

Paper #: 1951. Activities of Learning using ArcReader.
Water Is More Precious Than Gold: The Pascua Lama Mining Project

- **Title of Paper** : Activities of Learning of Geography using Open Source and ArcReader
- **Author Name**: Gustavo Moreira Riveros
- **Abstract**: Tracks: TEA Teaching With GIS in K-12 Education

Through CLAROLINE, a tool of type LMS (Learning Management System) with license GPL based on web, offer to the teachers of History and Geography of secondary education of Chile the creation of learning activities being used the ArcMap and the ArcGIS Publisher for the generation of maps with format "pmf".

The data that allow to generate the layers take from the public sector (www.snit.gob.cl/)¹ and are stored in the data base MySQL of the LMS.

The strategy is based on the creation and access hyperlinks stored in a layer file or ArcMap document and too the use of geographic data, demographic, climate, environment, etc; own of the region where the school is located. The students accede to the activities of learning through the tools offered by CLAROLINE supported by the ArcReader.



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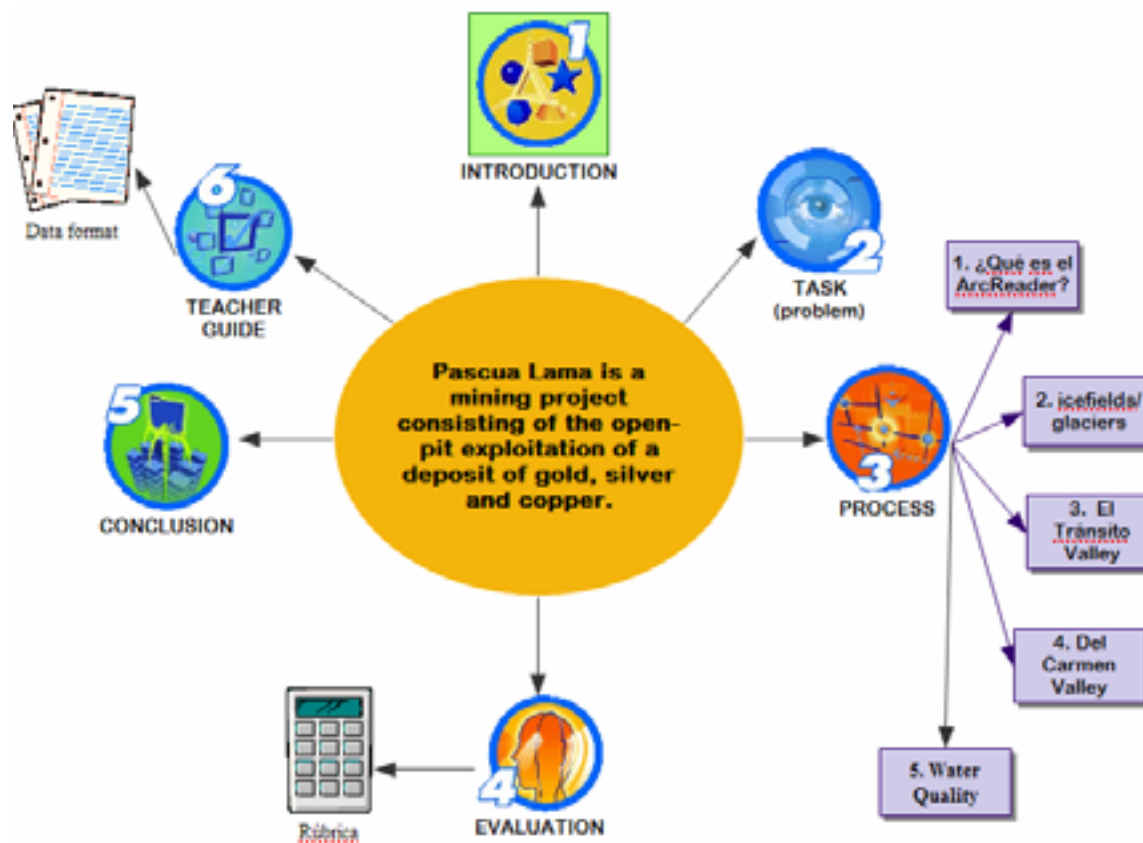
SOCIAL HISTORY and SCIENCES
9 YEAR SECONDARY EDUCATION
Unit One: Natural environment and regional community

MAIN TARGET: To value the preoccupation of environment, understanding the interaction between the this and human life.

TASK: to understand the importance of the quality of the water of the rivers of the commune 'Alto del Carmen' of the Region of Atacama and as it they can contaminate the operations of Pascua Lama gold mine project, being affected the agricultural production and the scholastic population of the zone.

PROCESS: the ArcReader with geographic information of the Region of Atacama is used to discover and to cross in interactiva form the commune of Alto of the Carmen, her valleys, rivers, ways, schools, students and to know in detail the mining facilities Pascua Lama. At the end of the activity the student will be able to interpret the cartography of the zone, to understand the importance of living in environment without contamination and the form to measure the quality of the water of the rivers affected by the mining.

RESOURCES: the support materials, the evaluation and conclusions give to the student through CLAROLINE, platform of e-learning.



The diagram was created with the application [Inspiration 8 IE](#) of Inspiration Software, Inc. and corresponds to the Webquest model², developed by [Bernie Dodge](#) with [Tom March](#), San Diego State University.

For the creation of the archives 'AGUA QUE VALE ORO' y 'MINA PASCUA LAMA' in format PMF (published map file) was used the extension ArcGIS Publisher and ArcView 9,1 of [Environmental Systems Research Institute](#) (ESRI).

Claroline is a free online collaborative learning platform developed at the Catholic University of Louvain (Belgium) by Thomas De Praeterey and the RESOURCES are available in www.educable.cl/sig/courses/GIS_CHILE/

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INTRODUCTION

Pascua Lama is a mining project consisting of the open-pit exploitation of a deposit of gold, silver and copper ore and its processing to produce doré (gold and silver) and copper concentrate.

The amount of the investment has been estimated to be 950 million dollars.

The deposit is located high in the Andes on the Chilean-Argentinean border, about 150 kilometres to the south-east of the city of Vallenar in the Commune of Alto del Carmen, Province of Huasco, III Region of Atacama, Chile. The nearest communities are Chollay and Las Breas, located 35 and 55 km away, respectively.

In Argentine territory a smaller portion of the open pit will be built, along with a waste rock dump, a processing plant, a tailings pond, the construction camp (for 4,000 people) and operation camp (for 1,000 people), in addition to a private aerodrome.

The ore will be extracted of the mine at the rate of 15 million tons per year and sent to a primary crusher in Chilean territory, to reduce its size. Then it will be transported by means of a conveyor belt to processing facilities located in Argentine territory, crossing the border through a 2.7 km long tunnel.

There will be substantial economic benefits that include 5,500 direct jobs during construction, 1,660 jobs during the two decades of operation, and the indirect job creation and tax revenues generated that will flow back to the communities. In addition, there will be substantial investment in infrastructure, the development of hundreds of local suppliers of goods and services and the implementation of sustainable development programs.



The project brings great benefits and economic development for the zones where it takes part; however, the population very is worried about the contamination problems. Mrs. Elena Barraza³, teacher of the school of San Felix, indicates that "we are terrified with the possible contamination of waters, since our community directly drinks waters of the rivers". The mining exploitation will irreversibly damage the way of life of the Diaguita people, who have lived in the now-affected zones for many hundreds of years.



Chile's Path; joining the valleys (Sendero de Chile)⁴

This path unites the towns of Pinte and San Félix, 39km apart. The journey provides beautiful scenery and impressive geological formations. Marine fossils and varied vegetation can be found along the way, with many medicinal herbs and fauna that includes typical Chilean animals such as guanacos and Vizcachas.



COMUNA ALTO DEL CARMEN⁵

Location: Alto del Carmen lies 45km east of the city of Vallenar, and can be reached by a paved road snaking around the beautiful scenery of the Santa Juana reservoir (at 22km from Vallenar). From the many curves and slopes of the path, you can appreciate the beautiful surrounding countryside in the Huasco valley.

The commune is rural, with predominance of agriculture in her valleys. From the locality can be acceded to valleys formed by El Tránsito river, towards the left and to the valley Del Carmen river, towards the right. In each one of them small localities and schools, being the most important the one of San Felix are located (ID 11025) and El Tránsito (ID 493), both denominated “Fronterizas” (Border).

LOCALIDAD	RBD	ESTABLECIMIENTO	ALUMNOS
La Marquesa	502	ESCUELA: LAS MARQUESAS	10
Alto Del Carmen	499	ESCUELA: ALTO DEL CARMEN	167
Retamo	501	ESCUELA: RETAMO	5
Crucesita	498	ESCUELA: CRUCECITA	7
La Higuera	513	ESCUELA: LA HIGUERITA	3
San Félix	11025	ESC. FRONTERIZA SAN FELIX	294
La Majada	511	ESCUELA: LA MAJADA	3
Las Breas	503	ESCUELA: LAS BREAS	12
Chancoquín	509	ESCUELA: CHANCHOQUIN	34
Los Perales	506	ESCUELA: LOS PERALES	16
El Tránsito	493	ESC. FRONTERIZA: EL TRANSITO	152
La Arena	504	ESCUELA: LA ARENA	13
Conay	495	ESCUELA: CONAY	21
La Pampa	497	ESCUELA: LA PAMPA	20
El Corral	514	ESCUELA: EL CORRAL	15

Fuente: División Planificación y Presupuesto. Ministerio de Educación. Chile 2005

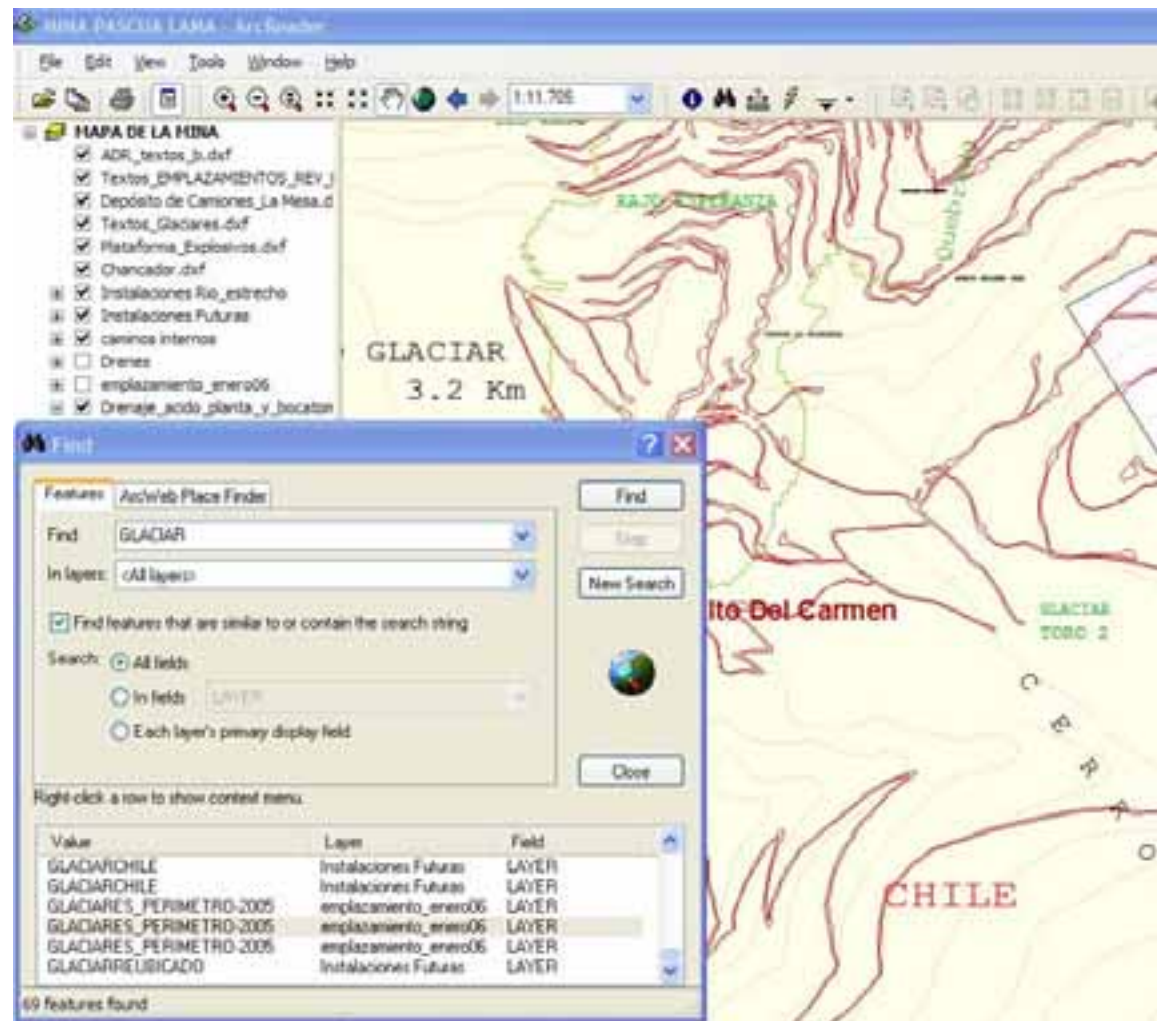
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WILL ICEFIELDS/GLACIERS IN THE VICINITY OF PASCUA-LAMA BE AFFECTED BY MINING OPERATIONS?

No. The Chilean approval of Pascua-Lama stated that “the company Barrick⁶ shall only access the ore in a manner that does not remove, relocate, destroy or physically intervene the Toro 1, Toro 2, and Esperanza glaciers.” The condition relating to the protection of icefields/ glaciers was among more than 400 conditions that were included in the approval of the project (February 2006).



In this satellite view of the project area, the Pascua-Lama open pit is outlined in red. To the south of the pit, you'll see icefields that are known as Toro 1, Toro 2 and Esperanza, which are outside of the pit limit.



On the Internet, I read that the orebody is under glaciers. Is this true?

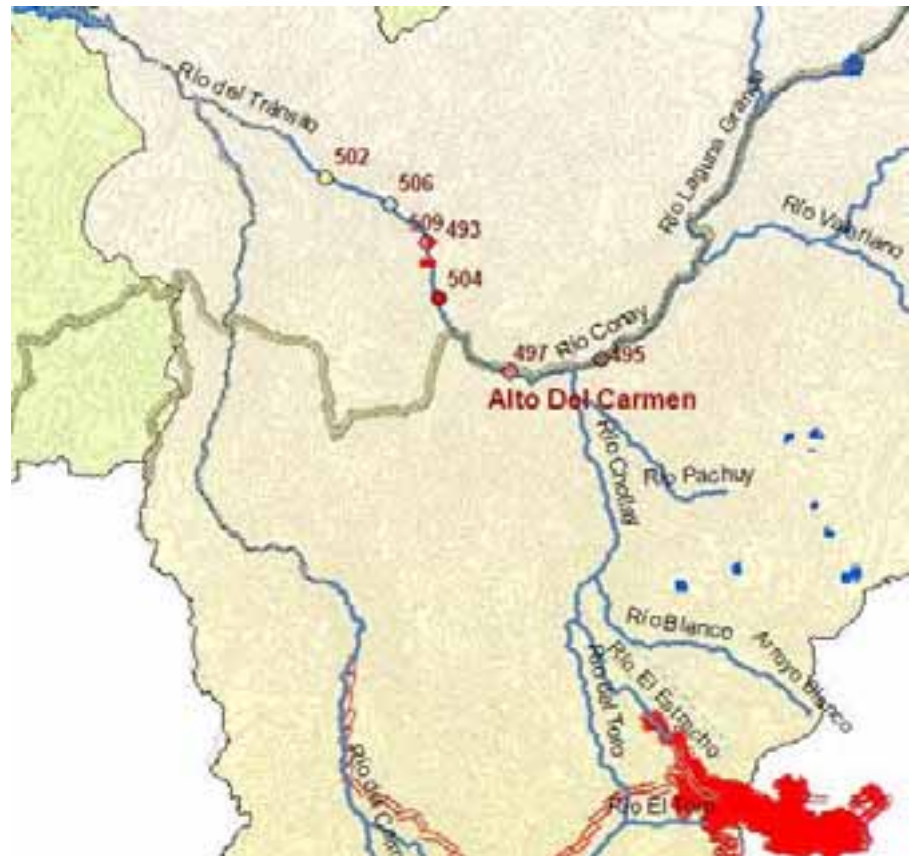
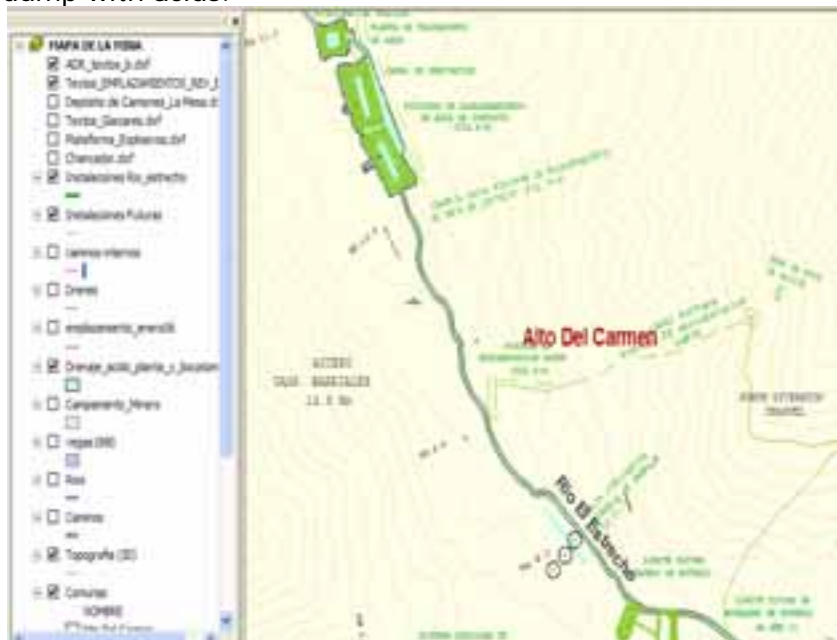
Absolutely not. Contrary to the inaccurate information on the Internet, you can judge for yourself using the attached map available in the file “MINA PASCUA LAMA.pmf” through of ArcReader of ESRI.

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El Tránsito Valley: Contamination of the rivers

A large part of the open pit will be in Chilean territory, as well as a waste rock dump, the processing plant, primary crusher, mine equipment maintenance complex, and powder magazine for the storage of explosives. These facilities will be located in the headwaters of El Estrecho River, at 4,400 metres above sea level; tributary of the Chollay River and this tributary the Tránsito river; where five schools in their edges are located. (see map, available in the file "AGUA QUE VALE ORO.pmf")

The rivers El Estrecho, San Félix and El Tránsito together with Santa Juana Dam are liable to be polluted by Pascua Lama. In the inferior plane, it is specifies the intervention of the Estrecho River on the part of the mining company (to see green swimming pools) and the proximity of the waste rock dump with acids.



The mining project will use **sodium cyanide**, arsenic, and produce toxic by products.

These dangerous poisons will be handled at the sources of the rivers and could damage water supplies to farms of El Tránsito Valley.

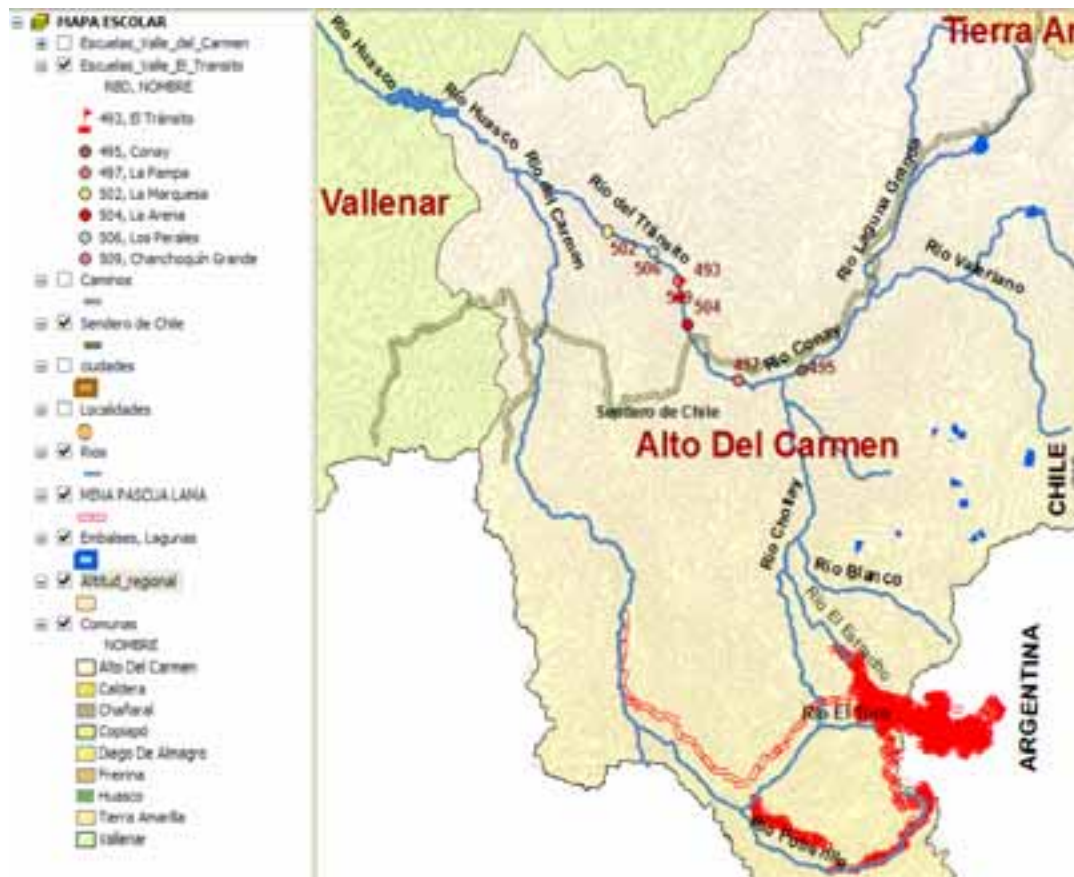
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Del Carmen Valley: Hight Traffic of Heavy Trucks

In Chile access will be from the city of Vallenar, via the road that connects Vallenar with the 'Alto del Carmen' area, followed by a secondary road to be developed up the entire Carmen River valley.

One of the great preoccupations for the community, has relation with the passage of trucks loaded with highly dangerous toxic substances by the way of Del Carmen valley. The frequency average will be of 140 daily trips (41 from Chile), including chemical agents, explosives, equipment, workers, etc. required by Pascua Lama.

- 120 truckloads per month of copper concentrates
- 2 truckloads per year of mercury
- 70 truckloads per month of processing chemicals
- 17 truckloads per month of cyanide
- 200 truckloads of explosives
- 1 truckload of fuel
- 180 truckloads of petrol



"The situation is very worrisome, the ways are not apt; they are very narrow, dangerous due to the infinity of curves as it is appraised in the photography, the fall from chemistries to the river as a result of an accident would cause a severe local contamination"



The affected establishment more corresponds to the School ID 493 Fronteriza San Felix with a matriculation of 294 students, the one that includes secondary education.

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Water Quality Monitoring

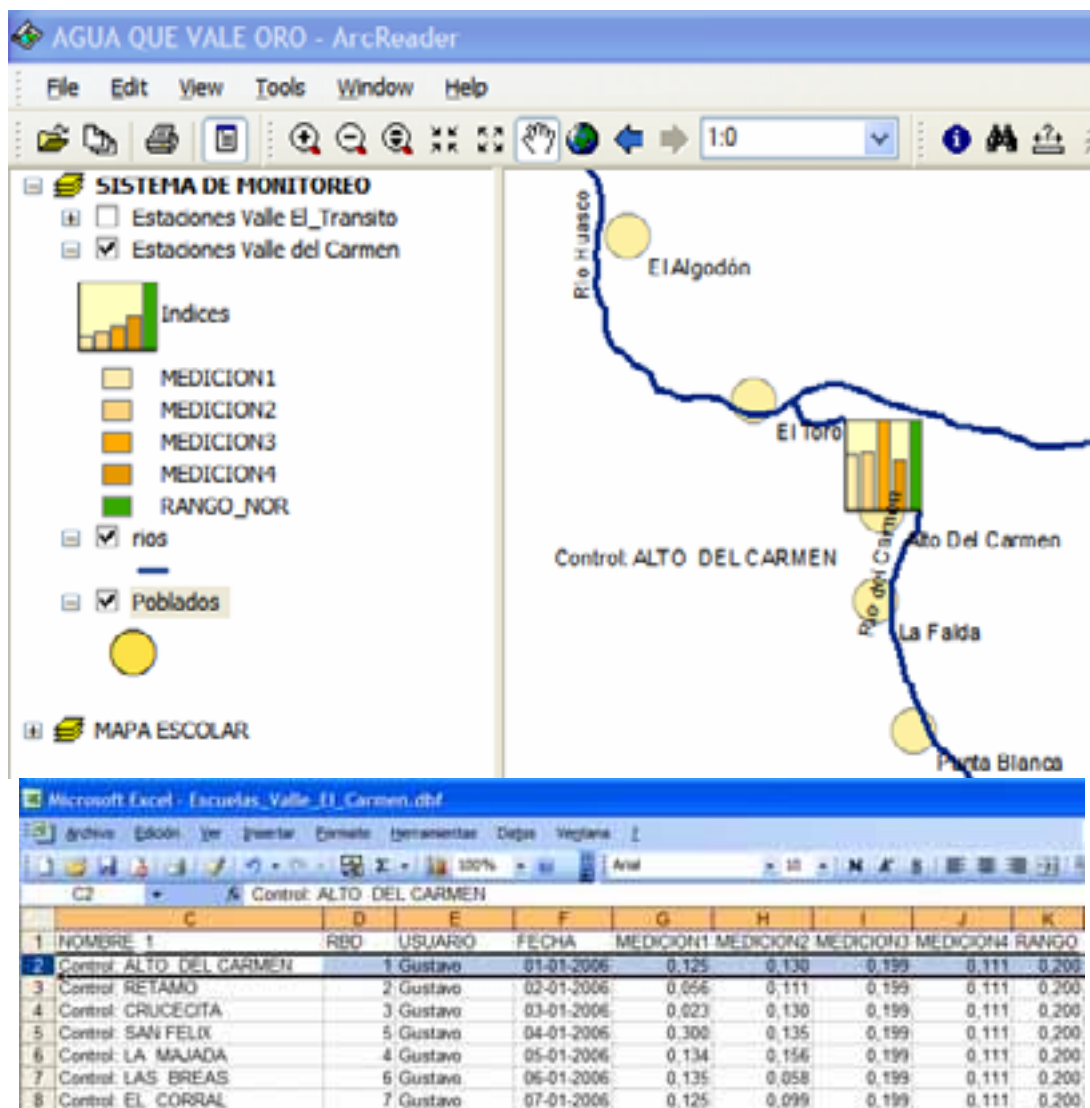
In relation to the problems of contamination of both valleys, a control system sets out that allows to visualize through a graph the four last measurements of the quality of the water; where the green bar corresponds at the normal level of the cyanide index according to the Chilean norm NCh 1333. There is contamination when the value of the measurement is greater to 0.2 mg/l.

The students can simulate the measures of the quality of waters through two tables, one for each valley, using Excel and refreshing the file "AGUA QUE VALE ORO.pmf".

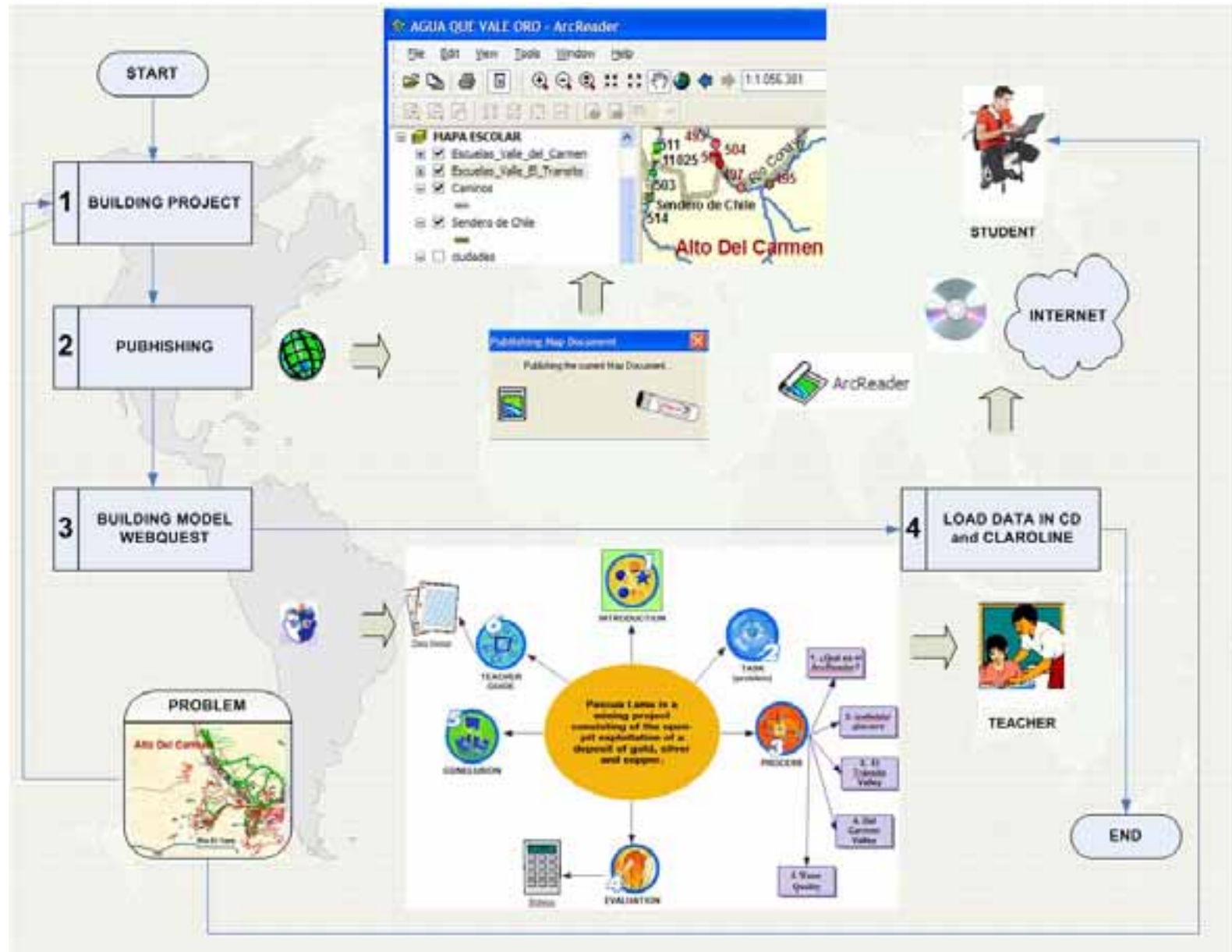
With the layer "Poblados" (Populated) it is possible to determine the population affected to a possible contamination of the rivers.



In the resources that are given to the students in platform CLAROLINE explains a chemical method to measure the cyanide (CN)⁷, where optionally it is possible to be occupied to measure in real form the contamination weekly.



SUMMARY OF THE PROCESS



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o **Acknowledgments**

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Appendixes

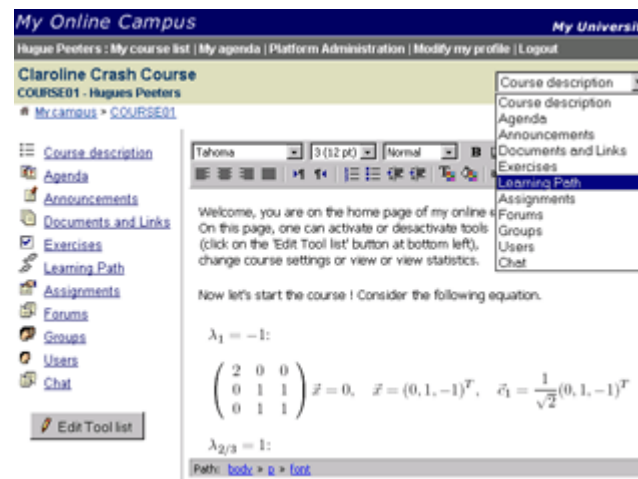
Claroline : Open Source e-Learning

Claroline is a free application based on [PHP/MySQL](#) allowing teachers or education organizations to create and administrate courses through the web.

Developed from teachers to teachers, Claroline is built over [sound pedagogical principles](#) allowing a large variety of pedagogical setup including widening of traditional classroom and online collaborative learning.

Claroline is translated in 32 languages and used by [hundreds of institutions](#) around the world.

Claroline is a free online collaborative learning platform translated into 31 languages. Today, it allows more than 500 organizations in 68 countries to create and manage courses through the web.



Working with Claroline is ...

- Managing documents and ressource links for learners.
- Guiding learners progress through a learning path tool.
- Designing and synchronize learner's collaborative works (shared calendar, document area, group management tool).
- Producing online multiple choice quizzes with a quiz generator.
- Providing synchronous (chat) and asynchronous (forum) discussion areas for learners.
- Proposing an effective users and contents tracking on the platform.

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- **References**

Richard Audet and Ludwig.
GIS in schools. ESRI PRESS 2000

EL EXILIO DEL CONDOR

Diego Luna Quevedo, César Padilla Ormeño y Julián Alcayaga Olivares. 2004

ESTUDIO DE IMPACTO AMBIENTAL (EIA)

http://www.e-seia.cl/expediente/ficha/publica/documentos.php?id_expediente=1048260&idExpediente=1048260

- **End Notes**

¹ Sistema Nacional de Información Territorial

² <http://webquest.sdsu.edu/>

³ http://www.olca.cl/oca/informes/exilio_del_condor.pdf, pág. 71-73

⁴ <http://www.senderodechile.cl/>

⁵ <http://www.turismoaltodelcarmen.cl/>

⁶ <http://www.barrick.com/Default.aspx?SectionID=bc4a30a5-5fbd-43d5-ac2f-efbd784058f6&LanguageId=1>

⁷ http://www.hannachile.com/catalogo/pdto~hi_93714/Medidor-de-Cianuro.htm

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