Visual Impact Assessment of Small-Scale Mining in Iceland: A Tool for Municipal Planning and Decision Making

Master's Thesis in
Environment and Natural Resources

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Faculty of Life and Environmental Sciences
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60 ECTS thesis submitted in partial fulfillment of a
Magister Scientiarum degree in
Environment and Natural Resources

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Abstract

Small-scale aggregates mines and quarries are very widespread in Iceland, with over 3000 mines alone registered with the Icelandic Road Administration. Most of the volume of aggregates and rock that is mined is used for construction. The mining of building stone and aggregates has mainly visual impacts on their surroundings, but can also have significant impacts on biodiversity and hydrology. Icelandic municipalities are required by law to include all extraction in their land-use plans and issue permissions for any new mining projects. The objective of this study is to develop and test a simple evaluation tool that can help municipal authorities and planners in these tasks. The tool is based on a modified version of the Visual Resource Management methodology developed in the United States of America. The tool assesses visual quality and sensitivity of a landscape in order to identify its vulnerability to change. In a second step, the actual impact of the project is assessed by rating the contrast to the surrounding environment. A study using the tool was carried out in the Municipality of Hornafjörður, where it was tested on 10 proposed mining sites relating to the construction of a new stretch of a road. The tool created was found to be useful for determining the visual impact of a mining project within the landscape. It can be a tool that, combined with other assessments, notably of biodiversity and hydrology impacts, enables municipalities to create sound plans and make informed decisions about the locations and dimensions of mining projects.

Ágrip

Tiltölulega litlar malar- og grjótnámur finnast afar víða á Íslandi og eru meira en 3000 slíkar á skrá hjá Vegagerðinni einni. Mest af því efni sem tekið er úr slíkum námum er notað til mannvirkjagerðar. Helstu umhverfisáhrif af grjótnámi, sand- og malarnámi eru hin sjónrænu áhrif á landslag, en einnig getur slíkt nám haft umtalsverð áhrif á lífríki og vatnafar. Sveitarfélög á Íslandi eiga lögum samkvæmt að gera grein fyrir allri efnistöku í aðalskipulagsáætlunum og þau hafa það hlutverk að veita leyfi til námuvinnslu. Tilgangur þessarar rannsóknar er að hanna og prófa einfalt matstæki fyrir áhrif námuvinnslu, sem nýst getur sveitarstjórnum og þeim sem annast skipulagsgerð. Tækið er byggt á bandarískri aðferðafræði fyrir mat á sjónrænum áhrifum (Visual Resource Management), sem löguð var að aðstæðum. Fyrst er lagt er mat á sjónræn gæði landslags í því skyni að meta viðkvæmni þess gagnvart breytingum. Í næsta þrepi eru áhrif námunnar metin með því að bera hana saman við nánasta umhverfi hennar. Matstækið var prófað á 10 stöðum í Sveitarfélaginu Hornafirði, þar sem námuvinnsla er fyrirhuguð í tengslum við lagningu nýs vegar. Niðurstaðan er að það geti nýst til að meta sjónræn áhrif námuvinnslu í landslagi. Sé tækinu beitt ásamt annars konar mati (á áhrifum á lífríki og vatnafar) getur það orðið sveitarfélögum til aðstoðar við skipulagsgerð og upplýstar ákvarðanir um efnistöku.

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1 Introduction

Mining of rock, gravel and sand is part and parcel of development in municipalities, providing raw material for local construction projects and necessary maintenance. The demand for material is directly linked to the amount and scale of projects undertaken. This is especially so in Iceland, where the island setting provides a small and closed market. Extraction in the countryside of Iceland is not comparable to commercial quarrying in other parts of Europe, where the quarries are run by corporations and the products are sold on a market to various customers. Many gravel pits and quarries in Iceland are opened and maintained to deliver material for maintenance of a single road segment or the development of a single project. The extracted volume is determined by the volume of the project and not the possible volume of the deposit. Social and economic factors are less important in this kind of mining activities since the extraction activity is seldom the base of any livelihoods. More dominant are environmental concerns, since some environmental impacts are not proportional to the size of the operation.

Quarries and gravel pits are a highly visible part of the Icelandic landscape. The impact on landscape and nature by quarries depends on various factors. Location, size, extracted volume and methods can influence the impact of mining activities on the visual appearance of the land, surface hydrology and ground water flows, as well as habitats and biological diversity. The choice of mining methods is on the other hand mostly influenced by the characteristics of the deposit and economic considerations. Icelandic municipalities are required to prepare a municipal plan (aðalskipulag), covering all the land within the municipality's boundaries and setting out the local authority's policy regarding land use, transportation and service systems, environmental matters and the development of settlement during a period of at least 12 years (Planning and Building Act, Article 16, 1999). Since many of the small projects are generally not planned over a long term, they might not be included in the municipal plan.

The municipalities have the authority to approve new mining sites and all mining activities which have a substantial influence on the environment and its appearance requires permit from the appropriate local government (Planning and Building Act, Article 27, 1999). According to Icelandic law, extraction of rock and gravel on land is subject to Environmental Impact Assessment (EIA) only if the area affected is larger than 50.000 m^2 or the extracted volume exceeds 150.000 m^3 (Environmental Impact Assessment Act, 2000). Many small quarries and mining sites are thus not covered by this act and therefore are not subjected to a thorough evaluation before extraction is started. Since they make up a large proportion of the extraction work in Iceland, it is necessary to integrate them better into environmental management and planning.

The aim of the project is to develop a technique that allows municipalities to justify decision making on mineral mining projects which are not subject to any law on environmental assessment. The purpose is not to create new tools for a general environmental impact assessment of extractive operations. The tool should rather be used in the decision making process and add comparability to the variety of types of mines in different settings. The project will discuss the possibilities of creating a framework which recognizes the key factors of a proposed project (size, utilization method, duration and location) and produces a tool useful for judgment of each individual site. The framework has to be flexible enough to create sound outcomes with varying data input.

Any method to compare small scale mining project has to fulfill the criteria to be easy to implement and cost-effective. The proposed framework is seen as a useful addition to the planning process without being legally required. Municipalities that adopt a rating framework for mining operations regardless of their size and the legal requirement to do so, must have the

financial and human resources to do so. Except from the capital area, Iceland has a low population density and local governments oversee large areas of land. Often the areas for which they are required to provide land-use plans are very large when considering the manpower available in municipal offices, which is determined by the number of inhabitants rather than the area the municipality covers.

The project is developed with the support of the municipality of Hornafjörður which is a large municipality in the south-east of Iceland. The data collection took part in close proximity to Höfn, the local centre where the municipal government is located. Hornafjörður is a typical rural community in Iceland consisting of a small town that functions as service centre for the region and a large rural area surrounding it, with low population density. A proposed new road to cross Hornafjarðarfljót will lead to the opening of new mining sites and the enlargement of existing sites, as is made clear in the current plan for the road (Vegagerðin, 2006). The plan proposes 10 possible mining locations, including mines of different size, material and mining method. This project outline is used in this research because it provides baseline data on a variety of mining operations. Some of the 10 sites are already active, whereas others are completely new. A contributing factor for choosing this particular location was the close proximity to the Vatnajökull National Park, which provides an interesting setting of extractive and possibly destructive operations close to a nature conservation zone.

2 Mining Impact

2.1 Impact Variables

Since the Brundtland Commission published *Our Common Future* in 1987, where sustainable development was defined as a form of development which allows for current needs to be met without compromising the ability of future generations to meet their own needs (WECD, 1987), any form of development has had to be seen in a new light. With an estimated 76 out of 90 elements frequently used in western society, being a product of mineral extraction, mining is playing a key role in present and future development (COM, 2005). The three dimensions of sustainable development – the social, economical and environmental – are as relevant for the mining sector as for any other industry or development. Exploiting resources on the other hand, that are not considered renewable, is contrary to any sustainability concept. Every particle removed from any geological feature is lost, and will not return in the same form or shape. Geological processes are providing new raw material, but in general these processes are to slow to compensate for the removed amounts. However, as explained above, resources are the key for current and future generations to be able to meet their needs. The flow of resources cannot be cut off, because as long as there are no sustainable alternatives, we keep on using traditional resources. Hence it is important that the process of exploiting any resource from the planet's surface is undertaken with the highest caution possible. Managing resources with caution and rethinking supply and demand are key issues to be considered. There are various factors that determine the influence on society, economy and environmental impact of a project. The developer of the resource in question is an important factor, but politics and geography can be important element as well.

To grasp all these different aspects and dimensions of the mining industry, the report *"Breaking New Ground" – Mining Minerals and Sustainable Development* was published some eight years ago (IIED, 2002). The report was published under the umbrella of the International Initiative for Environment and Development (IIED). The IIED is an independent international research organization which already was a contributor to the Stockholm Conference and the above mentioned Brundtland report. The MMSD report examines the unique features of various types of minerals and regional settings and how they hinder or contribute to sustainable development. For the first time a comprehensive oversight was given over a sector that operated in various environments, social surroundings and on different scales that seemingly had no connection to each other. The report was the spring board for various initiatives and policies. It clearly outlined the challenges that a fast-growing extractive sector could pose to environment and social values in the light of its importance for creating human well-being through mineral wealth. The report further triggered a new wave of corporate responsibility. Its development and publication led to the gave birth of the International Council on Mining and Minerals (ICMM). This group is an assembly of the world's largest mining corporations and has the aim to promote good practice and adopting the principles of sustainable development within the industry. The ICMM was a contributor to the mining specific supplement of development indicators of the Global Reporting Initiative (GRI) which will be published in early 2010. The GRI is an organization which, since 1997, has created a set of indicators for various industries. These frameworks are aimed at organizations of all sizes, sectors and locations. These indicators should help companies to assess their performance towards sustainable practice and file voluntary reports. This is intended to increase the corporate responsibility towards sustainable development and will in the long run lead to better practices of companies which should then respect all three spheres of sustainable development. Therefore the indicators are split into three categories: Economic, environmental and social performance indicators, while the social dimension is split further into labor practices, human rights, society and product responsibility (GRI, 2006).

The GRI indicators give a good overview of the demands the mining industry is facing when developing more sustainable strategies. Azapagic made an attempt to create a framework for sustainable development indicators for the mining and minerals industry based on the GRI indicators. (Azapagic, 2004). In the paper she outlines what aspects should be added to the GRI indicator set in order to address the specificities of the mining and minerals sector. Table 2-1 shows the general indicator categories of the GRI and compares it to the framework proposed by Azapagic.

Table 2-1 GRI Indicator categories and additions by Azapagic for the mining and minerals sector

	GRI indicator categories		Included in this framework	Additional to the GRI indicators
Economic	Customers		✓	Products
	Suppliers		✓	Local communities
	Employees		✓	
	Investors		✓	
	Public sector		✓	
Environmental	Materials		✓	Mineral resources
	Energy		✓	Land use
	Water		✓	Closure and rehabilitation
	Biodiversity		✓	Nuisance
	Emissions		✓	Contractors
	Effluents		✓	
	Wastes		✓	
	Suppliers		✓	
	Products and services		✓	
	Compliance		✓	
	Transport		✓	
	Overall (environmental expenditure)		Included in Economic indicators (Public sector)	
Social	Labour practices and decent work	Employment	✓	Suppliers and contractors
		Labour/management relations	✓	
		Health and safety	✓	
		Training and education	✓	
		Diversity and opportunity	✓	
	Human rights	Strategy and management	✓	
		Non-discrimination	Included in Diversity and opportunity (Labour practices)	
		Freedom of association	✓	
		Child labour	✓	
		Forced labour	✓	
		Disciplinary practices	–	
		Security practices	–	
		Indigenous rights	✓	
	Society	Community	✓	Stakeholder involvement
		Bribery and corruption	✓	
		Political contributions	✓	
		Competition and pricing	–	
	Product responsibility	Customer health and safety	✓	
		Products and services	✓	
		Advertising	–	
		Respect for privacy	–	
Integrated		Not available	N/A	Various indicators linking economic, environmental and social performance

(Source: Azapagic, 2004)

Indicators as listed above try to address common issues related to certain operations and help to identify them where they occur. An indicator set thus should be comprehensive enough not to let key problems slip through the net. The key issues related to the mining and mineral industry are widely discussed in the MMSD publication and a list for each category is given below.

Economic issues related to the mining and minerals industry:

- Creation of wealth and contribution to a nation GDP
- Profits and sales as well as costs
- Investments
- Added Value

Environmental issues related to the mining and minerals industry:

- Loss of biodiversity
- Emissions (and effects on global climate)
- Use of energy
- Use of land
- Use of water
- Creation of polluting substances
- Creation of waste
- Resource depletion

Social Issues related to the mining and minerals industry:

- Creation of employment
- Distribution of wealth
- Health and safety
- Corruption
- Education and skill improvement
- Human rights and business ethics
- Opportunities

Not all this issues will be important at every single mining location and for each mining type and size. Economic and social indicators are strongly bound to the revenue of a resource which is on the other hand affected by market prices. Environmental issues will be more relevant the larger the size of the operation is and how adaptable used methods are to protect the local and global environment.

2.2 Mining of Aggregates and Building Stone

Protecting the environment and resources can be achieved with various methods affiliated with either ecology or geography. While ecology and habitat research has been an integral part of conservation research for many years, approaches that are only based on geographical and geological criteria are less recognized. Naveh has called for a transformation of ecology and geography in goal-oriented and mission driven transdisciplinary sciences that provide meaningful programmatic information for helping to change reality (Naveh, 2007). A new argument has also emerged, which stresses that the geological foundations on which biological structures are bases have to be recognized (Gray, 2004).

This newly introduced concept of geodiversity is described in a publication by Gray.

> Geodiversity: a range of geological, geomorphological and soil features. It includes their assemblages, relationships, properties, interrelations and systems. (Gray, 2004, p. 8)

Geodiversity is diminished when special rock features or land forms are removed or destroyed by mineral extraction. Extraction can, on the other hand also make geological formations visible, adding geodiversity, but in general these exposures will not outweigh the loss of geodiversity due to extraction.

Construction work is using the largest volume of geological materials. Most commonly used and found in great variety all over the world are building stone and aggregates. Building stone is used as weight bearing material in walls or can be found in pavements or roads, bringing geological features into urban environments.

Mining of aggregates and building stone is a distinct sector within the mining industry with its very own and unique properties and implications for environmental management. Aggregates are crushed stone, sand and gravel. They are the basis for building material thus an integral part of human development. Aggregates are one of the earliest ground resources used by humans. Today they are used widely in many projects such as road construction, housing and many other man made constructs (Wilburn, 1998). These materials and their availability have been the driver for the shape of the cultural landscapes we see today. Aggregates are accessible all over the world in abundance. This on the other hand means that, compared to energy resources or other less abundant mineral resources, the issues that apply to this type of mining are somewhat different. The price of aggregates is mostly dependent on production cost and demand. And because of the high availability, the demand will be a trigger for any development in the first place (Poulin et al., 1994) Current prices for sand and gravel are around $7 per metric ton in the United States of America and prices for crushed stone around $8.7 per metric ton (Bohlen, 2009), (Willett, 2009). These relatively low prices mean that transportation costs very quickly overcome the unit value, which just allows for a small radius in which material from one source can be distributed. As Wilburn further states, because of the low price, profitability of an operation can be seriously affected by the way the operation is planned and executed. Another effect of the low price range is that the extractive activity will have the tendency to be close to the development for which it provides material. In the case of an expanding urban development, this can lead to serious land use conflict when the settlement grows closer to the quarry that enables it to grow.

2.3 The Icelandic Context

In Iceland aggregate mining the dominant use of ground resources, apart from the extraction of geothermal energy. About 3031 mines were registered in the files of the Icelandic Road Administration (Vegagerðin) of which 1621 were still open and not reclaimed yet (Vegagerðin, 2004). Reclamation and restoration of mines is the process of restoring the land previous occupied by a mine back to an alternative land use. While reclamation is the term for restoring land to the original contour or use and can be also achieved by purely natural forces, restoration normally refers to a man made change that allows for the land to be used in any other form then mining.

The number of 1621 mines open in Iceland is a fairly high figure, compared to the United States of America where the US Geological Survey estimates 10967 open aggregate mines. That is a ratio of 14.5 to 1 considering that the US has approximately 300 million inhabitants and Iceland just 300000. This high number of gravel mines in a fairly small population is one reason for this study. This study is just dedicated to the above mentioned sector of aggregates and building stone mining. Since this sector is dominant in Iceland it requires further study and better restrictions in order to minimize the impact those operations have. Mine and mining are from this point on used to describe these mining types, if not indicated otherwise.

To create an effective tool to govern small scale aggregate mining, it is important that the scope and scale of the tool reflects the operations and projects it is aimed at. As mentioned above, there are more than a thousand mines open in Iceland to this date but most of them are small in size and just very few are in continuous operations. Many of the sites were opened to serve one particular project. It is not a matter of exploiting the resource available but much more the demand of material from the closest location possible that is the driving force to open a new location.

Icelandic aggregate mines can be found all around the country, in the developed and accessible areas. No fewer than 1103 of the 1621 mines open in 2004 were in the responsibility of the Icelandic Road Administration (Bjarnason, 2004). They have a high demand for building and maintaining roads around the country and therefore many of the 1103 mines are located alongside the main road systems as can be seen in Figure 1.

Figure 1 Not rehabilitated mines in Iceland as of 2004 (Bjarnason, 2004)

The Icelandic Road Administration published together with other relevant governmental organizations and affiliated companies a report on mining activities. This brochure on the extraction and reclamation of mines describes common mining activities in Iceland (Vegagerðin, 2002) In the following sub-chapters, the 4 main extraction types will be presented sorted by location based on chapter 8 of the brochure cited above.

Extraction from Rivers

Extraction from rivers can take place in four types of environments, rough gravel river-beds, braided rivers with islands, meandering rivers and estuaries. Each type has characteristic surroundings and typical material properties affiliated with them. Rough gravel river-beds are usually found in the upper parts of rivers where the transport forces of the river haven't had too

much affect on the weathered rock transported. The river is likely to have dug into the landscape creating a valley.
Braided rivers are a second common form of rivers in Iceland. They are common source for gravel and sand. The river changes course very often due to the fluctuations of water discharge and the large amount of material transported. The actual river-bed can be very wide at times but just parts occupied by the river.

The 3rd form of extraction sites is where the river flows in a meandering riverbed in the low lands. The course of the river is rather stable and stays within its bed most of time also influenced by rather slow velocity of the water. Most common material found is sand and silt.

The last variety of extraction sites listed in the brochure is the possibility of extracting material at the estuaries of rivers. These are areas where the river is already under the tidal influence of the sea. The Riverbed widens and flow velocities drop. The material most common in these locations is sand and silt.

In wet environments like rivers or lakes, the bottom and sides of the river-bed will create a natural equilibrium after material is removed so that natural forms and angles are restored. This also means that extraction at one point can affect an area further away if material starts flowing towards the point of extraction disturbing river embankments.

Rivers are the habitats of various species. Migratory fish species like salmon use the rivers to spawn their eggs and the young fish will grow up there and later return as adults to complete and continue the cycle. River bottoms can also the habitat for diverse flora and fauna.

Extraction from Hard Rock

Extraction from hard rock is more complex in planning and execution then river-bed mining. To reach the rock to be mined a layer of overburden might have to be removed. And while extraction from river beds is mostly loose gravel, sand or silt that can be easily excavated, hard rock will need additional force in order to be removed. Most commonly drilling and blasting will be used for compact material and at vertical walls. On plain areas caterpillars can be used using a ripping tooth to loosen material. In Iceland both methods combined can be found as well.

Extraction from hard rock will always influence land-forms and the environment. Reclamation needs engineered solutions. If for example top soil is removed in order to reach the rock, it has to be restored before any form of vegetation can reclaim the land.

Extraction of Volcanic Remains

Volcanic features like craters or pseudocraters and lava flown have their own geological properties. But they are also in almost all cases landmarks and distinctive within a landscape. Any geological feature younger than 10.000 years is under special protection and extraction needs special approval by the Planning Agency.

Extraction from the Sea-Bed

A form of extraction that has no immediate visual effects is the extraction from sea beds. But sea beds are the habitat of various fish species and a lively flora and fauna on the sea bottom. The area where the sea bed is dredged has to be surveyed to identify possible impacts.

3 Planning and Legislation With Regard to Mining in Iceland

3.1 State of the System

This chapter introduces the laws and regulations that are relevant for mining operations in Iceland. The 4 pieces of Icelandic legislation discussed in this chapter are the Nature Conservation Act, the Planning and Building Act, the Environmental Impact Assessment Act and the Act on the Survey and Utilization of Natural Resources. None of these is exclusively dedicated to mining but include restrictions and guidelines for the extraction of ground resources to a varying degree.

3.1.1 Nature Conservation Act no. 44/1999

The nature conservation act is the umbrella legislative document that sets the boundaries for the interactions of humans with nature on the Icelandic territory. Its aim is to prevent harm to biosohere and geosphere, and prohibit any pollution. It further aims to encourage the use and utilization of resources through sustainable development (Art. 1, Nature Conservation Act 44/1999). The act also outlines certain restrictions for developers.

Article 34 of the act emphasizes that “major projects”, which affect the environment and change the appearance thereof, have to comply with zoning plans and the ruling of Environmental Impact Assessment, where applicable. There is no description to what is considered a major project. (Art. 34, Nature Conservation Act 44/1999)

Article 37 of the act provides a list of landscape types that are under special protection. Their disturbance should be avoided if at all possible. This list includes:

- Volcanic craters, rootless vents (pseudocraters) and lava fields
- Freshwater lakes and pools, 1000 m² or more
- Bogs and fens, 3 hectares or more
- Waterfalls, hot springs and other thermal sources; surface geothermal deposits, 100 m² or more
- Salt marshes and mudflats

(Art. 37, Nature Conservation Act 44/1999)

The law includes an entire section dedicated to the extraction of minerals from the earth and the management with regard to the environment thereof. The planning of those areas however has to follow the rules of the Planning and Building Act, which will be discussed later in this chapter.

For all extraction on land from under the seabed, the local authority has to grant an operating permission. Furthermore, the Act on Survey and Utilization of Ground Resources applies, discussed later in this chapter. Extraction by landowners on their own land for their own use is excluded from any operating permission.

Whoever holds the right for extraction of materials from the ground has to provide detailed information about the extraction area, including information on:

- Quantity and type of material
- Processing time
- Clean-up

Article 49 of the act further states that every area shall be brought back into a state, where it fits into its surroundings as well as possible, once the processing period is over. (Art. 49, Nature Conservation Act 44/1999)

3.1.2 Planning and Building Act no. 73/1997, 135/1997 and 58/1999

As explained above, the Planning and Building Act holds the key to permits for extraction activity and the planning thereof.

Article 27 of the act describes how development permits are given.

> Substantial development projects which have an effect on the environment and change its appearance, alteration of land by changing its soil or the removal of material, shall be in accordance with development plans and decisions on environmental impact assessments, where appropriate. It shall not be permitted to begin such projects […] until a development permit has been obtained from the relevant local authority. (Article 37, Planning and Building Act 58/1999)

The act further outlines how municipal plans should be prepared. These are the plans in which each extraction has to be outlined. Article 16 of the Planning and Building Act states that the municipal authority shall develop a plan that includes the policy regarding land use, transportation and service systems, environmental matters and the development of settlements during a period of 12 years (Article 16, Planning and Building Act 58/1999).

In the process regulation 400/1998, on the execution of the Planning and Building Act it is stated that regional and municipal plans should carry the information on the location of active and planned mining operations. Each site should be marked with its location and size and other important issues, not further specified (Proceedings of the Planning and Building Act 400/1998)

3.1.3 Act on the Survey and Utilization of Ground Resources no. 57/1998

This act shares some aspects of the Nature Conservation Act and the Planning and Building Act. The act covers all resources regardless of form, state and origin.

Article 6 of the act provides a new insight into requirements that need to be fulfilled before extraction can start. In order to utilize ground resources, the Ministry of Industry has to issue a license to the developer. However, rocks, stones, sand, clay, pumice, tephra and other volcanic and mineral material are excluded from a license by the Ministry of Industry, when utilized on private land (Art. 6, Act on the Survey and Utilization of Ground Resources 57/1998). It is not mentioned if the exclusion just covers extraction activity by the landowner himself or also extraction activity by a third party on private land.

The party conducting the extraction has to reach an agreement with the landowner, if extraction commences on private land, on the compensation for the resource.

3.1.4 Environmental Impact Assessment Act no. 106/2000, amended by Act no. 74/2005

Environmental Impact Assessment (EIA) is a tool to assess, minimize and mitigate the environmental impact of single projects or the cumulative impact of related projects. If a project is by law subject to EIA, the process of evaluating each dimension of the project, including involvement of the public, has to be carried out in order to obtain a license to go ahead with the

projects. EIAs are in general cost intensive and go through various audits which also make them time consuming. Whether a project is subject to EIA or not is determined by the project type and dimension. The criteria are listed in three annexes to the Environmental Impact Assessment Act.

According to the Icelandic Environmental Impact Assessment Act, quarrying on land and on the sea floor is subject to assessment if the planned extraction disturbs an area greater then 50.000m² or the extracted volume exceeds 150.000m³. If more then one extraction site in the same area contributes to the same project, they are subject to EIA if they together exceed an area of 50.000m² (Annex 1, Environmental Impact Assessment Act 74/2005)

Furthermore, all quarrying that covers an area of 25.000m² and more or has an extracted volume larger than 50.000m³ can be subject to EIA (Annex 2, Environmental Impact Assessment Act 74/2005). It is assessed on a case-by-case basis whether their impact and location will justify a thorough study as listed in Annex 3 of the Act which provides a list of criteria that could lead to the decision to make a project listed in Annex 2 subject to EIA (Annex 3, Environmental Impact Assessment Act 74/2005)

3.2 Discussion of the System

Legislation gives guidelines and restrictions which might be effective just up to a certain point. This chapter discusses the influences of the acts introduced above on the aggregates mining sector in Iceland. Conclusions are drawn how a framework proposed will be located within this legislative background and perhaps is justified by it.

The analysis of the legislation in place in Iceland to protect nature from harmful interference through extractive activity reveals a chain of weaknesses. Most of these weaknesses result from an inconsistency between the various legislative Acts. The three Acts – the Nature Conservation Act, Planning and Building Act and the Act on the Survey and Utilization of Ground Resources – describe the planning steps necessary before a mining project can go ahead, but they do so with different wordings. Further, certain aspects, like exclusions from rules mentioned in all these laws, are just described in one of them. It is the Act on the survey and utilization of ground resources which mentions the difference between private property and public land when issuing development licenses. Private property has a special status under the law, since a development license is not needed for any development on privately owned areas. The law fails to mention whether there are any limitations to third parties developing a project on privately owned land. It is common practice that a developer pays a landowner compensation for the resource extracted, but it is not clear if he then still has the benefit of having license-free development possibilities. The Act on the Survey and Utilization of Ground Resources excludes almost all mineral resources in solid form from any further licensing process under this act. This undermines the original stated purpose of the law and makes it merely a tool for managing geothermal resources. However, all mining activities are always subject to licensing under article 27 of the Planning and Building Act.

For small-scale aggregates mines in Iceland, there are many gaps in the legislative framework, which allow extraction without any further study and evaluation. Projects which can have a lasting effect on the environment might not be detected and subjected to thorough scrutiny. The information that developers have to provide for municipal plans is insufficient to determine the magnitude of impact. Size and location alone do not allow for a proper and reasoned judgment. But a judgment has to be provided by municipalities before any project can be included in a municipal or local plan. With a lack of guidance sound judgment is unlikely. Decisions will be made according to best practice and are therefore likely to be inconsistent, because “best practice” just can function if tools and guidelines are updated and controlled on continuous basis. There is no common environmental policy between municipalities. In small communities the task of applying

those policies in practice is on the shoulders of few municipal employees who are limited by their varying backgrounds and the guidance they receive from the legislative branch of the municipality and state.

Plans are developed to create a holistic look into the future of a municipality. If certain elements of the plan are already potentially flawed, the plan might draw a much more uncertain picture than originally intended. Furthermore, it can sometimes be difficult to determine 12 years in advance whether or where small projects, such as quarries opened for the maintenance of a stretch of road, are needed. Because the change of a municipal plan is a process that involves a substantial amount of work, it is unlikely to be undertaken for a small scale project. Thus municipal plans will contain a certain quantity of inaccurate information about future quarries, just to have future options covered. This sort of background noise information disables a true picture of the future impact of mining operations in the municipality.

A favorable solution would be a possibility for municipalities to assess small-scale projects on a case-by- case basis considering the knowledge of existing and already planned mines. If all quarries and pits are put through a comparable rating scheme, less and more favorable sites could be identified.

4 Methodology

This chapter explains the selection and development of the methodology used to create a framework for the assessment of aggregates mining in Icelandic municipalities.

4.1 Visual Resource Management

Visual Resource Management (VRM) has the objective to manage public land in a manner which will protect the quality of the scenic values of these lands. This is a tool created by the Bureau of Land Management, an organization of the U.S. Department of the Interior, and thus derives its authority through laws and regulations of the Unites States. In particular it is based on the Federal Land Policy and Management Act of 1976 and the National Environmental Policy of 1969. Both demand the protection of scenic values. The aim is to conserve esthetically pleasing surroundings that have value to the citizens of the United States of America. To ensure this, the BLM prepared the VRM policy which demands the preparation and maintenance of an inventory of visual values on public land. Further, visual management objectives or classes should be developed. These classes will provide the standards for the development of future projects. In these future projects visual design tools in form of a contrast rating are incorporated. (BLM, 2009a)

The Visual Resource Management System is split in two parts. The first step is the identification of visual values, to determine the appropriate level of management. This step, called VRM Inventory, has three components.

> **Scenic Quality Evaluation** is a measurement of visual appeal of a tract of land. 7 factors are used to rate the scenic quality in 3 categories named A, B and C. These 7 factors are: *landform, vegetation, water, color, adjacent scenery* and *cultural modifications*.
>
> **Sensitivity Analysis** which measures public interest for scenic quality. Each plot of land is assigned to a level of sensitivity which can be *high*, *medium* or *low*. The sensitivity level analysis takes into account: types of users, amount of use, public interest, adjacent land use, special areas and other factors if they influence the sensitivity level.
>
> **Distance Zones** are a measure of visibility from the observation points. There are three of these zones: *foreground-middleground*, *background* and *seldom seen*. (BLM, 2009c)

All three components are brought together in a map-overlay. Each area of similar quality or sensitivity, called either a Scenic Quality Rating Unit or a Sensitivity Level Rating Unit gets a certain marking on the map. This is overlapped by the Distance Zone.

The second part of the VRM system is the Contrast Rating, which is meant to evaluate proposed projects and how they relate to the approved management objectives. The degree of contrast of the project to the elements form, line, color and texture is evaluated after the specifications of the projects are known. (BLM, 2009b)

Tools created by a national agency which the Bureau of Land Management is, will always have national policy and values imprinted making it difficult to directly adopt the tool in a universal context. To suit the Icelandic circumstances, the VRM tool used by the BLM will have to be modified.

4.2 An Approach for Iceland

Using the American VRM approach directly in Iceland would not work, because certain values important for the BML are not comparable to Iceland. The American approach focuses on identifying exceptional landscapes from less interesting landscape forms. But in Iceland, landscapes that would be identified by the American approach as exceptional are common throughout the county and have a major impact on how the landscape is perceived. Values are set according to users and use of the landscape. One third of the Icelandic population lives in rural areas while the rest lives in the confined space of the capital region. Rural municipalities in Iceland cover a larger area than in other European countries, but they have significantly fewer inhabitants. Local governments have similar responsibilities as larger counterparts, but generally less staff to deal with the tasks. It is therefore important that any additional workload imposed on the municipal staff can be handled within the existing structure. Complicated and lengthy procedures are not applicable, nor are any forms that need a special education for the municipal employee. The VRM approach focuses on creating a complete cover of evaluated land when rating landscape quality and sensitivity. This would be a major undertaking in Iceland and would exceed the scope and aim of this project. However, the double-track structure of the BML approach and the link between landscape and project properties can be useful when comparing projects in Iceland. Moreover, VRM, developed for scenic landscapes, could be adapted to rural Iceland, where natural landscapes are still dominant over the layer of cultural modifications. The use of land during the past centuries has transformed the land, but the natural character has not been lost.

My project has the aim to create a tool to assess the landscape values threatened by aggregates mining developments in order to be able to compare different mining techniques and locations and create a base for decision making on them. VRM is a useful tool but can't be used directly to achieve the goal stated above. My project will thus use the structure and idea behind VRM but adopt it to the context in which it will be used. One reason, why VRM can't be used directly in an Icelandic context is the scale it demands. Another reason is that the VRM has certain flaws that would not benefit the objective of helping the planning process in Icelandic municipalities. The most important of these is the use of distance zones in the landscape inventory. Those distance zones, describing the distance of a land to the viewer, are in the opinion of the author not very useful, because they are giving a double input on distances to the quality and sensitivity evaluations. When evaluating landscape quality from a certain viewpoint, distances are already a major part of the assessment when assigning quality to landscape.

While using the ideas behind VRM, the tool to assess small mining projects in Iceland will be used on a case–by-case basis and not to create a complete inventory of landscape. For each project, an inventory of the plot of land in question will be created. This allows for an assignment of a management class and objective for each area. The rating of the project's impact is carried out after the inventory is created but still related to the same assessment process. This allows for the same team of planners to focus on one project and how this project will affect the municipality.

4.2.1 Structure of the assessment

The assessment is based on two separate evaluations, that combined contribute to the decision making process. The assessments are limited to the area impacted by the project in question. Each project has a different scope of visual impact. While certain developments will be seen in their full extent only from certain angles or viewpoints, others affect a large area and can be seen from afar. If the range of visibility is high, more than one assessment will be carried out taking in

account the areas the project affects visually. The following table gives an indication of how many assessments are necessary for each project.

Table 4-1 Determining number of assessments

Rating	Explanation	Number of assessments	
5	Visible in full from close and far, from different angles and approaches	5 to 4	Including views from settlements, different travel routes and distances and the maximum impact locations.
4	Fully visible from close and partly from far.	4 to 3	Including views from different travel routes and distances, the maximum impact locations and if necessary settlements.
3	Visible from close from various locations but not visible over long distances	3 to 2	Including views from different angles and the maximum impact location.
2	Visible in full from just one location.	2 to 1	Including the maximum impact location.
1	Visible partly from one location	1	From the maximum impact location.

The assessment points will be bound to the extent of each project. They will be located along travel routes, which will bring people into the proximity of the project. If the project can be seen from a nearby settlement complex, an assessment shall be carried out there as well. If possible redundant assessments will be avoided. At each point a full and independent assessment will be carried out.

Each assessment is split in two separate parts. The first, called the landscape inventory, determining the management the landscape requires by evaluating quality and sensitivity of the landscape. And second, the project rating, where the visual impact of the project is determined by conducting a contrast rating between the project and the existing landscape.

The landscape inventory is a capture of the existing landscape without the disturbance of the proposed project. This is necessary to evaluate the impact of the project and the contrast it creates. Landscape can be valued in many different ways. This project uses a numerical tool to assess the landscape quality. This is a method that accounts for the abundance of certain elements within the landscape. A second tool assesses the landscape sensitivity in a more subjective approach that allows more flexibility in evaluating the landscape character. Sensitivity is a measure of public interest in the area, not just the landscape. Both tools are combined to assign a management class to the landscape in question. Behind this class, stands a management decision that describes the recommended treatment of the landscape to the planner.

The project rating is an independent assessment, carried out from the same location as the landscape inventory. The project is pictured within the landscape and the key impacts according to the project outline are identified. The contrast to the existing landscape is determined by

comparing the effects of the project on various properties of the landscape. These are geometric and visual elements as form, lines, color and texture of land and water bodies and vegetation.

For the decision making on a project the contrast a project would have is compared to the recommended management of the landscape. The assessment will provide guidance in the decision making process and will give indications whether the location of the project or the proposed outline of the project are a major issue to reconsider. The final decision is made by the elected municipal authority where political reasons may influence the final judgment. These circumstances can't b discussed and foreseen by this study.

In Figure 2, the proposed assessment tool and its structure is visualized. The two separate parts of the overall assessment are show and the steps that are necessary to complete the evaluation forms. In chapter 4.2.2 and 4.2.3 the detailed execution of the assessment is described.

In the following paragraphs the forms used to create the Landscape Inventory and Project Rating are explained step by step as found on the evaluation forms.

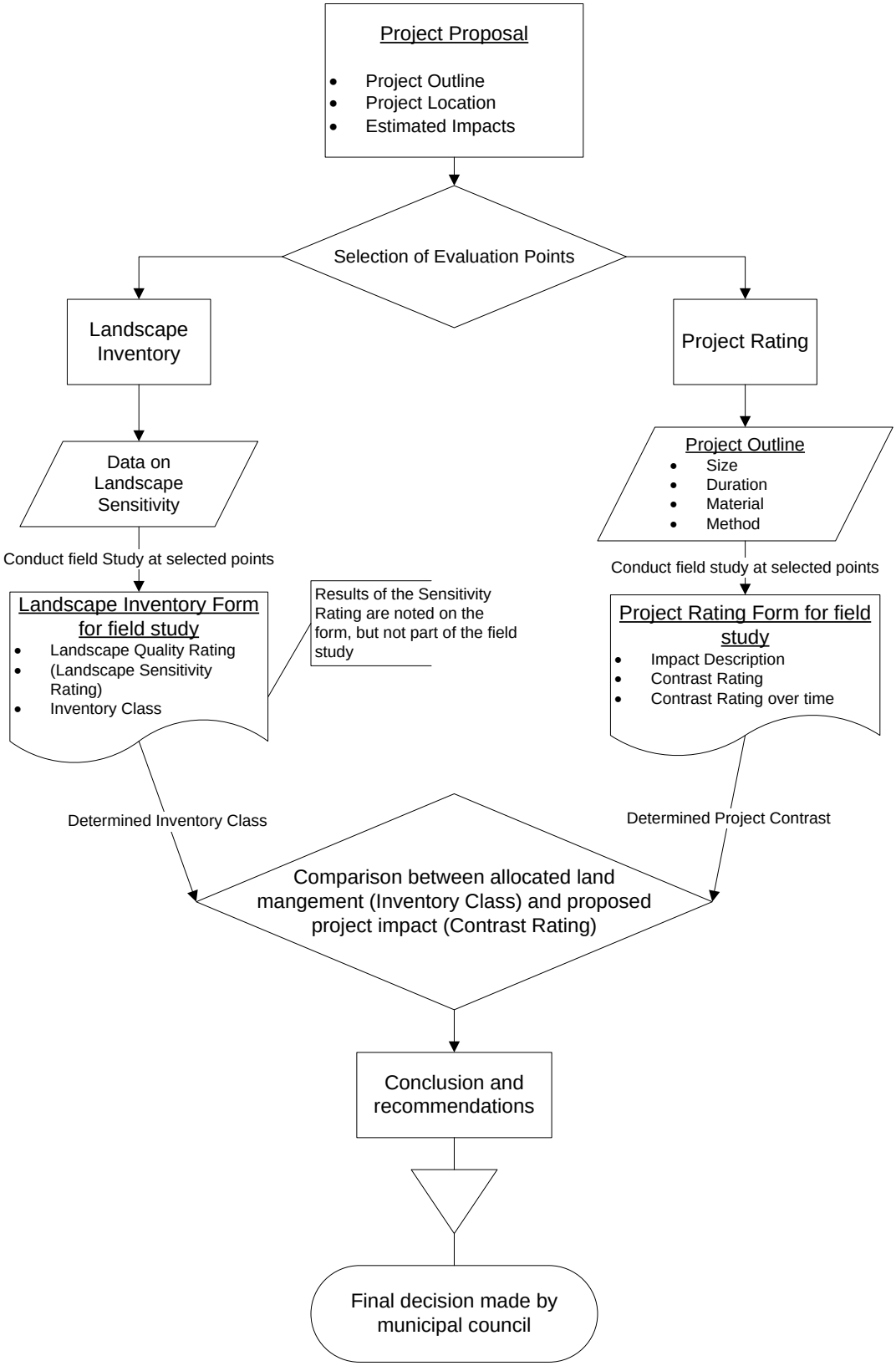

Figure 2 Assessment Structure

4.2.2 Landscape Inventory Form

The outcome of the landscape inventory form has to be the determination of the management class in which the landscape can be sorted. To achieve this, the following steps are necessary.

A. Narrative

A narrative is a verbal description of the evaluators view and an important for documentation of the evaluators' decisions. The focus of this description is on the area in question and it should not stray beyond its boundaries. Using simple phrases and words, the visible landscape will be described, paying close attention to landform, vegetation cover and density, and the presence or absence of water. Furthermore, adjacent scenery, the scarcity of landscape and cultural modifications to it, will be noted. Table 4-2 gives

Table 4-2 Evaluation elements and explanation

	Explanation
Landform	Landforms noticed and where they are located in the landscape and in relation to the viewpoint. Landforms include: • Mountains • Mountain ranges • Hills • Cliffs • Grasslands • Wetlands • Canyons • Glacial moraines • Lava-flows
Vegetation cover and density	Vegetation cover in the assessment area. Note density and variety of vegetation.
Water	The appearance of water in the area. • Lakes • Rivers (slow or fast flowing, one or more river beds) • Waterfalls • Flooded areas
Adjacent Scenery	A look beyond the area of assessment and how the landscape and scenery is changing in contrast.
Scarcity	How does the assessment area compare to other areas in the municipality? Does the assessment are feature landforms, vegetation or water-bodies which are more

	or less unique.
Cultural Modifications	Note cultural modifications and their degree in the assessment area. • Farmland (fields, ditches etc.) • Houses • Infrastructure (Transmission lines, roads etc.) • Industry

B. Visual Quality Evaluation

The evaluation of landscape quality is based on a numerical scheme. The aim is to divide landscape quality into 3 classes. These 3 classes are represented by the added score out of the evaluation of the categories:

- Landform
- Vegetation
- Water
- Adjacent Land-use
- Scarcity
- Cultural Modifications

For the definitions of these terms see Table 4-2.

The guidelines in Table 4-3 give an indication for the score of each factor. Each landscape will have unique properties and the guidelines give information on what has to be present to achieve a certain score. The score may be in between two given examples and has to be negotiated for each single case.

Table 4-3 Visual Quality Rating (Modified from: Illustration 2, BLM VRM manual 8400)

Factors	Rating Criteria		
Landform	High vertical relief as expressed in prominent cliffs, spires, or massive rock outcrops, or severe surface variation or unique new land formations due to volcanic activity including lava-flows (eroded or untouched), craters rows or systems of pseudo-craters; or detail features dominant and exceptionally striking and intriguing such as glaciers or massive lava-flows.	Steep canyons, mountain slopes or features related to volcanic activity like color alterations of rocks; or interesting erosion patterns or variety in size and shape of landforms; or detail features which are interesting though not dominant or exceptional.	Low rolling hills, foothills, or flat valley bottoms; or few or no interesting landscape features. Consider that even very flat landscapes can have a unique character within the region.
	5----------4----------3----------2----------1		
Vegetation	A variety of vegetative types as expressed in interesting forms, textures, and patterns.	Some variety of vegetation, but only one or two major types OR one or more type that is very distinctive for the region	Little or no variety or contrast in vegetation.
	5----------4----------3----------2----------1		
Water	Clear and clean appearing, still, or cascading white water, any of which are a dominant factor in the landscape.	Flowing, or still, but not dominant in the landscape.	Absent, or present, but not noticeable.
	5----------4----------3----------2----------1----------0		
Influence of adjacent scenery	Adjacent scenery greatly enhances visual quality.	Adjacent scenery moderately enhances overall visual quality.	Adjacent scenery has little or no influence on overall visual quality.
	5----------4----------3----------2----------1----------0		

Scarcity	One of a kind; or unusually memorable, or very rare within region. Consistent chance for exceptional wildlife or wildflower viewing, etc.	Distinctive, though somewhat similar to others within the region.	Interesting within its setting, but fairly common within the region.
	5----------4----------3----------2----------1		
Cultural modifications	Modifications add favorably to visual variety while promoting visual harmony.	Modifications add little or no visual variety to the area, and introduce no discordant elements.	Modifications add variety but are very discordant and promote strong disharmony.
	2----------1----------0----------1------2------3------4		

The score for each category is based on the individual perception of the item. But each category is small enough that little variation does not play a big role in the overall assessment.

The scores of all categories are added up. There are three classes that the score can fall into named A, B and C. A being the highest class, including all scores above 15. Class B ranges from 14 to 8 and class C includes all scores below 7. These classifications and scores are not a measure for absolute landscape quality. They are a mere tool to label landscapes, in order to compare them. This label is used to come up with a management recommendation for each landscape, which is based on landscape quality and an evaluation of landscape sensitivity.

C. Landscape Sensitivity

The landscape sensitivity rating is a not achieved in a field study. It is based on an understanding how the area is used and what factors might influence land use conflicts and which limiting factors for development might exist. It also has to be determined if special land management measures are already in place. A single factor can raise sensitivity levels, not just the cumulative effect of various factors. To determine sensitivity, a numerical rating is not really needed, but rather a descriptive list of the influences on sensitivity. It is the planner's decision whether one item is valued more or less. Public interest matters as much as ownership of land.

If special management is required for the land where the project is proposed, these directives have to be followed. Special land management can also have an influence if it applies to areas that are adjacent to the land that is currently under evaluation. In general, determination of landscape sensitivity is a case–by-case decision.

Table 4-4 Sensitivity Evaluation

Influence in landscape sensitivity		Description	Sensitivity Rating
Use	Sensitivity rating for the use is a combination of the 3 categories "users", "amount of use" and "adjacent land use". Rating is not based on a summary of these 3 categories, but on a weighing of importance between the three.		
	Users	Landowners: The use of the land is determined by its owner. Landowners are the most important individuals influencing development on land, and in some cases have the freedom to develop outside the control of municipalities. Farmers: Farmers use the land to raise their livestock or grow crops and other biomass. Farmers depend on the land as their sole source of income. Locals: Locals are people who live in close proximity to the assessment area. They frequently commute through the area and might have personal bonds to it. Tourists: Are people who come with the special intention to visit a particular site or to engage in recreational activity. Travelers: Different from tourists, travelers have no special intention in the area but pass through it.	The more diverse the type of users of a landscape the higher the landscape sensitivity. More users equal a higher risk of land use conflicts. Rating between *high*, *medium* and *low* is a subjective assessment based on the understanding of the importance of different users to a certain region.
	Amount of Use	Amount of use includes people who pass by on travel routes as well as people who stay for a purpose in the region or dwell in the area. Amount of use can be divided into the following sub-categories: • Continuous • Frequent • Periodical • Seldom	The higher the amount of use the higher the sensitivity of the area. Disturbances to the landscape will have an higher impact if they are noticed by a larger number of observers. Rating is based on available studies or estimates showing the amount of use over time.
	Adjacent Land Use	How the land use of adjacent areas compares to the area under survey. The use of the adjacent area might reflect on the study area.	The larger the difference between areas, the higher the sensitivity might be. The rating is based on a case to case evaluation.

Public interest	The visual quality is of concern to many people and interest groups. This category takes into account that each area can be of different interest to different people. Some areas might be special recreational areas, some might be of historical value. • Recreational area • Commons used for biomass collection (berries, mushrooms) • Fishing • Hunting • Historical sites	Public interest influences the sensitivity of landscape when one or more interests are present. • *High sensitivity* can occur if one interest is very strong or many overlapping moderate interests. • *Medium sensitivity* results from some moderate interests or if there is just one strong interest. • *Low sensitivity if there is little interest from few parties or one moderate interest group*
Special Areas	Special areas are areas which require special attention in policy making. This can be any sort of protected area, where a given set of rules and management decisions is in place.	The land that will include the project is a special management area, this will directly lead to the inventory class I. If there are special areas surrounding the proposed project area, it will increase the sensitivity.
Other Factors	This category includes all other factors that might influence the sensitivity of an area. This includes previous studies and reports that have been published on the area. This column further should be used to identify landscape or environmental management objectives that are already in place. This will have an important influence of the determination of the Inventory Class and therefore the proceeding of the assessment. Note determination of inventory class.	Depending on the actual case.

D. Inventory Class

The inventory classes are management proposals for certain landscapes. They are a set of recommendations and rules that should be followed when developing a project in a particular landscape. The inventory classes are determined by landscape quality and landscape sensitivity, which will be assessed prior to defining the inventory class and prior to rating the project.

There are 4 inventory classes, named I, II, III and IV.

Class I is reserved for areas where a special management plan is in place. Any new assessment must not overrule detailed environmental and landscape management plans, previously identified by the relevant authorities. These plans will have restrictions to development of their own and will have gone through detailed analysis and justification. As a result, the current assessment has to be put on hold and relevant authorities will have to be notified of a conflict in land-use planning.

Classes II, III and IV are determined through the key presented in Table 4-5.

Table 4-5 Determining of Inventory Classes

		Landscape Sensitivity			
		High	**Medium**	**Low**	
Landscape Quality	**A**	II	II	III	**Inventory**
	B	II	III	IV	
	C	III	IV	IV	**Class**

Class I Objective. The objective of this class is pre-determined by other management plans. This class is preserved for landscapes where detailed management plans are in place, which aim to preserve characteristic landscapes and nature. These plans will have an effect on future projects within the landscape of their own, and will overrule the current assessment.

Class II Objective. The main objective of this class should be to preserve the existing character of the landscape. Highly valued and/or sensitive landscapes will be managed under this class, therefore changes to the characteristics of the landscape must be minimal. Alternative options for proposed developments should be considered if feasible.

Class III Objective. The objective of this class should be to allow for moderate change to existing landscapes if other options are not feasible. Changes should not be dominant or permanent. Landscape characteristics should be retained and impacts mitigated as far as possible from an early planning stage.

Class IV Objectives. Landscapes that fall under this class can be altered to a higher degree. The development of projects that might have significant landscape impacts can proceed. Every possible step to mitigate and minimize the visual appearance of the project should be planned for. It is further recommended to develop a post-operation plan to rebuild and reshape the pre-operation character of the landscape as far as possible. Permanent impacts should be avoided if at all possible.

4.2.3 Project Rating Form

To carry out the project rating, the project outline and key data has to be made known by the developer of the project. This data will be used by the evaluator to envisage how the project will appear in the landscape and which contrasts it creates to the present landscape elements.

The aim of the project rating is to determine whether the proposed project coincides with the recommended management for the area. Therefore it is important to have carried out the landscape inventory and determined the inventory class before the project is rated. This is to ensure an impartial view on the landscape, because the judgment about the importance of certain landscape features might be clouded if taken their immanent destruction into consideration when doing the landscape inventory.

Contrast being considered the change to landscape properties compared to previous landscape properties has to be evaluated at the same scale as the landscape it is affecting. When selecting the scale for the landscape inventory, which is based on a pre-development landscape, so the landscape the contrast is rated against, the proposed project has to fit within those boundaries. But the landscape inventory will also include parts of the landscape that will never be affected by the project. On the other hand, the project rating will have to use the same scale and not just the boundaries of the project. Contrast is with the entire affected landscape, not just on the spot where change occurs.

The project rating will not produce a direct decision for the approval of the project. It is the planner's responsibility to compare the project's contrast with the recommended management of the area and draw the necessary conclusions. In the following paragraphs, the steps towards contrast rating of the project are explained in the order they appear on the proposed evaluation form.

A. Project Outline

All relevant details of the project should be listed. This helps to create an understanding of the scale and properties of the extraction site. The minimum information necessary is data on surface area and volume extracted and the precise location of the proposed site. Also important are explanations of the planned procedures for extraction, since they will give the planner an idea how the impact of the project will develop over time. Helpful as well for a rating will be information on the timeline and the planned efforts to minimize impacts after the active operation period. In general, the more detailed the description, the better the understanding of the proposed site for the planner.

B. Location of Project

To classify impacts and for the importance of documentation, the location of the project in relation to the viewer or evaluator has to be noted. This is fundamental since the same project might cause different impacts over various distances. In a majority of the cases more than one assessment will be carried out per site, therefore the changing contrast related to the different distances can be assessed. On the Project Rating Form it can be noted if the project is situated in the foreground, middleground or background. Foreground is the area stretching from the standpoint of the viewer up to approximately one third of the visible landscape. Background IS the area that is on the boundaries of the visual field. Middelground is the area between what is defined as foreground and background. However, there are no set boundaries for these zones and each landscape will give a different sense of where the zones are. Zones that are in the background can be larger then they appear to be, due to perspective.

C. Impact Description

Based on the project outline a certain set of impacts will occur in the landscape. To visualize these impacts the project has to the project has to “pictured” within the landscape. To assess the magnitude and severity of the impact the project has, a narrative description will help identifying them. This section should include all possible disturbing factors that can be associated with project.

D. Contrast

The contrast of the project under survey to the landscape it is located in, is rated in the categories *strong*, *moderate* and *weak*.

Strong: The contrast is dominant and draws attention

Moderate: The contrast is visible and is likely to draw attention

Weak: The contrast is visible but does not draw attention

The overall contrast rating is a composite rating resulting from the evaluating the contrast to four key elements that define landscape and visual character. Those elements are *form*, *line* and *color*.

Forms are the shape of landscape structures. Contrast occurs when new forms are introduced or existing forms are removed.

Lines are edges and boundaries that are visible in the landscape. Landforms, water bodies and vegetation can create lines in the landscape. Contrast occurs when new lines are introduced, existing lines are removed or existing lines are disrupted or changed.

Color of landscape and vegetation cover can change due to natural causes like the changing seasons. Contrasts of colors are just rated if the change is in direct correlation with the project and the activities associated with it. Color contrast can occur when new landforms or vegetation are added that cover the previous color patterns. Contrast is also possible if existing color in the form of land or vegetation is removed and other colors previously not seen are uncovered. Further, color contrasts also can occur in water. Secondary impacts like the lowering of ground water tables could also influence color changes in existing vegetation.

Texture. Vegetation, but also rock formations or water features, can form distinct patterns and textures in the landscape. A disruption of those or the creation of new textures can create contrast.

When assessing the contrasts of a project, jut elements that can be evaluated on the base of the project outline, should have an assigned contrast in the contrast rating form. The overall contrast is determined by the strongest and most dominant influences combined always acknowledging their proportional relevance to the entire project area and visibility from the viewpoint. The contrast rating form also provides room for a rating future and long term contrasts. If the appropriate information is given by the developer, this can be used to assess the contrast for the post-closure period. The effectiveness of measurements to rehabilitate the landscape can be tested. For this rating the same methods as explained above apply. Further, the timeline of the project, if known, can be noted. This will allow to identify when the maximum impact will occur and for how long. Some projects need some time until they reach their full operation size. And for planning ahead in municipalities, it can be important to be aware when which scale of disruption will be visible.

E. Concluding Remarks

The rating of the contrast is not a defined process that will produce exact and always comparable results. To classify the range of outcomes, this section allows for comments by the evaluator to explain his conclusion. He/she can highlight certain impacts that he thinks need special attention and perhaps further consideration and action. It also can be noted if one specific contrast contributed strongly to the decision of the overall contrast. These remarks will help to create an understanding how the rating was built, to a third person and for the decision making process.

4.2.4 Execution of the Assessment

The assessment should be executed in the steps outlined above. Both the landscape inventory and the contrast rating should be assessed separately but can be evaluated during the same visit to each viewpoint. Before the assessment forms are taken out to the field, the information necessary to conduct the field study should be prepared. This is of absolute necessity for the project rating, where outline and scope of the project in question is needed to conduct the rating. The sensitivity rating data can be accumulated before or after the actual field survey.

To test the methodology presented above, it was put to a practical test. In the following chapters these results are presented and discussed.

5 Research Area

5.1 Hornafjörður

Hornafjörður is a large Municipality in southeast Iceland. The regional centre of the municipality is Höfn where the municipal council has its seat and administrative services are located. The municipality can be accessed only from the west and east by the only major road, the ring road around Iceland. The settled areas stretch along the southern coast and are restricted to the north by Vatnajökull, the largest glacier in Europe. The Glacier and the parts of the land around it are within the Vatnajökull National Park, the largest National Park in Iceland. Some areas of the National park are parts of the municipality. The only harbor of the eastern south cost is located in Höfn, which is a tidal harbor with restrictions to the vessels able to land on, due to shallow waters and limited space. Fishing is a major income source for the region around Höfn and the other major two sources of income are the seasonal tourist activities and farming. The tourist activities are mostly related to the glacier and the National Park. The municipality is similar to others in Iceland, having large areas of rural land stretched along a main road and one or two settlements which function as service centers for the population.

5.2 Road Project

A new road is proposed to cross Hornafjarðarfljót a large flood plain in to the west of the settlement of Höfn. The road is to shorten travel time to Höfn by avoiding the detour to the north, the current road takes. The stretch of 11 km or 17 km depending on the route, is proposed by the road administration and subject to EIA. The final report for the assessment has been made and the Environment Agency (Umhverfisstofnun) already commented on the document, with the final ruling still pending.

In order to build a new road, large amounts of material are needed. For this stretch of road, 10 sited where proposed by the developer. Some of them are existing mines, some are sites newly to be opened. But all but two are in close proximity to the road project, and all but one have access to the current road (Gíslason, 2007).

This research has not the aim to discuss the feasibility of the proposed projects with regard to the road project or have influence on the proceedings of the ongoing EIA. This study will just take the opportunity that data of 10 extraction sites is made public. The data presented in the Environmental Impact Assessment is useful because the developer has a real interest in extracting at those sites and a strong interest to get a positive ruling on the assessment but will be used as data out of the context of the road project.

In Figure 3 the entire research area and the proposed road and mining locations can be seen.

5.3 Evaluation Sites and Points

As mentioned above this study will use 10 mining locations to test the outlines evaluation approach. Each mine is seen as an individual project. For each mine the number of evaluation points necessary was determined using Table 4-1. The selected viewpoints where numbered in the process, but in some cases some of the pre selected view points where dropped during the evaluation. The original numbering for each points was kept which results in a non-chronological order in some cases.

Table 5-1 all evaluation points and their exact position as well as basic information on the mine itself.

Table 5-1 Basic Information on Study sites and their location

Mine	Technical Specifications		Viewpoint	Name	Remarks	GPS Location
Mine 1	Area Volume Depth Material	130.000 m² 50.000 m³ 1-2 m Gravel	1	P 1.1		N64.28501° W015.51223°
			2	P 1.2	Parking lot for lookout Eskey	N64.26469° W015.51626°
			3	P 1.3	Lookout Eskey	N64.26469° W015.51626°
Mine 2	Area Volume Depth Material	550.000 m² 200.000 m³ 1-2 m Gravel	1	P 2.1		N64.31860° W015.43945°
			2	P 2.3		N64.31248° W015.40876°
Mine 3	Area Volume Depth Material	54.000 m² 60.000 m³ 1-2 m Gravel	1	P 3.1	Facing North-West	N64.34363° W015.39778°
			2	P 3.2	Facing South-East	
Mine 4	Area Volume Depth Material	130.000 m² 35.000 m³ 1-2 m Gravel	1	P 4.1		N64.39087° W015.34743°
			2	P 4.2		N64.38663° W015.35584°
Mine 5	Area Volume Depth Material	6.800.000 m² 450.000 m³ 1-2 m Gravel	1	P 5.1		N64.35589° W01536371°
			2	P 5.2	Lookout Sandhraun	N64.31076° W015.32020°
Mine6	Area Volume Depth Material	110.000 m² 190.000 m³ 14 m Sand and unspecified bedrock, most likely tertiary basalt	1	P 6.1	Lookout Sandhraun	N64.31076° W015.32020°
Mine 7	Area Volume Depth Material	130.000 m² 250.000 m³ Unspecified Gravel	1	P 7.1		N64.28777° W015.06779°
			2	P 7.3		N64.29105° W015.10422°
			3	P 7.4	Harbor of Höfn	N64.25198° W015.19160°
			4	P7.5	Northern boundary of the settlement of Höfn	N64.26488° W015.17792°
Mine 8	Area	32.000 m²	1	P 8.1		N64.30749°

	Volume Depth Material	35.000 m³ 1-2 m Gravel	2	P 8.2		W015.00675° N64.30589° W014.99448°
Mine 9	Area Volume Depth Material	15.000 m² 5.000 m³ 1-2 m Gravel	1	P 9.1		N64.30749° W015.00675°
Mine 10	Area Volume Depth Material	100.000 m² 230.000 m³ 2-3 m Unknown	1	P 10.1		N64.28415° W015.46654°

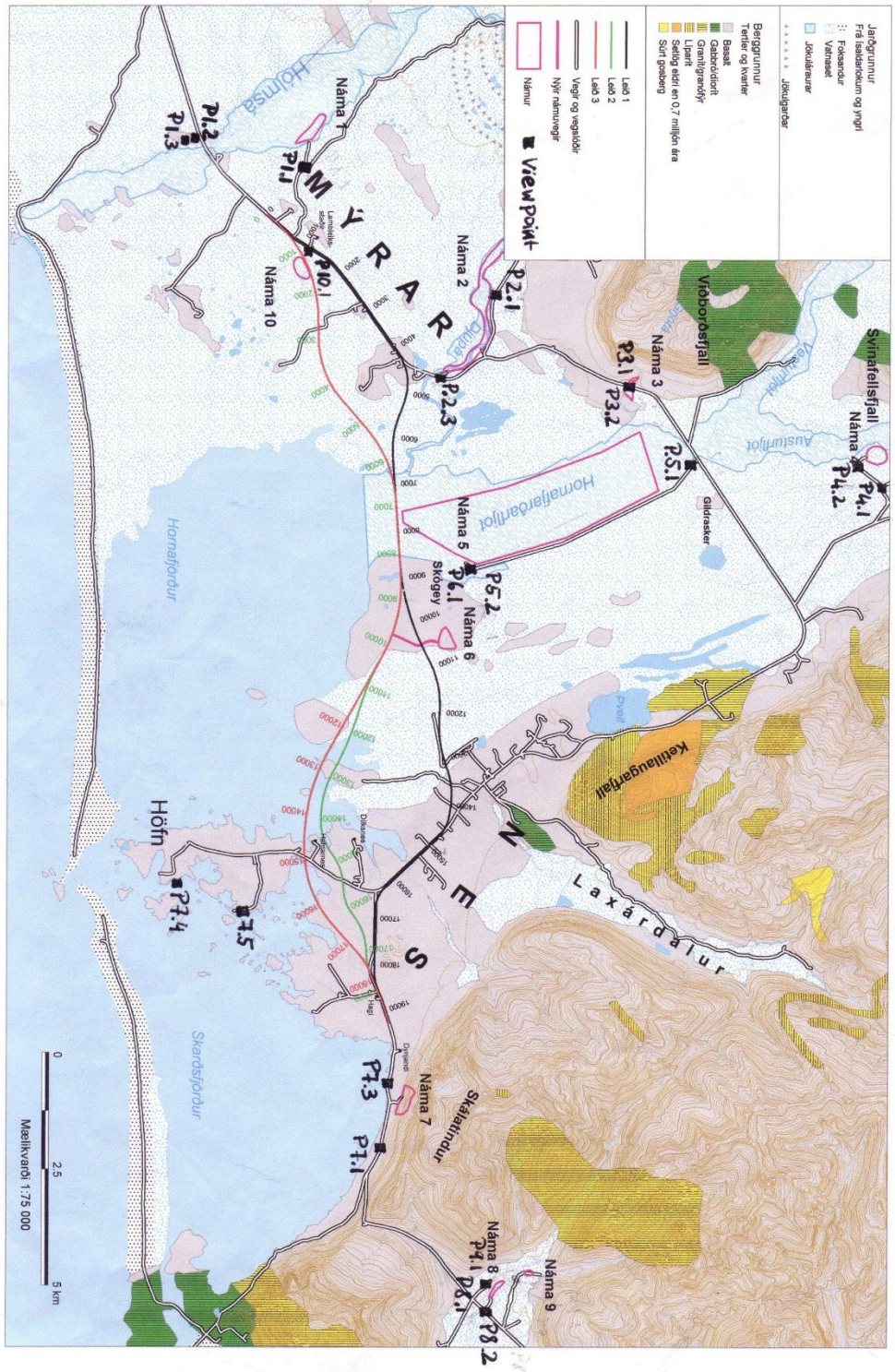

Figure 3 Research Area and Viewpoints (Figure taken and modified from Gíslason, 2007)

6 Evaluation of Sites

6.1 Mine 1

6.1.1 Landscape Inventory Narrative

Point 1

A wide riverbed dominates the landscape. The braided river runs through a gravelly outwash plain, flanked by grassland and hills. Some hills and cliffs can be seen in the distance. The water of the river is milky white to gray in color and is flowing fast in parts of the riverbed. The river stretches into the distance. A rough mountain range and glacier-covered peaks are on the horizon, rising abruptly from the mostly flat land. A few farmhouses in the distance are the only human development visible, apart from the road, where the viewpoint is located. The scenery is rather uniform, with grassland and a few farms and mountain ranges and glaciers in the distance.

Point 2

Figure 4 Viewpoint 2 Mine1

Low hills are visible in the foreground, next to a wide riverbed that stretches into the distance. The riverbed is a wide flooding area, where the braided river winds through sand and gravel banks. There is standing water as well as flowing water. Its color ranges from clear to gray-brown in appearance. The river is flanked by grassland. The background is dominated by rough mountain ranges and glaciers in the valleys. Little vegetation can be seen on these mountain slopes. Human development can be seen in the form of farmhouses and power lines in the distance.

Point 3

Figure 5 Viewpoint 3 Mine 1

This point provides an elevated view over Hólmsá, similar to the view of Point 2. The elevation makes surroundings of the river more visible and creates a better depth perception. The surrounding grassland is studded with small hills and cliffs. The wide riverbed, which the braided river does not fill in its entirety, stretches into the distance and appears to reach the mountain ranges that rise from the grassland in the background and create the horizon. From this elevated viewpoint, human development is more visible, including the main road stretching into the distance both east and west, fences, buildings and power lines.

6.1.2 Landscape Quality Evaluation

Point 1

Table 6-1 Quality Level Evaluation Mine 1 Point 1

Element	Score	Total score and quality level
Landform	2	10 Quality Level: **B**
Vegetation	1	
Water	4	
Adjacent Scenery	4	
Scarcity	1	
Cultural Modifications	0	

Point 2

Table 6-2 Quality Level Evaluation Mine 1 Point 2

Element	Score	Total score and quality level
Landform	3	12 Quality Level: B
Vegetation	1	
Water	3	
Adjacent Scenery	4	
Scarcity	1	
Cultural Modifications	0	

Point 3

Table 6-3 Quality Level Evaluation Mine 1 Point 3

Element	Score	Total score and quality level
Landform	3	13 Quality Level: B
Vegetation	2	
Water	3	
Adjacent Scenery	4	
Scarcity	2	
Cultural Modifications	-1	

6.1.3 Landscape Sensitivity

Point 1

Table 6-4 Landscape Sensitivity Rating Mine 1 Point 1

Influence in landscape sensitivity		Description	Sensitivity Rating
Use	Users	• Landowners • Locals • Tourists	Medium
	Amount of Use	• Access road to []; seldom to periodical, higher in the tourist season	Low
	Adjacent Land Use	• Pastures and grassland	Low
Public interest		• Access to the glacier and cabin of the Icelandic mountaineers	Low
Special Areas		N/A	N/A
Other Factors		N/A	N/A
Overall:		Low	

Point 2

Table 6-5 Landscape Sensitivity Rating Mine 1 Point 2

Influence in landscape sensitivity		Description	Sensitivity Rating
Use	Users	• Landowners • Locals • Farmers • Travelers • Tourists	**High**
	Amount of Use	• Landowners • Locals • Farmers • Travelers • Tourists	**medium**
	Adjacent Land Use	• Pastures and grassland	**low**
Public interest		• Parking spot for the viewpoint Eskey and rest spot along the route 1.	
Special Areas		N/A	**N/A**
Other Factors		N/A	**N/A**
Overall:		**Medium**	

Point 3

Table 6-6 Landscape Sensitivity Rating Mine 1 Point 3

Influence in landscape sensitivity		Description	Sensitivity Rating
Use	Users	• Landowners • Locals • Farmers • Travelers • Tourists	**High**
	Amount of Use	• Ring road (1); frequent	**Medium**
	Adjacent Land Use	• Pastures and grassland	**Low**
Public interest		• Viewpoint Eskey, provides view and description of locations over a far distance	**Medium**
Special Areas		N/A	**N/A**
Other Factors		• Viewpoint Eskey, provides information and views on all landscape features in the surrounding area. Disruption of the landscape would be very obvious from here.	**High**
Overall:		**High**	

The overall high rating is a result of the diverse kind of users and the high sensitivity created by the lookout at this point.

6.1.4 Inventory class

For this location the Quality of landscape is rated consistently with 'B'. The Landscape Sensitivity however ranges from Low over Medium to High.

Using table Table 4-5, this results in 3 different inventory classes:

- Point 1: **IV**
- Point 2: **III**
- Point 3: **II**

However, because point 3 has a better view due to its elevation over the area but sharing the same location with point 2, it can be argued that the inventory class of point 3 should apply for point 2 as well.

6.1.5 Project Outline

Mine 1 is the westernmost mining location. The mine is north of the ring road, accessible by a gravel road leading up to Fláajökull. The mine is within the riverbed of Hólmsá, a glacial river flowing from its outlet few kilometers north of the mine to the mouth on the coast, a few

kilometers to the south of the mine. After the active operation phase, the river itself is expected to take care of reclamation because of high discharge rates and material transport. For details of the project see Table 5-1.

6.1.6 Impact Description

Point 1

The impact occurs in the foreground. From this close range, disruptions in the patterns of the riverbed and color disturbances in the water will be visible. During the extraction period, the mining equipment will be visible and well as 'unnatural' forms like the cone-shaped forms of gravel piles.

Point 2

The impact occurs in the middle ground. The viewpoint is located downstream of the extraction site. Color changes of the water will be visible. During the extraction period, the mining equipment will be visible and unnatural forms may be temporarily seen. Just forms that stand out can be seen.

Point 3

The impact occurs in the middle ground and is from distance and direction equal to Point 2. The elevated view gives a better depth perception of the impact. The extraction site will be visible, as well as the temporary marks the extraction leaves behind when it progresses.

6.1.7 Contrast Rating

Point 1

Overall contrast is moderate during peak extraction activity, mostly due to the close proximity to the extraction site. Form, lines, color and texture of landforms and water are moderately affected while vegetation is not affected. The contrast will, with proper closure of the mine, have no lasting contrast. The material constantly transported by the river will fill excavated sites quickly.

Point 2

Overall contrast is weak. Forms and color are affected moderately, but lines and textures are not influenced. Vegetation is not affected. The extraction will, with the proper closure of the mine, have no lasting contrast.

Point 3

The overall contrast is moderate. From the elevated viewpoint in addition to moderate form and color contrasts, contrasts in lines around the extraction field will be visible. Vegetation is not affected. The contrast will, with proper closure of the mine, have no lasting contrast.

6.2 Mine 2

6.2.1 Landscape Inventory Narrative

Point 1

Figure 6 Viewpoint 1 Mine 2

Flat grasslands stretch into the distance, where few hills and cliffs are embedded. A wide, slow flowing river meanders through the grassland that is studded with small ponds and puddles of water here and there. The visual boundary in the distance is formed by rough mountain ranges and glacier tongues flowing down through valleys to the plains. A few separate farm buildings are visible. Further human developments visible include a gravel road and transmission lines in the distance.

Point 3

Figure 7 Viewpoint 2 Mine 2

A broad meandering riverbed with slow flowing water and partly vegetated gravel banks embedded in grassland. Massive glaciers and rough mountain ranges make up the horizon and adjacent scenery. Cliffs can be seen, but the ranges seem sparsely vegetated. A gravel road follows the side of the river and farm buildings are seen in the distance. A few indicators in the form of gravel piles of previous mining activities are visible in the riverbed.

6.2.2 Landscape Quality Evaluation

Point 1

Table 6-7 Quality Level Evaluation Mine 2 Point 1

Element	Score	Total score and quality level
Landform	3	11 Quality Level: **B**
Vegetation	2	
Water	2	
Adjacent Scenery	4	
Scarcity	2	
Cultural Modifications	-2	

Point 3

Table 6-8 Quality Level Evaluation Mine 2 Point 3

Element	Score	Total score and quality level
Landform	3	11 Quality Level: **B**
Vegetation	2	
Water	2	
Adjacent Scenery	4	
Scarcity	2	
Cultural Modifications	-2	

At both evaluation points, the score and the resulting quality level is the same. The quality level 'B' will be used for the whole area and both evaluations seen as one.

6.2.3 Landscape Sensitivity

Point 1

Table 6-9 Landscape Sensitivity Rating Mine 2 Point 1

Influence in landscape sensitivity		Description	Sensitivity Rating
Use	Users	• Farmers • Tourists • Land owners • Locals	Medium
	Amount of Use	• Secondary road (986); frequent to periodical	Low
	Adjacent Land Use	• Haukafell recreational area • Access and gateway to the national park	Medium
Public interest		• Access to Haukafell recreational area	Medium
Special Areas		N.A.	-

Other Factors		• Bird watching hotspots marked in the "Birds in Southeast Iceland" brochure:
		  ○ Haukafell
		  ○ Baulutjörn
			Medium

Overall:		**Medium**	

Point 3

Table 6-10 Landscape Sensitivity Rating Mine 2 Point 3

Influence in landscape sensitivity		Description	Sensitivity Rating
Use	Users	• Farmers • Tourists • Travelers • Land owners • Locals	**High**
	Amount of Use	• Ring road (1); frequent	**Medium**
	Adjacent Land Use	• Haukafell recreational area • Access and gateway to the national park	**Medium**
Public interest		N.A.	-
Special Areas		N.A.	-
Other Factors		• Bird watching hotspots marked in the "Birds in Southeast Iceland" brochure: ○ Haukafell ○ Baulutjörn	**Medium**
Overall:		**Medium**	

6.2.4 Inventory class

The Inventory class for both evaluation points is the same. With Quality Levels 'B' in both cases as well as 'Medium' Landscape Sensitivities the Inventory class can be determined using table Table 4-5.

The Inventory Class for the landscape relevant for Mine 2 is **III**.

6.2.5 Project Outline

Mine 2 is a riverbed mine in Djúpá. This river is a semi-glacial river, flowing down from its outlet and merging into Hornafjarðarfljót close to the mining site. The proposed mining area stretches several kilometers along the riverbed, starting at the bridge on the ring road and continuing upriver alongside the secondary road number 986. After the active operation phase, the river itself is expected to reclaim the land itself because of high discharge rates and material transport. For project details see Table 5-1.

6.2.6 Impact Description

Impact visible from Point 1 and Point 3 is similar.

Impact occurs in the foreground and middleground from the viewpoints. The riverbanks will be mined and shifted. New forms will emerge in the form of piles of gravel, which will be a temporary impact. Also temporary will be the color changes of the river water due to extraction activity and the visibility of extraction equipment.

6.2.7 Contrast Rating

Point 1

Overall contrast is moderate with moderate contrast to lines and forms, but weak contrasts to color and texture. Vegetation is not affected by changes.

Point 3

Overall contrast is moderate with moderate contrasts to lines, forms and color, due to the visible of the downstream affects on water color changes. Contrast on texture is weak. Vegetation is not affected by changes.

6.3 Mine 3

6.3.1 Landscape Inventory Narrative

Point 1

Figure 8 Viewpoint 1 Mine 3

Wide river bed, with bare gravel and the meandering marks of the changing river. Seasonal changes in water level, making water a more or less dominant in the landscape throughout the year. Gravel slopes and distinct cliffs rise behind and around the riverbed. The hills are covered in grass and moss, while the riverbanks and gravel slopes are sparsely vegetated. The river is confined in its bed by gravel levees, stretching from the point where the river flows under the bridge up until the hills.

Point 2

Figure 9 Viewpoint 2 Mine 3

This viewpoint provides the downstream view, 180° opposite to Point 1. The land is gradually sloping down towards sea level and Hornafjarðarfljót. The wide riverbed is filled with gravel. Hills and cliffs are visible on one side of the river, grassland on the other. In the distance, on the other side of Hornafjarðarfljót, mountain ranges rise from sea level. These mountains are partly vegetated and party display very colorful rock formations.

6.3.2 Landscape Quality Evaluation

Point 1

Table 6-11 Quality Level Evaluation Mine 3 Point 1

Element	Score	Total score and quality level
Landform	4	15 Quality Level: **A**
Vegetation	2	
Water	3	
Adjacent Scenery	4	
Scarcity	3	
Cultural Modifications	-1	

Point 2

Table 6-12 Quality Level Evaluation Mine 3 Point 2

Element	Score	Total score and quality level
Landform	3	12 Quality Level: B
Vegetation	3	
Water	1	
Adjacent Scenery	4	
Scarcity	2	
Cultural Modifications	-1	

6.3.3 Landscape Sensitivity

Point 1

Table 6-13 Landscape Sensitivity Rating Mine 3 Point 1

Influence in landscape sensitivity		Description	Sensitivity Rating
Use	Users	• Landowners • Locals • Tourists • Travelers	Medium
	Amount of Use	• Ring road (1); frequent	Medium
	Adjacent Land Use	• Human influence in this direction of view seems little except from the road where the viewpoint is located. The natural grasslands are used for grazing. In the adjacent area farming is more intensive and land more cultivated and influenced by human activity.	Medium
Public interest		N/A	-
Special Areas		N/A	-
Other Factors		• The assessed landscape is cut by a major road.	Medium
Overall:		Medium	

Point 2

Table 6-14 Landscape Sensitivity Rating Mine 3 Point 2

Influence in landscape sensitivity		Description	Sensitivity Rating
Use	Users	• Landowners • Locals • Tourists • Travelers	**Medium**
	Amount of Use	• Ring road (1); frequent	**Medium**
	Adjacent Land Use	• The natural grasslands are used for grazing. In the adjacent area farming is more intensive and land more cultivated and influenced by human activity.	**Medium**
Public interest		N/A	-
Special Areas		N/A	-
Other Factors		• The assessed landscape is cut by a major road.	**Medium**
Overall:		**Medium**	

6.3.4 Inventory class

The assessment of this landscape is split in two points, but just one inventory class should apply because the viewpoint is the same, just the angle of view is different. Both assessments deliver a 'Medium' sensitivity rating but at one angle the Quality is rated as 'A' and from the other angle it is rated 'B'. The higher rating should be used when determining the inventory class. The Inventory class can be determined using Table 4-5.
For the landscape surrounding proposed Mine 3, the inventory class is **II**.

6.3.5 Project Outline

This mining area is located directly alongside the main travel route in the area, the ring-road. The mine is split in two equal halves on both sides of the road. Excavation takes place in a braided river-bed that can be dry at times. For technical details of the operation see Table 5-1.

6.3.6 Impact Description

The impact occurs in directly left and right of the main road on which the viewpoint is located. The impact is in the foreground. The mining takes place in the sparsely vegetated river bed and will mostly affect the appearance of the river, including color changes and changes of the river pass. The amount of water filling the riverbed depends on the season and the precipitation. The river has the ability to recreate natural patterns very quickly. In the downstream view, vegetation in more abundant, and will be replaced by gravel, which will lead to color changes and the creation of new lines in the landscape.

6.3.7 Contrast Rating

Point 1

Overall contrast is moderate. Form, line and color change moderately although just temporary. Vegetation is only slightly changed, if at all.

Point 2

Overall contrast is moderate. Form, line and color change moderately although just temporary. Vegetation is changed moderately as well, especially new lines and colors appear. This contrast may persist for a longer period.

6.4 Mine 4

6.4.1 Landscape Inventory Narrative

Point 1

Figure 10 Viewpoint 1 Mine 4

The viewpoint is located on a embankment. A gravel road runs along the top of the embankment which cuts though grassland and gravel plains, vegetated in parts. A small mountain rises in the middle of the valley. Taller mountains build the valley walls. Standing water and a small river can be seen. Piles of gravel on the gravel plains indicate ongoing extraction activity. High mountains are part of the adjacent scenery as well as farmland on the valley floor.

Point 2

Figure 11 Viewpoint 2 Mine 4

A river bed and gravel plains created by the river are seen in the foreground. The gravel plains that are covered by light vegetation and gravel stretch towards the gently inclined slopes of a sparsely vegetated mountain in the center of the valley. On the foot of the mountain, a farm surrounded by cultivated land which differs in color from the surrounding area, can be seen. In the foreground, piles of gravel are an indication for ongoing extraction activity from the riverbed. The extraction site is accessed via a gravel road. A partly vegetated mountain and hills close to the viewpoint enhance the scenery.

6.4.2 Landscape Quality Evaluation

Point 1

Table 6-15 Quality Level Evaluation Mine 4 Point 1

Element	Score	Total score and quality level
Landform	3	11 Quality Level: B
Vegetation	2	
Water	2	
Adjacent Scenery	4	
Scarcity	2	
Cultural Modifications	-2	

Point 2

Table 6-16 Quality Level Evaluation Mine 4 Point 2

Element	Score	Total score and quality level
Landform	3	10 Quality Level: B
Vegetation	2	
Water	2	
Adjacent Scenery	4	
Scarcity	2	
Cultural Modifications	-3	

6.4.3 Landscape Sensitivity

Point 1 / 2

Because of the close proximity of Point 1 and 2 to each other, the sensitivity can be evaluated for both together.

Table 6-17 Landscape Sensitivity Rating Mine 4 Point 1/2

Influence in landscape sensitivity		Description	Sensitivity Rating
Use	Users	• Landowners • Locals • Tourists	Medium
	Amount of Use	• Periodical, seasonal	Medium
	Adjacent Land Use	• Mainly similar intensity • very close to National Park boundary	Medium
Public interest		• National Park as a recreational area • Access to Hoffellsjökull	Medium
Special Areas		N/A	-

Other Factors	The viewpoint is past the sign that welcomes visitors into the Vatnajökull National Park. The viewer passes an active mine which should not be there if the area would be actually within the park-boundaries. The visitor will rather know that a mine is against land use policies of the national park then to be aware of the actual plans and boundaries in the region. There for the visitor might take offence in the development after being welcomed to the national park.	**High**
Overall:	**Medium**	

6.4.4 Inventory class

Landscape Quality rates 'B' for both viewpoints and Landscape Sensitivity is evaluated as 'Medium'. Using Table 4-5 the Inventory Class can be determined as **III**.

6.4.5 Project Outline

Mine 4 is an active river bed mine in the river bed of Austurfljót, which is the eastern branch of Hornafjarðarfljót as it emerges from the glacier. Glaciers are constantly moving and in the past decades they have been retreating. This influences the water discharge into the various channels. Currently most of the glacial discharge water and with it most of the transported material takes the route through Vesturfljót and very little glacial water flows through Austurfljót. It is hard to determine how the situation will evolve. The mine is at the border with the Vatnajökull National Park and is accessible by a gravel road also being used to reach the National Park and Hoffellsjökull. For technical aspects of the mine see Table 5-1.

6.4.6 Impact Description

Adding to the existing disturbances in natural forms and lines, the expansion of the mine will result in a magnification of unnatural elements like gravel piles and newly created lines due to excavation. The water of the river might change in color during the actual extraction process. Some of the light vegetation will be removed or covered with gravel. Construction equipment will be visible during the active phase of removing and processing and transporting material.

6.4.7 Contrast Rating

Point 1

The impact occurs in the middle-ground but not to far away from the observer. Overall contrast is medium resulting from medium contrasts in form line and color. Vegetation is also changed on a medium level compared to the pre-existing state. The impact should not last much longer then the operation, since the leveling on unnatural forms and lines can be done easily and the river will take back the land in time.

Point 2

The only difference to the first point is that the impact now occurs in the foreground of the view. The overall contrast is still medium and due to the close view change in textures and patterns can be observed on a medium level. The duration of the contrast will not outlive the operation for long, as explained above.

6.5 Mine 5

6.5.1 Landscape Inventory Narrative

Point 1

Figure 12 Viewpoint 1 Mine 5

A wide flooded area stretches from the point of view into the distance, confined by a gravel dam on one side. Little vegetation, most of the visible land is covered by water. Some gravel banks are visible through the shallow water. A road crosses the river on a long concrete bridge. Transmission lines can be seen in the distance and a few remains of previous mining activity in the foreground. In the distance, over the water body, a few low hills can be seen. The adjacent scenery is dominated by high mountain ranges and glaciers in the background and marsh and farmland closer to the viewpoint.

Point 2

Figure 13 Viewpoint 2 Mine 5

A wide flooding area dominates the landscape. Although it is a very wide river, the water appears still. Little vegetation can be seen, and most of the visible area is covered by water. High mountain ranges with rough peaks and glaciers dominate the background view. Similar landscapes are seen all around. Human development is seen all around in the form of farms, power lines, gravel dams and roads.

6.5.2 Landscape Quality Evaluation

Point 1

Table 6-18 Quality Level Evaluation Mine 5 Point 1

Element	Score	Total score and quality level
Landform	1	11 Quality Level: B
Vegetation	1	
Water	4	
Adjacent Scenery	4	
Scarcity	3	
Cultural Modifications	-2	

Point 2

Table 6-19 Quality Level Evaluation Mine 5 Point 2

Element	Score	Total score and quality level
Landform	3	13 Quality Level: **B**
Vegetation	1	
Water	4	
Adjacent Scenery	4	
Scarcity	3	
Cultural Modifications	-2	

6.5.3 Landscape Sensitivity

Point 1

Table 6-20 Landscape Sensitivity Rating Mine 5 Point 1

Influence in landscape sensitivity		Description	Sensitivity Rating
Use	Users	• Landowners • Locals • Tourists • Travelers	Medium
	Amount of Use	• Ring road (1); frequent use	Medium
	Adjacent Land Use	• Mostly farmland	Low
Public interest		• Access to viewpoint "Skógey"	Medium
Special Areas		N/A	-
Other Factors		N/A	-
Overall:		Medium	

Point 2

Table 6-21 Landscape Sensitivity Rating Mine 5 Point 2

Influence in landscape sensitivity		Description	Sensitivity Rating
Use	Users	• Landowners • Locals • Tourists	Medium
	Amount of Use	• Seldom	Low
	Adjacent Land Use	• Mostly farmland	Low
Public interest		• Lookout "Skógey"	Medium
Special Areas		N/A	-
Other Factors		N/A	-
Overall:		Medium	

Although there are Low and Medium ratings, the overall rating was determined as Medium because of the lookout which will highlight any changes to the area.

6.5.4 Inventory class

For both viewpoints the Landscape Quality is rated 'B' and the Landscape Sensitivity is 'Medium'. The Inventory class can be determined using table Table 4-5 as **III**.

6.5.5 Project Outline

This is the largest mine of the project, both in terms of size and volume. The mining area covers a large piece of Hornafjarðarfljot. The operation, south of the current ring road, is a site where material was previously extracted for the building of levees on both sides of the river. Excavation will not occur simultaneously over the whole area demarcated on the map as the mine's location, but in different sites at different times.
After the active operation, the river and material transported is expected to fill up the excavated area. Sediment transport is a continuous process as long as the glaciers produce material.

6.5.6 Impact Description

Most of the extraction area is covered by water. During excavation color changes in the water will be visible as well as the construction and transportation equipment. No vegetation is affected and few forms are above water level that might disappear.

It is unclear if there will be effects on the banks on the flooding area due to removal of material.

6.5.7 Contrast Rating

Point 1

The impact occurs through the entire area of view, but not to the same extent everywhere. Forms and textures are contrasted moderately as gravel banks disappear. The color of the water changes moderately during extraction. There is no contrast in vegetation cover. Overall contrast is medium to weak. There are barely any long term contrasts to be expected.

Point 2

Impact occurs through the entire field of view. Overall contrast is weak because nothing changes except some medium color changes during the excavation. There are no long term contrasts.

6.6 Mine 6

6.6.1 Landscape Inventory Narrative

Figure 14 Viewpoint 1 Mine 6

Flat marsh stretches into all directions. Standing shallow water is interrupted by little islands that are partly sand dunes and partly have embedded cliffs. Mountain ranges rise in the background. In the distance the settlement of Höfn can be seen as well as various small farm houses and power lines running across the flooded area. A ring of high mountains and glaciers surrounds the viewpoint on three sides, but one side faces the fjord or lagoon.

6.6.2 Landscape Quality Evaluation

Table 6-22 Quality Level Evaluation Mine 6 Point 1

Element	Score	Total score and quality level
Landform	2	13 Quality Level: **B**
Vegetation	3	
Water	3	
Adjacent Scenery	4	
Scarcity	2	
Cultural Modifications	-1	

6.6.3 Landscape Sensitivity

Table 6-23 Landscape Sensitivity Rating Mine 6 Point 1

Influence in landscape sensitivity		Description	Sensitivity Rating
Use	Users	• Landowners • Locals • Tourists	Medium
	Amount of Use	• Seldom	Low
	Adjacent Land Use	• Mostly farmland	Low
Public interest		• Lookout "Skógey"	Medium
Special Areas		N/A	-
Other Factors		N/A	-
Overall:		Medium	

Although there are Low and Medium ratings, the overall rating was determined as Medium because of the lookout which will highlight any changes to the area.

6.6.4 Inventory class

The Inventory class can be determined using table Table 4-5 as **III**.

6.6.5 Project Outline

Mine 6 is the only area where an elevated feature of landscape will be partially removed. The mine will be cut into a rocky hill that is part of Skógey, an area whose vegetation had been degraded previously but has been recently reclaimed into a marshy pasture. The operation is not close to major travel routes at the moment, but will be very close to the road it is intended to provide material for. Technical specifications of the mine can be found in Table 5-1.

For reclamation, the mining front will be sloped out to a ratio of 4:1 after extraction and partially covered by sand extracted at the start of the operation.

6.6.6 Impact Description

The cliff will be substantially smaller after extraction has taken place, but the immediate impact is hard to determine, since concrete information on method and extent of the operation are not available. For operations that are more than a surface extraction, volume and area alone are not enough to quantify the impact.

6.6.7 Contrast Rating

Due to the missing information on impact, a contrast rating is not possible.

6.7 Mine 7

6.7.1 Landscape Inventory Narrative

Point 1

Figure 15 Viewpoint 1 Mine 7

A small belt of grassland stretches between the shore of the lagoon and the steep mountain range that dominates the view. The slopes of the mountains are barely vegetated and gravel covers most parts except few cliff outcrops. On the stretch of grassland a major road and transmission lines run along the shore of the lagoon. Previous extraction activity is visible in some distance. Glaciers and high mountains can be seen in the distance.

Point 3

Figure 16 Viewpoint 3 Mine 7

A small belt of grassland stretches between the shore of the lagoon and the mountain range rising steeply and dominating the view. The slopes of the mountains are barely vegetated and bare gravel covers most parts except few cliff outcrops. On the stretch of grassland a major road and transmission lines run along the shore of the lagoon. The mountain slopes are cut by previous extraction activity.

Point 4

Figure 17 Landscape from Viewpoint 7.4

Mine 7 is to the left of the picture. Landscape characteristics are similar as seen above.

Grass-covered islands and cliffs are located in the foreground in a lagoon with calm clear water. Beyond the lagoon, high mountain ranges with rough peaks rise up from the plain. Parts of the mountain slopes appear to be vegetated but most of the slopes are covered with bare gravel. Some cliffs outcrops are visible as well. The viewpoint is located at the edge of the settlement of Höfn, and surrounded by the harbor and related industrial complexes. But in the distance also mountain ranges and glaciers add positively to the scenery.

Point 5

Figure 18 Viewpoint 5 Mine 7

A lagoon with calm water stretches into the distance. Little grass covered islands are located close to the viewpoint in the lagoon. In the distance high mountain ranges with rough peaks rise from the lagoon. The slopes are covered with gravel and cut by gorges and waterfalls. Farmhouses are seen along the shore of the lagoon.

6.7.2 Landscape Quality Evaluation

Point 1

Table 6-24 Quality Level Evaluation Mine 7 Point 1

Element	Score	Total score and quality level
Landform	4	14 Quality Level: B
Vegetation	2	
Water	3	
Adjacent Scenery	4	
Scarcity	3	
Cultural Modifications	-2	

Point 3

Table 6-25 Quality Level Evaluation Mine 7 Point 3

Element	Score	Total score and quality level
Landform	4	11 Quality Level: B
Vegetation	2	
Water	2	
Adjacent Scenery	3	
Scarcity	3	
Cultural Modifications	-3	

Point 4

Table 6-26 Quality Level Evaluation Mine 7 Point 4

Element	Score	Total score and quality level
Landform	4	15 Quality Level: A
Vegetation	2	
Water	4	
Adjacent Scenery	3	
Scarcity	4	
Cultural Modifications	-2	

Point 5

Table 6-27 Quality Level Evaluation Mine 7 Point 5

Element	Score	Total score and quality level
Landform	4	13 Quality Level: B
Vegetation	2	
Water	4	
Adjacent Scenery	2	
Scarcity	3	
Cultural Modifications	-2	

6.7.3 Landscape Sensitivity

Point 1

Table 6-28 Landscape Sensitivity Rating Mine 7 Point 1

Influence in landscape sensitivity		Description	Sensitivity Rating
Use	Users	• Landowners • Locals • Tourists • Travelers	**Medium**
	Amount of Use	• Ring road (1); frequent use	**Medium**
	Adjacent Land Use	• Farmland	**Low**
Public interest		• Low public interest	**Low**
Special Areas		N/A	
Other Factors		• Bird watching hot spot "Skarðsfjörður"	**Medium**
Overall:		**Medium**	

Point 3

Table 6-29 Landscape Sensitivity Rating Mine 7 Point 3

Influence in landscape sensitivity		Description	Sensitivity Rating
Use	Users	• Landowners • Locals • Tourists • Travelers	**Medium**
	Amount of Use	• Ring road (1); frequent use • Viewpoint; frequent use	**Medium**
	Adjacent Land Use	• Farmland	**Low**
Public interest		• Parking spot and viewpoint	**Medium**
Special Areas		N/A	
Other Factors		• Bird watching hot spot "Skarðsfjörður"	**Medium**
Overall:		**Medium**	

Point 4

Table 6-30 Landscape Sensitivity Rating Mine 7 Point 4

Influence in landscape sensitivity		Description	Sensitivity Rating
Use	Users	• Landowners • Citizens • Locals • Tourists	**Medium**
	Amount of Use	• Continuous	**High**
	Adjacent Land Use	• Urban landuse	**Medium**
Public interest		• Viewpoint over the lagoon, recreational spot for inhabitants of Höfn	
Special Areas		N/A	
Other Factors		• Bird watching hot spots all around the Höfn peninsula	**Medium**
Overall:		**Medium**	

Point 5

Table 6-31 Landscape Sensitivity Rating Mine 7 Point 5

Influence in landscape sensitivity		Description	Sensitivity Rating
Use	Users	• Landowners • Farmers • Locals	**Medium**
	Amount of Use	• Continuous by a small amount of people	**Medium**
	Adjacent Land Use	• Farmland and urban housing	**Low**
Public interest		N/A	-
Special Areas		N/A	-
Other Factors		• Brid watching hot spots all around Höfn.	**Medium**
Overall:		**Medium**	

6.7.4 Inventory class

Points 1, 3 and 5 score 'Medium' Landscape Sensitivity and rate 'B' in Landscape Quality assessments. Using table Table 4-5 the Inventory Class can be determined as III. At point 4 the Landscape Sensitivity scores ‘Medium’ as well but the Landscape quality rates ‘B’ resulting in the inventory class being II.

6.7.5 Project Outline

Located to the northeast of the settlement of Höfn, the mine Friðsæld is the only hillside mine of the 10 mines under survey. There are other similar mines in the nearby area, but they are not part of the project. The mine is already active and the cone-shaped extraction mark formed by gravel moving down the slope reaches from top to bottom. The height of the slope is more the 100 m but a exact measurement is missing. The loose material is extracted at the bottom of the slope by excavator and gravel from further up will flow down until the angle of repose is regained. The final outline of the mine is unpredictable because of the proposed method and the free flow of material. The mine is located directly besides the ring road, accessible by a short stretch of gravel road. See Table 5-1 for technical specifications.

6.7.6 Impact Description

The impact occurs from base to top of the mountain slope. The extraction forms a cone shaped cavity. Color differences between the untouched gravel and the fresh cut are visible. New lines appear running vertically as well as horizontally along the slope marking the areas where gravel has given way and moved downhill. At the base of the slope the gravel is removed on a wider front to create a working platform. The upper two thirds of the slope are highly visible over long distances and from various angles. The further the away the viewpoint is located, the more contrasts in color and lines become dominant over others. The slope has little vegetation cover and vegetation will not greatly affected by the extraction. But the vegetated base of the slope will be partly covered in gravel.

6.7.7 Contrast Rating

Point 1

The overall contrast to the pre-existing landscape is moderate. The previous landscape contains a mine at the same location creating similar effects on lines and color of the slope. The enlargement of the mine will create moderate color and line contrasts. The slope is not and if at al sparsely vegetated and thus there are no effects on vegetation. The created contrasts will last for an indefinite amount of time since there is not method or technique to rehabilitate this kind of slope mining.

Point 3

The overall contrast is strong. The mine will fill most of the view from this point and the changes to the previous landscape will be dominant. Even though the pre-existing landscape already is dominated by a similar mine with similar effects on the environment, the substantial enlargement will lead to a magnification of those contrasts. The element strongest seen are the new lines that are created by the slope-mine where material is withdrawn. Since the viewer is so close to the slope textures in rock formations can be seen that will be contrasted moderately due to removal or being covered. New forms create moderate contrasts as well as color changes due to the removal of weathered top material. New lines cut through the vegetation covering the hill side, which just can be seen in this close up position. This creates new boundaries of vegetated and non vegetated areas. This strong contrast will last long past the closure time of the slope-mine.

Point 4

Overall contrast is moderate compared to the pre-existing landscape. Since this view is from afar, no effects on vegetation can be estimated. Changes in color and vegetation are the most prominent from this view, changing moderately. The contrast will last for an indefinite time even after closure of the mine, at maximum impact. This contributes to the medium rating although the mine is just a little part of the range of view from this point.

Point 5

The overall contrast at this point is moderate. Although the mine is just seen in the distance moderate changes in line and color can be observed due the size of the mine, reaching from top to bottom of the slope in the distance. Forms and textures seem not affected from this angle since the mine is to far away to see details or create a three dimensional image of it shape. This is the same reason why vegetation seems not affected from this view. The impact is long-lasting which contributes to the overall moderate rating although the mine can just be seen from far away.

6.8 Mine 8

6.8.1 Landscape Inventory Narrative

Point 1

Figure 19 Viewpoint 1 Mine 8

A wide valley that splits into two side valleys surrounded by high mountains with little vegetation. The steep mountain slopes, partly consisting of cliffs and partly of gravel slopes, are very colorful.

The valley floor is partly vegetated, but also filled by the dry river channels of a braided river with fluctuating course and varying seasonal discharge rates. In one of the side valleys a waterfall cascades down cliffs. In the gravel of the riverbed there are remains of previous extraction activity, mostly visible in piled up gravel. The valley opens up to wards the sea. Mountain ranges run alongside the shoreline.

Point 2

Figure 20 Viewpoint 2 Mine 8

A wide riverbed filled with gravel dominates the partly vegetated valley floor. High mountains with steep slopes rise left and right of the river. The slopes are partly covered with gravel and partly cliffs. The river meanders through the riverbed and a waterfall can be seen in the distance. A gravel road leads up-valley and there are small power-lines in the foreground. The valley opens up towards the sea. Mountain ranges run alongside the shoreline.

6.8.2 Landscape Quality Evaluation

Point 1

Table 6-32 Quality Level Evaluation Mine 8 Point 1

Element	Score	Total score and quality level
Landform	4	15 Quality Level: A
Vegetation	2	
Water	2	
Adjacent Scenery	4	
Scarcity	4	
Cultural Modifications	-1	

Point 2

Table 6-33 Quality Level Evaluation Mine 8 Point 2

Element	Score	Total score and quality level
Landform	4	15 Quality Level: A
Vegetation	2	
Water	2	
Adjacent Scenery	4	
Scarcity	4	
Cultural Modifications	-1	

6.8.3 Landscape Sensitivity

Point 1

Table 6-34 Landscape Sensitivity Rating Mine 8 Point 1

Influence in landscape sensitivity		Description	Sensitivity Rating
Use	Users	• Landowners • Locals	Low
	Amount of Use	• Periodical	Low
	Adjacent Land Use	• Landfill, Farmland	Low
Public interest		• Berry picking, hunting (seasonal activity)	Medium
Special Areas		N/A	-
Other Factors		• Landfill close by emits odors and is visible in the valley	Low
Overall:		Low	

Point 2

Table 6-35 Landscape Sensitivity Rating Mine 8 Point 2

Influence in landscape sensitivity		Description	Sensitivity Rating
Use	Users	• Landowners • Locals • Travelers • Tourists	Medium
	Amount of Use	• Ring road (1); frequent use	Medium
	Adjacent Land Use	• Landfill, Farmland	Low
Public interest		• Berry picking, Hunting	Medium
Special Areas		N/A	-
Other Factors		N/A	-
Overall:		Medium	

6.8.4 Inventory class

From both viewpoints that provide a very different view on the valley the Landscape Quality is rated 'A'. But the Landscape Sensitivity is 'Low' at Point 1 and 'Medium' at Point 2. But considering the higher exposure due to higher frequency of use the 'Medium' sensitivity should apply for determining the Inventory Class. Using table Table 4-5 the Inventory Class can be set to **II**.

6.8.5 Project Outline

In this location, mining has taken place in the past. The mine is located in a riverbed and the river has reclaimed the land since. Access to the mine is by a short gravel road from the ring road. The mine is together with mine 9, which is in the same valley and river-bed, the easternmost site of the project. Technical detail of the project can be found in Table 5-1.

6.8.6 Impact Description

Material will be removed from a riverbed with little vegetation and chaotic forms and lines due to the ever changing path of the braided river. During extraction, piles of gravel and extraction equipment will be visible. The water of the river will change in color during the active period of the gravel pit.

6.8.7 Contrast Rating

The contrast the gravel pit will have in the landscape is different at both observation points. Point 1 provides an elevated overview of the mine while point 2 is located on the same level then the mine.

Point 1

Overall contrast is strong, mostly influenced by the close up view of the strong new lines created and the change in textures. The mine will dominate the view from this point although the changes in color and the creation of new forms are just moderate. The riverbed has some vegetation that is affected by the development by creating new lines cutting through vegetation and removing or covering vegetative textures and patterns. The river will reclaim the land by itself which will take

some time. But eventually natural pattern will reemerge and create a landscape similar to that before mining started.

Point 2

The overall contrast from this viewpoint is moderate. This viewpoint gives an elevated view of the mine but also gives a view far beyond making the mine a part of a much bigger landscape. The contrasts observed are very similar to those of Point 2 although the changes all appear moderate and not strong. After human made forms are removed and the river has reshaped the riverbed, a landscape similar to the pr-mining landscape will be visible.

6.9 Mine 9

6.9.1 Landscape Inventory Narrative

Figure 21 Viewpoint 1 Mine 9

A wide valley that splits into two side valleys surrounded by high mountains with little vegetation. The steep mountain slopes, partly consisting of cliffs and partly of gravel slopes, are very colorful. The valley floor is partly vegetated, but also filled by the dry river channels of a braided river with fluctuating course and varying seasonal discharge rates. In one of the side valleys a waterfall cascades down cliffs. In the gravel of the riverbed there are remains of previous extraction activity, mostly visible in piled up gravel. The valley opens up to wards the sea. Mountain ranges run alongside the shoreline.

6.9.2 Landscape Quality Evaluation

Point 1

Table 6-36 Quality Level Evaluation Mine 9 Point 1

Element	Score	Total score and quality level
Landform	4	15 Quality Level: A
Vegetation	2	
Water	2	
Adjacent Scenery	4	
Scarcity	4	
Cultural Modifications	-1	

6.9.3 Landscape Sensitivity

Point 1

Table 6-37 Landscape Sensitivity Rating Mine 9 Point 1

Influence in landscape sensitivity		Description	Sensitivity Rating
Use	Users	• Landowners • Locals	Low
	Amount of Use	• Periodical	Low
	Adjacent Land Use	• Landfill, Farmland	Low
Public interest		• Berry picking, hunting (seasonal activity)	Medium
Special Areas		N/A	-
Other Factors		• Landfill close by emits odors and is visible in the valley	Low
Overall:		Low	

6.9.4 Inventory class

Using Table 4-5 the Inventory Class can be determined as **III**.

6.9.5 Project Outline

This mine is an ongoing mining location, just a bit upriver from mine 8. The riverbed mine is accessible by a stretch of gravel road directly from the ring-road. The volume to be extracted from this mine is the smallest of all the 10 mines in the project. However, the mine is an ongoing mine and will be kept open for further extraction for other projects and developments.

6.9.6 Impact Description

The extraction takes place in a river bed. The sparse vegetation on the riverbank is going to be affected, but in general the removal of material is from an already bare area. During the active

period, piles of gravel will be visible. The water color will change and extraction equipment will be visible in the landscape. The depths of the extraction pit will not be visible due to the shallow removal of material.

6.9.7 Contrast Rating

Overall contrast is moderate. The impact occurs mainly during the active period of the mine, but the river will be able to reclaim the natural patterns after extraction ceases. The rating results from moderate contrast ratings for form, line and texture. Vegetation lines and textures are also moderately affected.

6.10 Mine 10

6.10.1 Landscape Inventory Narrative

Figure 22 Viewpoint 1 Mine 10

Flat grasslands and fields stretch into the distance. Few hills and cliff outcrops are visible on the horizon. The grassland is cut by little creeks and rivers. Few farm houses can be seen in the distance as well as some fences cutting through the fields. Colorful rough mountain ranges with glaciers in the background create the adjacent scenery together with farmland with single farm houses in-between.

6.10.2 Landscape Quality Evaluation

Point 1

Table 6-38 Quality Level Evaluation Mine 10 Point 1

Element	Score	Total score and quality level
Landform	2	11 Quality Level: B
Vegetation	2	
Water	2	
Adjacent Scenery	4	
Scarcity	1	
Cultural Modifications	0	

6.10.3 Landscape Sensitivity

Point 1

Table 6-39 Landscape Sensitivity Rating Mine 10 Point 1

Influence in landscape sensitivity		Description	Sensitivity Rating
Use	Users	• Landowners • Farmers • Locals • Tourists • Travelers	High
	Amount of Use	• Ring road (1); frequent	Medium
	Adjacent Land Use	• Farmland	Low
Public interest		• Mostly private land, low public interest	Low
Special Areas		N/A	-
Other Factors		N/A	-
Overall:		Medium	

6.10.4 Inventory class

Using Table 4-5 the Inventory class can be determined as **III**.

6.10.5 Project Outline

This is a new mine, to be opened on what is now uncultivated pastureland. The mine will cut into a level surface and a subsurface pit created. The access road still has to be built, but the road is very close to the current location of the ring road. Afterwards, the ring road will pass directly by the mining site. The groundwater level is just 0.5 to 0.9 m below surface.

After extraction, the groundwater level will rise naturally when pumping stops, and a small man-made lake will be created.

6.10.6 Impact Description

A large pit will be opened close to the road which is the main travel route through the area. An access road does not exist yet, and still has to be constructed. The pit will disrupt the grassland. New elevated elements will appear during excavation in the flat landscape. After mine closure, the pit will be filled with water, adding a new feature to the landscape. While the resulting pond will be a contrast to the previous landscape, water is still a common landscape feature in the area.

6.10.7 Contrast Rating

The overall contrast is moderate to strong. Form and line as well as textures are moderately affected by the pit. Color will be strongly affected. The pit also will lead to strong contrasts in vegetation lines and moderate contrasts in vegetation texture and color.

The contrast will last through the active period of the pit. After the pit is filled with water, creating a lake, there will low to moderate contrast to the previous landscape mostly in line and color.

7 Discussion of Results

7.1 Summary of Results

In the study, some 10 mining sites were under survey with a total of 20 evaluation points assigned to them. In this chapter, the effectiveness of the methodology developed for landscape impact assessment will be discussed, in light of the data that was collected from these evaluation points. Each part of the assessment that individually contributes to the end result and their usefulness in the context of municipal planning will be examined.

The following table summarizes the results of the 10 mining locations with their 20 evaluation points.

Table 7-1 Summary of Results

Mine	Viewpoint	Quality	Sensitivity	Inventory Class	Contrast Rating
Mine 1	1	B	Low	IV	Moderate
	2	B	Medium	II	Weak
	3	B	High		Moderate
Mine 2	1	B	Medium	III	Moderate
	3	B	Medium	III	Moderate
Mine 3	1	A	Medium	II	Moderate
	2	B	Medium		Moderate
Mine 4	1	B	Medium	III	Moderate
	2	B			Moderate
Mine 5	1	B	Medium	III	Weak
	2	B	Medium	III	Weak
Mine6	1	B	Medium	III	-
Mine 7	1	B	Medium	III	Moderate
	3	B	Medium	III	Strong
	4	A	Medium	II	Moderate
	5	B	Medium	III	Moderate
Mine 8	1	A	Low	II	Strong
	2	A	Medium		Moderate
Mine 9	1	A	Low	III	Moderate
Mine 10	1	B	Medium	III	Strong
Ø	**2**	**B**	**Medium**	**III**	**Moderate**

7.1.1 Landscape Quality Summary

Landscape Quality levels are rated with an average **B**. The average score for all viewpoints is 12.5 and 11.7 for those who achieved the **B** rating. Overall, 15 out of the 20 viewpoints achieved a rating as **B**. The remaining 5 points were all in the higher class **A,** all with a score of 15, which is the minimum rating for the A class. The general surroundings for all evaluation points are similar, due to the relative homogeneity of the research area. This might explain the rather even distribution of rating results and the narrow window of scores. Only five points fall between the highest score of 15 to the lowest score of 10, which is still in the B-class.

7.1.2 Landscape Sensitivity Summary

The average Landscape Sensitivity rating is **Medium**. The two points for mine 4 share a sensitivity rating. Of the 19 ratings, only four are not **Medium**. Three of them have a **High** sensitivity and at only at Point 1.1 the sensitivity is rated **Low**. Again, as for the Quality Rating, the fairly even distribution of results could be a result of the restricted research area, where the land use is fairly homogeneous. At most of the points, land use was the only factor that could be determined as an influence to sensitivity.

7.1.3 Inventory Classes Summary

Inventory classes are a result of the Quality and Sensitivity ratings, as explained in chapter 4.2.2 above. Because of this, the distribution of Inventory Classes follows the even distribution of Quality and Sensitivity results. The average management class is **III.** Overall, 16 different classes where set, with the points 2 and 3 at mine 1 and all points at mine 3, 4 and 8 sharing the same class due to their close proximity to their respective development areas. Of the 16 classes, four are rated as **II**, 11 as **III** and only one as **IV**.

In two cases, point 1.1 and 1.3, an above- or below-average Sensitivity Rating is responsible for the above- or below-average inventory class. In two other cases (point 3.1 and 7.4), the Quality Evaluation raises the Inventory class to **II** with an above average **A**-rating. Moreover, at point 9.1 an **A**-rated landscape is combined with a **Low** Sensitivity, resulting in an average Inventory Class of **III**.

In none of the cases, a class **I** was given to any parts of the landscape. However, some areas, like mine 1 to 6, are quite close to the boundary of the Vatnajökull National Park. Within the park boundary, a different management classification would apply: the conservation status would instantly lead to a **I**-rating because mining is generally prohibited within the park boundaries. The proximity to the National Park still affects the Sensitivity Rating, for example for mine 1, 2 and 4, but does not dictate management as of yet, because the quarries are outside its boundaries.

7.1.4 Project Rating Summary

Since the contrast rating heavily relies on the available information about the design and size of the mines in order to evaluate the impact over time on the visual landscape, only 19 out of 20 points could be rated. The information given for the development of mine 6 was not enough to estimate the location within the visual landscape and therefore the contrasts it would create with the pre-existing landscape. The project outline for mine 6 further gives 2 different methods of excavating the quantity of material needed, which both would have significantly different impacts and would also create not the same long term impact.

The average Contrast of the remaining 19 points is **moderate**. For three points the contrasts are rated as **strong** and for other three as **weak**. Mine 1, 7 and 8 have dissimilar inventory classes from the different evaluation points. This will be discussed below, since this could lead to conflicting judgement about the required management.

7.1.5 Decisions

Acknowledging that the objectives for the Inventory Classes are nothing more than a proposal and will have to be adopted in this or another form by the respective municipalities and their own agendas, the outcome of the Contrast Rating has to be compared against the proposed objectives. This will show if decision making on the basis of the proposed framework is possible and if the information gathered in this study is sufficient to draw conclusions. Listed below are the three objectives relevant for this study:

Class II Objective. The main objective of this class should be to preserve the existing character of the landscape. Highly valued and/or sensitive landscapes will be managed under this class. Therefore changes to the characteristics of the landscape must be minimal. Alternative options for proposed developments should be considered, if at all feasible.

Class III Objective. The objective of this class should be to allow for moderate change to existing landscapes if other options are not feasible. Changes should not be dominant or permanent. Landscape characteristics should be retained and impacts mitigated as far as possible from an early planning stage.

Class IV Objective. Landscapes that fall under this class can be altered to a higher degree. The development of projects that might have significant landscape impacts can proceed. Every possible step to mitigate and minimize the visual appearance of the project should be taken, however. It is further recommended to develop a post-operation plan to rebuild and reshape the pre-operation character of the landscape as far as possible. Permanent impacts should be avoided if at all possible.

As already explained, a judgement about the feasibility of mine 6 cannot be made because no contrast rating could be arrived at. Of the remaining nine mines, eight deliver conclusive results and one would give different results at its evaluation points. Below the respective decision that would follow the ratings and the definitions above are listed.

Mine 1

At mine 1, all three points would lead a different conclusion, owing to differences in Inventory Class and Contrast Rating. While point 1 and 2 would allow development with moderate and weak contrast where moderate changes are allowed, at point 3 the proposed impact is barred by the Class II objective. Point 3 and 2 view the same area, but as point 3 is elevated and marked explicitly as a viewpoint for the region, it achieves a high sensitivity rating. However, the impact of the mining operation is temporary and the design of the mine already minimizes visual impacts. A solution could be to close the lookout for the time of the operational phase of the mine. This would reduce the exposure of the public to the disruption in landscape. This is a solution which would not minimize the impact itself but the exposure, because at the other 2 points the contrasts are compatible with the proposed management and at Point 3 the higher management class is highly influenced by the presence of the lookout.

Mine 2

Moderate contrasts to pre-existing landscape are allowed by the objective of Class III. The long-term impacts of this gravel mine are minimal.

Mine 3

At mine 3 the Inventory Class is II, due to an A-rated landscape quality. This on the other hand prohibits the moderate contrasts estimated by the evaluation and caused mainly by the very close and exposed location to the main transport route in the region. A change of project outline to minimize impact is hardly possible. A movement of the mine to an area of lower landscape quality and reduced sensitivity should be considered. A second option, that might be more sound, could be to split the amount of material needed from mine 3 among other mines in the proximity, which are approved.

Mine 4

Moderate contrasts to the pre-existing landscape are in correlation with the objective of the determined Class III. Mine 4 is an extension to an existing mine and will therefore contribute to the continuous removal of material from one site, rather than exploiting constantly new locations. The method used has the minimal effects on its surroundings and the reclamation of land will be possible, leaving only little impacts behind.

Mine 5

The location and proposed outline and method of mine 5 will only create weak contrast to the pre-existing landscape. Even if the area that will be subject to extraction is quite substantial, the point of impact will be always reduced to a single location of extraction. The area is already covered with water and will remain as such. The landscape the project is located in, allows for medium changes as explained in the Class III objective. A development in this location should be favored over others (?).

Mine 7

Mine 7 has different Inventory Classes as well as Contrast Ratings for different evaluation points. However, the conclusion drawn for mine 7 is unequivocal: Mine 7 should not be developed at all if that can be prevented. The location already has the markings of a previous mine, which will have a permanent impact in the years to come. The new proposed extraction would create long-term contrasts of a strong to moderate magnitude. The strongest contrast occurs where the mine is fully visible from the closest distance. The Inventory Classes determined for mine 7 are II and III. While Class II does not allow for changes as proposed, Class III could allow moderate changes if they where not permanent. But this form of hillslope-mining is hardly reclaimable and will have a constant strong to moderate contrast to comparable adjacent landscapes. Hillslope-mines of this kind should not be allowed in areas that have restrictions for development.

Mine 8

The contrast for this mine is both rated strong and moderate. Point 8.1, which is more elevated, provides the strong Contrast Rating, because the extent of the mine is fully visible. This would require an Inventory Class IV, but at both points the Inventory Class is II. This would only allow for minor changes to the landscape. Just a few hundred meters further up the valley is a mine that is already active. It excavates the same material, but is better hidden from the view of most of the land users. The quantity needed from mine 8 could potentially be excavated there or at another, less vulnerable location.

Mine 9

The same riverbed mining type as mine 8 and in very close proximity to it, here the evaluated contrast would allow a development, considering the Inventory Class. The contrast is moderate, but the reclamation of the mine is simple and the impact will not last for long after active excavation if the necessary steps are taken. The mine is hidden away from the main land-users of the area and fewer people will ever be able to see it, leading to a lower sensitivity and thus a Class-III rating. However, the landscape quality is rather high, so caution has to be taken when expanding the mine in order not to damage any important elements of the landscape. Extraction already takes place at this location. The enlargement therefore helps preventing new areas from being disturbed.

Mine 10

This mine is the only location where a substantial cavity is planned below the surface. The contrast that the operation will in all likelihood create will have strong contrasts to the area consisting mostly of flat grassland. The strong contrast is also a result of the impacts that will occur around the mine to facilitate the operation. While the Inventory Class was determined as III, which would only allow for moderate changes, the close proximity to the current and planned road make it almost impossible to lower the contrast so that it might become acceptable under this class. A lasting contrast will remain, since the excavated cavity will fill with a lake. This is a contrast that might be pleasing to the viewer but a contrast nevertheless. Mine 10 should be relocated and the material brought from elsewhere, where the impact can be reduced and the landscape allows for the changes proposed. The post-mining landscape has their own benefits and would, if the lake as such would exist in the landscape, even lead to a higher Quality Rating. But this alone should not be justification for a disruptive project in the first place.

7.2 Quality Rating

The quality ratings yielded a result for all 20 forms. This alone is not a determining factor of the effectiveness of the approach. The structure of the rating helps the evaluator to concentrate on key elements of the landscape and provides focus on the importance of certain features. When rating the single elements however, the evaluator's judgement alone is responsible for a higher or lower rating. With a narrow window of possible ratings from 1 or 0 up to 5, a diversion in just 1 grade higher or lower can have a significant influence on the results especially if these are a constant diversion throughout the document. A preliminary testing of the methodology had shown that even though each element was rated differently, the overall sum was similar, leading to similar classes (A, B or C). However, the full field study was undertaken by the author alone, without a second evaluator. This might result in a distinct tilting of results into one direction and one ideology. In the context of this study, the work was conducted by a single person simply for practical reasons, but in general more than one evaluator is favorable because it reduces personal influence on the results. Landscape evaluations always will be influenced by personal views and emotions. Even though the quality rating is achieved through a numerical scheme, the information behind the scheme is highly influenced by the individual perception of the landscape.

One property of the quality rating is that landscape elements are rated by a numerical scheme, which then is translated into a fictional three-class system, which does not do anything more than sorting the results by value. A key issue that evolves out of this method of classifying landscape qualities are the boundaries which divide the classes from each other. Used later in a context of determining the inventory class, are just the classes and not the numerical rating of the elements assessed. In cases like Point 7.1, 7.4, 8.1, 8.2, 9.1 and 3.1, where the numerical rating is right above or below the boundary, it is crucial to be certain about the outcome of the rating. Some evaluations, like the determination of vegetation cover and its rating, can be flawed and therefore a higher or lower result should have been given. This would subsequently lead to a different management class and therefore different conclusion in the case of a proposed development. A possibility that was used in the implementation tried to implement were 'soft boundaries'. Between three borderline ratings, the class would have been determined by a final ruling. The problem that emerged from this idea was that it is already a system that enables some error due to the less stringent evaluation rules. Who would have been given the power to make a decision that would determine the classes? Wouldn't this lead to decision making in favor for a certain outcome rather than a simple evaluation, what the quality assessment is thought to be? If the assessment is carried out by more than one person some disputes might be able to be settled on site and it also will prevent manipulation of results.

As already mentioned above, the elements used for the rating itself can pose some difficulties. The appearance of vegetation and water for example can be influenced heavily by seasonal effects. That is why the time of the year the assessment if done, is critical. The field study executed for this research took place in early September. By then the discharge in glacial rivers is at or beyond its peak and the grass shows the first signs of wilting. But the overall appearance would have been similar in the summer months. However, in winter when the land is covered in snow, vegetation could not be evaluated and the visual appearance of the landscape would be very different due to a lack of color contrast in the landscape. Other landscapes might be even more affected by seasonal changes.

Besides the seasonal influences, vegetation is generally difficult to evaluate. Without proper training in estimating the diversity of species in a certain region, the evaluator will use vegetation cover as the sole indicator for his rating. However, sometimes a single plant species might be a key species for the ecosystem, or a generally rare species, perhaps only found at this particular spot. To rate vegetation will therefore very strongly rely on the knowledge and judgement of the evaluator, which again underlines his/hers important role. Other studies that have been published on plant diversity and their importance in this particular region will also influence the sensitivity rating and will be added to 'other factors'.

Another element that might be difficult to evaluate is *scarcity*. Scarcity rating can be highly influenced by an emotional attachement to the region. In such case, a local evaluator would rate the scarcity higher than someone that is not affiliated with this particular landscape. It is important that the evaluator remains objective and tries to rate scarcity by comparing the landscape to other landscapes in the country and not by using his own interest in this particular landscape.

7.3 Sensitivity rating

At all viewpoints, the sensitivity of the landscape could be determined. These ratings were based in some cases on very little information, but in other cases on a variety of available information. In the end, only studies and facts known to the evaluators can be used for the ratings. But more available information is not responsible for a higher sensitivity rating. The overall question that has to be kept in mind is how the available information will influence the sensitivity of the landscape to change and how the users of the landscape would be affected by the change. The sensitivity should be determined over time in a study that does not have to be located in the field. Sensitivity can even be determined after the quality evaluation and project rating are complete.

In some cases, information about the sensitivity of a landscape might not exist or may be difficult to obtain. But much information might be misleading as well. It cannot be assumed that many little facts about a landscape automaticly increase its sensitivity. Every fact that is presented has to be weighed against its actual influence on how the landscape is used today and in the future and how this fact might increase the landscape's vulnerability to change.

Table 4-4 is of help for determining the landscape sensitivity. But it is not necessarily complete and leaves room for additions and a lot of freedom to the evaluator. Since there are no numerical guidelines to determine if a landscape has a high, medium or low sensitivity, an evaluator will develop his own understanding of sensitivity after rating a few landscape segments. This is a obstacle for comparability because this would require the same standards for all forms and landscapes. But a sensitivity rating can never be more comparable than the common sense allows.

7.4 Inventory Class

The proposed Objectives for each class are meant as guidelines and are not seen as a final policy component for land management in the community where the study took place. In the end, each municipality is responsible for their own land management plans, where mining projects are just one part of a bigger picture. A municipality like Hornafjörður, with its connection to the Vatnajökull National Park, might have an increased interest in preserving landscape values and therefore adopt more stringent objectives for each class than a municipality that does not include a national park or another large protected area. These are however political considerations that have to be determined before municipal planners are able to carry out any landscape evaluations or contrast ratings.

Since there are only four classes, with one reserved for areas with special management criteria in place, the three remaining classes do not provide fine gradations between stringent and lax landscape protection. But since the Contrast rating also does not provide this sort of nuanced rating, it is enough to provide information for the rather simple forms of mining that this framework is aimed at.

7.5 Contrast Rating

The contrast rating is one of the most vulnerable parts of the entire assessment. It heavily relies on correct and sufficient information given by the developer. Without creating new responsibilities and demands for developers of quarries and gravel mines, the evaluator will find it difficult to create a sufficient picture of the expected visual impacts of the project. The data used in this study were provided by the developer for an even more encompassing environmental assessment, and yet it still was hardly enough in some cases to create a sufficient information for this study´s evaluation of the location and of the proposed operation.

In order to evaluate the contrast that a project will create within a landscape, the following data is needed:

- Exact location of project
- Size of the project, if possible with exact boundaries
- Development over time of the project (in some cases, like river bed mines, the project area is larger than the size that is effected at any given time of the duration of the project)
- Material excavated and proposed use and location thereof
- Methods used for extraction
- Time of extraction
- Detailed plans for reclamation of land (including financing thereof and a vision of the post-mining landscape)

Although the data used in this study was provided for an Environmental Impact Assessment, there was little detail to the information provided. Mining projects might share similarities with projects

using the same methods or being of similar size. But each project will have unique features that will just present itself in the location and landscape setting. This is why this assessment favors a contrast rating over a impact description, because a contrast rating has the potential to capture those unique interactions between the project properties and the landscape in which it is situated. That is why the information listed above is necessary.

But having gathered all the needed information, does not grant an easy achievement of the contrast rating. Picturing a project based on its outline is more or less difficult and depends on the level of technical knowledge and understanding of the evaluator. Being informed about the possible mining operations and their usual proceedings is preferable. This assessment purposefully avoids graphic imaging and the use of Geographical Information Systems. These techniques are used extensively in big plans and in major assessments, but they are expensive and will require a municipality to contract a third party to provide knowledge and material. This is contrary to the aim of this assessment, which wants to enable every small municipality to gain knowledge on the feasibility of proposed mining projects. If it is possible to use computer software to create a better understanding of the projects impacts, this possibility should be of course pursued.

The division of the impacts and contrasts into three classes poses the risk of losing sight of the reality of the impact. The impact description on the Project Rating form is important. It gives the evaluator the option to always stay informed about the real impacts before squeezing them through a grid of weak, moderate and strong contrast. The outcome of the contrast rating might not be precise, but the analysis of impacts and contrasts will create a strong understanding of the strengths and weaknesses of the proposed project. The concluding remarks field on the Project Rating Form gives the evaluator the chance to note those concerns or recommendations that will later influence the decision making when compared with the inventory class.

7.6 Comparability

As discussed above, the entire chain of gathering information through to the process of decision making has weak spots. The Landscape Quality Evaluation has elements that are difficult to evaluate and is exposed to subjective influence. So is the Sensitivity Rating, which also has the risk of little or too many information falsely influencing the judgement. The Project rating, then, has the problem of insufficient data and the problematic identification of impacts and the contrasts they create. It is questionable if comparability can exist between projects under these circumstances.

Comparability between mining locations and projects was a main aim of this study, because it will allow municipalities to identify areas where mining is more feasible and methods that are less intrusive in landscapes. It has to be said that such direct comparability based on the result of the assessments is not ensured. There are too many uncertainties and possible flaws in the process to take the verbal outcomes of Landscape Inventory and Project Rating for granted and keep those answers for future comparison with other projects. However, the evaluation and rating process gives the planner a good overview of the possible visual impacts of the project and also a good understanding of valuable landscape features and landscape sensitivity subject to change. Each evaluation will give a reliable result if conducted properly and sufficient information is available and therefore be a valuable addition to the tools available for local land use decisions. But the results can just be comparable if the external parameters are similar and the evaluators share the same understanding of landscape values.

8 Conclusion

As a tool for creation of understanding and a unified method of gathering key information on mining projects, the visual assessment method presented in this study is very useful. But the conclusions drawn from the assessment are not to be seen as a direct decision, but rather as guiding information. The decision making process will be strengthened through the creation of informed consent. The evaluator of the project can only pass on recommendations to the municipal authority, which is in all cases the deciding body (according to current legislation). The assessment of contrast in landscape can be used as a guiding factor in the process of deciding on a project but should not be the only guidance since the tool is not capable of determining loss of biodiversity and impacts on water sources. This method was developed as a tool that is easy to use and should give a quick understanding of the general impacts. But it is absolutely not the only possible approach. More thorough assessments could follow. Studies of the effect on groundwater resources and hydrology might be feasible especially for projects in active river systems or mines that operate below the groundwater table, like mine 10 in this study.

The approach used in this study is a result of the lack of stringent requirements and thus evaluations of mining projects, combined with the consideration of the actual capabilities and possibilities of municipal planning in Iceland. While this tool is still aimed at voluntary adoption and to be commitment by the municipalities, more precise regulations should be developed to guide mining in Iceland. This approach to identify landscape impacts could be a part of those new regulations, but shouldn't be the sole deciding source. To fit in the current environment of planning practice, this approach was kept simple, but does not have to exclude other possible impacts, which have a weak representation so far. Biodiversity and hydrology are barely considered in this approach. Although it is flexible enough to include other specified studies in the sensitivity rating, tools giving similar guidance to the municipal authorities as the Contrast Rating, could be developed and adopted.

The method proposed by this study relies on municipalities to implement it voluntarily. But every step taken willingly by any authority can create a real commitment to environmental protection and make space for further assessment methods which then should be in more detail and depth. Once in place, it will further put more pressure on developers to rethink the locations and outline of their proposed operations. As outlined in this study, some mines are rated not feasible for operation under the proposed framework. Rejecting a proposal is not a common step taken by municipalities as of now, but should become common practice for those proposals which clearly pose a threat to landscape values and their identified management or where better alternatives are obvious. Developers themselves could adopt similar methods to understand the landscape impacts and could do so, with little cost due to the simplicity of the tool. The study has shown that the combination of two mines in close proximity and at the more favorable location could be the better choice then opening two different ones in terms of overall impact.

In conclusion, the tool presented can and should be adopted by Icelandic municipalities if they acknowledge its weaknesses and use it for guidance in their decision making. Municipalities should mature in the decision making on mining projects on their land and work actively to minimize the impacts created by those developments.

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Appendix I

Landscape Inventory Form		
Date: *Place:* *GPS (viewpoint):*	*Municipality:* *Area:*	*Names:*

A. Narrative *include landform, water, vegetation, structure, form, line, color and texture*

continue on back

B. Evaluation *estimate the visual quality of each element (use Table [] for guidance)*

				Σ	*circle applicable level*
	Landform	1 to 5			**A** (15+)
	Vegetation	1 to 5			**B** (8 to 14)
	Water	0 to 5			**C** (7 or less)
	Adjacent Scenery	0 to 5			
	Scarcity	1 to 5			
	Cultural Modifications	-4 to 2			

C. Landscape sensitivity *use Table [] for guidance*

	High	Medium	Low	*estimate sensitivity level (high, medium, low)*
Use				
Public Interest				
Special Areas				
Other Factors				

D. Inventory Class: *circle applicable class*

I	II	III	IV

Appendix II

Project Rating Form							
Date: *Place:* *GPS (viewpoint):*	*Municipality:* *Area:* *Project:*		*Names:*				
A. Project Outline: *basic facts including extent and duration of the project*						*Inventory Class:* *Landscape Quality:* *Sensitivity Level:*	
B. Location of Project from viewpoint	Foreground ☐		Middleground ☐			Background ☐	
C. Impact Description: *apparent visual impacts on the existing surroundings*							
D. Contrast: *contrast of the project compared to the existing landscape*							
tick applicable box	Landform / Water Body			Vegetation			Overall contrast:
	strong	moderate	weak	s	m	w	**strong** **moderate** **weak**
Form							
Line							
Color							
Texture							
							Overall contrast over time:
After reclamation of land							1 year: 3 years: 5 years: 10 years: 25 years:
Form							
Line							
Color							
Texture							
E. Concluding remarks:							