14,000 and 11,000 years ago. As the ice cap melted the uplands emerged from beneath the ice before lower areas (Fulton, 1969). As the glacier, now confined to the valley floor, lowered, several large meltwater channels formed along the margin of the ice on mid-elevation slopes. As the ice downwasted further, extensive glaciofluvial sediments were deposited, largely on the mid and lower slopes on the eastern side

of the valley. These deposits typically occur in the landscape as glaciofluvial terraces, fans and raised deltas. Elevations of these deposits range generally from 400m to 600m. Examples of these surfical deposits occur in East Kelowna, Crawford Estates, Southwest Mission, and the east side of Wood Lake.

Ice-tongues blocked drainage so that Glacial Lake Penticton (Roed, 1995) was created, depositing glaciolacustrine sediments (silts and clays) along the valley bottom. Locations of clays in the Central Okanagan include the Glenmore Valley and the Klassen Road area in North Rutland.

The clays that were deposited by glacial lakes hold some potential for brick manufacturing.

During post-glacial times, natural processes have re-worked some glacial sediments and weathered bedrock to redistribute them as colluvium (sediments moved by gravity) and fluvial (sediments moved by post-glacial rivers and streams) sediments. Creeks and rivers that have graded to the present day lake level have downcut into glacial deposits creating terraces, benches, and steep-sided scarps.

This section gives the typical characteristics of surficial materials in the Central Okanagan.

3.1 Glaciofluvial Materials

Glacial meltwater streams near the end of the most recent glaciation deposited glaciofluvial materials. Sands and gravels accumulated along ice margins and on top of melting ice (ice contact deposits), and downstream of glaciers (outwash plains). Where outwash streams flowed onto flat ground, fans were formed. Where outwash streams drained into former lakes, deltas were created. Postglacial streams have cut down through some outwash plains and fans transforming them into terraces. Glaciofluvial sediments commonly overlie till.

Glaciofluvial materials consist of sand and gravel with small quantities of finer material. Sorting and bedding characteristics are variable depending on the mode and site of deposition.

Gravels range from unsorted to well sorted, and bedding can range from absent to well defined (see Photo 4). Gravels tend to be subangular to subround. Ice-contact deposits may have distorted bedding, slump structures and faults as a result of settling and collapse due to melting of supporting ice.

The sands and gravels of glaciofluvial materials form a matrix that is highly porous and permeable, and thus they form relatively dry and well drained sites. The material is non-cohesive, and so tends to slump when exposed in steep slopes (greater than 70%) and road cuts. Glaciofluvial sands and gravels are primary potential sources of aggregate.

➢ Glaciofluvial sediments have been moved by glacial rivers and streams.

3.2 Fluvial Materials

Streams have deposited fluvial gravels in post-glacial time. These sediments are loose, non-cohesive and the deposits are highly porous and permeable. Associated landforms, such as floodplains and parts of fans that are close to stream-level, have high water tables and are moderately to imperfectly drained. Floodplains are subject to periodic inundation during high flows. Fluvial terraces stand above present day creek-levels and are relatively well drained and dry, and good locations for roads and landings.

➢ Glaciofluvial deposits are a primary source of aggregate.

The particle size of fluvial sediments vary in accordance with the stream velocity at the location of deposition. For example, in the upper reaches of a stream, where water velocities are high, the sediments deposited will be boulders, cobbles and gravels. As the stream goes further into the floodplain, the velocity will slow, releasing sands and silts. For this reason, the lower floodplain areas within the study area have been mapped as having secondary potential for aggregate production. The mid and upper stream reaches, where gravel and cobbles are likely to occur, have been mapped as having primary aggregate potential. However, some fluvial deposits will have environmental constraints relating to aggregate production. Active stream corridors, for example, are protected under the Fisheries Act). All activities in these areas must adhere to the Land Development Guidelines for the Protection of Aquatic Habitat (Chilibeck, 1995). A fluvial terrace, on the other hand, may be a suitable distance away from an active channel, and therefore may be accessible for the purposes of aggregate extraction. Fluvial deposits must be considered on a site specific basis.

➢ Fluvial sediments are those transported by post-glacial streams.

➢ Some fluvial deposits have primary potential for aggregate production. However, environmental considerations must be taken into account adjacent to active streams and watercourses.

3.3 Till

Till is deposited directly by glacier ice and usually exists as a veneer, blanket, or mantle of variable thickness over the underlying bedrock surface. It typically consists of a fine-grained matrix (silts and clays) that surrounds and supports clasts (particles of sands, gravels, cobbles and boulders) of a variety of sizes, shapes and rock types. Till characteristics, such as grain size distribution and consolidation grain size distribution, vary according to specific processes of deposition by glacier ice. These deposits can be highly variable and gradations in texture and consolidation can vary over short distances. Over the last 12,000 years, the upper half metre to one metre of these deposits have weathered creating loose, permeable soils.

➢ Till is the surficial material moved by glacial ice.

For the purposes of this study, till is considered to have secondary potential for sand and gravel extraction. This is due to the large percentage of silts and clays that typically form the matrix of these deposits. While sands, gravel, and cobbles will occur within this matrix, the quantity of fines present generally make gravel extraction economically unfeasible, due to a high waste content and demanding processing requirements.

➢ Till is considered to have secondary potential for aggregate production.

3.4 Colluvium

Colluvial materials have accumulated during post-glacial time as a result of gravity-induced slope movement, such as soil creep and landslides. The physical characteristics of colluvium are closely related to its source and mode of accumulation.

➢ Colluvial sediments are those that have been transported by gravity.

Four processes generally create colluvial deposits. These are rockfall from bedrock bluffs, soil creep in weathered bedrock, mass movement processes in gullies (debris flows and debris slides), and rockslides and rock slumps.

Rockfall from bedrock bluffs typically forms talus slopes. Talus is typically loosely packed rubble or blocks with little interstitial silt and sand near the surface, and is rapidly or well drained.

Colluvial veneers and blankets develop where weathered bedrock has been loosened and moved downslope by gravitational processes such as soil creep. The characteristics of this colluvium closely resemble those of the material it was derived from. It is loosely packed and usually well drained. These slopes are mainly located on the mid and upper slopes and the gully walls of the larger, deeply incised creeks.

Colluvial fans and cones form at the base of steep gullies due to deposition by debris flows. These deposits are generally compact, and sorting may range from poorly sorted to well sorted. The deposit may or may not be matrix supported, where the matrix is usually sand.

Rockslides and deep-seated slumps in bedrock result in hummocky, irregular colluvial deposits. Rockslide deposits consist of loosely packed rubble and blocks with little or no interstitial silt and sand and are well drained. Rock slump deposits contain blocks and rubble with little or no interstitial silt and sand.

Colluvium is considered to have secondary potential with respect to aggregate production. The physical and chemical properties of colluvial deposits vary, and will depend on the nature of it's source rock and the process of it's formation. Colluvium may occur primarily as broken rock, such as a talus deposit. Alternatively, it may contain a matrix of sands, as may be found in fans in the base of gullys produced by debris flows. The source rock will also determine the chemical suitability of a particular colluvial deposit for aggregate production. For example, colluvial deposits that contain pyrite, (such as those which occur in the Wilson Landing area), have an acidity which will react with concrete, and, as such, provide a poor aggregate resource. Due to the variability in rock type and particle size, colluvium has been mapped as secondary potential for aggregate extraction.

➢ The particle size and chemical properties of colluvium are variable. As such, it is considered to be an aggregate source of secondary potential.

3.5 Glaciolacustrine Materials

Glaciolacustrine materials consist of fine sediments that accumulated in ice-dammed lakes. Fine sand, silt, and clay ("rock flour"), initially produced by glacial abrasion, were transported to the lakes by meltwater streams. Finer sediments tend to remain suspended in the lake, and then slowly settle to the lake bottom. Glaciolacustrine sediments typically consist of interlayered silt, clay, and fine sand. Dropstones from floating melting ice, ranging up to boulder-size, may be embedded in the finer material. The sediments are usually slowly permeable to impermeable and are generally moderately to highly cohesive, depending on the percentage of clay. Beach sediments tend to be sands and gravels, and are loose and porous.

➢ Glaciolacustrine sediments are those which have been deposited by glacial lakes, such as glacial Lake Penticton.

Glaciolacustrine deposits are considered to have poor (tertiary) potential for sand and gravel producton. There is potential, however, for deposits with high clay content to have potential for brick production. Within the Central Okanagan, glaciolacustrine

➢ Glaciolacustrine deposits have low (tertiary) potential for aggregate extraction.

deposits with high clay contents occur in the Glenmore Valley, and near Klassen Road in North Rutland.

3.6 Lacustrine Materials

Lacustrine sediments consist of fine particles that settle out of suspension in lakes and coarser sediments that accumulate along the shoreline (littoral zone). Fine sand, silt, and clay are transported in suspension by streams to lakes where they settle to the lake bottom. Sand, pebbles, and cobbles are deposited on the shore by wave action. These sediments may be sub-aerial on beaches, due to seasonal fluctuation in water levels and where lake basins have drained. These sediments are usually slightly permeable to impermeable and are generally moderately to highly cohesive depending on the percentage of clay.

➢ *Lacustrine sediments have been deposited by modern day lakes.*

Lacustrine deposits have been mapped as having low (tertiary) potential for aggregate production. While some shoreline deposits may have an appropriate particle size distribution, there are environmental constraints in terms of excavation procedures along lake shores.

➢ *Lacustrine deposits have low potential for aggregate production.*

APPENDIX C

PROCESSING

Sand and gravel processing primarily involves sizing of product to conform to the specifications set by the end users. The bulk of sand and gravel products are extracted from unconsolidated deposits by bulldozers and loaders or, where water table permits, with drag line, clam shell or bucket-ladder dredges.

Quarrying or mining operations for aggregate supplement the more typical extraction from unconsolidated deposits. The crushed stone product of a hard rock mining operation tends to produce more cubical aggregates. Starting with a massive rock (rock with few fractures per meter), the mine operator can control product size from the largest riprap to finest sand sizes. The operator is not dependent on the uncontrollable size distribution of the sand and gravel size in the natural deposits. The mining operation does have associated with it the noise from blasting in addition to normal machine and processing plant noise. Plants for either type of extractive operation are often portable or semi-portable and can be moved easily from the site upon closure of operations.

Washing is often the first processing step, with rotary drum washers with lifters, blade mills, log washers and screw conveyors being used for this purpose. The very fine fraction, clays and fine silts and wood fragments are washed out at this stage. Simple wet screening may be used without a separate washing step and the oversize is then crushed and screened again. The crushing may be carried out wet or dry with some advantage over dust control in the wet process but an additional water supply requirement. Crushers may include cone, gyratory, jaw and impact crushers. The impact crushers have become popular because they deliver a somewhat more cubical product. Secondary size reduction is typically carried out with cone or roll crushers, or by recycling screened over-sizes with the primary feed material.

A wide range of screen type is used in the industry. Rugged construction and high capacity units predominate. Screens are often designed to produce a certain particle shape as well as size. Screens can remove flat and elongated particles, unsatisfactory in concrete aggregates, with slots running at right angles to the flow of material, leaving a more cubical product in the oversize.

The separation into different sizes of sand fraction is carried out after screening using hydraulic classification equipment. This carries a high water requirement and recycling of the water has become a requirement in most jurisdictions today. The screw or rake classifier, often used in combination with a cyclone for the recovery of fine sand, is typically used for this service. Hindered settling classifiers permit the production of several different size fractions from a single unit. It is very important to operate the classification equipment at appropriate slurry densities and water flow rates. Flow rates, which are too fast, may result in losses of good sand product to the fine tailings. Over dense slurry may cause silting of the classification tank and a reduction in volume, which increases the slurry velocity and again transports sand to the fine tailings.

Some operations may include a sluice box prior to the wet classification for the recovery of small amounts of precious metals. Since Mission Creek is a known placer gold source, it is probable that some gold could be recovered from bench and valley floor sand and gravel operations in the Mission Creek valley.

In cases where the deposit may include dense and light aggregate materials, jigging and heavy media concentrators have been applied to upgrade the product quality. The vesicular (pumice type) volcanic cobbles that occur in some Central Okanagan deposits may be sortable by heavy media processing to produce an aggregate that is composed mainly of granite and dioritic clasts. However, the profit margins for sand and gravel are not particularly large so, unless the customer requires the higher specification product and is prepared to pay for the additional processing costs, this sort of upgrading is not common.

Primary de-watering of the sand and gravel is carried out with screens and screw and rake classifiers and the moist product is then conveyed to stockpiles for final de-watering by drainage. Specialty sands may be further de-watered by filtration and heated drying.

The blending of products to meet specified particle size mixtures has reached a high degree of sophistication in some operations. It can be accomplished by fully automated systems that obtain the desired mix control by varying the rate of feed from the various stockpiles.

APPENDIX D

DATE: PRODUCER SURVEY

CONTACT:

COMPANY:

FAX : PHONE NO:

ADDRESS:

FILE NO: 0808-98-88101 Aggregate Supply and Demand Study

CENTRAL OKANAGAN GROWTH MANAGEMENT STRATEGY

AGGREGATE SUPPLY AND DEMAND STUDY – PRODUCER SURVEY

The Regional District of the Central Okanagan in conjunction with the municipalities of Kelowna, Lake Country and Peachland have initiated an Aggregate Supply and Demand Study. EBA Engineering Consultants Ltd. has been selected as the consultant to prepare the study. The objectives of the study are:

- to identify and determine the capacity of existing aggregate extraction sites and life expectancy of each operation;
- to assess current demand levels and assess projected future demand levels;
- to make recommendations on the aggregate permitting and approval process; as well as
- to assess potential conflicts with neighbouring land uses and the natural environment.

SURVEY CONFIDENTIALITY

We appreciate your help in completing this survey. All information received will be confidential. The information will be used to determine general trends for the industry within the Okanagan, such as: average hauling distance, average volume per year for the District, and so on. Details on individual operations will not be published. We have included space at the end of the survey for your comments and concerns. This information will also be helpful in completing the study. Additional pages may be added if required.

Estimated Aggregate Use

Roads (construction and maintenance)	_____	%	
Concrete production (incl. mortar sand)	_____	%	
Asphalt production	_____	%	
Structural fill	_____	%	
Landscaping	_____	%	
Other uses	_____	%	Please specify _____
Total	100	%	

Please return to: EBA Engineering Ltd. Fax: 250-862-2941 Phone: 250-862-4832

Volume (Estimated #s for general information)

Total Aggregate Volume

Total average raw aggregate volume per year from pit	_____	cubic m. / m. tonne
Estimated percentage waste (e.g. overburden, silty sand)	_____	%
Estimated percentage marketable aggregate	_____	%
Total	100	%

Marketable Aggregate Volume

Total estimated aggregate volume for 1998	_____	cubic m. / m. tonne
Total aggregate average volume per year for last 5 years	_____	cubic m. / m. tonne
Total aggregate average volume per year for last 10 years	_____	cubic m. / m. tonne

Aggregate Percentage According to Season

January to March	_____	%	April to June	_____	%
July to September	_____	%	September to December	_____	%

Recycled Aggregate Volume

Recycled asphalt	_____	cubic m. / m. tonne
Recycled concrete	_____	cubic m. / m. tonne
Other	_____	Please specify _____

Marketable Aggregate Composition

Sands (less than 4.75mm)	_____	%	
Gravels (greater than 4.75mm)	_____	%	
Crushed material	_____	%	
Topsoil	_____	%	
Other	_____	%	Specify _____
Total	100	%	

Rock Volume

Total raw rock volume per year from quarry	_____	cubic m. / m. tonne
Estimated percentage waste (e.g. overburden, etc.)	_____	%
Estimated percentage marketable rock volume	_____	%
Total	100	%

Rock Volume

Total rock volume production per year	_____	cubic m. / m. tonne
Total rock volume for 1998	_____	cubic m. / m. tonne
Total rock average volume per year for last 5 years	_____	cubic m. / m. tonne
Total rock average volume per year for last 10 years	_____	cubic m. / m. tonne

Please return to: EBA Engineering Ltd. Fax: 250-862-2941 Phone: 250-862-4832

Rock Volume According to Season

January to March	_____	%	April to June	_____	%
July to September	_____	%	September to December	_____	%

Rock Composition

Decorator Rock (e.g. shale, granite)	_____	%	
Rip Rap	_____	%	
Dimension stone (e.g. gneiss)	_____	%	
Waste (e.g overburden)	_____	%	
Other	_____	%	Please specify _____
Total	100	%	

Reserve -- Aggregate and Rock

Total estimated volume of reserve -- aggregate _____ cubic m. / m. tonne
Total estimated volume of reserve -- rock _____ cubic m. / m. tonne

Estimated life remaining in pit / quarry at present production levels (in # of years) _____

Overburden Depth

Average overburden depth _____ metres
Range in overburden depth from _____ to _____ metres

General comments about over burden composition (e.g. topsoil, aggregate fill, etc.)

_____

_____

_____

Ground Water

Average depth to ground water _____ cubic m. / m. tonne
Range in depth to ground water from _____ to _____ cubic m. / m. tonne

General comments about depth to ground water:

_____

_____

_____

Transportation

Typical transportation Routes

_____

_____

_____

_____

Please return to: EBA Engineering Ltd. Fax: 250-862-2941 Phone: 250-862-4832

Average truck size _____ (capacity cubic m. / m. tonne) # axels _____
Average # trucks per day _____
Average # trucks per week _____

Hauling distances

Range of hauling distances from _____ to _____ kilometres
Average hauling distance _____ kilometres
General area of service:

Costs *(Attach price list – optional)*

Trucking Costs

Truck _____ $ per hour
Truck & Pup _____ $ per hour

Reclamation Plans

Reclamation plans available? Yes No
Comments on reclamation plans:

General comments and / or concerns to help us better direct focus of aggregate study (e.g. planning policy, permit process, future land designation, transportation issues, etc.)

Please return to: EBA Engineering Ltd. Fax: 250-862-2941 Phone: 250-862-4832

APPENDIX E

PROVINCE OF BRITISH COLUMBIA

MINISTRY OF TRANSPORTATION AND HIGHWAYS

PAVEMENT

DESIGN

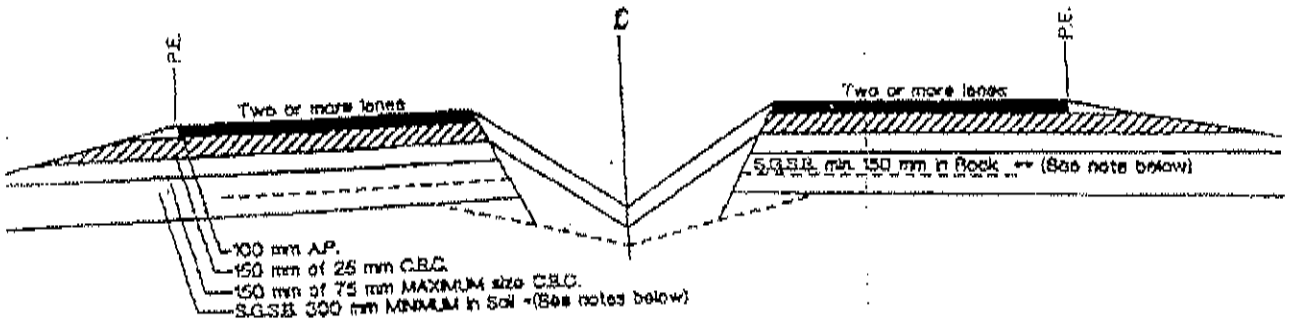
STANDARDS

(TECHNICAL CIRCULAR T-9/95)

GEOTECHNICAL AND MATERIALS ENGINEERING BRANCH

JULY 10, 1995

FIGURE - 1



TYPE "A"

HIGH VOLUME ROADS
>1,000,000 ESAL's

NOTES:

* No S.G.S.B. is required in exceptional circumstances where the following criteria have been met:

Structural Design Criteria is satisfied

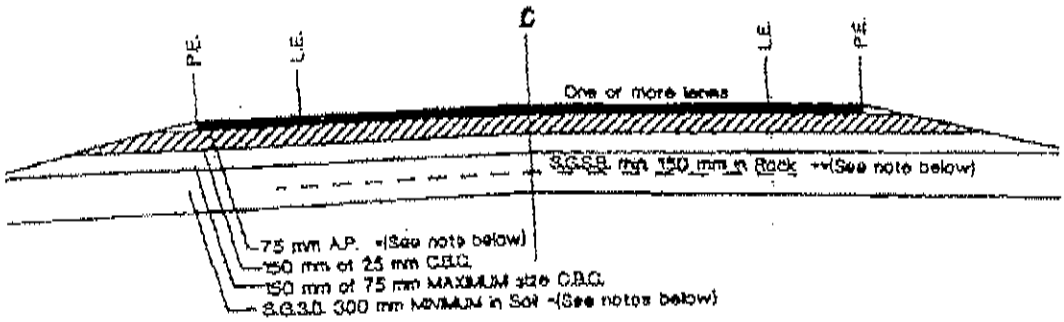
and

Subgrade material consists of clean granular deposits that satisfy S.G.S.B. gradation and construction criteria (i.e. rutting criteria) in accordance with the latest version of the B.C. MOTH Standard Specifications for Highway Construction - Section 202 "GRANULAR SURFACING, BASE AND SUB-BASES". (Subsection 202.06).

** All levelling materials applied directly to blasted rock cuts shall be of S.G.S.B. quality.

* THE FINAL S.G.S.B. THICKNESS MUST BE APPROVED BY THE REGIONAL GEOTECHNICAL AND MATERIALS ENGINEER.

FIGURE - 2



TYPE "B"

MEDIUM VOLUME ROADS
100,000 to 1,000,000 ESAL's

NOTES:

* 75 mm A.P. to be constructed in 2 lifts for 19 mm MAXIMUM size aggregate and 1 lift for 25 mm MAXIMUM size aggregate.
(In accordance with the latest version of the B.C. MOTH Standard Specifications for Highway Construction - Section 223, Subsection 223.23.06)

* No S.G.S.B. is required in exceptional circumstances where the following criteria have been met:

Structural Design Criteria is satisfied

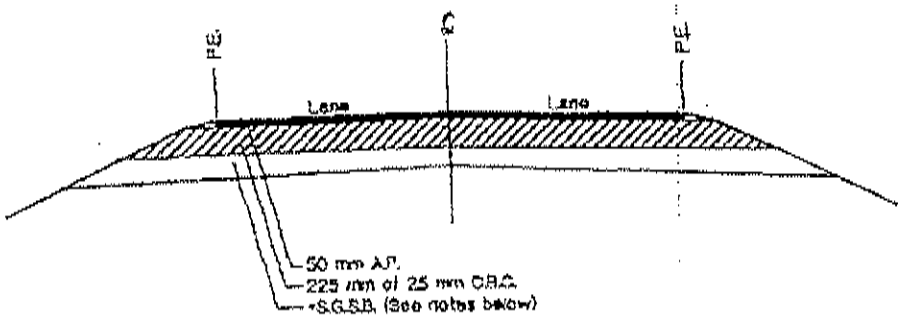
and

Subgrade material consists of clean granular deposits that satisfy S.G.S.B. gradation and construction criteria (i.e. rutting criteria) in accordance with the latest version of the B.C. MOTH Standard Specifications for Highway Construction - Section 202 "GRANULAR SURFACING, BASE AND SUB-BASES", (Subsection 202.06).

**All levelling materials applied directly to blasted rock cuts shall be of S.G.S.B. quality.

* THE FINAL S.G.S.B. THICKNESS MUST BE APPROVED BY THE REGIONAL GEOTECHNICAL AND MATERIALS ENGINEER.

FIGURE - 3



TYPE "C"

LOW VOLUME ROADS

<100,000 ESAL's

NOTES:

- Minimum 150 mm S.G.S.B. on Course Grained Subgrades (Unified Soils Classification System - GW/GP/GM/GC/SW/SP/SM/SC) where groundwater does not pose a drainage problem and frost penetration does not affect the structure.

- Minimum 300 mm S.G.S.B. on Fine Grained Subgrades (Unified Soils Classification System - ML/CL/OL/MH/CH/OH).

- No S.G.S.B. is required in exceptional circumstances where the following criteria have been met:

  Structural Design Criteria is satisfied

  and

  Subgrade material consists of clean granular deposits that satisfy S.G.S.B. gradation and construction criteria (i.e. rutting criteria) in accordance with the latest version of the B.C. MOTH Standard Specifications for Highway Construction - Section 202 "GRANULAR SURFACING, BASE AND SUB-BASES", (Subsection 202.06).

- Minimum 150 mm S.G.S.B. in Rock.

- All levelling materials applied directly to blasted rock cuts shall be of S.G.S.B. quality.

- THE FINAL S.G.S.B. THICKNESS MUST BE APPROVED BY THE REGIONAL GEOTECHNICAL AND MATERIALS ENGINEER.

APPENDIX F

Future Direction

The Ministry of Employment and Investment, Energy and Minerals Division continually seeks to improve the regulation of the aggregate industry. The ministry is implementing an eight point strategy for change focusing on:

- ☐ Industry and Public Consultation
- ☐ Permitting Roles
- ☐ Policies and Procedures
- ☐ Forecasting Aggregate Demand
- ☐ Aggregates and Regional Growth Strategies
- ☐ Review of the Health, Safety and Reclamation Code for Mines in B.C.
- ☐ Monitoring for Compliance
- ☐ Reclamation Securities

For More Information

For more information on how the aggregate industry is regulated, phone or write to the Ministry of Employment and Investment, Energy and Minerals Division office nearest you:

Smithers
Bag 5000
Smithers, B.C.
V0J 2N0
(604) 847-7383

Nanaimo
Shenton Bldg. Rm 1A
3411 Shenton Rd.
Nanaimo, B.C.
V9T 2H1
(604) 751-7240

Prince George
3990 22nd Ave
Prince George, B.C.
V2N 3A1
(604) 565-6125

Victoria
4th Floor
1810 Blanshard St.
Victoria, B.C.
(604) 952-0462
V8V 1X4

Kamloops
Suite 200
2985 Airport Dr.
Kamloops, B.C.
V2B 7W8
(604) 828-4566

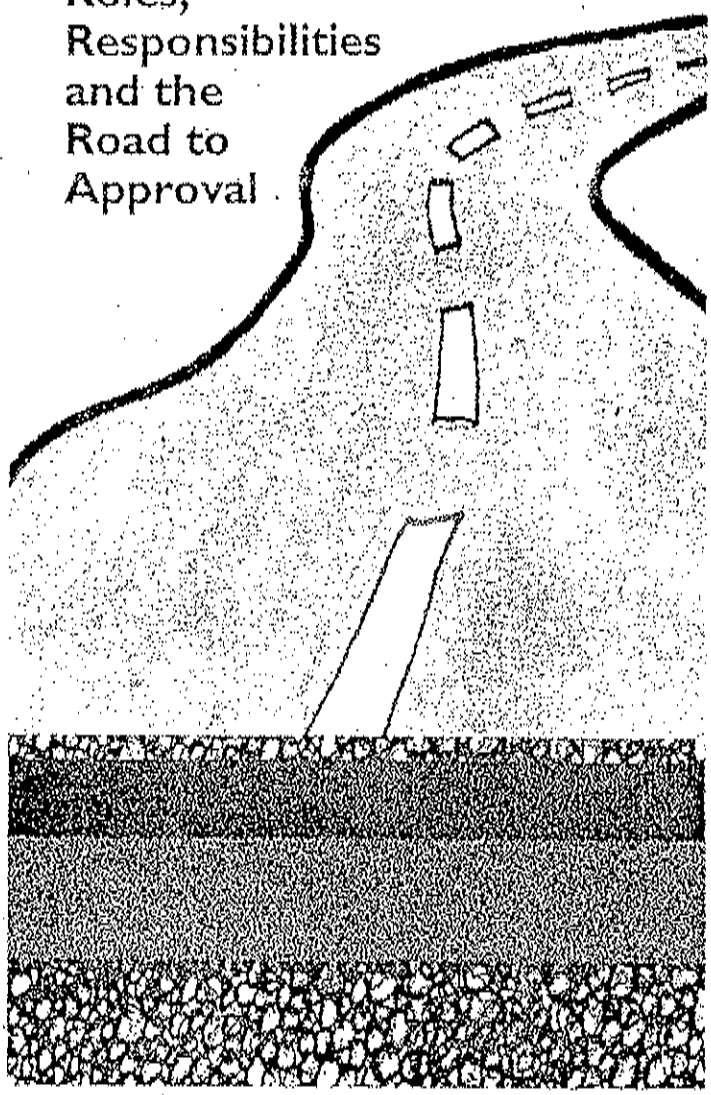
Cranbrook
2nd flr.
100 Cranbrook St. N.
Cranbrook, B.C.
V1C 3P9
(604) 426-1557

Sand & Gravel

Operations

In Your Community

Roles, Responsibilities and the Road to Approval



BRITISH COLUMBIA

Ministry of Employment and Investment
Energy and Minerals Division

Aggregates and You

British Columbia's aggregate industry produces $170 million worth of sand, gravel and crushed stone annually for use in everything from skyscrapers to sidewalks. Even though aggregate operations may not seem to "fit" with the communities and lifestyles springing up around them, aggregate products are increasingly in demand.

Understanding who has the authority to regulate the industry and how the public can become involved will help communities and local governments appreciate how aggregate operations come to exist in, and be part of, their communities.

Industry Regulation

An aggregate operator must obtain tenures, permits and approvals from various government agencies before work can begin. These describe "where" and "how" a pit or quarry may operate.

The "Where to Mine" Decision

Under the *Land Act*, the **Ministry of Environment, Lands and Parks (MELP)** grants **tenures** to mine aggregate on Crown land. Such tenures are not required for aggregate operations on private lands.

A pit or quarry proposed on land designated as an agricultural land reserve or forest land reserve requires **approval** from the **Agricultural Land Commission** or **Forest Land Commission**, respectively. These commissions require the site be reclaimed in a way that maintains or enhances pre-development agricultural or forestry capability.

The *Municipal Act* allows **local governments** to designate land uses through **official community plans.** These plans are required to include information on sand and gravel deposits which may result in:

- ☐ continued accessibility of local aggregates;
- ☐ building of public facilities at a reasonable cost; and
- ☐ compatibility between future operations and other land uses.

However, local governments cannot regulate Crown land and sand and gravel extraction is not considered a "land use" amenable to local planning.

The primary tool of local governments in determining where aggregate operations may or may not occur is a **soil removal bylaw.** Such bylaws provide local government some regulatory authority over aggregate operators by requiring them to obtain a **soil removal permit.** A bylaw **prohibiting** soil removal in any part of a municipality must be approved by the Minister of Municipal Affairs and Housing, and the Minister of Employment and Investment.

The "How to Mine" Decision

The Ministry of Employment and Investment (MEI) is the primary agency regulating the "how to" of aggregate operations. Before issuing a *Mines Act* **permit**, the Chief Inspector of Mines must ensure the operator has thoroughly addressed the following:

- ☐ public and worker health and safety
- ☐ environmental impacts of the operation
- ☐ efficient extraction of the aggregate resource
- ☐ reclamation of the land and watercourses

A *Mines Act* permit can only contain operating conditions that are consistent with the *Mines Act*. The Chief Inspector's decision cannot be constrained by local policies regarding scenic areas or lifestyle, land-use conflicts or local zoning.

Soil removal bylaws of local governments can **regulate** as well as prohibit aggregate mining. For example, community concerns about noise levels, hours of operation and safety may be addressed in these bylaws. A bylaw regulating soil removal must be approved by the Minister of Municipal Affairs and Housing. While soil removal bylaw regulations often overlap with *Mines Act* regulations, the two permits are obtained under separate permitting processes.

MELP regulates aggregate operations by issuing **water and waste management permits**. Both MELP and the federal **Department of Fisheries and Oceans** review applications to ensure the protection of fish and fish habitat.

Permit Application

Deciding whether a *Mines Act* permit should be issued begins with the submission of an application which:

- ☐ details the proposed work;
- ☐ describes the operation;
- ☐ outlines the area to be disturbed;
- ☐ describes the local environment;
- ☐ identifies present land uses; and
- ☐ details a program for the protection and reclamation of the land and watercourses

If an application is incomplete or contains major health, safety or environmental concerns, it will be returned to the applicant for revisions.

Government Referral

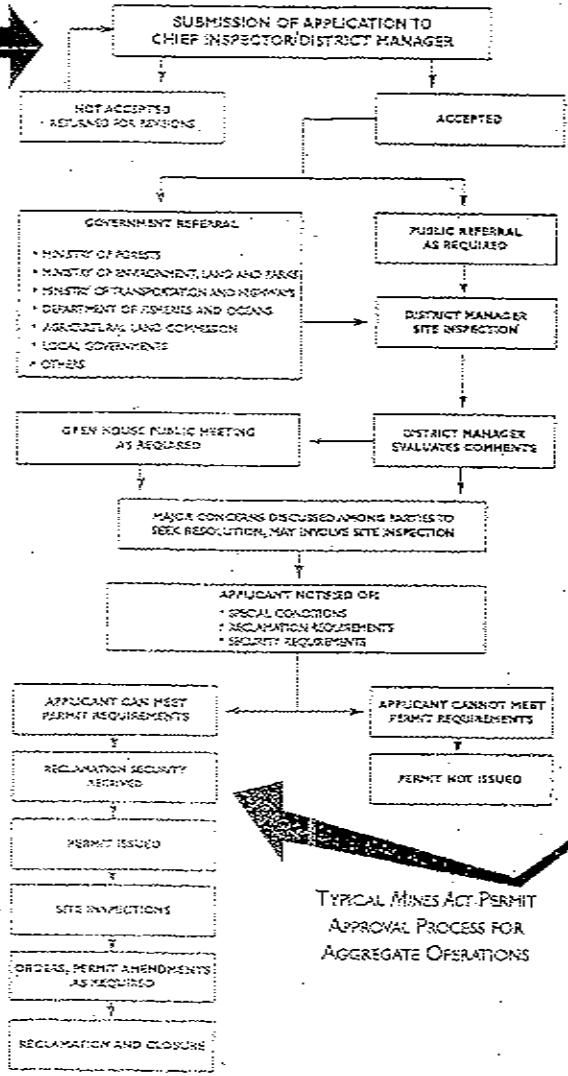
An application is forwarded to the appropriate agencies for review and comment. Comments are made regarding the project's potential impacts, how they might be reduced and what permits or approvals will be required to run the operation. Permits address the technical questions of "how to" operate a pit or quarry.

Agencies typically have 30 days to respond to an application referral.

When issues cannot be resolved, the legal responsibility to decide whether or not to issue a *Mines Act* permit rests with the Chief Inspector. Since demands of the marketplace may result in an operation's production rate to vary over time, a permit is usually tied to a mine plan rather than a specific period of time.

Site Inspection

Once an operation is permitted and in production, MEI ensures that the operator is in compliance with the permit by conducting site inspections on a regular basis. Large or sensitive sites are inspected more frequently than small or especially well managed sites.



TYPICAL *MINES ACT* PERMIT APPROVAL PROCESS FOR AGGREGATE OPERATIONS

Operators not in compliance when an inspector visits will be ordered to comply or be required to stop operations. Amendments to the permit may be considered if inspections indicate circumstances regarding the operation have changed.

Public Involvement

MEI may require applicants to place a notice in local newspapers announcing their proposal and seeking public comment. The public has 30 days from the last day the notice was posted to provide written comments to the Chief Inspector.

If there are major concerns, the Chief Inspector may require:

- ☐ an open house or public meeting be held;
- ☐ a site inspection with agency staff (in certain instances, with local officials or stakeholders); and
- ☐ further discussions to seek resolution on major concerns.

If the Chief Inspector considers that the applicant has not addressed reasonable concerns regarding the health, safety and environmental impacts of the project, the permit may be denied.

Site Reclamation

Pit and quarry operators are required to post security as a condition of their permits to ensure that the mine sites will be reclaimed in an acceptable manner upon completion of mining. The Chief Inspector has the discretion under the *Mines Act* to determine the amount of the security. A *Mines Act* permit is not issued until the security is deposited with MEI. A security deposit is returned to the operator after satisfactory reclamation has taken place.

APPENDIX G

Model

[NAME OF MUNICIPALITY]
BYLAW NO. [XXXX]
A BYLAW TO REGULATE THE REMOVAL AND DEPOSIT OF SOIL
FROM LAND IN THE [MUNICIPALITY]

WHEREAS section 723 of the Municipal Act R.S.B.C. 1996, c. 323 allows Council to regulate or prohibit the removal or deposit of soil on any land within it's jurisdiction and to make different regulations and prohibitions for different areas and to require permits and impose rates or levels of fees;

AND WHEREAS Council desires to regulate both the removal and deposit of soil within the [Municipality];

AND WHEREAS Council desires to collect fees for the removal and deposit of soil within the [Municipality] for the purposes of repairing and maintaining roads damaged by truck traffic related to permitted Soil Removal and Deposit;

NOW THEREFORE, the [Municipality], enacts as follows:

Citation

1. This Bylaw may be cited for all purposes as the "[Municipality] Soil Removal and Deposit Bylaw [date of bylaw], Bylaw No. [XXXX]".

Interpretation

2. In this Bylaw:

"Application" means a Soil Removal or Deposit Permit Application in the form of Schedule B;

"Aquifer" means a water-bearing stratum of permeable rock, sand or gravel;

"Berm" means an embankment built of Soil for the purpose of reducing the transmission of noise emanating from soil removal or deposit operations and for screening the soil removal or deposit operations from the view of the users of properties adjoining the Soil Removal or Deposit Area;

"Buffer Zone" means a strip of land left in a natural state or landscaped for the purpose of screening a Soil Removal or Deposit Area from view from a highway or from a parcel of land other than that for which a Permit is issued and to provide setbacks between adjacent properties and highways;

"Clerk" means the Clerk appointed under any Act by the Municipality;

"Council" means the Council of the [Municipality];

"Deposit" means the act of placing soil on any lands in the Municipality where the soil did not previously exist or stand, including a stockpile or other storage facility;

"Designated Soil Removal Zone" means those areas of the Municipality identified in Schedule A within which Soil Removal may be permitted;

Model

"Engineer" means a person appointed by Council to administer this Bylaw and includes that person's designate or other persons authorized by Council;

"Local Newspaper" means a publication that is distributed at least weekly in the Municipality or area that is affected by the matter in respect of which a provision of this Bylaw requires publication in a local newspaper;

"Mine Manager" means manager as defined in the *Mines Act*;

"Municipality" means the {Municipality};

"Permit" means a valid Soil Removal or Deposit Permit issued by the Council in the form of Schedule C;

"Permittee" means an applicant who has received a permit under this Bylaw;

"Permit Fee" means the fee required to be paid to the Municipality pursuant to Section 21(1) of this Bylaw;

"Reclamation Liability" means an estimate, as referred to in Sections 10 and 18 of this Bylaw, of the cost of reclaiming a Soil Removal or Deposit Area to the standard or condition shown on the plans submitted as part of the Application;

"Registered Professional" means a person who is registered with a professional association that is regulated under a statute of British Columbia to practice in the capacities described under the sections of this Bylaw requiring a Registered Professional and is acceptable to Council;

"Remove" or "Removal" means the act of removing soil from any lands in the Municipality, or from any area of the Municipality, from where it existed or stood, which place or location shall include a stockpile or other storage facility;

"Removal or Deposit Fee" means the fee payable to the Municipality by the Permittee for the Removal or Deposit of Soil pursuant to Section 21.2 of this Bylaw;

"Soil" means soil, sand, gravel, rock, silts, clays, peats, or any other substance of which land is composed, or any other combination of these substances;

"Soil Removal or Deposit Area" means an area within the Municipality in respect of which a Permit has been issued;

"Sound Level" means the sound levels as measured using the "A" weighting network setting of an approved sound meter meeting the following standards:

(1) for sound level meters International Electrotechnical Commission Standard Publication 651 (1979), "Sound Level Meters", for type 2 sound level meters or better, and

(2) for integrating or averaging sound level meters IEC Standard Publication 804 (1985) "Integrating Averaging Sound Level Meters", for type 2 sound level meters or better.

Model

Other Legislation

3. Where any provision of this Bylaw would be invalid as either being inconsistent with or in conflict with any Provincial legislation requiring either consistency or that municipal bylaws not be in conflict, then such provision shall be construed in a manner that preserves the validity and application of the provision to the broadest extent possible. A provision of this Bylaw is not necessarily inconsistent with or in conflict with other Provincial legislation merely because it enacts a higher or more onerous standard or requirement provided a person may comply with both such Bylaw provision and the Provincial legislation.

Designation

4. (1) A Permit may be issued for Soil Removal only on those lands identified as being within the Designated Soil Removal Zone of Schedule "A" to this Bylaw.

(2) Despite City of [ ] Procedure Bylaw number {xx, 19xx}, no amendment to Schedule "A" shall be adopted by Council until a public information meeting has been held pursuant to Section 18 of this Bylaw, and Council has received a written report from the Clerk of the public information meeting.

Model

Permit Exemptions

5. Soil may be removed or deposited in any part of the Municipality without a Permit only where the Removal or Deposit of Soil:

   (1) is by a florist, nurseryman, horticulturist, or farmer and such Soil is required and used on lands upon which that person carries on such trade, purpose, or use;

   (2) is for the sole purpose of constructing or maintaining a forest service road or private logging road contained within an approved forest development plan or access management plan, and where such Removal or Deposit occurs within the plan area;

   (3) is required for construction of a utility service or ditch by or on behalf of, the Municipality ;

   (4) is required for landfill operations or solid waste transfer stations operated by, or on behalf of, the municipality;

   (5) is from or on parks and municipally-owned lands and is conducted by or on behalf of the Municipality;

   (6) is from or on private lands by the Municipality; or

   (7) is subject to a permit under the *Mines Act* for the purpose of exploring for or producing minerals or placer minerals, as both defined in the *Mineral Tenure Act*, or coal.

Soil Removal and Deposit Requirements

6. No person may:

   (1) remove Soil from land outside the Designated Soil Removal Zone, unless an exemption in Section 5 of this Bylaw applies.

   (2) remove soil from land within the Desinated Soil Removal Zone unless:

      (a) an exemption in Section 5 of this Bylaw applies, or
      (b) the person has a valid and subsisting Permit for that removal.

   (3) deposit soil on any land anywhere in the Municipality unless:

      (a) an exemption in Section 5 of this Bylaw applies, or
      (b) the person has a valid and subsisting Permit for that deposit.

   (4) where a Permit has been issued for the Removal or Deposit of Soil, the Permittee must not Remove or Deposit Soil from or on the land to which the Permit relates, except in compliance with the terms of the Permit.

Model

Classes of Permits

7. Any Soil Removal or Deposit operation proposed in an Application shall be considered for a:

   (1) Class 1 Permit if:

   (a) the total amount of Soil to be removed or deposited is less than or equal to 25,000 cubic metres; and

   (b) the proposed duration of the operation is less than or equal to two years; and

   (2) Class 2 Permit if paragraph (1) does not apply:

   (a) the total amount of Soil to be removed or deposited is greater than 25,000 cubic metres;

   (b) the proposed duration of the operation is greater than 2 years; or

   (c) the proposed operation is to be located within an area designated under an Official Community Plan pursuant to Section 879(1)(a) or (b) of the *Municipal Act*.

Permit Application

8. (1) An Application for a Permit shall comply with Section 9 of this Bylaw, and:

   (a) include a fully completed and signed form set out in Schedule "B" to this Bylaw; and

   (b) be accompanied by the applicable Permit Fee calculated in accordance with Section 21(1) of this Bylaw.

   (2) An Application that does not comply with this Section 8 and Section 9 of this Bylaw shall be considered incomplete, and the Engineer shall be under no duty or obligation to process or consider any incomplete Application.

Model

Plans and Specifications

9. (1) An Application for a Class 2 Permit shall contain information as required by the Engineer for good and valid reasons in respect of the Soil Removal or Deposit Area with respect to the following matters:

(a) all existing buildings, fences, structures, tree cover, roads, lanes, bridges, natural watercourses, and location of sewage disposal systems, and public utilities that are located within the Soil Removal or Deposit Area and:

(i) within one hundred (100) metres of the boundary of the Soil Removal or Deposit Area; or

(ii) if blasting operations are required as part of the Soil Removal or Deposit, within three hundred (300) metres of the boundary of the Soil Removal or Deposit Area;

(b) the proposed methods to control:

(i) dust, noise, and visual impacts to adjacent lands; and

(ii) tracking of material onto highways;

(c) the proposed methods of drainage control and protection of natural water courses during the proposed Soil Removal or Deposit;

(d) the proposed methods and locations of access to the Soil Removal or Deposit Area during Soil Removal or Deposit;

(e) water table elevations and aquifer characteristics including water quality;

(f) the proposed method of extraction, deposit and processing including but not limited to washing and crushing;

(g) the proposed slopes which will be maintained upon completion of the operation;

(h) the methods proposed to control the erosion of the banks of the excavation or fill;

(i) the fencing and enclosing methods proposed to minimize the hazards to human and animal life;

(j) the proposed progressive stages of excavation or filling showing vertical contours as specified above and showing the method of access and position of permanent drainage on a separate plan;

(k) proposed progressive and final reclamation plans which conform to the Municipality's Official Community Plan or other existing land-use objectives for reclamation of the Soil Removal and Deposit Area and which show all pertinent features and measures to stabilize,

...continued on page 25

landscape and restore the land and the Soil after the work is completed;

(l) the Reclamation Liability for the first year of operation of the proposed soil removal or deposit operation provided in a written report submitted by a Registered Professional, together with a letter of credit, in the form of Schedule E, in the amount of the Reclamation Liability for the first year of operation,

(m) the proposed location and description of buffer zones, stockpiles and tree cover, and the location, grade and width of berms;

(n) the general description and volume of Soil to be Removed or Deposited at each of the proposed progressive stages of excavation or filling;

(o) the proposed major truck haulage routes to and from a removal or deposit area;

(p) a proposed communications plan to advise and inform on a periodic basis residents adjacent to the property as to the operation's activities;

(q) the legal boundaries of the Soil Removal and Deposit Area;

(r) a site profile pursuant to the provisions for contaminated sites as defined in the *Waste Management Act* and its regulations.

(2) An Application for a Class 2 Permit shall contain detailed plans and sections, data, and specifications for the proposed site and adjacent areas prepared by a Registered Professional to a scale of 1:1,000 or larger showing the contour of the ground in its current state with vertical contours at such intervals as the Registered Professional may determine according to sound professional standards.

(3) An Application for a Class 1 Permit shall be required to contain only that information, data and other requirements as described in Section 9(1) deemed by the Municipality necessary to protect properties adjacent to the proposed works and to ensure public safety and the protection of the environment and such information shall be prepared by a Registered Professional where considered necessary by the Engineer.

Model

Permit Issuance

10. (1) A Permit constitutes written authority under this Bylaw to conduct the Soil Removal or Deposit activity described in the Application.

(2) The issuance of a Permit does not constitute authority to conduct processing of Soil unless approval for such activity is otherwise provided through other bylaws.

(3) Where the requirements of this Bylaw have been met and if Council has deemed it necessary, a public information meeting has been held pursuant to Section 18 of this Bylaw, and after Council has received a written report from the Clerk of the public information meeting; Council must issue a Permit for which the Application is made.

(4) All plans, specifications and other information forming part of an Application in respect of which a Permit is issued shall form part of and be incorporated in the Permit and without limiting the foregoing a permit issued shall be limited to the type and volume of Soil that is to be Deposited or Removed.

(5) Every permit issued shall cease to authorize the Deposit or Removal of Soil as the case may be upon the earlier of:

(a) the Deposit or Removal of the amount of Soil authorized to be Removed or Deposited by the Permit; and

(b) the expiry date expressly stated in the Permit.

Permit Suspension, Cancellation and Amendment

11. (1) If:

(a) there is a contravention of any term or condition of the Permit including start and completion dates;

(b) the Permit was issued on the basis of statements made in an Application for a Permit, report, declaration, or record required under this Bylaw that were false or misleading with respect to a material fact or that omitted to state a material fact, the omission of which made the statement false or misleading; or

(c) the Permittee has not paid, or refuses to pay, a Removal or Deposit Fee pursuant to this Bylaw, the Municipality may:

(i) suspend in whole or in part the rights of the Permittee under a Permit,

(ii) cancel the Permit, or

(iii) amend or attach new conditions to a Permit with the consent of the Permittee.

Model

(2) For any proposed material changes to the plans, data and specifications submitted as part of the Application for which a Permit has been issued, the Permittee must, prior to implementation of such changes, request an amendment to the Permit which consists of the Permittee:

(a) submitting a report pursuant to Section 14(1)(b) of this Bylaw to the Municipality for review; and

(b) obtaining written authority from the Engineer allowing for the implementation of the proposed changes to the Permit.

Permit Transfer

12. (1) Upon notice in writing to the Engineer, an applicant may upon payment of a fee of $ _____ transfer a valid and subsisting permit to the Transferee.

(2) Upon notice of a transfer provided pursuant to subsection (1) of this Section 12 being provided to the Engineer, the Transferee shall become the permit holder for all purposes of this Bylaw, and the Municipality may enforce all the provisions of this Bylaw against the Transferee notwithstanding that any violation, breach or offences under this Bylaw arose or occurred prior to the transfer.

(3) Notice of a transfer pursuant to subsection (1) of this Section 12 shall not constitute or be deemed to constitute representation by the Municipality of the validity of the Permit, or that any actions authorized by the Permit were undertaken or completed in compliance with this Bylaw or the Permit.

Permit Renewal

13. If an Applicant applies for a renewal of a Soil Removal or Deposit Permit, the Engineer may issue the renewal if:

(1) all applicable drawings and specifications for the Soil Removal or Deposit Area are updated as necessary to identify any material changes to site conditions and to demonstrate compliance with current bylaws and regulations;

(2) a security has been deposited with the Municipality pursuant to Section 22 of this Bylaw to cover the cost of any reclamation requirements associated with the material changes identified pursuant to Section 13(1) of this Bylaw; and,

(3) a fee of $ _____ has been paid to the Municipality for the renewal of the Permit pursuant to section 21(5) of this Bylaw.

Model

Prime Consultant

14. (1) Where the Engineer considers it necessary for good and valid engineering reasons:

(a) the Applicant for a Class 2 Permit shall retain a Registered Professional to act as the prime consultant for the Applicant and to be responsible for the co-ordination, preparation, and presentation of the required plans, specifications, and reports required for the Application pursuant to Section 9 of this Bylaw for the proposed Soil Deposit or Removal Area, and to certify that the proposed operation has been designed in compliance with good engineering practices;

(b) the Permittee shall retain a Registered Professional to act as the prime consultant in the preparation of a report pursuant to Section 11(2)(a) of this Bylaw describing the significant proposed changes to the Application and to certify that the proposed changes have been designed in compliance with good engineering practices.

(2) If a Registered Professional is required for a Class 2 Permit under subsection (1) of this Section 14 the Permittee shall:

(a) make available to the Engineer the name of the Registered Professional retained for Sections (b) and (c) below;

(b) upon completion of the Soil Removal or Deposit operation deliver to the Municipality a certificate from the Registered Professional stating that all works substantially comply with the requirements of the Permit and good engineering practices; and,

(c) provide to Municipality, on or before the last day of the month preceding each twelve (12) month interval following the issuance of the Permit, a report, signed and sealed by the Registered Professional, confirming whether the operation is in substantial compliance with the Permit and good engineering practice.

Model

Operating Standards

15. (1) A Permittee shall ensure that:

(a) Soil Removal or Deposit is carried out in a manner consistent with the Permit;

(b) the effects or impacts of Soil Removal or Deposit are confined within the Soil Removal or Deposit Area so that such activities do not encroach upon, undermine, or physically damage any adjacent property;

(c) written permission is obtained from the appropriate provincial and federal authorities and Council prior to any alteration or diversion of a natural watercourse occurring within the Soil Removal or Deposit Area;

(d) the boundary of the Soil Removal or Deposit Area is clearly marked and that those markings are maintained for the duration of the Permit and the markings noted on plans and sections;

(e) any notice or certificate issued pursuant to any provision of this Bylaw and required to be affixed to any structure remains readable, in good condition, unaltered or otherwise untampered with;

(f) any statement contained in a report, declaration, or record required under this Bylaw is accurate and not misleading with respect to a material fact and does not omit any material facts, the omission of which makes the statement false or misleading; or,

(g) no other provision of this Bylaw is contravened.

(2) Notwithstanding any local noise or business regulation bylaws, the decibel levels specified in Section 15(3)(b) of this Bylaw shall apply to any permitted Soil Removal or Deposit.

(3) Unless specified in the Permit:

(a) the Permittee shall allow Soil Removal or Deposit to occur only during the following times:

(i) Monday through Saturday inclusive, from _____ a.m. to _____ p.m.;

(ii) Sunday and statutory holidays from _____ a.m. to _____ p.m.

(b) Sound levels emitted from any part of the Soil Removal or Deposit Area will be measured at the boundary of the Soil Removal and Deposit Area and shall not exceed:

(i) _____ decibels between the hours of _____ a.m. to _____ p.m.;

(ii) _____ decibels between the hours of _____ p.m. and _____ a.m.

Model

Verification of Quantities

16. A Permittee shall:

(1) submit, in the form of Schedule D, a statutory declaration within 60 days after the last day of each twelve (12) month interval following the issuance of the Permit, showing the volume of Soil removed or deposited during the preceding 12 months and indicating compliance with the provisions of the Bylaw;

(2) maintain accurate and up-to-date records on the Soil Removal or Deposit Area of all Soil Removal or Deposit and make these records available for inspection by the Municipality on request.

Model

Right to Enter and Inspect

17. (1) The Engineer, Bylaw Enforcement Officer, and all Municipality employees under their direction may for the purposes of administering or enforcing the provisions of this Bylaw:

(a) enter on a Soil Removal or Deposit Area at all reasonable times and inspect all aspects of Soil Removal or Deposit ; and

(b) request records of Soil Removal and Deposit volumes maintained by the Permittee be provided.

Public Information Meeting

18. (1) Where the Municipality has deemed a public information meeting necessary, notice of the meeting shall:

(a) state the time, date, location, and purpose of the meeting and the location of the proposed Soil Removal or Deposit Area that is the subject of the meeting;

(b) be published in not less than two consecutive issues of a Local Newspaper, the last publication to appear not less than 3 nor more than 10 days before the public information meeting;

(c) be mailed or otherwise delivered at least 10 days before the public information meeting to the owners and tenants in occupation of the land that is the subject of the meeting, and the owners and tenants in occupation of all land within 300 metres of the property boundary to the land that is the subject of the meeting; and

(d) be posted on a sign that is legible at a distance of 10 metres and is located on the land that is the subject of the meeting at a location most visible to the public.

(2) The costs of notification, advertising and holding a public information meeting will be paid by the Applicant.

Model

Offences

19. Every person commits an offence against this Bylaw who:

(1) violates any of the provisions of this Bylaw;

(2) fails to comply with any of the terms and conditions of a Permit;

(3) suffers or permits any act or thing to be done in contravention or violation of this Bylaw or the terms and conditions of a Permit; or

(4) fails to comply with any order or notice given under this Bylaw.

Penalties

20. (1) Every person who commits an offence under this Bylaw of this Bylaw is liable upon summary conviction to a penalty of not more than $ _____ plus costs.

(2) Each day of any violation, contravention or breach of this Bylaw shall be deemed to be a separate and distinct offence.

Fees

21. (1) A non-refundable Permit Fee in the amount of $ _____ shall accompany each Application.

(2) The Permittee shall pay to the Municipality a Removal or Deposit Fee in the amount of $ _____ for each and every cubic metre of Soil Removed from or Deposited on the Soil Removal or Deposit Area and shall pay such fee in all cases where a Permit is required pursuant to this Bylaw, whether or not a Permit has been issued. The Removal or Deposit Fee shall be paid to the Municipality on or before the last day of each month for the amount of the Soil Removed or Deposited in the preceding month.

(3) Where a Removal or Deposit Fee is payable or has been paid pursuant to subsection (2) of this Section 21 for the Removal or Deposit of Soil, and the Soil for which the fee is payable or has been paid has been moved from one Soil Removal or Deposit Area to another Soil Removal or Deposit Area, the Permittee:

(a) shall not be required to pay an additional Removal or Deposit Fee pursuant to this Section 21 for that move;

(b) shall be required to pay the applicable Removal and Deposit Fee for each and every subsequent move of such Soil, or portion thereof; and,

(c) shall be required to pay the applicable Removal and Deposit Fee for any move of Soil occurring subsequent to a move of Soil to a temporary location, such as for a "preload" of lands, which shall be considered the initial move.

Model

(4) Where Soil is quantified in terms of tonnes, cubic yards, or both, the conversion table contained in Schedule F of this Bylaw applies for the purposes of the calculation of Removal or Deposit Fees unless the Engineer determines another method of conversion is more applicable.

(5) A non-refundable Renewal Fee in the amount of $ _____ shall accompany each request for a Permit renewal pursuant to Section 13(1) of this Bylaw.

Security

22. (1) Any letter of credit required to be provided under this Bylaw shall be drawn in favour of the Municipality and shall be a clean, unconditional and irrevocable letter of credit made by a Canadian Chartered Bank and capable of presentation at a branch of the bank situated within the Municipality. Such letter of credit shall be maintained as good and valid security by the Permittee at all times as required by this Bylaw, and in the event that the Permittee fails or omits to renew or replace any letter of credit and deliver such renewal or replacement to the Municipality within 14 days prior to the expiry of any letter of credit then held by the Municipality, the Municipality may draw on the then current letter of credit without notice or restriction and hold the moneys in lieu thereof.

(2) A Permittee shall provide the Municipality with an irrevocable letter of credit in the form of Schedule E as a reclamation security for full compliance with the reclamation requirements specified in the Application and plans for a Permit.

(3) The amount of the reclamation security shall be updated annually and shall be, at the Permittee's option, either:

(a) $ _____ for each and every hectare of land disturbed on the Soil Deposit or Removal Area during the preceding twelve months as indicated on Schedule D; or,

(b) an amount equivalent to the Reclamation Liability determined by a Registered Professional during the two month period prior to the anniversary date of the issuance of the Permit and that is deemed, on the basis of good and valid engineering practices, acceptable by the Engineer.

(4) Subject to subsection (5) of this Section 22 the security required pursuant to subsection (2) of this Section 22, shall be returned to the Permittee provided that:

(a) the Soil Removal or Deposit Area has been reclaimed in accordance with the plans submitted as part of the Application;

(b) the Engineer has received a report, signed and sealed by the Registered Professional, confirming that the Soil Removal or Deposit Area has been reclaimed in accordance with the plans, and that the land is safe for the use intended; and,

(c) Council has considered the report from the Registered Professional, and has determined that the security shall be returned.

...continued on page 43

Model

(5) Within 30 days of receiving the report required under subsection (4)(b) of this Section 22 Council must:

(a) return the security required under Section 22(2) of this Bylaw to the Permittee; or,

(b) reject the report and give notice to the Permittee of the deficiencies in the report or in the reclamation of the Soil Removal or Deposit Area.

(6) If the Permittee has not remedied the deficiencies referred to in subsection (5)(b) of this Section 22 to the satisfaction of the Engineer within 60 days of receipt of the notice pursuant to subsection (5)(b) of this Section 22 the security may at the discretion of Council be forfeited to the Municipality.

(7) Where a security is forfeited to the Municipality, Council may direct the funds to be used to commission a Registered Professional to prepare a report pursuant to subsection (4)(b) of this Section 22 and to carry out any required reclamation work.

(8) The security shall be forfeited to the Municipality on the last day of the ninth month following the suspension or cancellation of the Permit, pursuant to Section 11 of this Bylaw, where the Engineer has not received a report, acceptable to Council, of a Registered Professional required pursuant to subsection (4)(b) of this Section 22.

(9) The Council may consider a request by the Applicant or Permittee, as the case may be, for a reduced reclamation security where a reclamation security has been deposited with the Provincial government respecting reclamation of the Soil Removal or Deposit Area which would have the effect of reducing the Reclamation Liability of the Soil Removal or Deposit Area.

Model

Severability

23. If any section, subsection, clause or phrase of this Bylaw is for any reason held to be invalid or illegal by a decision of any Court of competent jurisdiction it shall be severable, such a decision shall not affect the validity of the remaining sections, subsections, clauses or phrases of this Bylaw.

Insurance

24. (1) The Permittee shall save harmless and indemnify the Municipality from any claims in connection with any Soil Removal or Deposit activities for which a Permit has been issued and for such purpose shall maintain at all times during these activities, and reclamation works comprehensive liability insurance for the activities in the amount of $5,000,000.00 and shall name the Municipality as a co-insured. The insurance policy shall provide that no expiry, cancellation, or material change in the policy shall become effective until after thirty (30) days of notice of such cancellation or change shall be given to the Municipality by registered mail. The Permittee shall deliver over to the Municipality true copies of the policy of insurance and the receipts of payment. Should the Permittee fail to maintain the policy, then the Municipality may maintain the policy and all moneys expended by the Municipality for insurance premiums shall be charged to the Permittee.

Building Construction and Landscaping Provisions

25. (1) Despite the other provisions of this Bylaw, but subject to compliance with other bylaws of the Municipality, Soil may be Removed or Deposited in any area of the Municipality where the Removal or Deposit is incidental to building construction, subdivision development or landscaping as follows:

(a) no Permit Fee as provided by Section 21(1) shall be required to obtain a building, development, development variance or temporary commercial industrial use permit;

(b) Soil Removal and Deposit Fees shall be payable to the Municipality in the amount of $ _____ for each and every cubic metre of Soil actually removed or deposited as part of the construction or landscaping as follows:

(i) at the time of an Application for a building permit as required pursuant to a Municipality or building regulation bylaw, the Application shall be made, accompanied by an advance payment on account of the Removal and Deposit Fees. Such advance payment shall be calculated based on the volume of Soil which the Applicant estimates will be Deposited or Removed. The Municipality may, as a condition of the issuance of the Permit, require a written estimate of such volume prepared and certified by a Registered Professional;

(ii) within 30 days of the earlier of:

(1) the completion of all Soil Removal or Deposit related to the building construction or landscaping; or,

(2) the actual use and occupancy of the building;

the Permittee shall pay to the Municipality the Removal or Deposit Fees. Except where the Soil is obtained from a mine or other source within the boundaries of the Municipality, the Municipality may draw down the Removal or Deposit Fees from the advance payment referred to in subsection (1)(b)(i) of this Section 26 unless within such 30 days the Permittee provides to the Municipality evidence satisfactory to the Municipality of the actual amount of Soil deposited or removed in which event a reconciliation payment shall be paid by either the Municipality or the Permittee;

(c) the Permittee shall not be required to retain a Registered Professional as otherwise required under Section 14(1).

Model

Schedules

26. (1) Schedules A, B, C, D, E, and F are attached to and form part of this Bylaw.

Model

READ A FIRST TIME this _____ day of _____, 19____

READ A SECOND TIME this _____ day of _____, 19____

READ A THIRD TIME this _____ day of _____, 19____

APPROVED BY THE MINISTERS OF MUNICIPAL AFFAIRS AND HOUSING AND EMPLOYMENT AND INVESTMENT this _____ day of _____, 19___

ADOPTED this _____ day of _____, 19____

_____
MAYOR

_____
CLERK

I hereby certify the foregoing to be a true and correct copy of the [Bylaw name and number] as read a third time by the Council on the

_____ day of _____, 19____

Dated at [City], B.C. this

_____ day of _____, 19____

I hereby certify the foregoing to be a true and correct copy of the [Bylaw name and number]. Dated at [City], B.C. this _____ day of _____, 19____

_____
CLERK

_____
CLERK

"Soil Removal and Deposit Bylaw 19XX, No. XXXX"

Schedule A to Municipality [or Regional District]
"Soil Removal and Deposit Bylaw 19XX, No. XXXX"

[MUNICIPALITY OR REGIONAL DISTRICT]
DESIGNATED SOIL REMOVAL OR DEPOSIT AREAS

insert map

"Soil Removal and Deposit Bylaw 19XX, No. XXXX"

Schedule B to Municipality [or Regional District]
"Soil Removal and Deposit Bylaw 19XX, No. XXXX"

[MUNICIPALITY OR REGIONAL DISTRICT] SOIL REMOVAL OR DEPOSIT PERMIT APPLICATION

Applicant Information
(filled out by applicant)

Name of applicant

(if company, insert company name and individual representative applying on behalf of company)

Applicant's address for service

Applicant's telephone number

Land Identification Information

Legal description

Municipal [or Regional District] address

Land Ownership

Registered owner
Address of owner
Lease holder
Address of lease holder

Soil Removal or Deposit Information
Prepared by Prime Consultant, if required:

	Type of Material	Quantity
Estimated quantity of Soil		
1) to be removed	_____	m^3
2) to be deposited	_____	m^3

Estimate prepared by: (signature and seal, if required)

Date

"Soil Removal and Deposit Bylaw 19XX, No. XXXX"

Schedule B to Municipality (or Regional District) (continued)

Consultant's Reports

Attached, as part of this Application, are the following reports, as provided by sections 9 of the Soil Removal and Deposit Bylaw:

	(Title)	(Author)	(Date)
1)			
2)			
3)			

I, _____, as applicant on my own behalf, or as authorized signatory of the applicant (print company name), _____, make this Application.

I confirm that the applicant has the authority to remove or deposit the Soil as provided by this Application.

Declared the _____ day of _____, 19 _____.

(Signature of Applicant)

(Authorized Signature of Owner)

Processing Information: (filled out by Municipality or Regional District)

A.L.R. approval
Ministry of Employment and Investment approval
Title and legal correct
Zoning correct
Consent of owner for Application
Environmental study
Permit Fee receipt no.

"Soil Removal and Deposit Bylaw 19XX, No. XXXX"

Schedule C to Municipality [or Regional District]
"Soil Removal and Deposit Bylaw 19XX, No. XXXX"

[MUNICIPALITY OR REGIONAL DISTRICT]

Soil Removal or Deposit Permit No. _____

PERMIT ISSUED ON: _____
PERMIT EXPIRES ON: _____

Pursuant to the [Municipality or Regional District] "Soil Removal and Deposit Bylaw No. XX", 19XX (the Bylaw), this Soil Removal or Deposit Permit No. _____ is hereby issued to

_____(the Permittee) of

_____
address telephone

for the: removal of _____ m^3 of soil from:
OR deposit of _____ m^3 of soil on:

_____
(address of property)

_____
(legal description of property)

The Permittee is subject to compliance with the Bylaw and the following reports, plans and other supporting documents which form part of this Permit and constitute the terms and conditions of this Permit:

(Title) (Author) (Date)

1)

2)

3)

_____ _____
Municipal Engineer [or Regional Administrator] Date

"Soil Removal and Deposit Bylaw 19XX, No. XXXX"

Schedule D to Municipality [or Regional District] "Soil Removal and Deposit Bylaw 19XX, No. XXXX"

[MUNICIPALITY OR REGIONAL DISTRICT]

Declaration of Soil Removal or Deposit Quantities

Permit Information

Soil Removal or Deposit Permit No._____ Date of Issue _____

Land Identification Information

Legal description

Municipal (or Regional District) address

I hereby declare that during the period _____to _____ inclusive, the volume of Soil removed was _____ cubic metres, and that the volume of Soil deposited was _____ cubic metres.

I declare that I have personal knowledge hereinafter disposed and I make solemn declaration conscientiously believing it to be true and knowing that it is of the same force and effect as if made under oath and by virtue of the *Canada Evidence Act.*

Signed:

(address)

(position title, owner, lessee or signing officer of limited company)

SWORN BEFORE ME at the City of _____ in the Province of British Columbia, this _____ day of _____, 19 _____

_____

A Commissioner for taking Affidavits for British Columbia

"Soil Removal and Deposit Bylaw 19XX, No. XXXX"

Schedule E to Municipality (or Regional District)
"Soil Removal and Deposit Bylaw 19XX, No. XXXX"

[MUNICIPALITY OR REGIONAL DISTRICT]

LETTER OF CREDIT FORMAT

Schedule "C"

TO BE ON BANK LETTERHEAD

day of , A.D. 19

Municipality (or Regional District)
Address
Postal Code

Dear Sir:

IRREVOCABLE COMMERCIAL LETTER OF CREDIT NO

We hereby authorize you to draw on (NAME OF BANK), (ADDRESS OF BANK), Province of British Columbia, for account of (NAME OF TENDERER), up to an aggregate amount of _____ available by drafts at sight for 10 per cent of tender value;

1. Drawings are to be made in writing to (NAME OF BANK).

2. Partial drawings may be made.

3. The Bank will not inquire as to whether or not the District has a right to make demand on this Letter of Credit.

4. This Letter of Credit is irrevocable up to the expiry date.

DRAFTS MUST BE DRAWN AND NEGOTIATED NOT LATER THAN

The drafts under this Credit are to be endorsed hereon and shall state on their face that they are drawn under (NAME OF BANK), (ADDRESS OF BANK), Vancouver, B.C. Letter of Credit No.

Yours truly,

Manager
On Behalf of (NAME OF BANK)

"Soil Removal and Deposit Bylaw 19XX. No. XXXX"

Schedule F to Municipality [or Regional District]
"Soil Removal and Deposit Bylaw 19XX, No. XXXX"

[MUNICIPALITY OR REGIONAL DISTRICT]

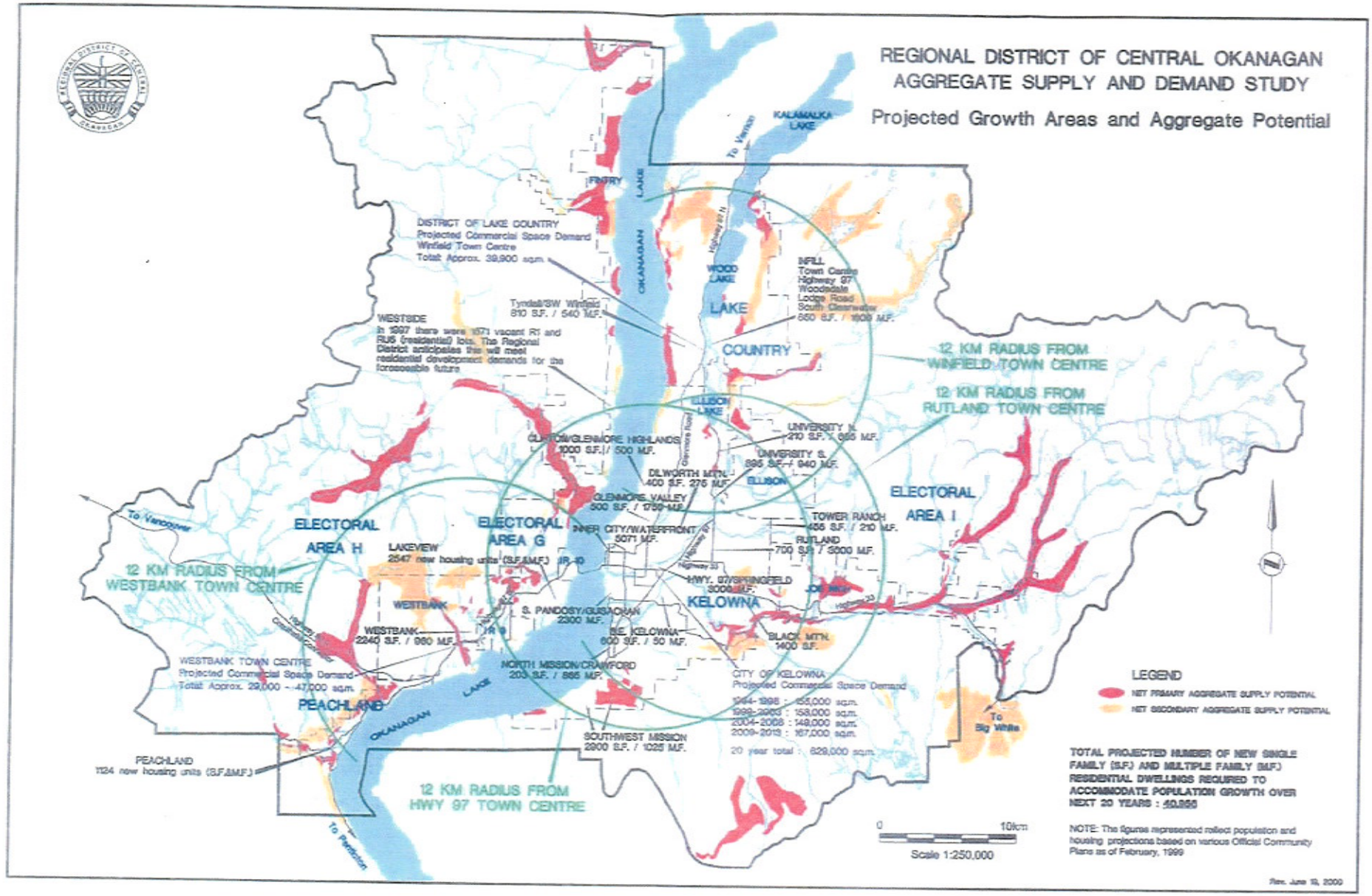
CONVERSION CHART

Sand and Gravel

BANK DEPOSIT	STOCK PILE DEPOSIT
1 Cubic Meter	1.18 Cubic Meters
1 Cubic Meter	1.54 Cubic Yards
1 Cubic Meter	2.17 Metric Tonnes

STOCK PILE DEPOSIT	BANK DEPOSIT
1 Metric Tonne	0.462 Cubic Meter
1 Cubic Yard	0.650 Cubic Meter
1 Cubic Meter	0.850 Cubic Meter

APPENDIX H


REGIONAL DISTRICT OF CENTRAL OKANAGAN
AGGREGATE SUPPLY AND DEMAND STUDY
Projected Growth Areas and Aggregate Potential
KALAMALKA LAKE
To Vernon
OKANAGAN LAKE
Highway 97 N
FINNEY
DISTRICT OF LAKE COUNTRY
Projected Commercial Space Demand
Winfield Town Centre
Totalt Approx. 39,900 sqm.
WOOD LAKE
LAKE
COUNTRY
INFILL
Town Centre
Highway 97
Woodsdale
Lodge Road
South Clearwater
660 S.F. / 1600 M.F.
Tyndall/SW Winfield
810 S.F. / 540 M.F.
WESTSIDE
In 1997 there were 1571 vacant R1 and
RU6 (residential) lots. The Regional
District anticipates this will meet
residential development demands for the
foreseeable future
12 KM RADIUS FROM
WINFIELD TOWN CENTRE
12 KM RADIUS FROM
RUTLAND TOWN CENTRE
ELLISON
LAKE
CLIFTON/GLENMORE HIGHLANDS
1000 S.F./ 500 M.F.
Glenmore Road
UNIVERSITY N.
210 S.F. / 695 M.F.
UNIVERSITY S.
695 S.F./ 940 M.F.
DILWORTH MTN.
400 S.F. 275 M.F.
ELLISON
GLENMORE VALLEY
500 S.F. / 1750 M.F.
ELECTORAL
AREA I
ELECTORAL
AREA H
ELECTORAL
AREA G
INNER CITY/WATERFRONT
5071 M.F.
TOWER RANCH
455 S.F. / 210 M.F.
RUTLAND
700 S.F. / 3000 M.F.
To Vancouver
LAKEVIEW
2547 new housing units (S.F.&M.F.)
IR 10
12 KM RADIUS FROM
WESTBANK TOWN CENTRE
Highway 33
HWY. 97/SPRINGFIELD
3000 M.F.
KELOWNA
WESTBANK
WESTBANK
2240 S.F. / 660 M.F.
IR 9
S. PANDOSY/GUISACHAN
2300 M.F.
SE. KELOWNA
600 S.F. / 50 M.F.
BLACK MTN.
1400 S.F.
WESTBANK TOWN CENTRE
Projected Commercial Space Demand
Totalt Approx. 29,000 - 47,000 sqm.
NORTH MISSION/CRAWFORD
203 S.F. / 885 M.F.
CITY OF KELOWNA
Projected Commercial Space Demand
1994-1998 : 155,000 sqm.
1999-2003 : 153,000 sqm.
2004-2008 : 149,000 sqm.
2009-2013 : 167,000 sqm.
20 year total : 629,000 sqm.
LEGEND
NET PRIMARY AGGREGATE SUPPLY POTENTIAL
NET SECONDARY AGGREGATE SUPPLY POTENTIAL
To
Big White
PEACHLAND
PEACHLAND
1124 new housing units (S.F.&M.F.)
OKANAGAN LAKE
SOUTHWEST MISSION
2900 S.F. / 1025 M.F.
12 KM RADIUS FROM
HWY 97 TOWN CENTRE
To Penticton
TOTAL PROJECTED NUMBER OF NEW SINGLE
FAMILY (S.F.) AND MULTIPLE FAMILY (M.F.)
RESIDENTIAL DWELLINGS REQUIRED TO
ACCOMMODATE POPULATION GROWTH OVER
NEXT 20 YEARS : 40,866
NOTE: The figures represented reflect population and
housing projections based on various Official Community
Plans as of February, 1999
0
10km
Scale 1:250,000
Rev. June 15, 2000