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Métodu GIS ba mapiamentu hídrojeolójia iha Timor-Leste, versaun QGIS (software gratuitu)

Avaliasaun vulnerabilidade impaktu husi mudansa klima ba bee-rai-
okos iha Timor-Leste

Gerard Stewart, David Craven, Sam Dawson, Luke Wallace no Baskaran Sundaram



Prepara ba Governu Austrália Departementu Mudansa Klima no Efisiénsia Enérgia **Jullu 2012**

APPLYING GEOSCIENCE TO AUSTRALIA'S MOST IMPORTANT CHALLENGES

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PREPARA BA GOVERNUN AUSTRÁLIA DEPARTEMENTU MUDANSA KLIMA NO
EFISIÊNCIA ENÉRJIA

HUSI GEOSCIENCE AUSTRALIA

Jullu 2012

husi

Gerard Stewart¹, David Craven², Sam Dawson¹, Luke Wallace¹ no Baskaran Sundaram¹.



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1. Geoscience Australia
 2. Timor-Leste GIS & Mapping Institute

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1. Intródusaun

1.1 OBJETIVU

Dokumentu ida ne'e haklaken métodu seira balun ne'ebé mak utiliza ona husi Geoscience Australia (GA) hodi simoloza mapa Jeolójia no Hídrojeolójia Timor-Leste. Ida ne'e designa ona atu utiliza hanesan instrument fahe-koiñesimentu no edukasionál ida husi jestaun rekursu bee no ema tékniku jeolójia sira husi ajénsia governu Timor-Leste sira.

1.2 ANTESIDENTE

Iha Agustu 2010 Ekipa projetu Bee-rai-okos husi Geoscience Australia no Timor-Leste kolekta ona númeru daduskoletánia sira husi departementu governu sira balun iha Timor-Leste. Dadus sira ne'e inklui mapa jeolójia sira, maibé ne ida husi mapa sira ne'e mak aplika ona kores tuir padraun ne'ebé iha ba sira, inklui ida ne'ebé mak eskollia ona hanesan baze ba mapa hídrojeolójikál. Nomós, mapa ne'ebé mak GA utiliza la iha *metadata* ruma mak anéksa ba mapa ne'e, tantu iha ne'ebá la iha kriador *atributu*. Maske eksperimenta ona dala barak ita la bele atu determina makers husi mapa ne'e, nomós la bele atu konsulta ho sira tanba kores sira ne'ebé utiliza wainhira kria mapa sira ne'e. Ida ne'e decide ona katak, ba atu fasil atu uza no hanesan produtu ida hodi fila ba nasaun, tau kores tuir padraun jeolójikál tenke aplika ba mapa ida ne'e. Detaillu sira tuir-mai utiliza ona hodi aplika padraun tau kores ba mapa.

1.3 AUDIÉNSIA

Sani-na'in sira ne'ebé ekspekta atu lee dokumentu ne'e mak utilizador GIS sira husi DNGRA, SERN, BESIK no departementu governu sira seluk no grupu interesadu sira seluk iha Timor-Leste.

1.4 KONTAKTU IMPORTANTE

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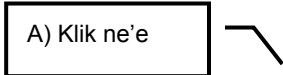
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Tlf: +61 2 6249 9205

Email: Luke.wallace@ga.gov.au

1.5 KONVENSAUN NE'EBÉ UTILIZA

Tabela tuir-mai deskreve indikadór instruksionál husi manuál treinamentu métodu GIS.

DESKRIPSAUN	EZEMPLU	OBJETIVU
Tekstu <i>Bold</i>	Klik <i>button</i> Add Data .	Indikasaun atu klik <i>button</i> ka <i>tool</i> , ka hetan atensaun sani-nain sira ba buat importante ruma.
<i>Keyboard button</i>	Klik <i>button</i> <Enter> iha O-nia <i>keyboard</i> .	Indikasaun atu hanehan <i>Enter key</i> iha O-nia <i>keyboard</i> .
Diagrama <i>label</i>		<i>Label</i> utiliza atu hatudu pasu sira iha diagrama. A) B) C) sst hatudu klalaok atu kompleta sekuénsia ida husi funsionámentu ka prosedimentu

1.6 NOTA

Dadus Treinamentu no dirétoria

Dadus presiza atu kompleta ezersisiu sira ne'ebé deskreve iha dokumentu ne'e inklui::

ET_geol UTM – *polygon shapefile* ida deskreve karakteristika sira husi Timor-Leste nia jeolójia no hídrojeolójia.

ET_Towns UTM – *point shapefile* ida define lokalizasaun sira husi Timor-Leste nia fatin-hela importante sira (kapital Distritu no subdistritu sira)

Software

Dokumentu ne'e fô instruksaun no guia ba utilizador sira husi *software Quantum GIS 1.7.2*. Operasionamentu *software* utiliza mak *Microsoft Windows XP Professional Service Pack 3*.

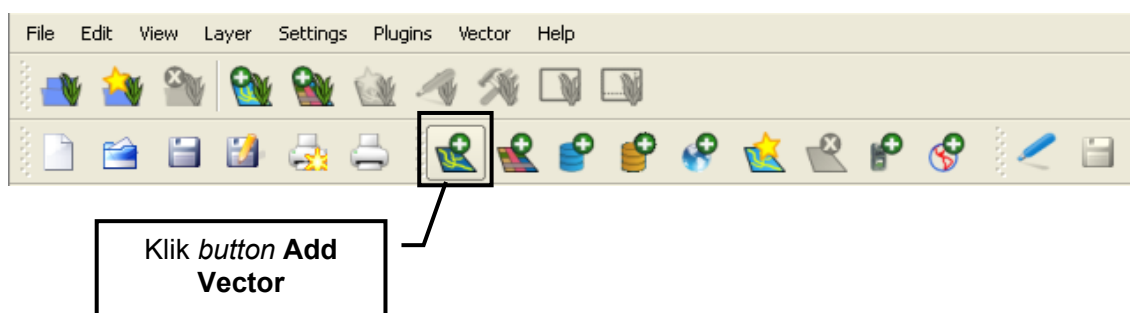
Estudante sira sei simu CD ida ne'ebé kompleta ho kopia *software* no dadus ne'ebé mak uza ona ba kursu ne'e.

2 *Edita* atributu Jeolójikál no Hídrojeolójikál

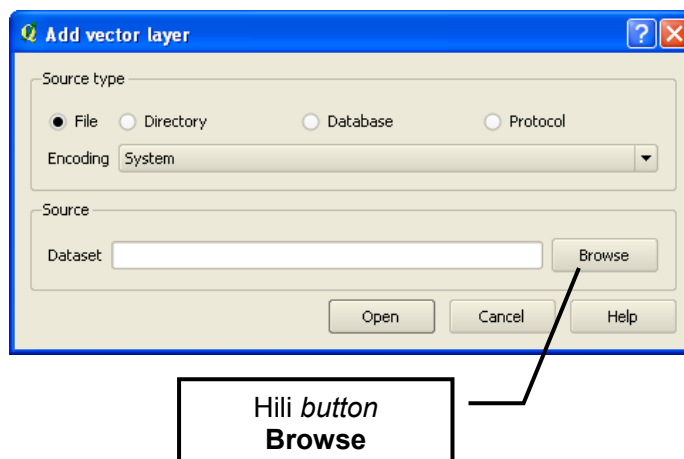
2.1 KRIA NO TAU-HAMUTUK FATIN IDA BA PADRAUN SIMBULU MAPA JEÓLOJIKÁL

Servisu ba ezersisiu ida ne'e mak atu muda simbolu mapa jeólojikál sira ne'ebé rekorda iha attribute table **ET_Geol UTM**. O sei kria area foun no tau-mutuk fatin ho simbolu foun ida no tuir standar ba kada unidade mapeamentu jeólojikál.

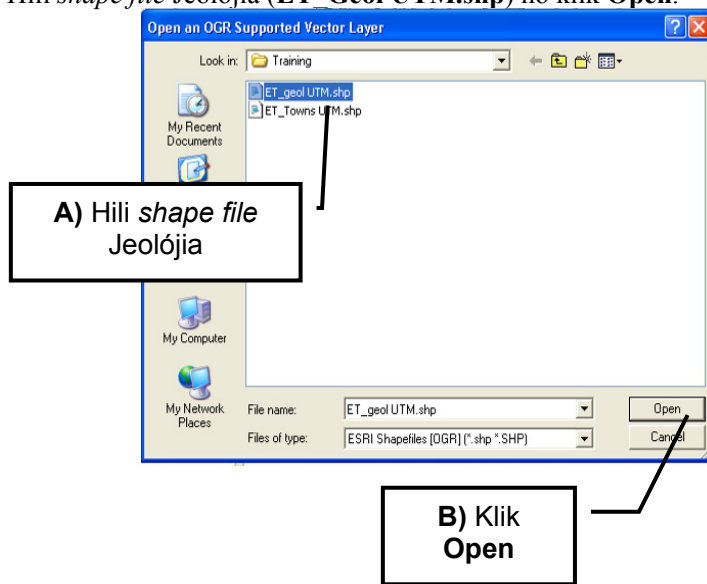
1. Loke **QGIS**.
2. Klik *button* **Add Vector Layer**.



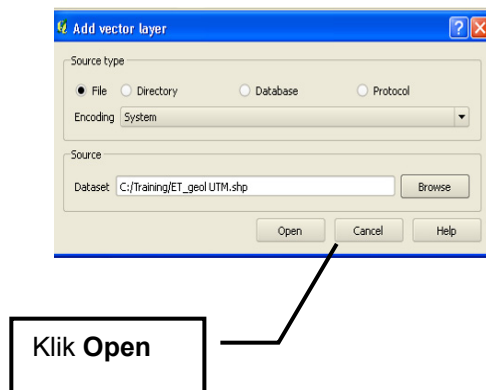
3. Klik *button* **Browse** no dalan ba dirétoria husi *folder* Treinamentu.



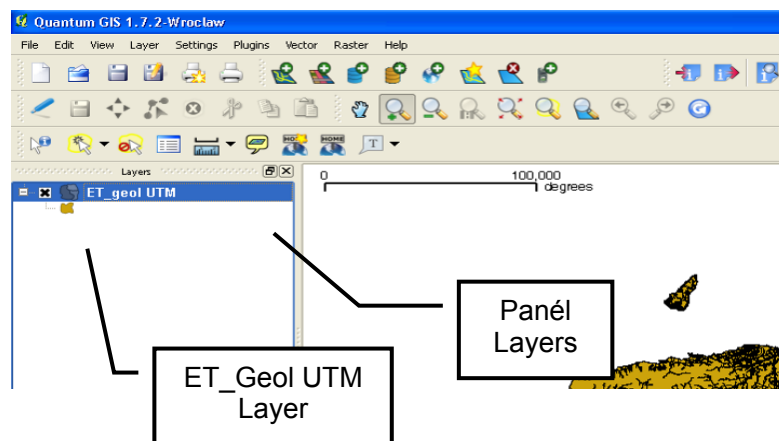
4. Hili *shape file* Jeolójia (ET_Geol UTM.shp) no klik **Open**.



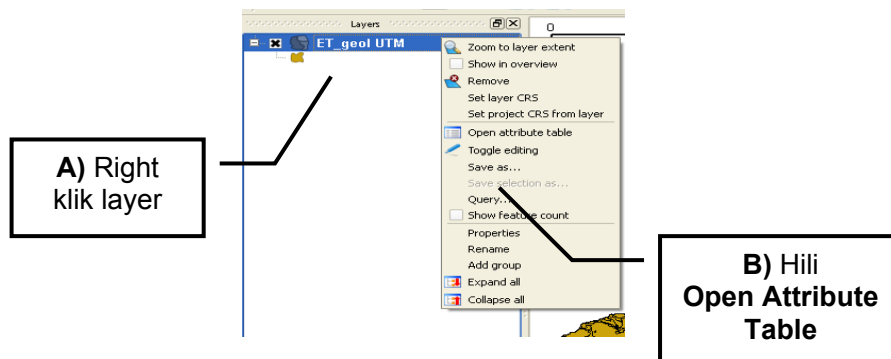
5. Iha *window* **Add vector layer**, klik **Open**.



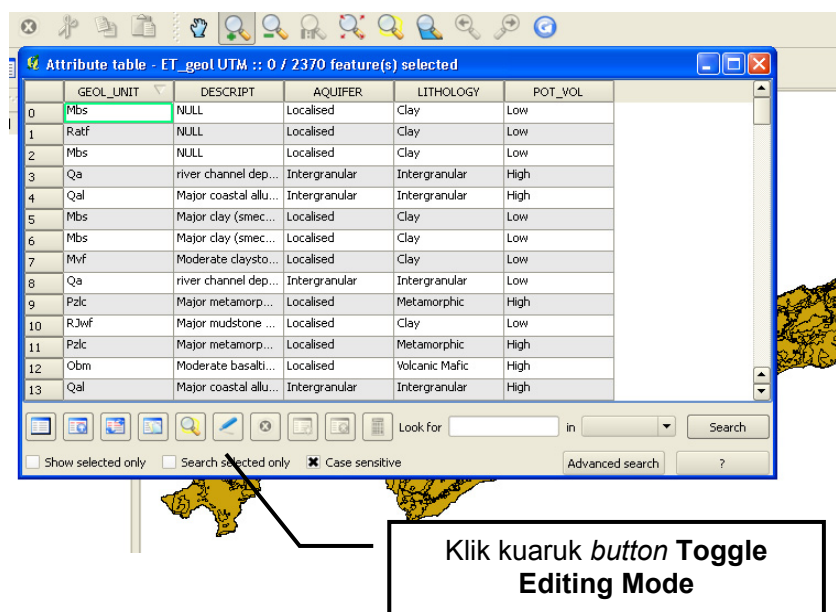
File jeolójia (ET_Geol UTM) hanesan hatudu iha *main window*, nomós aumenta hanesan *layer* ida iha panél **Layers**, iha kuaruk *main window*.



6. Loke attribute table **ET_Geol UTM** iha panél *layers* liu-hosi klik kuana naran *layer* iha *table of content* nia alran no hili **Open Attribute Table**.



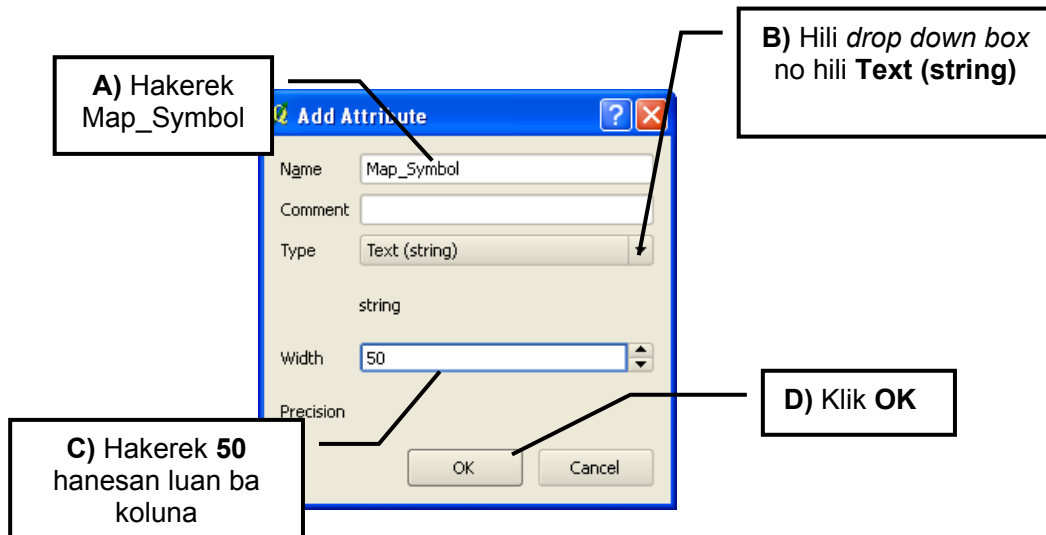
7. Attribute table **ET_Geol UTM** sei nakloke. Iha tabela nia okos, ativa *editing* liu-hosi hili *button Toggle editing mode*. Ida ne'e sei habiban ita ba halo *edit* ba fiatura.



8. Aumenta koluna/area seluk ba attribute table liu-hosi klik kuaduk iha *button New Column*.



9. Iha **box Add Attribute**, hakerek **Name: Map_Symbol**, iha **Type**, uza *drop down arrow* no hili **Text (string)** (ida ne'e signífika katak nia sei sai *text* no la'os númeru iha area ne'e. Ba koluna **Width** hakerek 50.



Nota: Area naran la bele iha espasu, tantu ita uza *_(underscores)* ba espasu.

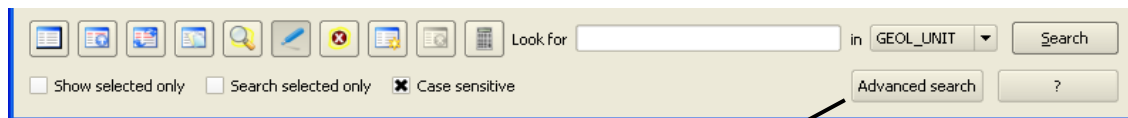
10. Klik **OK**.

Rezultadu: area Map_Symbol nakloke hanesan area ikus iha tabela atributu. Iha faze ne'e valor, Map_Symbol ba fiatura 2,370 hanesan 'NULL'.

Koluna Foun

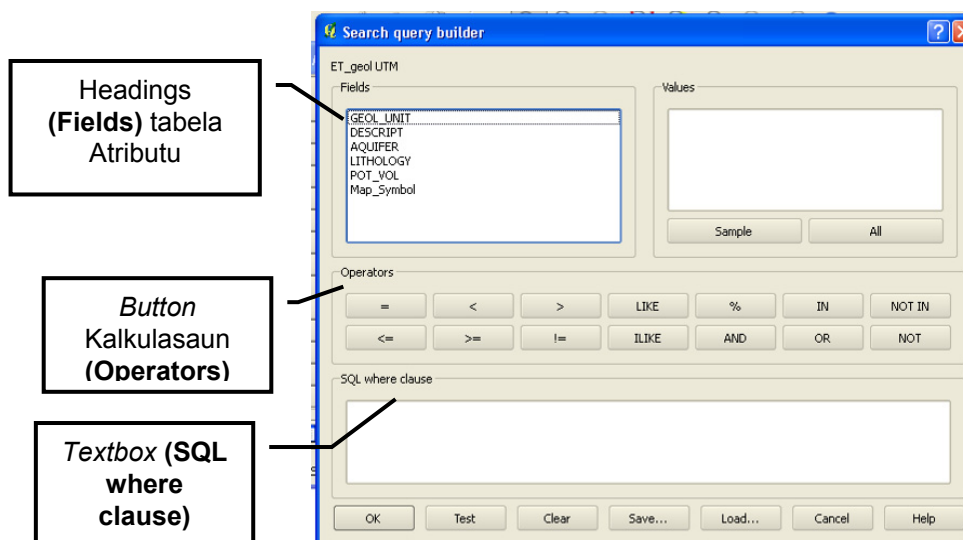
	GEOL_UNIT	DESCRIPT	AQUIFER	LITHOLOGY	POT_VOL	Map_Symbol
0	Mbs	NULL	Localised	Clay	Low	NULL
1	Ratf	NULL	Localised	Clay	Low	NULL
2	Mbs	NULL	Localised	Clay	Low	NULL
3	Qa	river channel dep...	Intergranular	Intergranular	High	NULL
4	Qal	Major coastal allu...	Intergranular	Intergranular	High	NULL
5	Mbs	Major clay (smec...	Localised	Clay	Low	NULL

11. Iha table atributu, klik *button* **Advanced search**.



Klik *button*
Advanced search

Window **Search query builder** nakloke ho lista ida husi *headings (Fields)* attribute table, *button* kalkulasaun sira balun (**Operators**) no *textbox* ida iha okos ba tipu ekspresaun ida (**SQL where clause**).



12. Iha lista *headings (Fields)* tabela n atributu hili area ne'ebé O hakarak atu halo operasaun ba. Iha kazu ne'e, ita hakarak hili fiatura sira bazeia ba valor sira iha area unidade jeólojikal, tantu *double* klik iha **Geol_Unit**. Area naran **Geol_Unit** sei nakloke iha *textbox*.

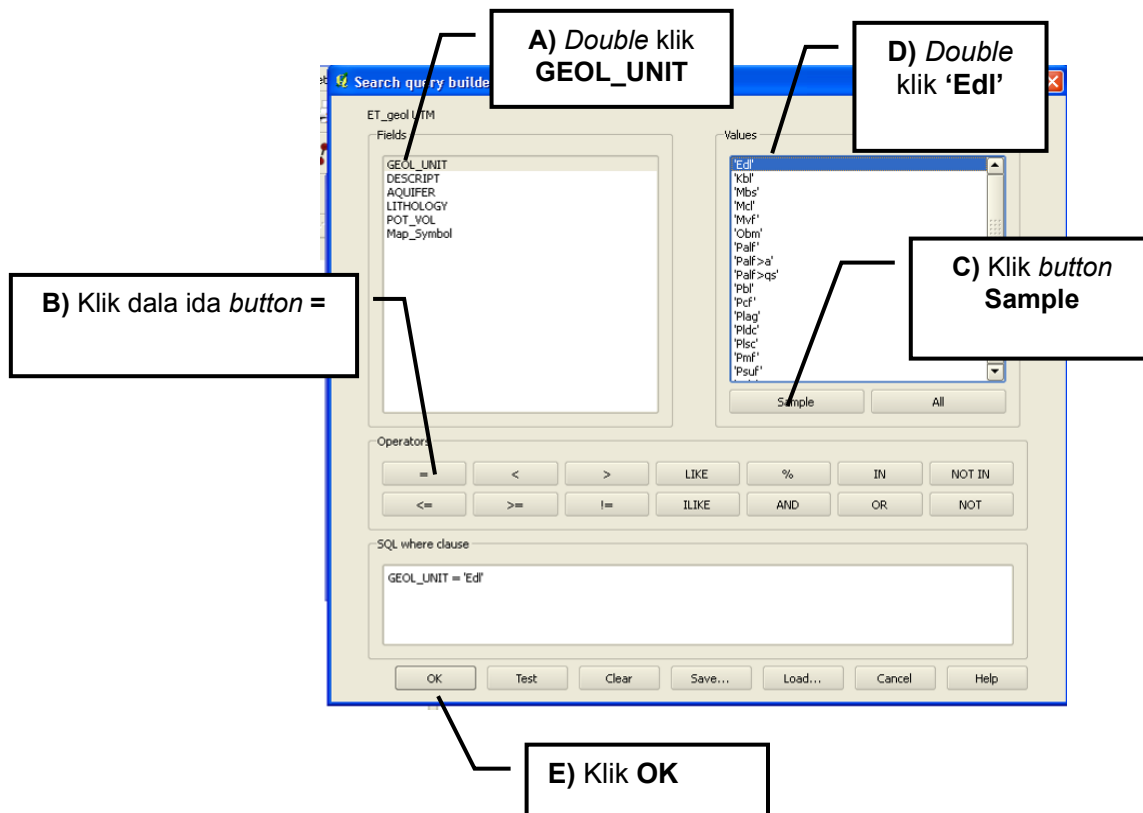
13. Klik dala ida iha *button* =.

14. Klik dala ida iha *button* **Sample**.

Lista ida husi valor úniku iha area **GEOL_UNIT** sei nakloke iha *right-hand window*. Ida ne'e mak lista valor sira husi ne'ebé O presiza atu hili atu eskollia fiatura sira ne'ebé konkorda duni ho ita-nia criteria peskiza. Ba dahuluk, eskollia fiatura hothotu hanesan kode jeolójikál ne'ebé define hanesan **Edl**.

15. *Double* klik '**Edl**'.

16. Klik *button* **OK**.



Ilustrasaun **SQL where clause** (ka ekspresaun peskiza) iha leten mak husu *Quantum* atu eskollia fiatura hothotu ne'ebé valor **GEOL_UNIT** mak **Edl**

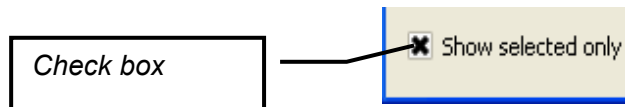
Iha kazu ne'e, nota iha leten husi attribute table hatoo ba O katak fiatura iha valor **GEOL_UNIT** sira husi Edl (**13/2370 features selected**).

Attribute table - ET_geol UTM :: 13 / 2370 feature(s) selected

	GEOL_UNIT	DESCRIPT	AQUIFER	LITHOLOGY
0	Mbs	NULL	Localised	Clay
1	Ratf	NULL	Localised	Clay
2	Mbs	NULL	Localised	Clay
3	Qa	river channel dep...	Intergranular	Intergranular
4	Qal	Major coastal allu...	Intergranular	Intergranular
5	Mbs	Major clay (smec...	Localised	Clay
6	Mbs	Major clay (smec...	Localised	Clay
7	Mvf	Moderate claysto...	Localised	Clay
8	Qa	river channel dep...	Intergranular	Intergranular
9	Pzlc	Major metamorp...	Localised	Metamorphic
10	Rjwf	Major mudstone ...	Localised	Clay
11	Pzlc	Major metamorp...	Localised	Metamorphic
12	Obm	Moderate basalti...	Localised	Volcanic Mafic
13	Qal	Major coastal allu...	Intergranular	Intergranular

Fiatura 13 ne'ebé mak nanesan criteria peskiza ne'ebé mak eskollia ona

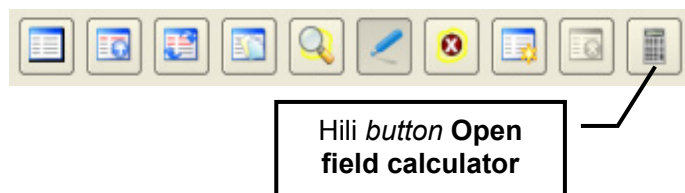
17. Iha attribute table nia okos, eskollia *box* husi **Show selected only**.



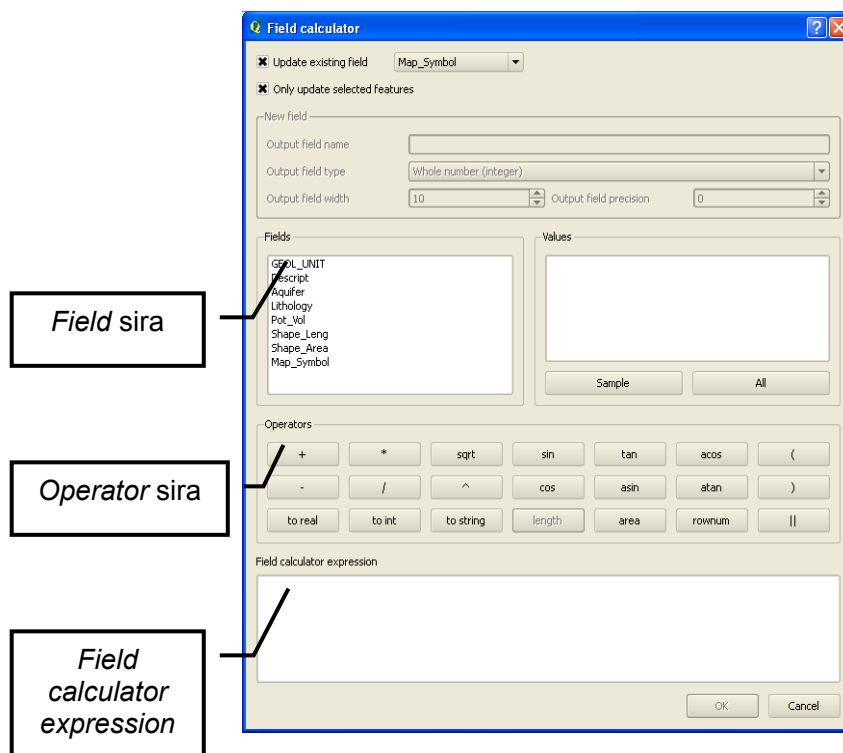
Nota: Tabela atributu agora hatudu rejistu de'it ba fiatura 13 ne'ebé mak eskollia ona.

Ba kada fiatura 13, ita agora hakarak atu aumenta valor padraun simbulu mapa foun ida iha area **Map_Symbol**.

18. Hili *button* **Open field calculator**.



Window **Field calculator** sei hatudu no iha lista **field heading (Fields)** husi attribute table, *button* kalkulasaun sira balun (**Operators**) no *textbox* ida iha okos ba tipu ekspresaun sira ne'ebé utiliza ba tau-hamutuk area sira ne'ebé kalkula ona (**Field calculator expression**).

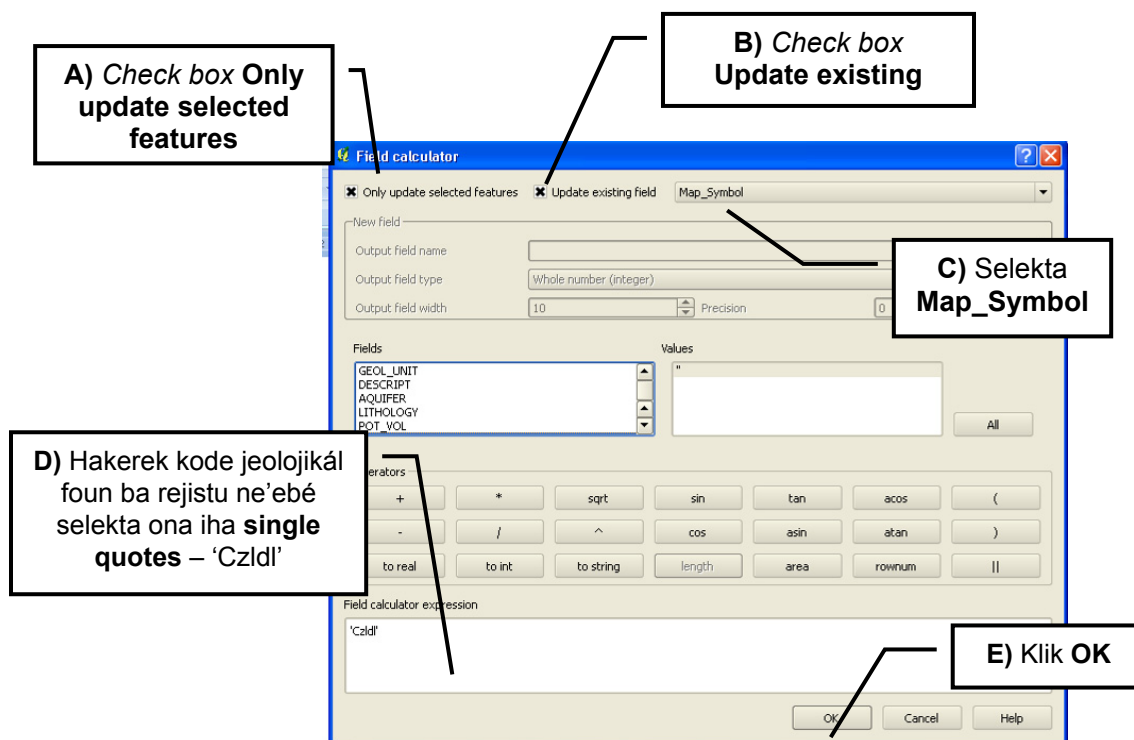


Nota: *Field calculator* haré barak liu hanesan *Search query builder*, maibé nia iha funsaun diferente.

19. Iha window nia leten, *check box* **Update existing field** no **Only update selected features**.
20. Hili **Map_Symbol** iha *drop down box*. Ida ne'e mak naran husi area eziste sira ne'ebé ita hakarak atu kalkula ka atualiza.
21. Iha *textbox* **Field calculator expression**, hakerek tekstu ne'ebé ita hakarak hatama ba area **Map_Symbol**. Ba fiatura 13 ita hili ona bazeia ba sira valor **GEOL_UNIT** husi Edl, ita hakrak hatama Czldl hanesan valor **Map_Symbol**. Atu halo ne'e, hakerek '**Czldl**' iha *textbox* **Field calculator expression**.

Nota: Ita-boot tenke uza *single quote* iha tekstu ne'e – '**Czldl**'. Karik ita-boot la tau *single quote* nia sei la funsiona.

22. Klik *button* **OK**.



REZULTADU: Ho etapa 12 – 23 ita-boot hatama valor **Map_Symbol** husi '**Czldl**' ba fiatura 13 ne'ebé iha valor **GEOL_UNIT** husi 'Edl'.

Attribute table - ET_geol UTM :: 0 / 2370 feature(s) selected

	GEOL_UNIT	DESCRIPT	AQUIFER	LITHOLOGY	POT_VOL	Map_Symbol
0	Edl	Moderate Imesto...	Fissured	Carbonate (Karst)	High	Czdl
1	Edl	Moderate Imesto...	Fissured	Carbonate (Karst)	High	Czdl
2	Edl	Moderate Imesto...	Fissured	Carbonate (Karst)	High	Czdl
3	Edl	Moderate Imesto...	Fissured	Carbonate (Karst)	High	Czdl
4	Edl	Moderate Imesto...	Fissured	Carbonate (Karst)	High	Czdl
5	Edl	Moderate Imesto...	Fissured	Carbonate (Karst)	High	Czdl
6	Edl	Moderate Imesto...	Fissured	Carbonate (Karst)	High	Czdl
7	Edl	Moderate Imesto...	Fissured	Carbonate (Karst)	High	Czdl
8	Edl	Moderate Imesto...	Fissured	Carbonate (Karst)	High	Czdl
9	Edl	Moderate Imesto...	Fissured	Carbonate (Karst)	High	Czdl
10	Edl	Moderate Imesto...	Fissured	Carbonate (Karst)	High	Czdl
11	Edl	Moderate Imesto...	Fissured	Carbonate (Karst)	High	Czdl
12	Edl	Moderate Imesto...	Fissured	Carbonate (Karst)	High	Czdl

Look for in Search

☐ Show selected only ☐ Search selected only ☒ Case sensitive Advanced search ?

23. Repete etapa 11 – 22 sira atu fiatura sira barak iha *ET_Geol UTM* layer, selekta hotu fiatura sira iha attribute table ho valor *GEOL_UNIT* turi-mai, kalkula dadaun valor korespondensia, no hatama valor sira ne'e iha area *Map_Symbol*.

Nota: *Save edit* ne'ebé ita-boot halo regularmente. Atu halo ne'e, ba iha *main toolbar* lokalizadu iha leten husi QGIS no klik **button Save Edits**.



REZULTADU: Ita-boot sei hatama padraun valor *Map_Symbol* foun ba 526 husi fiatura 2,370 iha *layer ET_GEOL UTM*.

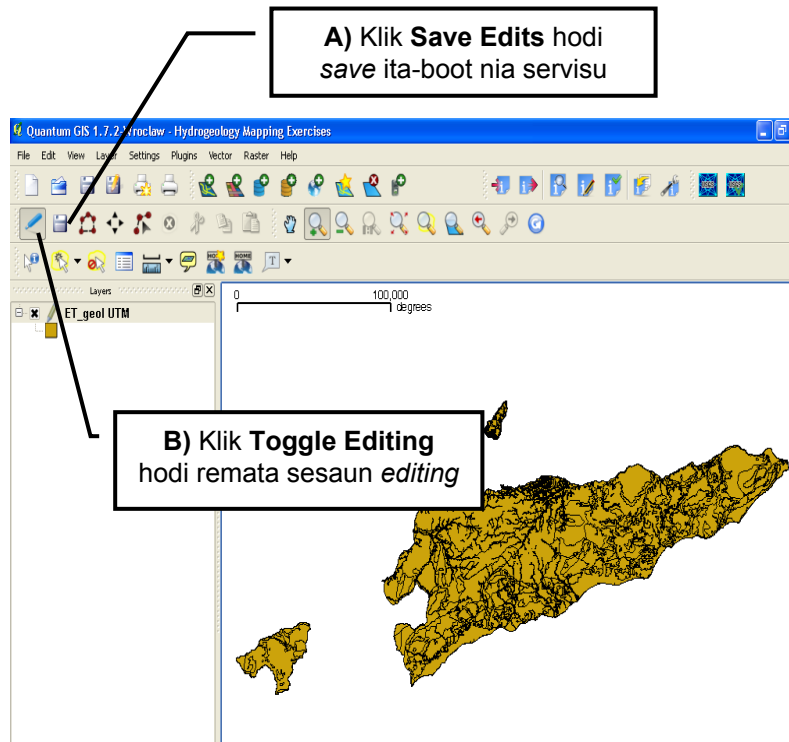
Attribute table - ET_geol UTM :: 526 / 2370 feature(s) selected

	GEOL_UNIT	DESCRIPT	AQUIFER	LITHOLOGY	POT_VOL	Map_Symbol
0	Qal	Major coastal allu...	Intergranular	Intergranular	High	Qa
1	RJwf	Major mudstone ...	Localised	Clay	Low	RJswlf
2	Qal	Major coastal allu...	Intergranular	Intergranular	Low	Qa
3	Qal	Major coastal allu...	Intergranular	Intergranular	High	Qa
4	RJwf	Major mudstone ...	Localised	Clay	Low	RJswlf
5	RJwf	Major mudstone ...	Localised	Clay	Low	RJswlf
6	RJwf	Major mudstone ...	Localised	Clay	Low	RJswlf
7	Qal	Major coastal allu...	Intergranular	Intergranular	High	Qa
8	RJwf	Major mudstone ...	Localised	Clay	Low	RJswlf
9	Qal	Major coastal allu...	Intergranular	Intergranular	Low	Qa
10	Qal	Major coastal allu...	Intergranular	Intergranular	Low	Qa
11	Pbl	Major limestone, ...	Fissured	Carbonate (Karst)	High	Czbl
12	Qal	Major coastal allu...	Intergranular	Intergranular	Low	Qa
13	Qal	Major coastal allu...	Intergranular	Intergranular	Low	Qa
14	Qal	Major coastal allu...	Intergranular	Intergranular	Low	Qa
15	RJwf	Major mudstone ...	Localised	Clay	Low	RJswlf
16	Pbl	Major limestone, ...	Fissured	Carbonate (Karst)	High	Czbl
17	Qal	Major coastal allu...	Intergranular	Intergranular	High	Qa
18	RJwf	Major mudstone ...	Localised	Clay	Low	RJswlf

Look for in
☐ Show selected only ☐ Search selected only ☒ Case sensitive

Halo hotu servisu liu-hosi kalkula valor **Map_Symbol** ba fiatura 1,844 sira seluk ho **repete Pasu 11-22** ba kada valor úniku iha area **GEOL_UNIT**. Refere ba **tabela iha Anéxu I (p. 58)** ne'ebé hatudu koresponde **Map_Symbol** sira ba simbúlu **GEOL_UNIT** sira hothotu iha attribute table.

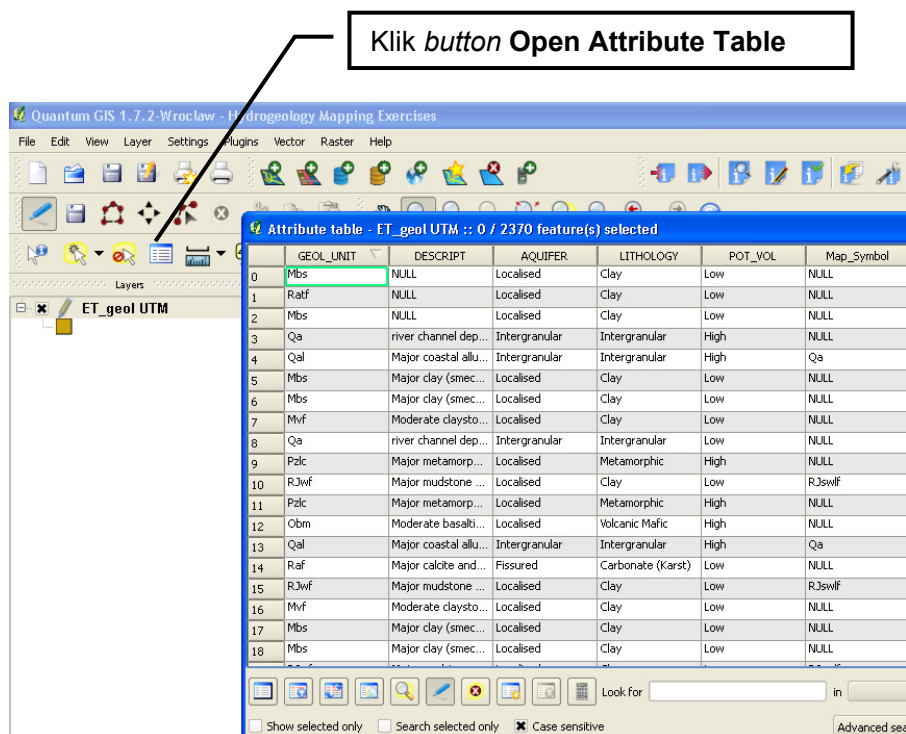
24. Wainhira ita-boot halo hotu kalkulasaun ba valor **Map_Symbol**, *save* mudansa sira liu-hosi klik *button Save Edits*, no hafoin taka sesaun *editing* liu-hosi klik *button Toggle Editing*.



2.2 KALKULA FIATURA JEOMÉTRIA – AREA NO PERIMETER

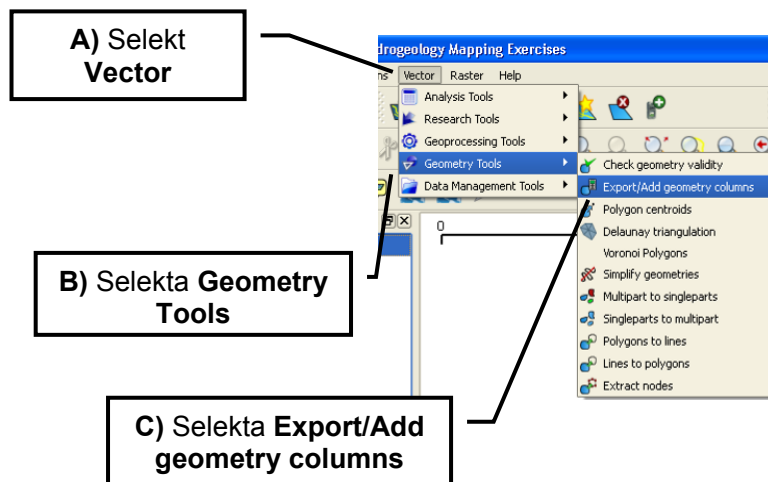
Layer **ET_geol UTM** ladauk kontein fiatura jeométria ruma. Atu kompleta ezersisiu iha seksaun 3.1.1 ita-boot presiza atu hatene area husi kada fiatura (unidade jeolojikal) iha *layer*. Iha ezersisiu (2.2) ita-boot sei kalkula jeometria ba *polygon 2,370* sira iha **ET_geol UTM**, no ita-boot sei hatama dadus ba iha *field* foun rua – **Area** no **Perimeter**. Ita-boot sei kria tan *field* foun rua ne'ebé ita-boot sei *convert* valor area husi *square metres* ba **Hectares** no **Square Kilometres**.

1. Wainhira programa ne'e ladauk opera, loke Quantum GIS no **load ET_geol UTM**
2. Klik button **Open Attribute Table** hodi loke *attribute table* ET_geol UTM.

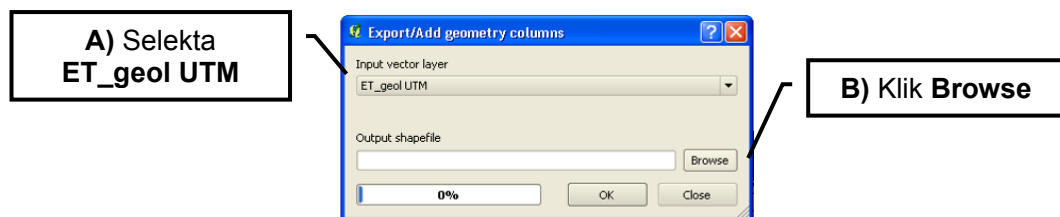


Nota: *Attribute table* iha *field* 6 - GEOL_UNIT, DESCRIPT, AQUIFER, LITHOLOGY, POT_VAL no Map_Symbol, maibé ne'e la iha *field* **Area** ka **Perimeter**.

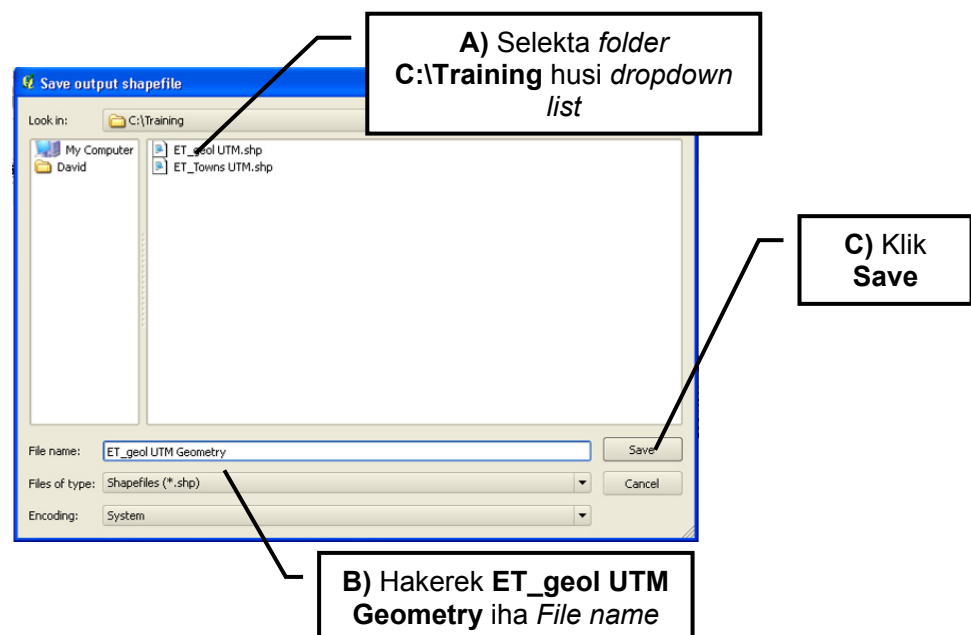
3. Taka *attribute table*, hafoin, husi *menu bar* iha *window main Quantum GIS*, selekta **Vector – Geometry Tools – Export/Add geometry columns**.



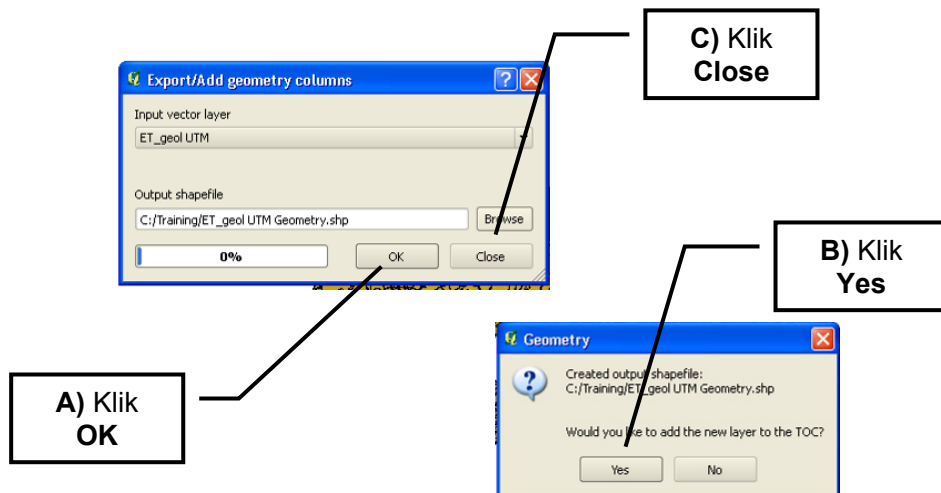
4. Iha *window Export/Add geometry columns*, selekta **ET_geol UTM** husi *drop down list* hanesan *Input Vector Layer* (ita-boot la iha opsaun tanba ita-boot iha de'it *layer 1* ne'ebé loaded iha *Layers panel*). Hafoin klik **Browse** hodi hatama naran husi *output shapefile*.



5. Iha *window Save output shapefile*, hakerek **ET_geol UTM Geometry**. Koidadu atu *save* shapefile foun iha **C:\Training folder**. Hafoin klik **Save**.

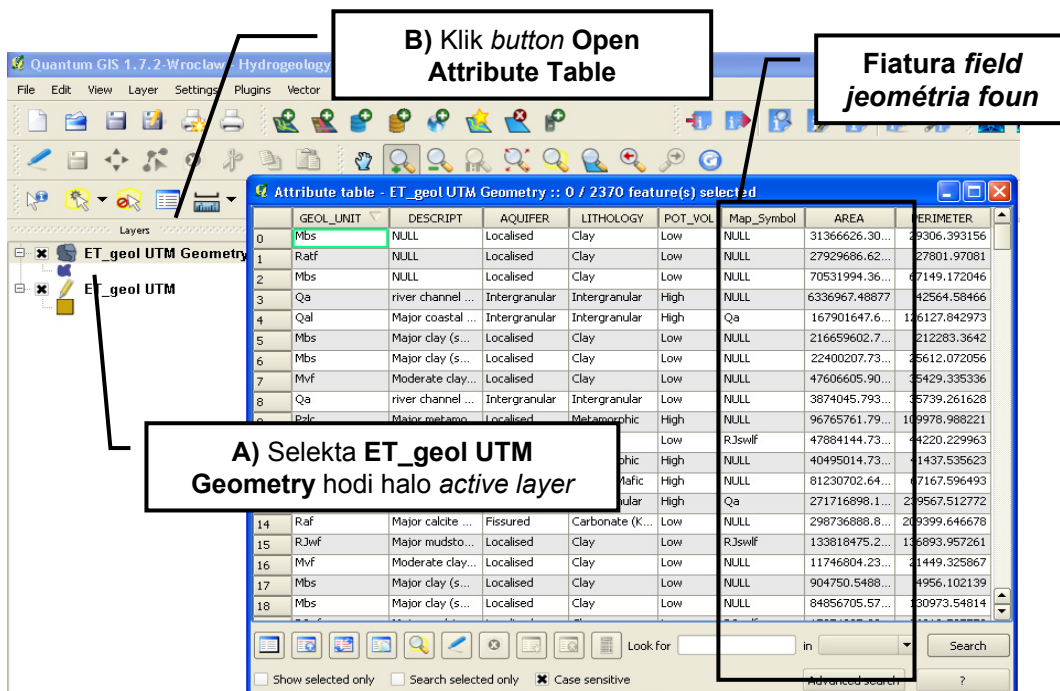


6. Klik **OK** iha *window* Export/Add geometry columns no hein ba Quantum atu prosesa *data*.
Hafoin responde **Yes** ba pergutan “Would you like to add the new layer to the TOC?”
Hafoin **Close** *window* Export/Add geometry columns.



Rezultadu: Ita-boot kria ona *layer* foun ida ne'ebé hatama ona Area populadu no *field* Perimeter ba *layer* ET_geol UTM orijinál.

7. Atu hare ita-boot nia rezultadu sira, klik **ET_geol UTM Geometry** iha *panel* Layers hodi sai *active layer*, no hafoin klik **button Open Attribute Table**. *Field* Area no Perimeter sira nakloke iha parte *right-hand* husi *attribute table*.

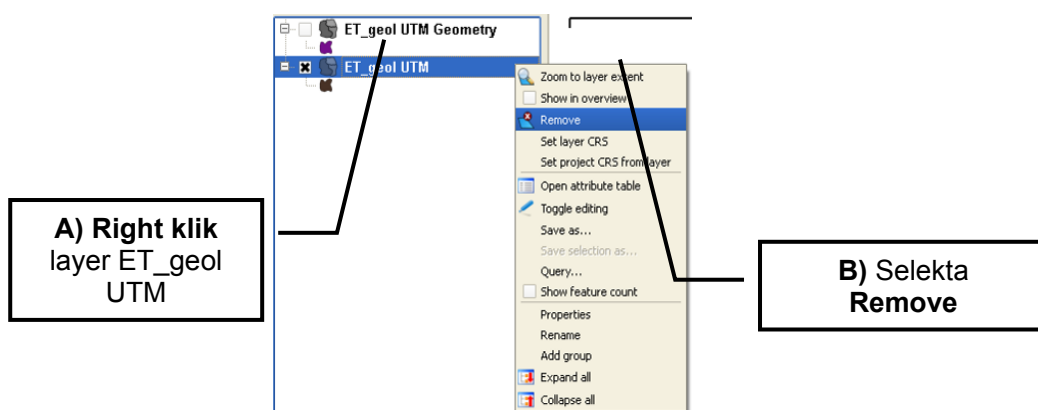


Nota: Barometru jeométria sira mak relata iha **square metres** ba Area no **metres** ba Perimeter. Sira mós relata ba *six decimal places*, **very high level of precision** ne'ebé bele atu la lao loos iha nivel daduskoletánea nasionál ne'ebé mak jeneralizadu liu, hanesan iha dadus koletánea Jeolojikal Timor-Leste ne'ebé mak ita utiliza iha ne'e.

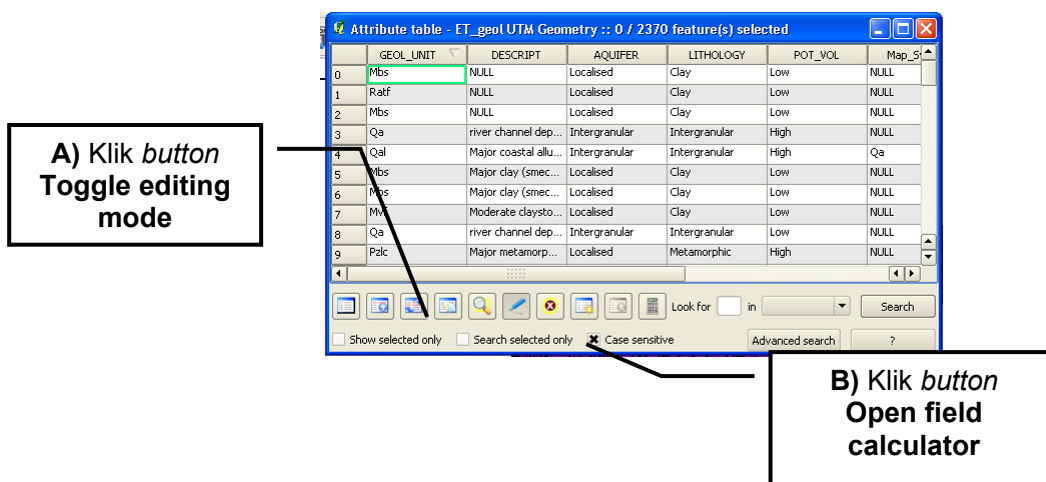
Ita sei *convert area data* ba **hectares** no **square kilometres** no ita sei redúz nivel prezisaun ba **decimal place 1**, representa ita-nia data iha unidade hanesan no redúz prezisaun sira ne'ebé sala

Ba dahuluk, hasai tiha *layer ET_geol UTM* husi *panel Layers* tanba ita sei la utiliza ona ne'e durante ita-nia kursu.

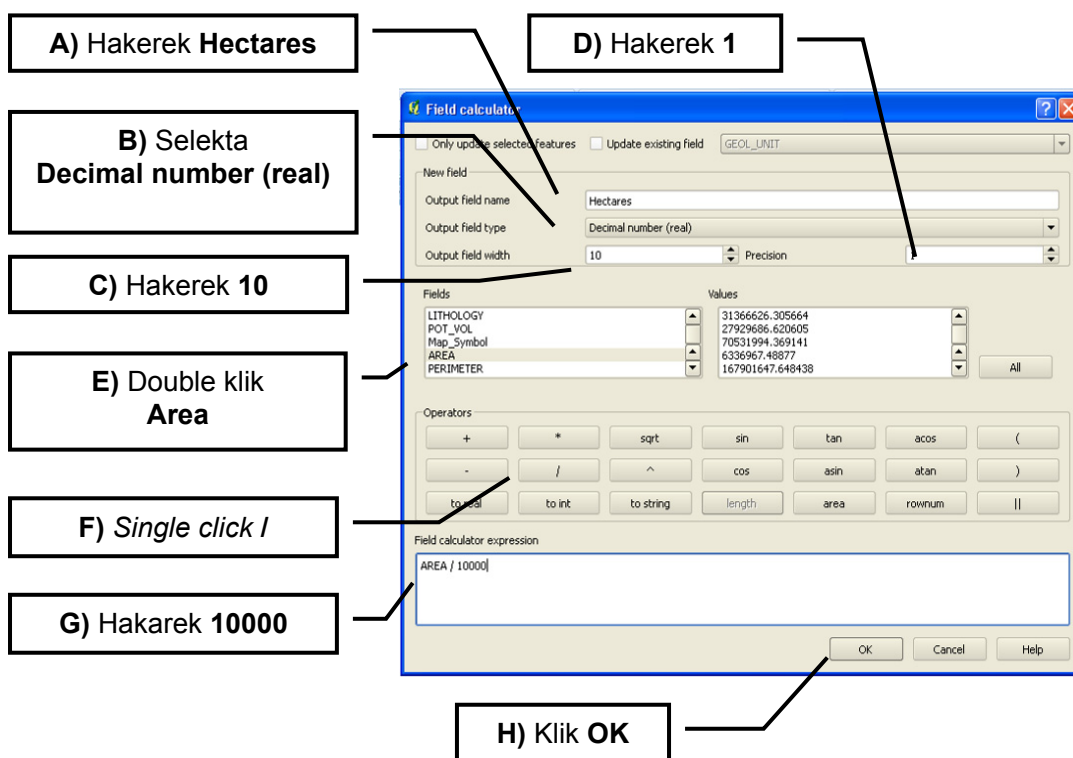
8. Right klik ET_geol UTM iha panel Layers noo selekta Remove.



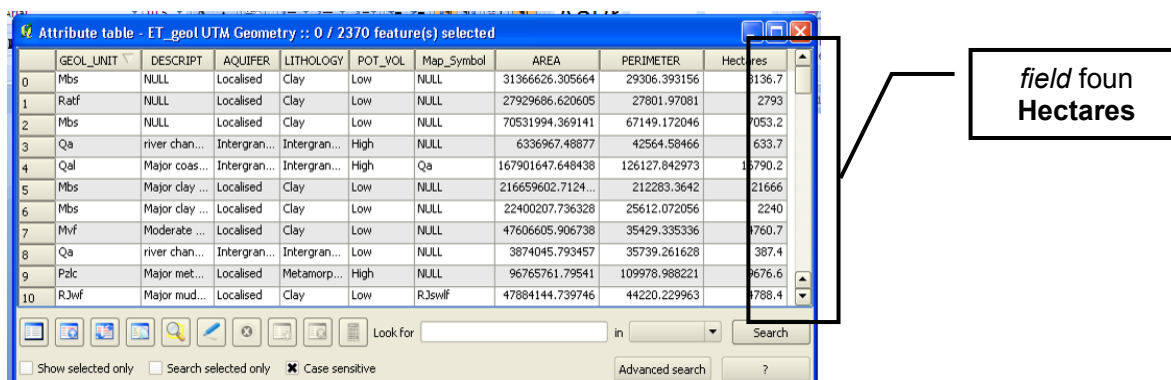
9. Loke attribute table ba ET_geol UTM Geometry no átiva editing mode liu-hosi klik button Toggle editing mode. Klik button Field calculator. Ita sei utiliza Field calculator hodi kria field foun rua, Hectares no Sq Km, no iha tempu hanesan halo kalkulasiun sira ne'ebé presiza atu popula field sira ne'e.



10. Iha seksaun **New field** husi Field calculator, **hakerek Hectares** ba Output field name, **selekta Decimal number (real)** husi drop down list ba Output field type, define Output field nia luan ba karakter **10**, no **set** nivel Precision ba **1**.
11. Iha Field calculator *box expression*, hatama *expression* $AREA / 10000$. *Expression* ne'e haruka Quantum ba kada fiatura iha *layer* ET_geol UTM Geometry, uza númeru square metres husi *field* Area, hakfahek ba 10,000, no hatama rezultadu iha *cell corresponding* husi *field* Hectares. Atu hatama *expression*, **double klik AREA** iha Fields box, **single klik /** iha Operators box no **hakerek 10000** hafoin/iha Field calculator expression box. Hafoin **klik OK**.



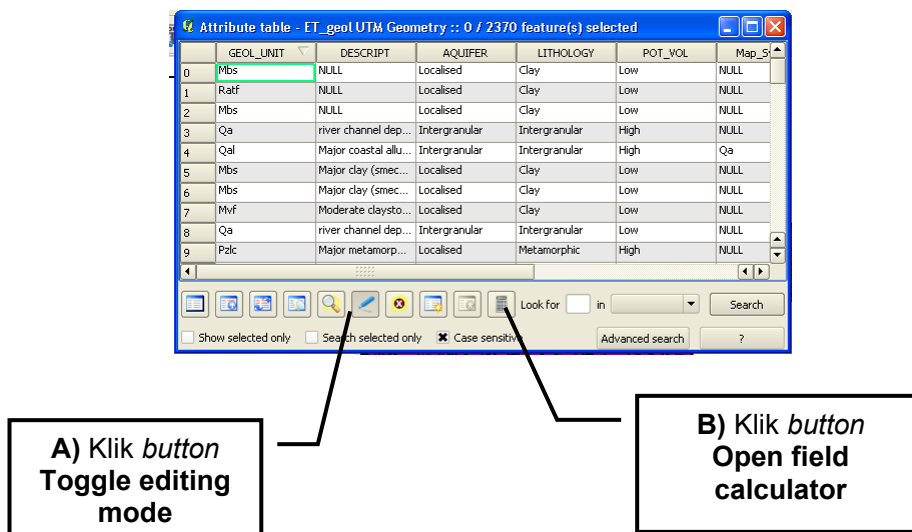
Rezulta: Ita boot kria ona *field* foun ida iha *attribute table* hanaran **Hectares**. *field* ne'e rejista medida husi kada unidade Jeolójikál iha ET_geol UTM Geometry, iha hectares, ba nivel prezisaun ida husi *decimal place* 1.



	GEOL_UNIT	DESCRIPT	AQUIFER	LITHOLOGY	POT_VOL	Map_Symbol	AREA	PERIMETER	Hectares
0	Mbs	NULL	Localised	Clay	Low	NULL	31366626.305664	29306.393156	3136.7
1	Ratf	NULL	Localised	Clay	Low	NULL	27929686.620605	27801.97081	2793
2	Mbs	NULL	Localised	Clay	Low	NULL	70531994.369141	67149.172046	7053.2
3	Qa	river chan...	Intergran...	Intergran...	High	NULL	6336967.48877	42564.58466	633.7
4	Qal	Major coas...	Intergran...	Intergran...	High	Qa	167901647.648438	126127.842973	16790.2
5	Mbs	Major clay ...	Localised	Clay	Low	NULL	216659602.7124...	212283.3642	21666
6	Mbs	Major clay ...	Localised	Clay	Low	NULL	22400207.736328	25612.072056	2240
7	Mvf	Moderate ...	Localised	Clay	Low	NULL	47606605.906738	35429.335336	4760.7
8	Qa	river chan...	Intergran...	Intergran...	Low	NULL	3874045.793457	35739.261628	387.4
9	Palc	Major met...	Localised	Metamorp...	High	NULL	96765761.79541	109978.988221	9676.6
10	Rjwf	Major mud...	Localised	Clay	Low	Rjswlf	47884144.739746	44220.229963	4788.4

Tuir-kedas prosedimentu sira ne'ebé mak haklaken iha Etapa 9, 10 no 11, kria *field* foun seluk ida, *field* ida ne'e regista area husi kada unidade jeolojikal iha square kilometres.

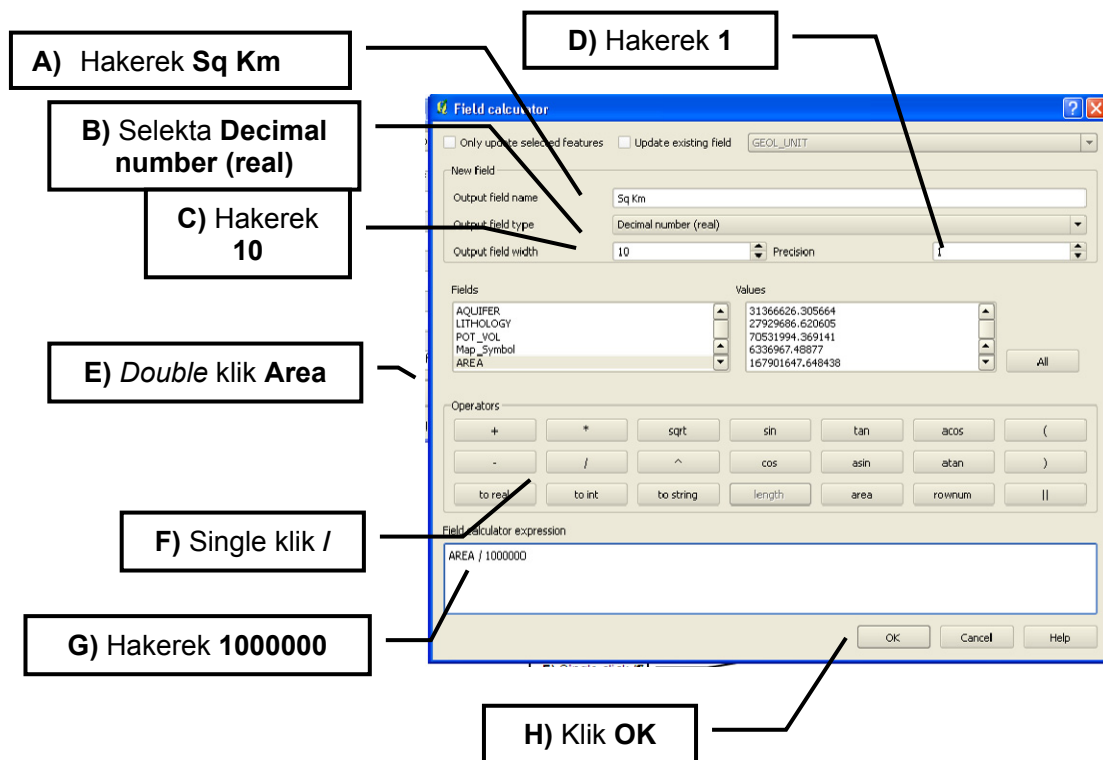
- Loke attribute table ba ET_geol UTM Geometry no átiva *editing mode* liu-hosi **klik button Toggle editing mode**. **Klik button Field calculator**.



**A) Klik button
Toggle editing
mode**

**B) Klik button
Open field
calculator**

- Iha seksaun **New field** husi Field calculator, **hakerek Sq Km** ba Output field name, **selekta Decimal number (real)** husi drop down list ba Output field type, define Output field nia luan ba **10** characters, no **set** nivel Precision **1**.
- Iha **box Field calculator expression**, hatama *expression* **AREA / 1000000**. Ida ne'e haruka Quantum ba kada fiatura iha *layer ET_geol UTM Geometry*, foti númeru square metres husi field Area, hakfahek ne'e ba 1,000,000, no hatama rezultadu iha corresponding cell husi *field* Sq Km. Atu hatama expression ne'e, **double klik AREA** iha Fields box, **single klik /** iha Operators box no **hakerek 1000000** hafoin / iha Field calculator expression box. Hafoin klik **OK**.



Rezultadu: Ita-boot kria ona *field* foun seluk ida. *Field* ne;e hanaran **Sq Km**. *Field* ne'e rejistu medida husi kada unidade jeolójikál iha ET_geol UTM Geometry, iha square kilometres, too nivel prezisaun decimal place 1.

Attribute table - ET_geol UTM Geometry :: 0 / 2370 feature(s) selected

	GEOL_UNIT	DESCRIPT	AQUIFER	LITHOLOGY	POT_VOL	Map_Symbol	AREA	PERIMETER	Hectares	Sq Km
0	Mbs	NULL	Localised	Clay	Low	NULL	31366626.305664	29306.393156	3136.7	31.4
1	Ratf	NULL	Localised	Clay	Low	NULL	27929686.620605	27801.97081	2793	27.9
2	Mbs	NULL	Localised	Clay	Low	NULL	70531994.369141	67149.172046	7053.2	70.5
3	Qa	river chan...	Intergran...	Intergran...	High	NULL	6336967.48877	42564.58466	633.7	6.3
4	Qal	Major coas...	Intergran...	Intergran...	High	Qa	167901647.648438	126127.842973	16790.2	167.9
5	Mbs	Major clay ...	Localised	Clay	Low	NULL	216659602.712402	212283.3642	21666	216.7
6	Mbs	Major clay ...	Localised	Clay	Low	NULL	22400207.736328	25612.072056	2240	22.4
7	Mvf	Moderate ...	Localised	Clay	Low	NULL	4760605.906738	35429.335336	4760.7	47.6
8	Qa	river chan...	Intergran...	Intergran...	Low	NULL	3874045.793457	35739.261628	387.4	3.9
9	Pzlc	Major met...	Localised	Metamorp...	High	NULL	96765761.79541	109978.988221	9676.6	96.8
10	RJwf	Major mud...	Localised	Clay	Low	RJswf	47884144.739746	44220.229963	4788.4	47.9

Field foun
Sq Km

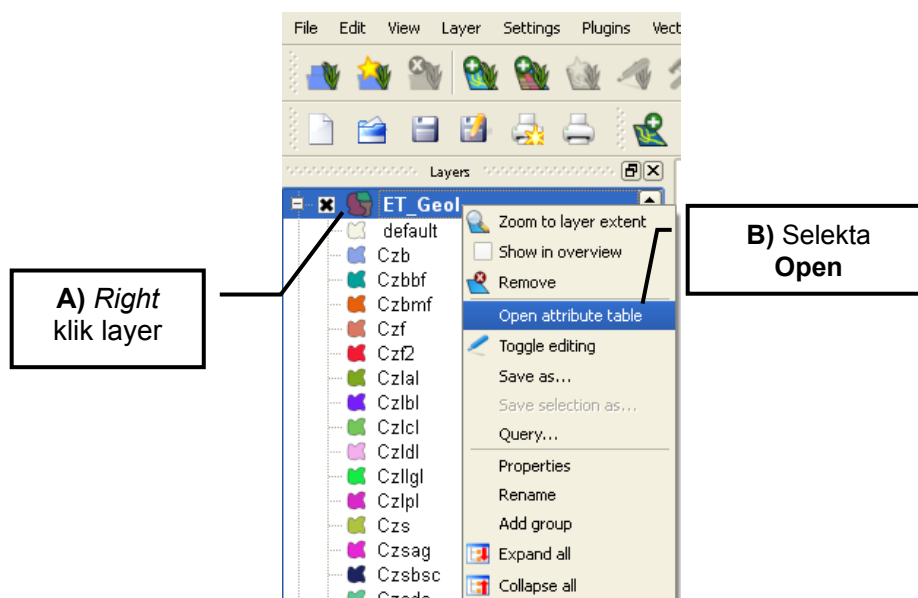
2.3 KRIA NO TAU-MUTUK *FIELD HÍDROJEOLÓJIKÁL POTENSÍÁL*

Oportunidade ida tan presiza iha attribute table molok ita atu hahú tau simbulu ba *data* no loke ida ne'e kategorikamente. Atu permite ita hodi simboliza efetivamente hídrojeolójikál potenciál iha mapa ida, ita presiza atu *express* tipu aquifêru no volume husi bee-rai-okos iha kada *field* ida. Atu halo ida ne'e ita presiza atu *merge* valor iha *field* **Aquifer** ho valor iha *field* **Pot Vol** (potensiál volume), no rejista rezultadu iha *field* foun ida hanaran **Aqu_w_PV**

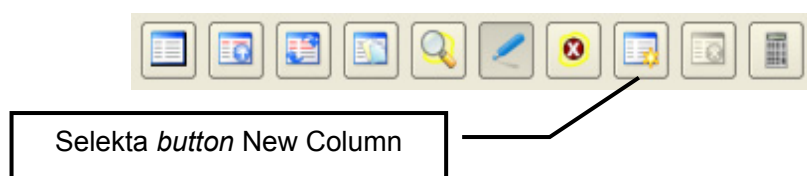
1. Átiva *editing* liu-hosi selekta *button* Toggle editing mode.



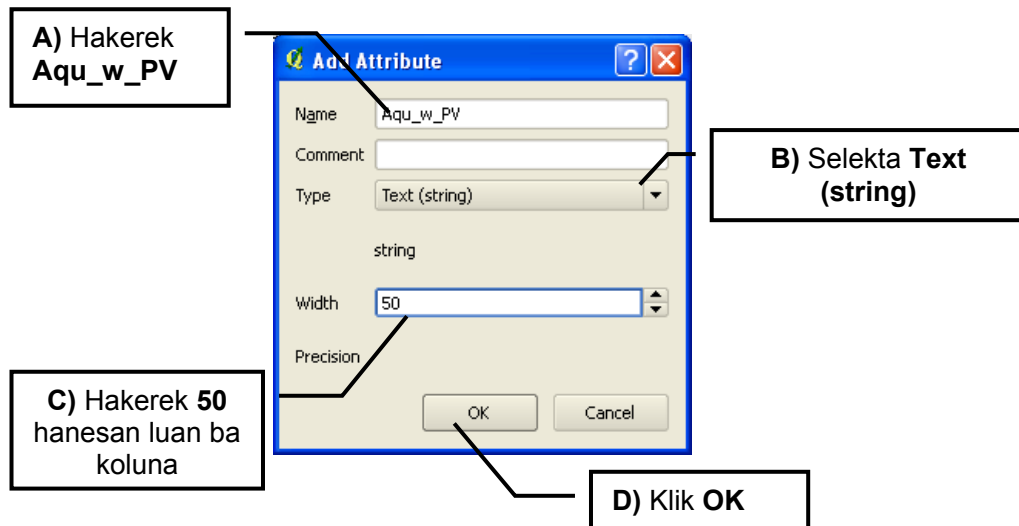
2. Loke attribute table husi ET_Geol UTM liu-hosi *right* klik iha *layer name* iha tabela kontiúdu no selekta **Open Attribute Table**.



3. Aumenta koluna/*field* seluk ba attribute table liu hosi selekta **New Column** button.



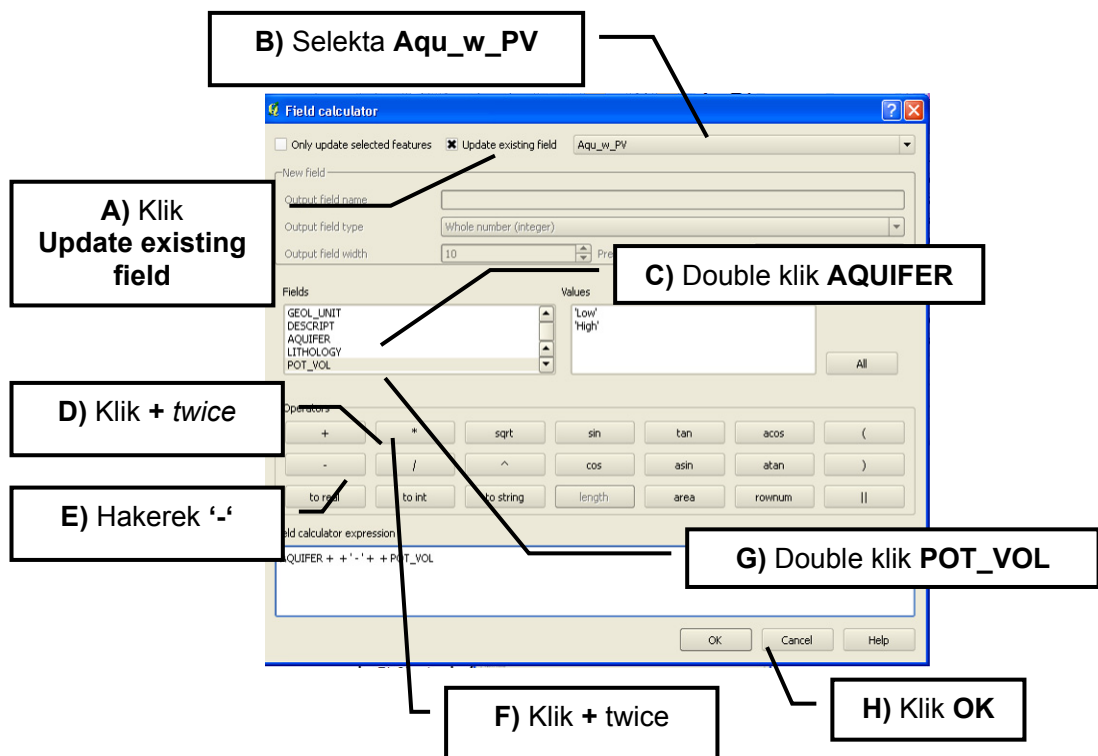
4. Iha **Name**: text box, hakerek **Aqu_w_PV**, hafoin **Type**, uza *drop down arrow* no selekta **Text (String)**. Ba koluna **Width** hakerek 50.
5. Klik **OK**.



6. Iha attribute table ET_Geol UTM, selekta button Open Field Calculator.

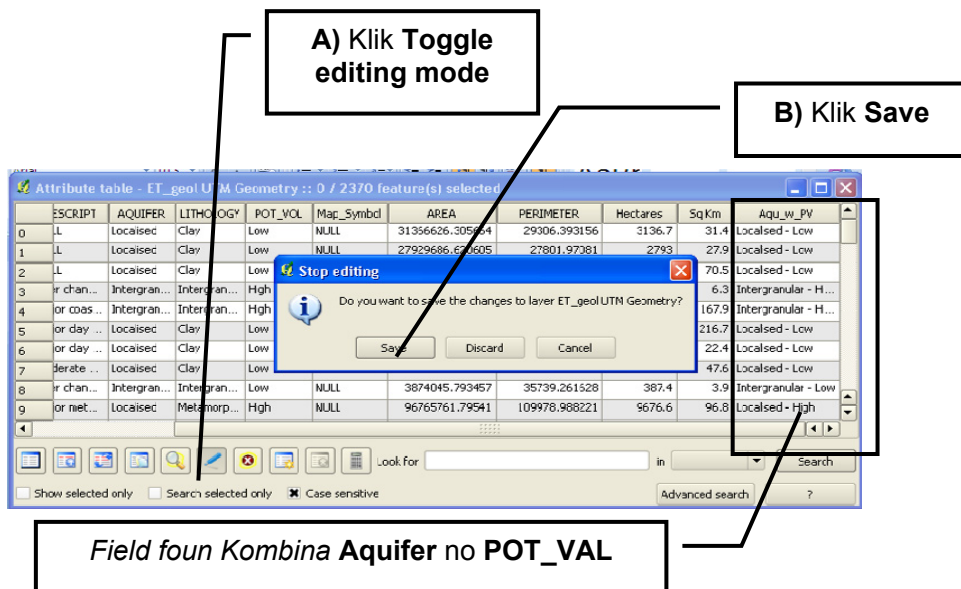


7. Atu konfigura **Field calculator** no hatama *expression* ba iha **Field calculator expression** textbox, halo tuir etapa sira iha diagram tuir-mai. Ida ne'e importante katak etapa sira ne'e halo tuir duni sekuénsia hanesan hatudu, husi A too H.

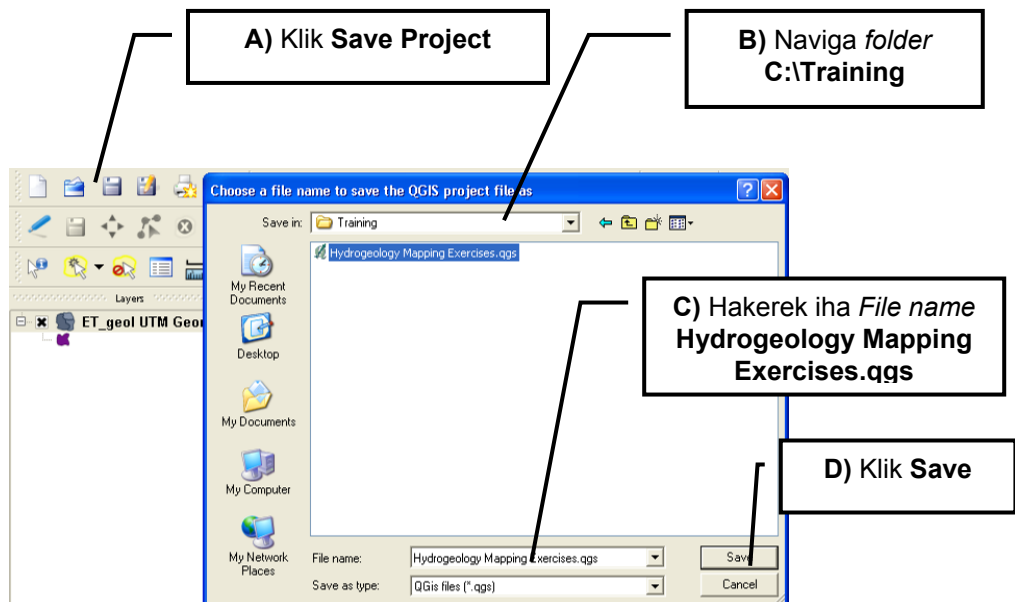


Rezultadu: Ita-boot kria tiha ona *field* **Aqu_w_PV** foun ida no tau-mutuk ona ne'e ho valor *field* **Aquifer** no **Pot_Vol** sira *merged* hamutuk no hakfahek ho *dash* (-).

- Klik iha **Toggle editing mode** hodi remata sesaun *editing*. Wainhira hetan pergunta "Do you want to save the changes to layer ET_geol UTM Geometry", klik **Save**.



9. Klik *button Save Project* no *save* ita-boot nia projetu
C:\Training\Hydrogeology Mapping Exercises.qgs



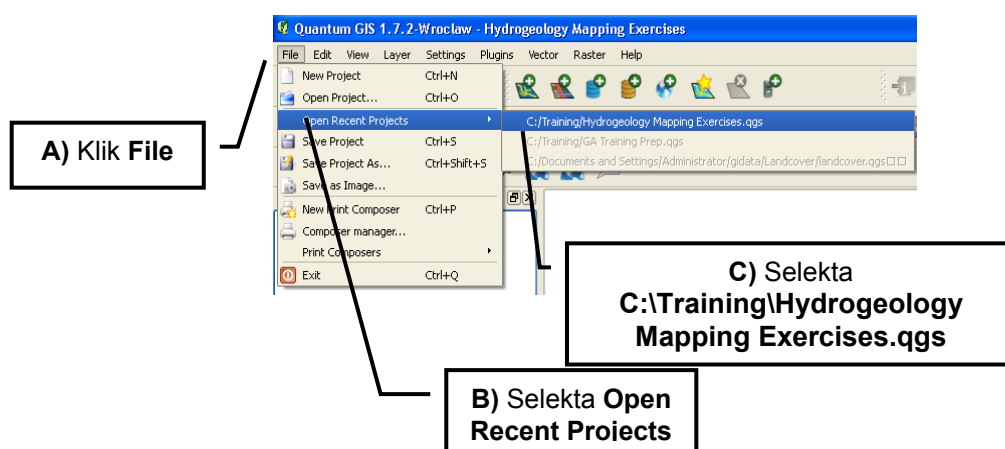
Ita-boot kompleta ona modifikasaun ba *attribute table*. Mudansa sira ne'ebé mak ita-boot halo hanesan preparasaun ba ezersisiu sira tuir-mai ne'ebé ita-boot sei simboliza karakteristika jeolójikál no hídrojeolójikál diferente sira iha mapa, no ba ezersisiu analiza espasial sira seluk ne'ebé sei halo tuir-mai.

3 Simbolizamentu Karakteristika Jeolojikál

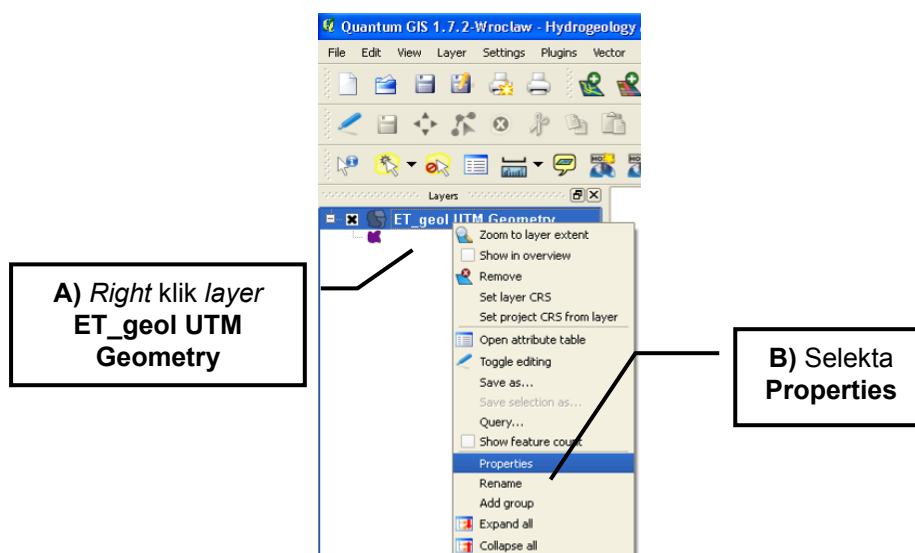
3.1 SIMBOLIZA JEOLÓGIA HO PADRAUN KORES INTERNASIONAL

Karik ita-boot hatama hotu ona *Map_Symbol data* ba fiatura hothotu iha layer *ET_geol UTM Geometry*, ita-boot sei hatudu dadus ho padraun kores sira ne'ebé mak utiliza ba simboliza unidade jeolojikál sira.

1. Hahú Quantum GIS no loka **C:\Training\Hydrogeology Mapping Exercises.qgs**, *file* projetu ne'ebé ita-boot *save* wainhira remata ezersisiu iha leten.

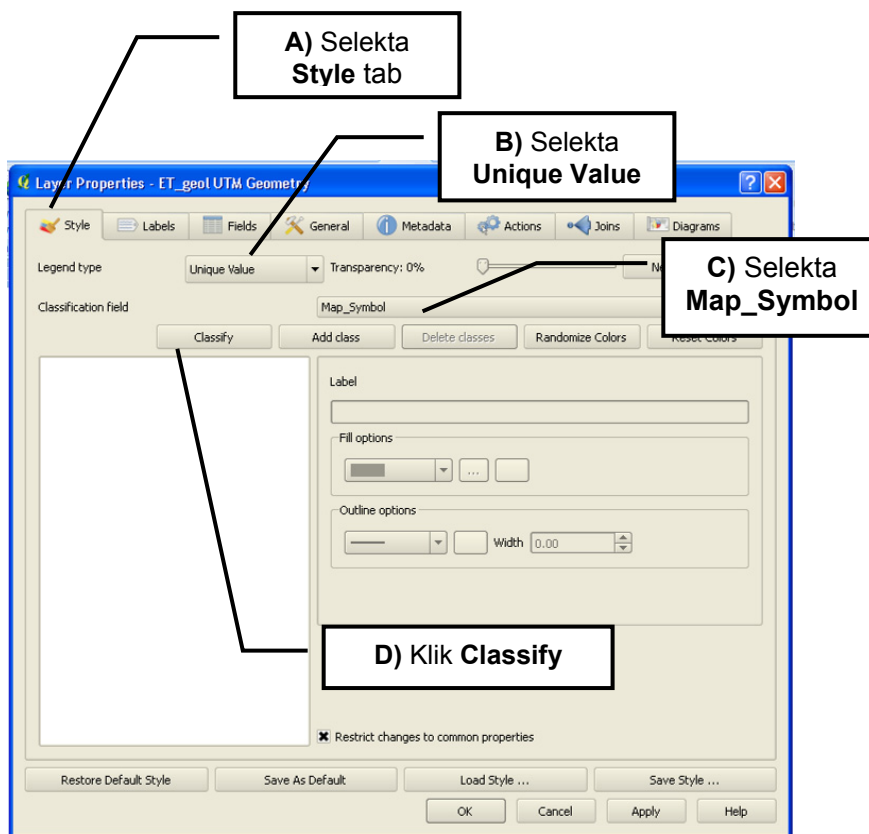


2. *Right* klik layer *ET_geol UTM Geometry* iha tabela kontiúdu no selekt **Properties**.



3. Iha *window* ne'ebé loke selekt **Style** tab.

4. Iha **Legend type**, selekta **Unique Value** husi *drop down list*.
5. Iha **Classification field**, selekta naran husi *attribute field* ne'ebé ita-boot hakarak atu simboliza iha ita-boot nia mapa, ne'ebé oha kazu ne'e mak **Map_Symbol**.
6. Klik *button Classify*.



Ida ne'e sei hatudu lista klasifikasaun ida, ida husi kada valor úniku husi *field Map_Symbol*. Kada klase deigna simbulu kor ida. Ka kores espesifiku sira selekta ona, QGIS sein *randomly* deigna kores, ida ba kada klase.

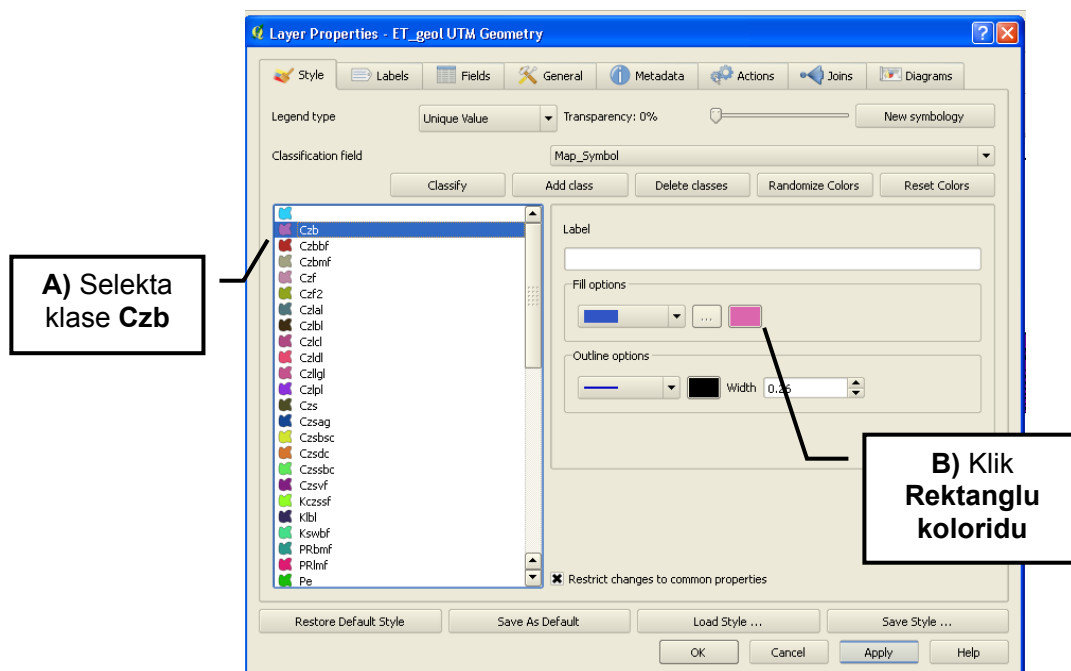
Ita la koho atu hatudu ita-nia klase jeolójikál sira ho *randomly deigna kores*, tantu ita bele aplika **Padraun kores sira ba mapeamentu jeolójikál**.

Ita halo ida ne'e hodi deigna valor espesifiku mean, matak no azul (RGB) ba kada klase. Valor sira atu uza ne'e aprezena iha *Jeolójia RGB Tabela iha Anéksu II (p. 58)*.

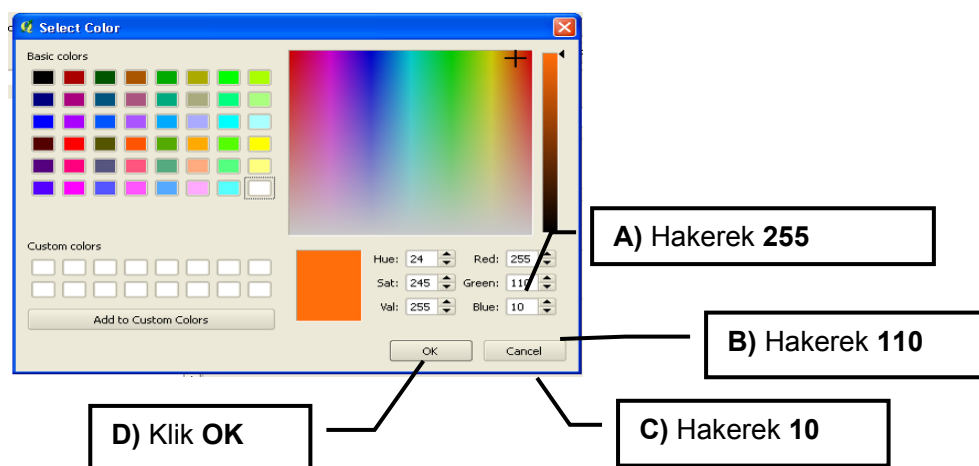
7. Selekta **Czb**, primeitu iha lista klase *Map_Symbol* sira. *Properties* husi simbulu Czb hanesan hatudu iha ba parte liman los. *Properties* mak **Label**, **Fill options** no **Outline options**.

Iha ne'ebá iha rektanglu koloridu rua iha *Fill options*. Ida iha liman kwaruk spesifika *pattern of the symbol* (solidu, liña diagonál, *cross hatching*, sst); ida ba liman los spesifika *colour of the symbol*

8. Klik rektanglu iha liman los hodi muda kor husi simbulu ba klase Czb.



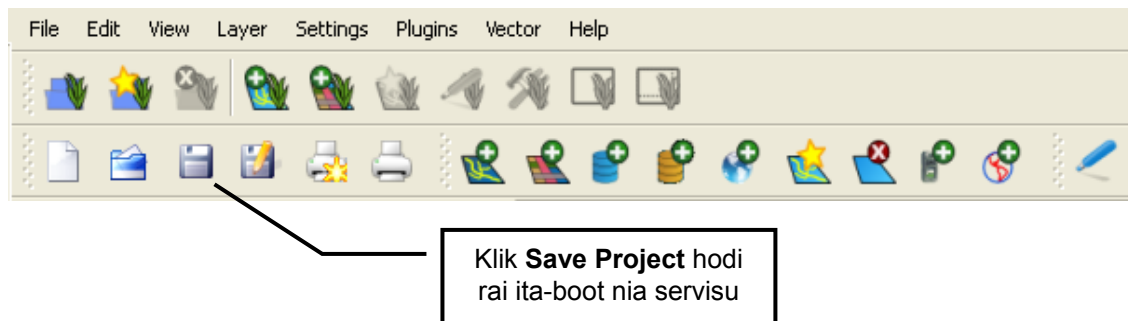
The *Window Select Colour* sei hatudu.



9. Refere ba tabela Jeolójia RGB iha Aneksu II (p. 58), **hakerek iha valor Mean, Matak no Azul ba valor Matak no azul** ba klase Czb iha box ne'ebé apropiadu.

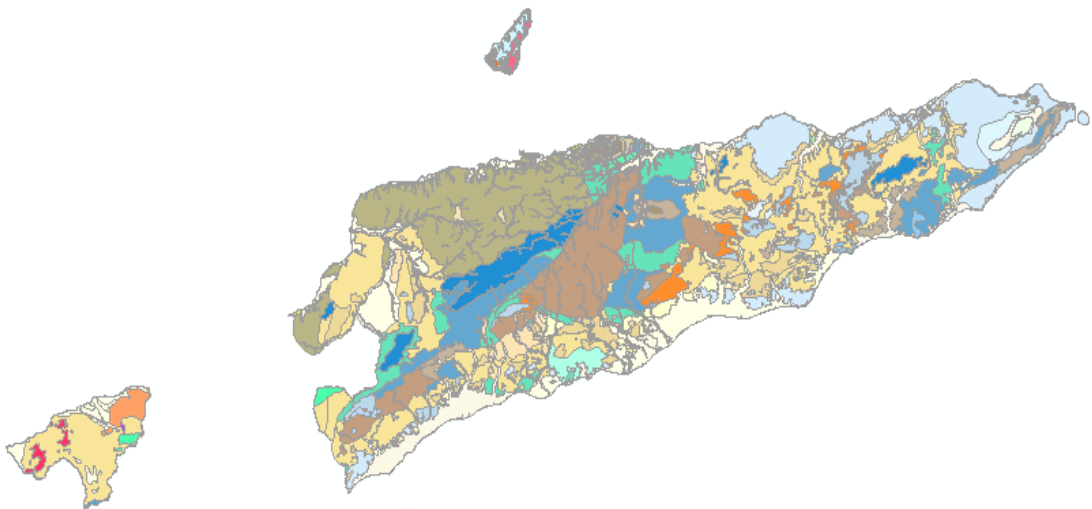
10. Klik OK.

11. Repete pasu 7 too 10 sira ba kadak klase jeolójia iha lista. Klik regular no frekvente interval *button Save Project* hodi *save* ita-boot nia servisu no asegura katak mudansa sira iha nafatin.



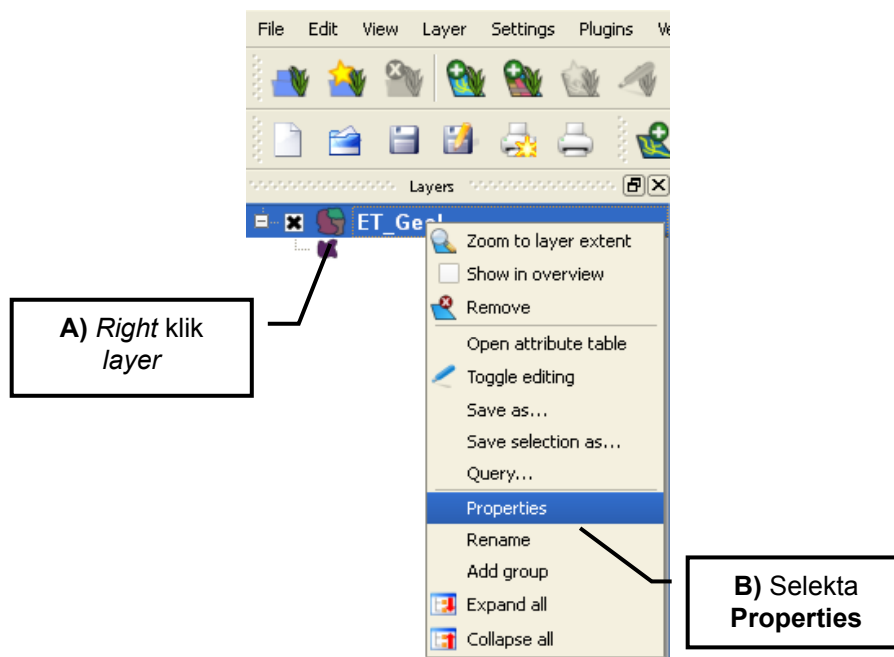
12. Klik **OK** iha *window Layer Properties*.

Ita-boot nia map haré hanesan ida ne'e.

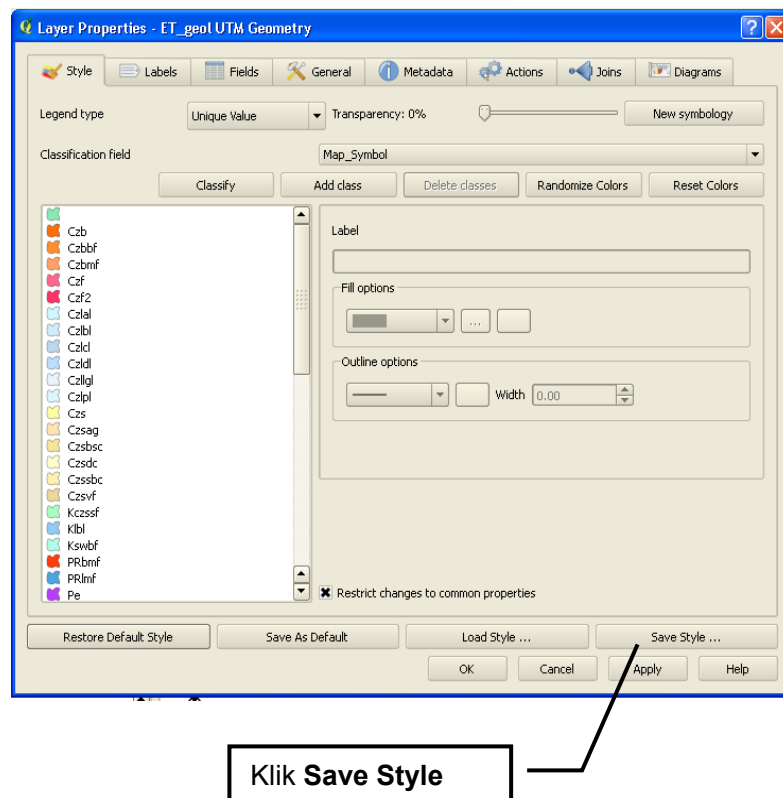


Wainhira ita-boot espesifika ona valor RGB sira husi padraun simbolu sira ba klase jeolojikál hothotu, *save symbol properties* iha *Style File* ho *extension* qml hanesan hatudu tuir-mai. Ho aplika *Style File* ida, ita-boot sei bele automatikamente dezigna padraun simbolu sira ba ita-boot nia *layer* ET_geol UTM Geometry, tantu hasees prosedimentu ba hatama-hikas valor RGB manualmente wainhira ita-boot *load* nia.

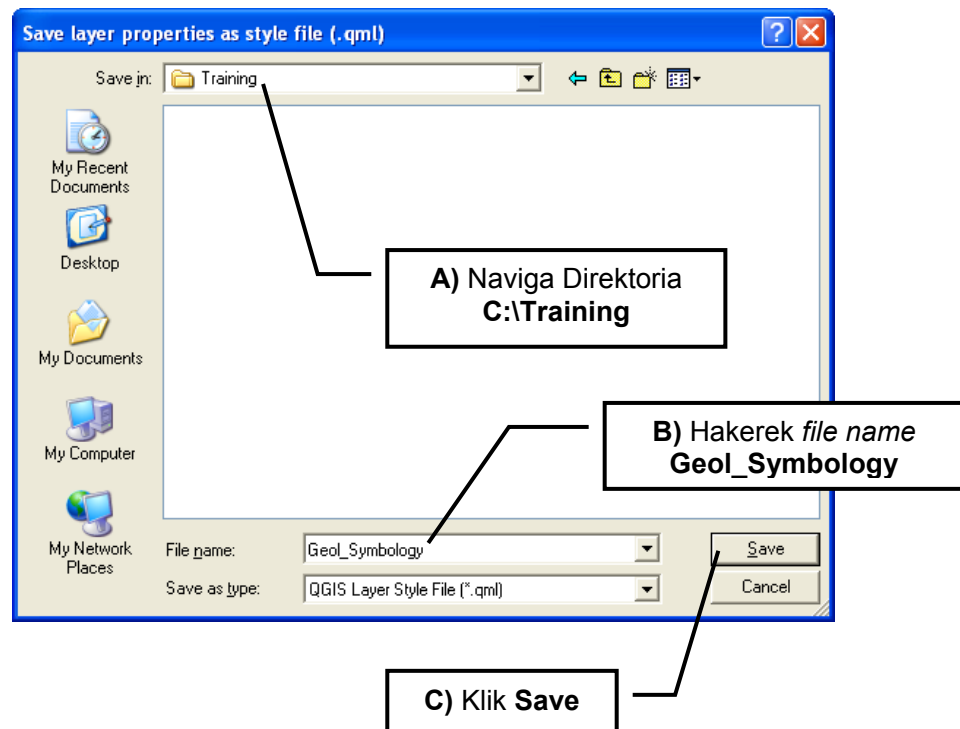
13. *Right* klik ET_geol UTM Geometry iha *layer* panel no selekta **Properties**.



14. Iha *window* *Layer Properties* klik *button* **Save Style**.



15. Iha window ne'ebé hatudu, naviga ba *training folder*, hakerek iha *file name* **Geol_Symbology** no klik **Save**.



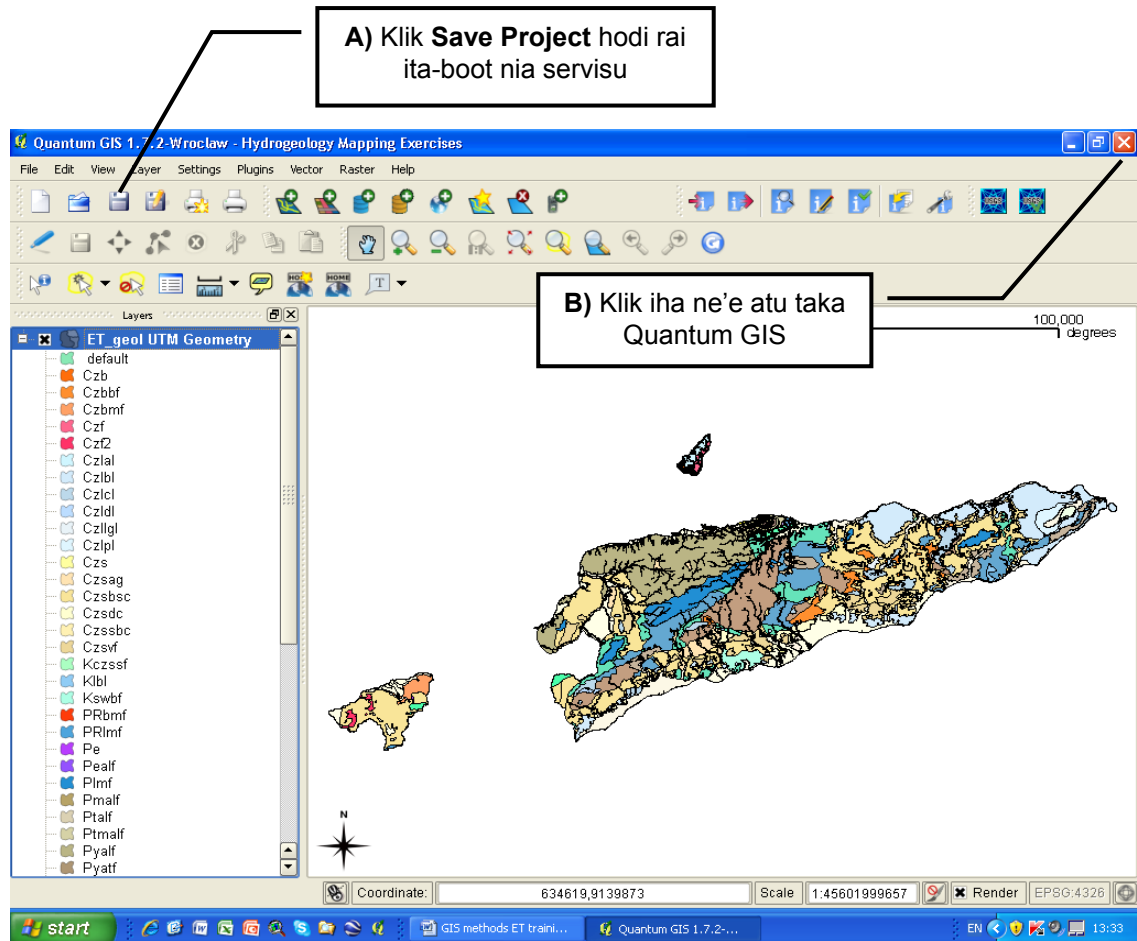
Avizu:

Style File (.qml) ida **la'os** shapefile ida ka fiatura klase, nia la rai dadus ka shape husi polygon, nia rai de'it no dikta klalaok mapa ida nian ne'e hetan pinta no loke. Ida ne'e refere hikas ba klase shapefile/feature original ba informasaun hothotu.

Wainhira ita-boot muda ka delete klase shapefile/feature orijinál layer file sei la bele atu opera ona. Wainhira klase shapefile/feature orijinál la iha fatin hanesa iha tempu oin mai ita-boot loke layer file nia sei hatudu. **Wainhira klase shapefile orijinál hetan delete iha ne'ebá la iha dalan atu atu halo layer file opera hikas, maibé bele halo wainhira ita-boot iha kopia EXACT SAME**

RESULT: Ita-boot bele ona kompela mapa jeolójia husi Timor-Leste utiliza padraun koreskoletanea rekoiñesidu mundiál no simbulu mapa sira.

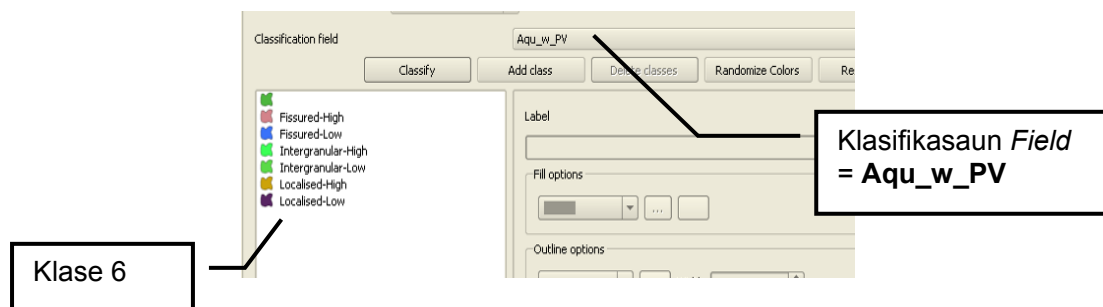
16. Klik **button Save Project** hodi rai ita-boot nia servisu no taka Quantum GIS liu-hosi klik iha *red box* iha *top right*.



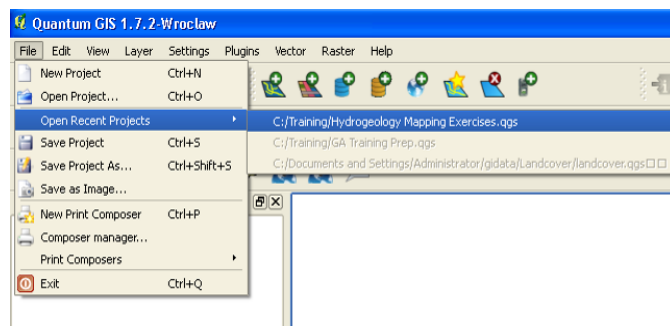
3.2 SIMBOLIZA HÍDROJEOLÓJIA HO PADRAUN KORES INTERNASIONAL

Ein termu metodolojia GIS, prosesu ba halo mapa hídrojeolójia hanesan ho prosesu iha leten ne'ebé utiliza hodi kria mapa jeolójia. Razaun no justifikasaun ba klasifikasaun hídrojeolójia sira mak deskute ona iha relatóriu seluk no sei la kobre iha ne'e.

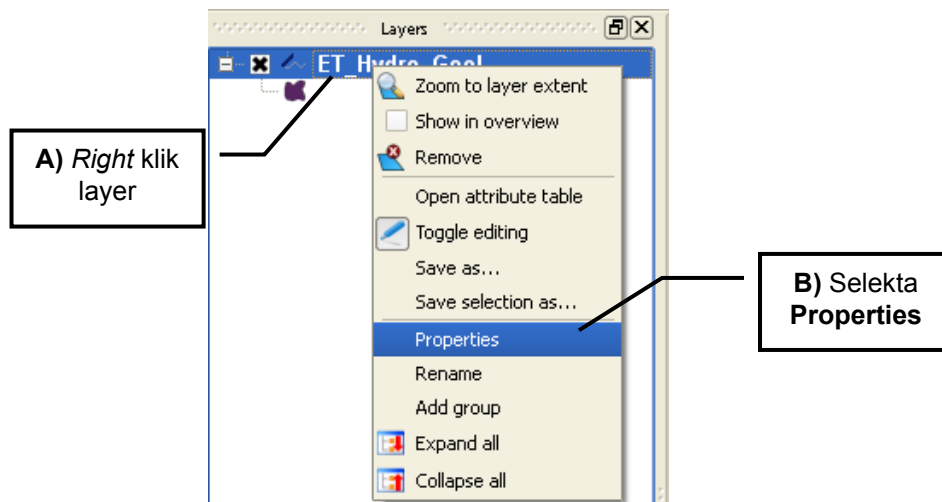
Saida mak ita atu halo iha ezersisiu ne'e mak **designa valor RGB ba padraun kores sira** ne'ebé mak utiliza atu reprezenta klase neen (6) iha *field* Aqu_w_PV:



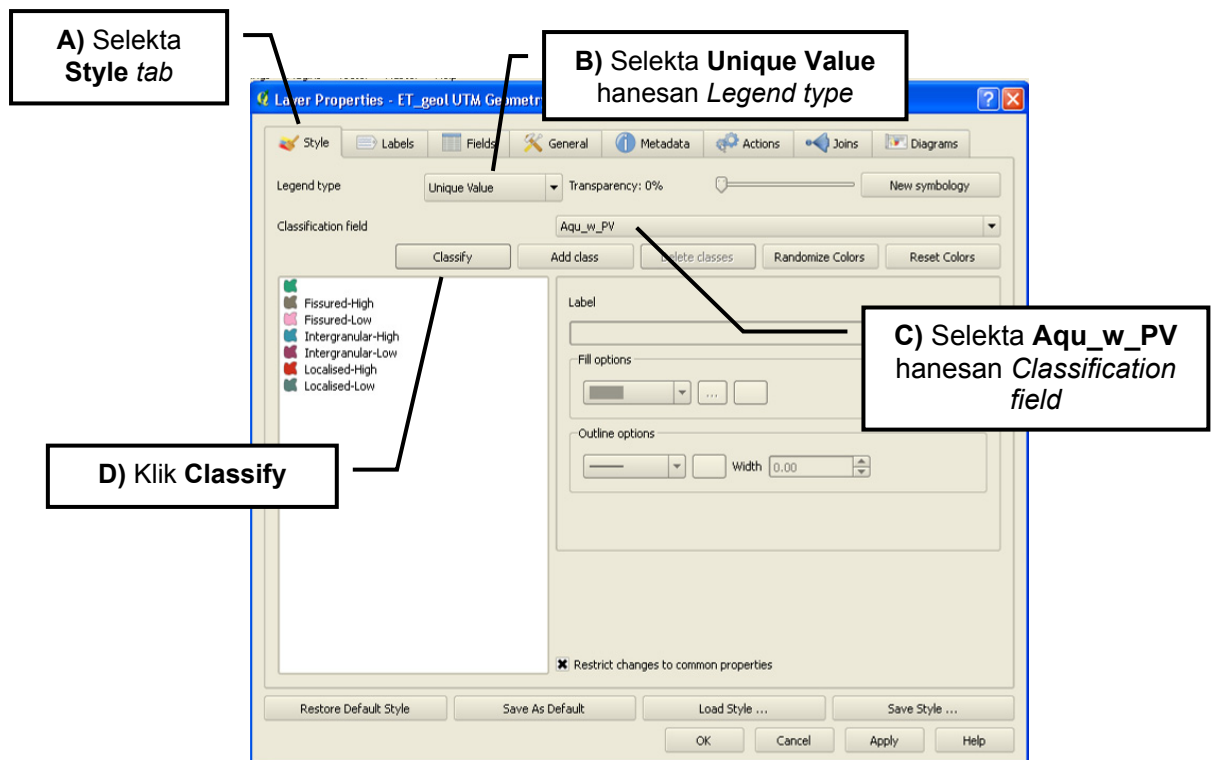
1. Loke Quantum GIS no *load* ita-boot nia *file* projetu liu-hosi selekta **File – Open Recent Projects – C:\Hydrogeological Mapping Exercises.qgs**



2. Right klik ET_geol UTM Geometry iha *Layers panel* no selekta **Properties**.



3. Iha *window* ne'ebé nakloke selekta **Style tab**.
4. Selekt **Unique Value** hanesan *Legend type*.
5. Iha *Classification Field* ne'ebá iha *drop down menu* ida. Selekt *títulu field* ne'ebé mak ita-boot hakrak atu klasifika, iha kazu ne'e mak **Aqu_w_PV**.
6. Klik *button Classify*. Ida ne'e sei hatudu simbulu sira ne'eb'e mak dezigna ona ba klase úniku 6 husi Aqu_w_PV.

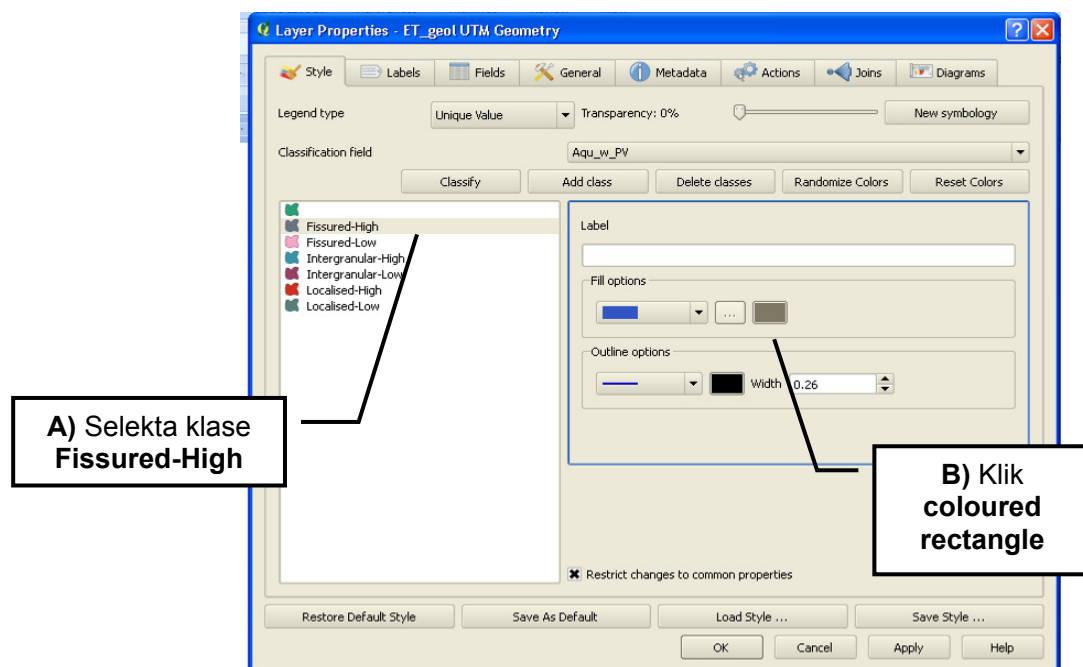


Potensiál hídrolojikál husi kada unidade mapeamentu jeolojikál ne'ebé mak hatudu dadaun iha *randomly* ida dezigna ona kores bazeia ba klase 6 iha *field* **Aqu_w_PV**. Ita-boot sei aplika padraun kores internasionál liu-hosi hatama valor RGB sira ba kada klase husi tabela Simbulu Hídrojeolójia iha Aneksu II (p. 60).

7. **Selekta Fissured – High**, primeitu husi lista klase Aqu_w_PV. *Properties* husi simbulu *Fissured - High* mak hatudu iha liman-los. *Properties* mak **Label**, **Fill options** no **Outline options**.

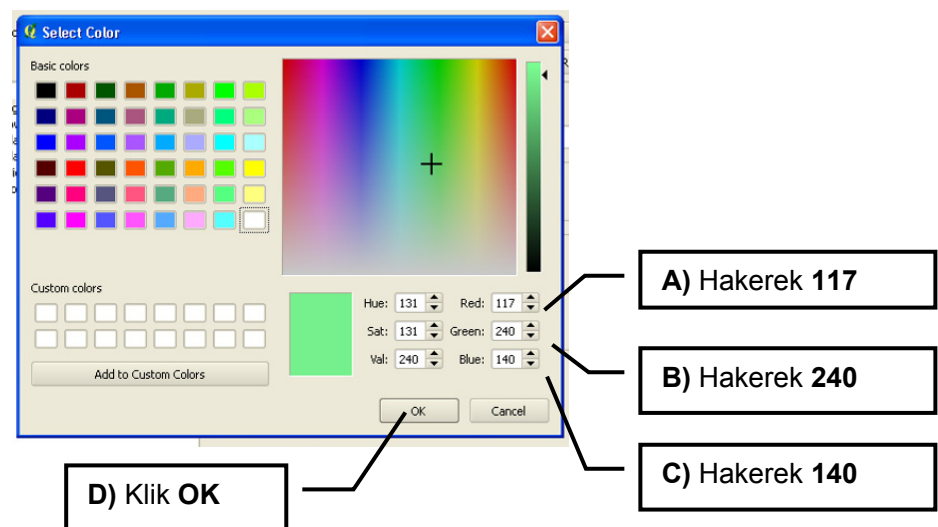
Iha ne'ebá iha rektanglu koloridu rua iha *Fill options*. Ida iha lima-karuk espesifika *pattern* husi *simbulu* (*solid, diagonal lines, cross hatching, sst*); ida iha liman-los espesifika **kores** husi *simbulu*.

8. **Klik rektanglu iha liman-los** atu muda kor husi simbulu ba klase Fissured - High.

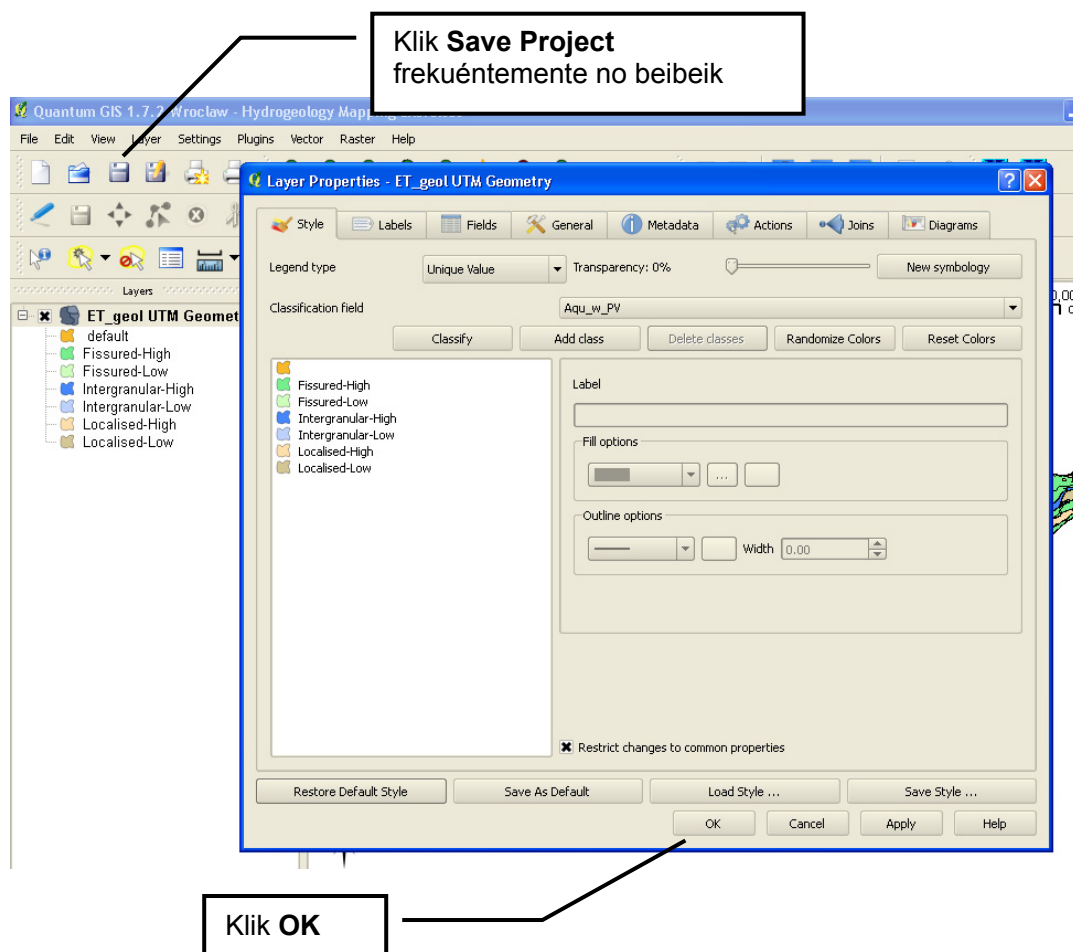


Window *Select Colour* sei nakloke.

9. Refere ba tabela Jeolójia RGB iha Aneksu II (p. 58), **hakerek valor Red, Green no Blue** ba klase **Fissured - High** ba iha *box* ne'ebé apropiada. Klik **OK**.



10. Repete etapa 7 too 9 sira ba kadak klase potenciál hídrolojikal iha lista ne'e. Klik regular no beibeik interval **button Save Project** hodi *save* ita-boot nia servisu no asegura katak mudansa sira ne'e iha nafatin.



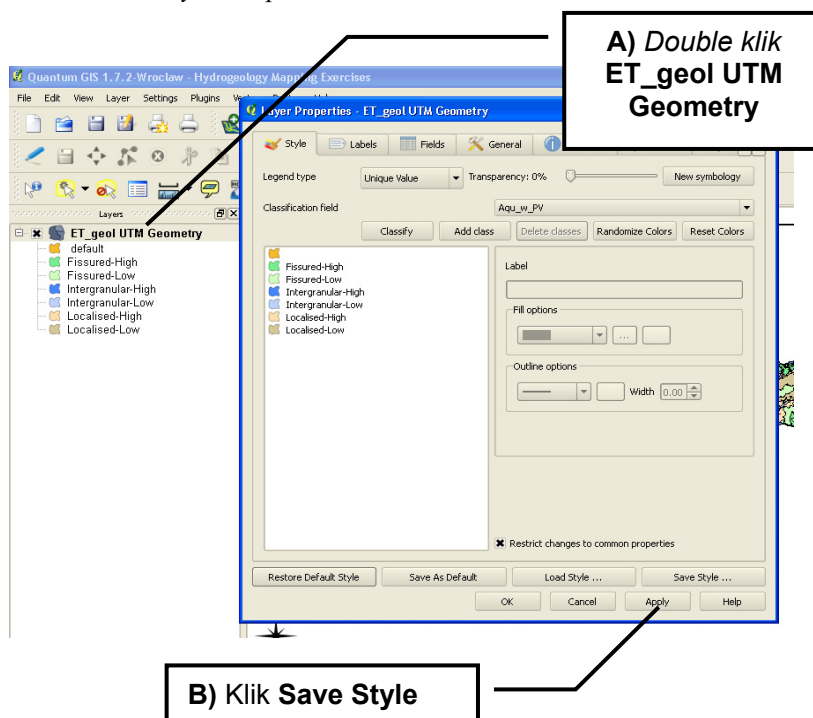
11. Klik **OK** iha *window* Layer Properties.

REZULTADU: Ita-boot bele ona atu kompela mapa Hídrojeolójia potenciál husi Timor-Leste utiliza kores koletanea ne'ebé mak rekoñese internacionalmente



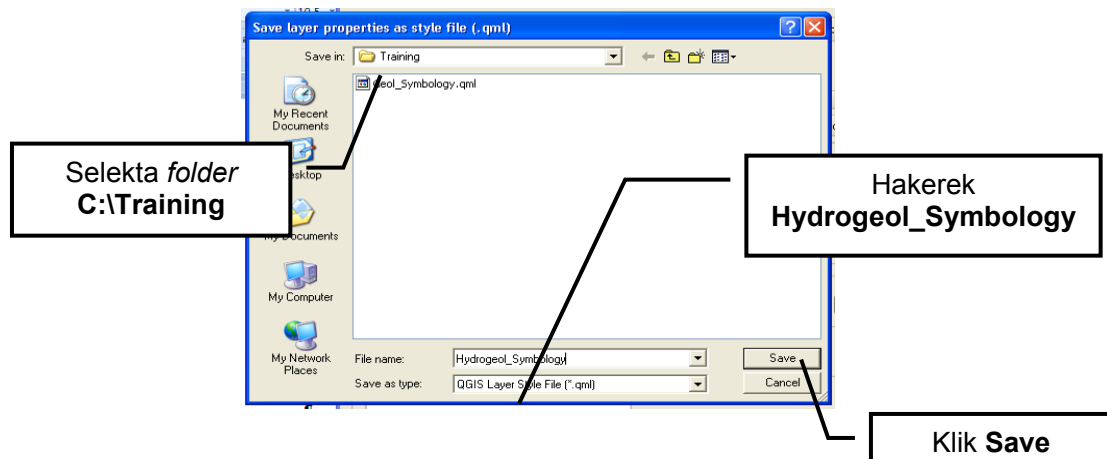
Kuandu ita-boot *saved* simbulu padraun internasionál ne'ebé espesifika ona ba klase sira iha mapa jeolójia, *save* simbulu sira ne'ebé mak iha espesifika ba klase hídrojeolojikál potenciál. Dala ida tan, ita-boot halo ida ne'e liu hosi *saving Style File* (.qml) ida.

12. *Double* klik ba **ET_geol UTM Geometry** iha panel Layers. Ida ne'e hanesan dalan seluk ida ba olek *window* Layer Properties.



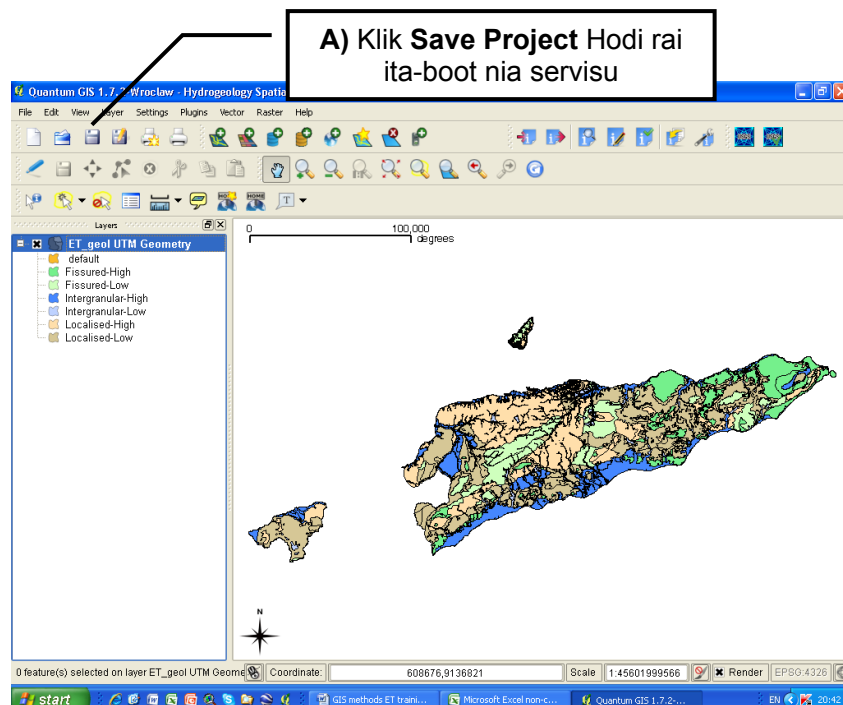
13. Iha *window* Layer Properties klik *butto* **Save Style**.

14. Iha *Save layer properties* hanesan *window style file (.qml)*, hakerek **Hydrogeol_Symbology** hanesan *File name* no naviga ba *folder C:\Training* iha *Save* iha *drop down menu*. Klik **Save**.



15. Klik **OK** iha *window* Layer Properties.

Mapa ne'ebé haré iha *main window* Quantum GIS hatudu Timor-Leste nia hídrojeolójikál poténsiál iha kores rekoñesidu internasionalmente.



4 Analiza Espasiál

4.1 KALKULA AREA HUSI KLASSE HÍDROJEOLÓJIKÁL POTENSIÁL

Objetivu: Buka resposta ba kestaun sira tuir-mai liu-hosi analiza ita-boot nia dados hídrojeolójikál ba Timor-Leste:

- 1) Hira mak totál area rai husi Timor-Leste?
- 2) Sa'de'it mak area husi kada klase 6 hídrojeolójikál potenciál sira?
- 3) Proporsaun sa'ida mak Timor-Leste nia totál area rai halo ba kada klase representa?

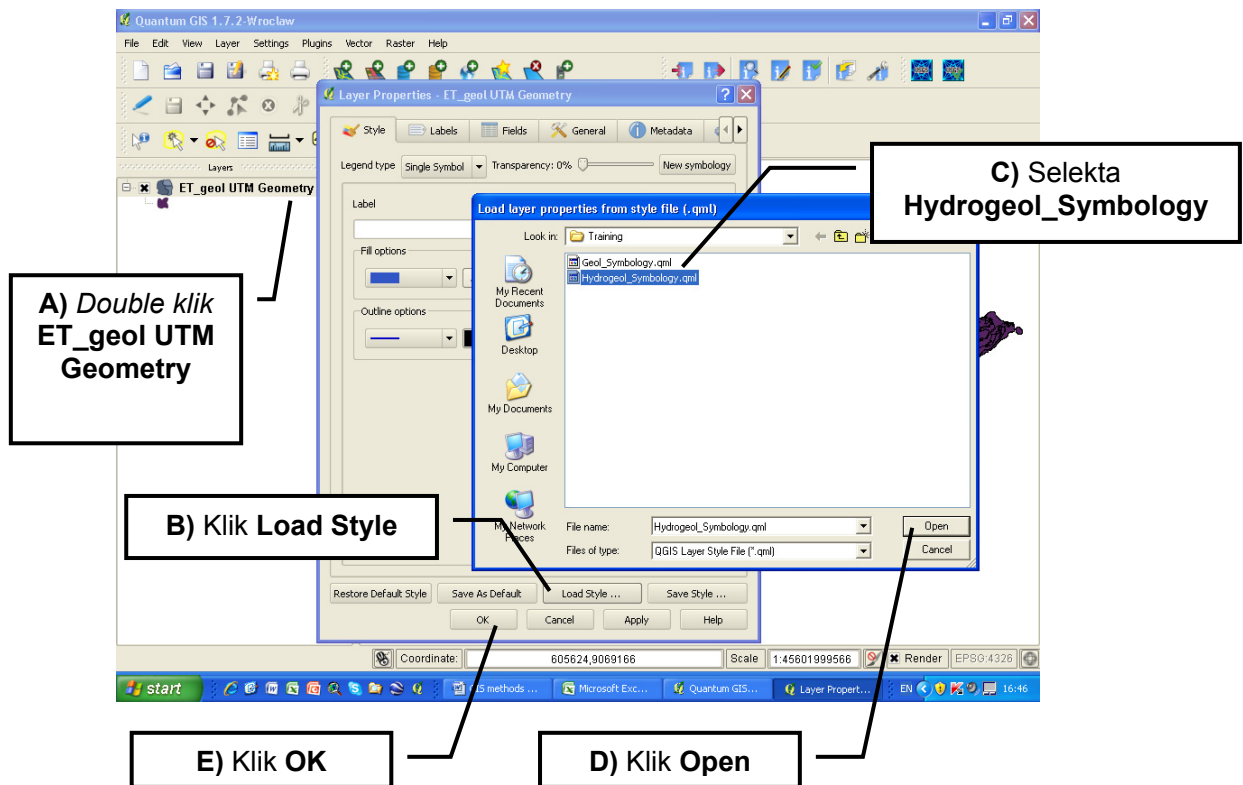
Rejistu ita-boot nia resposta iha tabela ne'e:

		Area (sq km)	% Timor-Leste
Fissured - High			
Fissured - Low			
Intergranular - High			
Intergranular - Low			
Localised - High			
Localised - Low			
Timor-Leste			

Kria projetu foun ba ezersisiu ne'e – la bele loke projetu ne'ebé mak ita *save* husi ita-nia servisu dahuluk.

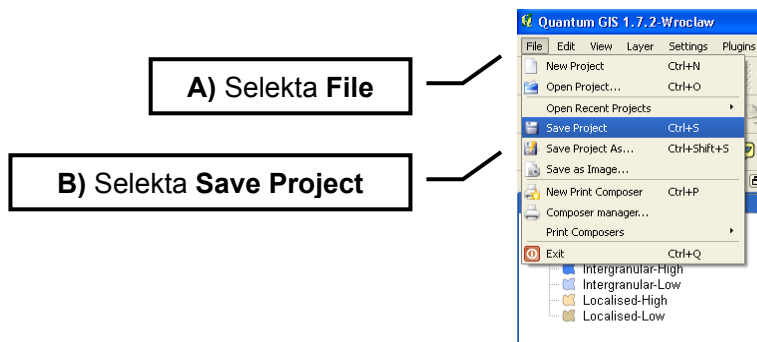
1. **Hahú loke Quantum GIS no load vector layer ET_geol UTM Geometry.** Ita-boot sei hare hetan *layer* representa ho simbulu ida de'it – ida ne'e ladauk klasifika.
2. **Double klik name layer** iha panel Layers hodi loke Layer Properties - ET_geol UTM Geometry.
3. Klik **Load Style** iha *box* Layer Properties
4. Selektá **C:\Hydrogeol_Symbology.qml** husi *Load Layer properties* husi *window style file*, hafoin klik **Open**
5. Klik **OK**

Métudu GIS ba mapiamentu hídrojeolójia iha Timor-Leste

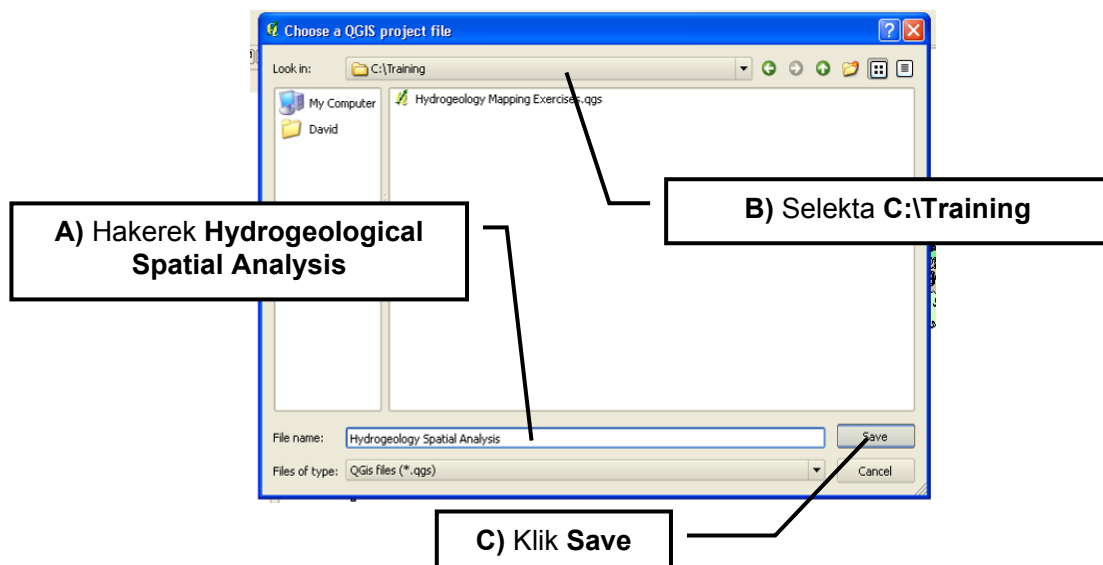


The map will show Timor-Leste's hídrojeolójikál potenciál, symbolized according to the international standards you specified in the previous exercise.

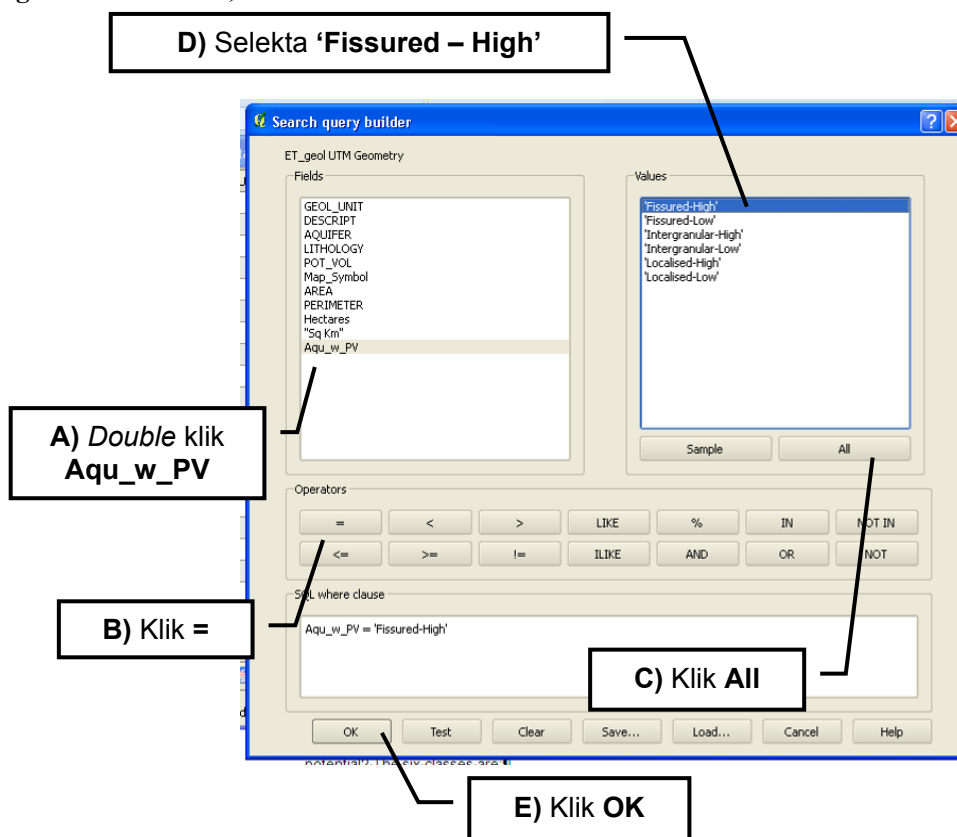
6. Create a new project file by selektaing **File – Save Project**



- Hakerek **Hídrojeolójikál Spatial Analysis** hanesan *file name*, asegura **C:\Training** mak folder selekta hodi *save* projetu ne'e, hafoin, klik **Save**.



- Loke **attribute table** husi **ET_geol UTM Geometry** no klik **Advanced Search**.
- Iha *window* **Search query builder**, harí *expression* **Aqu_w_PV = 'Fissured – High'** liu-hosi *double* klik **Aqu_w_PV** iha *Fields*, *single* klik **Operator =**, klik **All** no selektá **'Fissured – High'** iha *box* **Values**, no hafoin klik **OK**.



Fiatura 158 mak selektá ona iha *attribute table*.

10. Iha *attribute table*, check **Show selektaed only**. Tabela ne'e agora hatudu de'it rejistu sira ba fiatura 158 ne'ebé mak iha valor Fissured – High iha sira-nia *field* Aqu_w_PV.

B) Klik hodi taka *attribute table*

Selekta fiatura 158

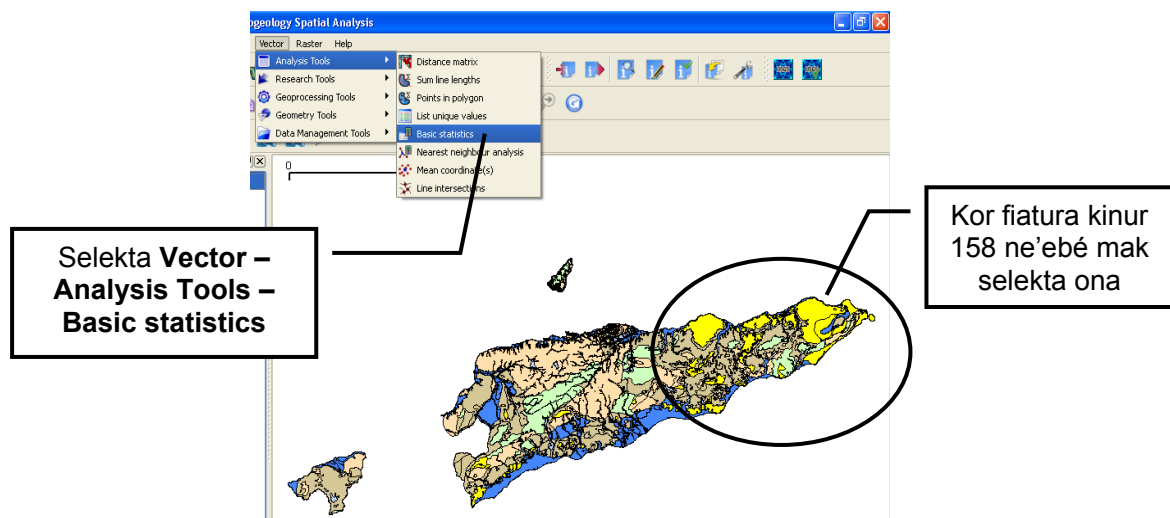
A) Check Show selected only

Fiatura hothotu ne'ebé mak selekta ona iha klase Fissured – High

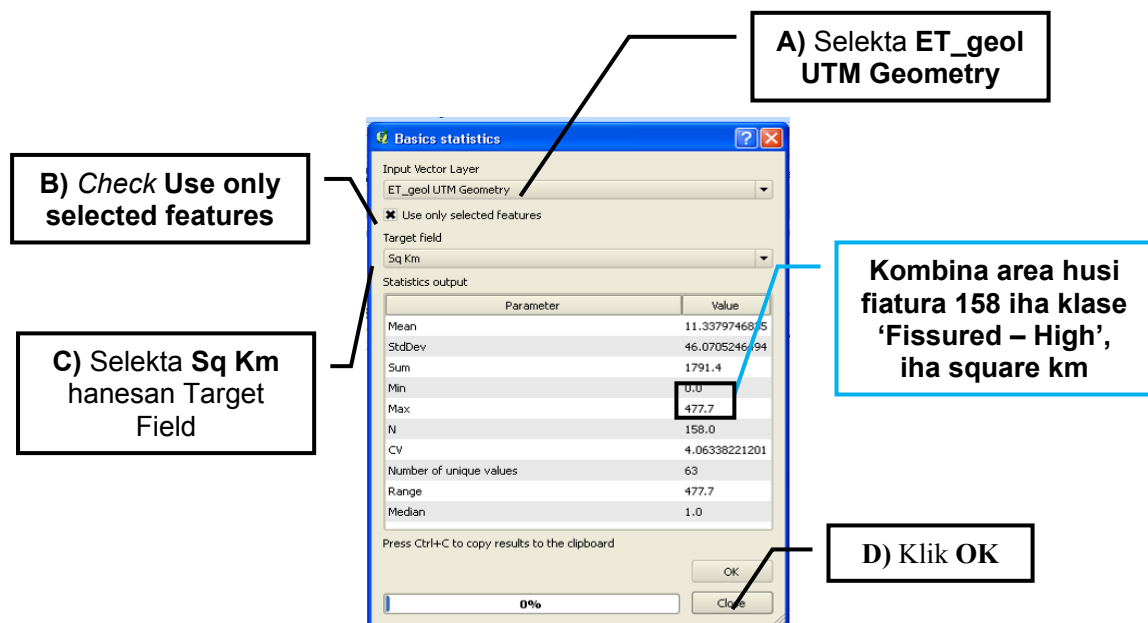
	ESCRIPIT	AQUIFER	LITHOLOGY	POT_VOL	Map_Symbol	AREA	PERIMETER	Hectares	Sq Km	Aqu_w_PV
204	limestone, ...	Fissured	Carbonate (Karst)	High	Czbl	24186.047363	598.561206	2.4	0	Fissured-High
205	limestone, ...	Fissured	Carbonate (Karst)	High	Czbl	265934.204...	2155.694493	26.6	0.3	Fissured-High
206	limestone, ...	Fissured	Carbonate (Karst)	High	Calcl	2140913.33...	6242.304971	214.1	2.1	Fissured-High
207	limestone, ...	Fissured	Carbonate (Karst)	High	Calcl	10167315.3...	17884.832247	1016.7	10.2	Fissured-High
208	limestone, ...	Fissured	Carbonate (Karst)	High	Czbl	1740946.60...	7379.189435	174.1	1.7	Fissured-High
209	limestone, ...	Fissured	Carbonate (Karst)	High	Calcl	4842918.55...	11100.835554	484.3	4.8	Fissured-High
260	limestone, ...	Fissured	Carbonate (Karst)	High	Czbl	5537028.20...	11177.907393	553.7	5.5	Fissured-High
283	limestone, ...	Fissured	Carbonate (Karst)	High	Czbl	269741118....	93304.345629	26974.1	269.7	Fissured-High
285	ate hard s...	Fissured	Carbonate (Karst)	High	Calcl	3115823.35...	10142.343116	311.6	3.1	Fissured-High
288	ate hard s...	Fissured	Carbonate (Karst)	High	Calcl	383829.922...	2397.005123	38.4	0.4	Fissured-High
295	ate hard s...	Fissured	Carbonate (Karst)	High	Calcl	2306969.02...	6595.4256	230.7	2.3	Fissured-High
297	ate hard s...	Fissured	Carbonate (Karst)	High	Calcl	15135.742188	460.150644	1.5	0	Fissured-High
302	limestone, ...	Fissured	Carbonate (Karst)	High	Czbl	4095199.84...	9916.161444	409.5	4.1	Fissured-High
315	limestone, ...	Fissured	Carbonate (Karst)	High	Czbl	5926158.22...	12995.594189	592.6	5.9	Fissured-High
326	ate limesto...	Fissured	Carbonate (Karst)	High	Calcl	25504.161621	636.365921	2.6	0	Fissured-High
328	limestone, ...	Fissured	Carbonate (Karst)	High	Czbl	477662928....	270266.212742	47766.3	477.7	Fissured-High
333	ate limesto...	Fissured	Carbonate (Karst)	High	Calcl	54072.786621	941.291793	5.4	0.1	Fissured-High
339	ate limesto...	Fissured	Carbonate (Karst)	High	Calcl	1698921.56...	8473.462665	169.9	1.7	Fissured-High
345	limestone, ...	Fissured	Carbonate (Karst)	High	Czbl	105473.919...	1239.464999	10.5	0.1	Fissured-High
380	limestone, ...	Fissured	Carbonate (Karst)	High	Czbl	905557.219...	4659.473758	90.6	0.9	Fissured-High

11. Taka *attribute table* hodi fila hikas ba *window main Quantum GIS*. Haré hetan *polygon* balun iha mapa ho kor kinur. Sira ne'e mak fiatura 158 ne'ebé mak ita-boot foin selekta.

12. Selektá **Vector – Analysis Tools – basic Statistics** husi *main menu bar*.



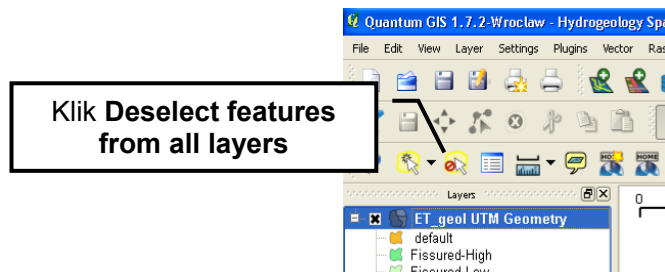
13. Iha *window* Basic statistics, selekta **ET_geol UTM Geometry** hanesan Input Vector Layer, *check* box ba **Use only selektaed features**, selekta **Aqu_w_PV** hanesan Target Field no klik **OK**.



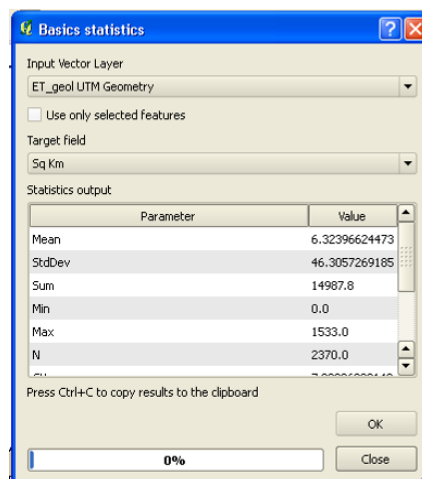
REZULTADU: Statistics output apresenta sasukat estatistika baziku ba fiatura hothotu iha klase 'Fissured – High'. Estatistika sira ne'e inklui númeru ne'ebé ita-boot buka--totál area rai husi fiatura 158 ne'ebé mak selekta ona, ne'ebé iha kazu ne'e mak **1,791.4 square kilometres**.

14. Hakerek area klase 'Fissured – High' iha tabela Pájina 37.

15. Klik **Deselect features from all layers** hodi deselekta fiatura 158 sira ne'ebé mak ita-boot foin kakula estatistika baziku. Kores kinur iha ita-boot nia mapa sei lakon no *attribute table* sei relata fiatura 0/2370 ne'ebé selekta ona



16. Repete etapa 8 – 14 ba klase 5 hidrojeolójikál sira seluk, no hakerek totál area husi kada klase iha tabela iha **Pájina 37**.
17. Atu kalkula totál area Timor-Leste, tuir prosedimentu *Vector - Analysis Tools – Basic statistics* ho **la selekta fiatura sira**. La bele *check box Use only selected features*.



Iha kazu ne'e, *box Statistics output* relata $Sum = 14,987.8$ no $N = 2,370$. Ida ne'e hatete ba ita-boot katak area kombina husi fiatura 2,370 hothotu iha *layer* mak $14,987.8$ *square kilometre*.

18. Hakerek area Timor-Leste iha box apropriadu iha tabela iha **Pájina 37**.
19. Taka *window Basic statistics* no **any attribute tables** ne'ebé mak nakloke.
20. Klik *button Save Project* hodi *save* ita-boot nia servisu
21. Continua ba ezersisiu tuir-mai; **LA BELE** taka projetu ka taka Quantum GIS

4.2 EKSPLORA RELASAUN ENTRE HÍDROJEOLÓJIKÁL POTENSIÁL NO SENTRU POPULASAUN

Objetivu: Atu ezamina distribuisaun populasaun Timor-Leste ein relasaun ba disponibilidade potensíal bee-rai-okos liu-hosi responde ba pergunta hanesan:

- Sa'mak potensíal bee-rai-okos ba Timor-Leste nia sentru populasaun importante?
- Sentru populasaun hira mak lokalizadu iha kada klase husi klase 6 hídrojeolójikál potensíal?
- Sidade sira ne'ebé mak preokupa katak sira-nia rekursu bee-rai-okos bele la natoon atu responde ba nesesidade sira iha futuru?

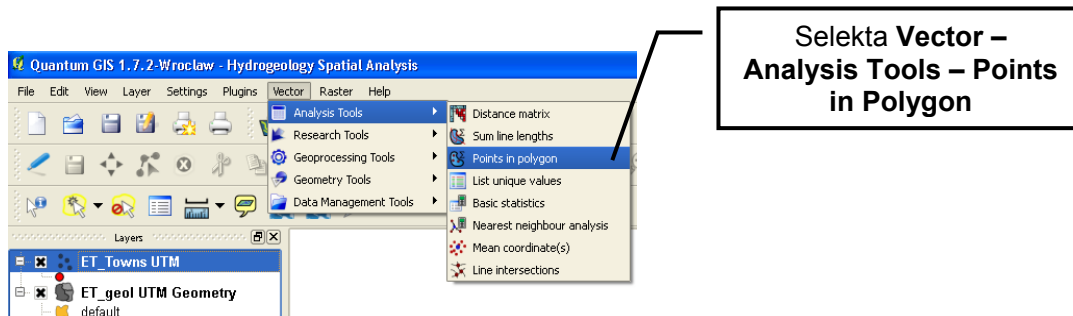
Ba ezersisiu ne'e ita-boot sei buka tuir relasaun entre *layer* 2 husi dadus jeografiku – **ET_geol UTM Geometry** (hídrojeolójikál potensíal) no **ET Towns UTM** (sentru populasaun sira).

1. ET_geol UTM Geometry ne'e *load* tiha ona ba iha Quantum GIS. Agora *load vector layer* **ET Towns UTM** ba iha *window* projetu hanesan. *Layer* ne'e mós sei rai iha *folder* C:\Training.
2. Muda simbulu ne'ebé utiliza ba *ET Towns UTM* hodi **lee dot sira** hodi atu fasil haré sira.

Ita bele **haré** relasaun entre hídrojeolójikál potensíal no sidade sira liu-hosi haré iha mapa, maibé ita sei atu halo ne'e fasil para kompriênde, analiza no relatóriu liu-hosi hala'o analiza GIS overlay padraun rua– **point-in-polygon** no **intersect**.

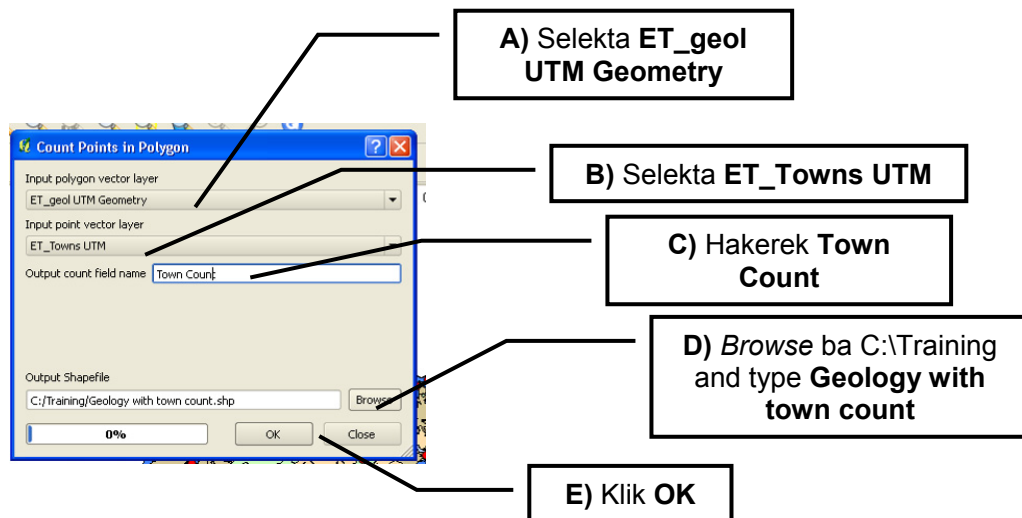
Point-in-polygon sei kalkula oinnusa sentru populasaun barak lokalizadu iha kada ida husi unidade mapeamentu jeolójikál 2,370. Ida ne'e sei rejistu dadus iha *field* foun iha *attribute table* ba ET_geol UTM Geometry.

3. Husi *main menu bar* iha *main window* Quantum GIS, selekta **Vector – Analysis Tools – Points in polygon**.



4. Iha Count Points iha *window* Polygon, selekta **ET_geol UTM Geometry** hanesan *Input polygon vector layer*, selekta **ET_Towns UTM** hanesan *Input point vector layer*, no hakerek **Town Count** hanesan *Output count field name*.

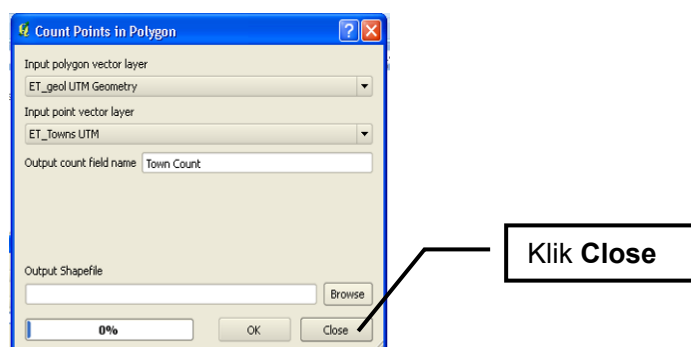
5. Prosedimentu ne'e hamosu *shapefile* foun ida, tantu ita-boot presiza atu espesifika naran ida ba ne'e. *Browse* ba C:\Training no hakerek iha *Output Shapefile name* **Geology with town count**



6. Responde **Yes** ba pergunta, *Would you like to add the new layer to the TOC?*

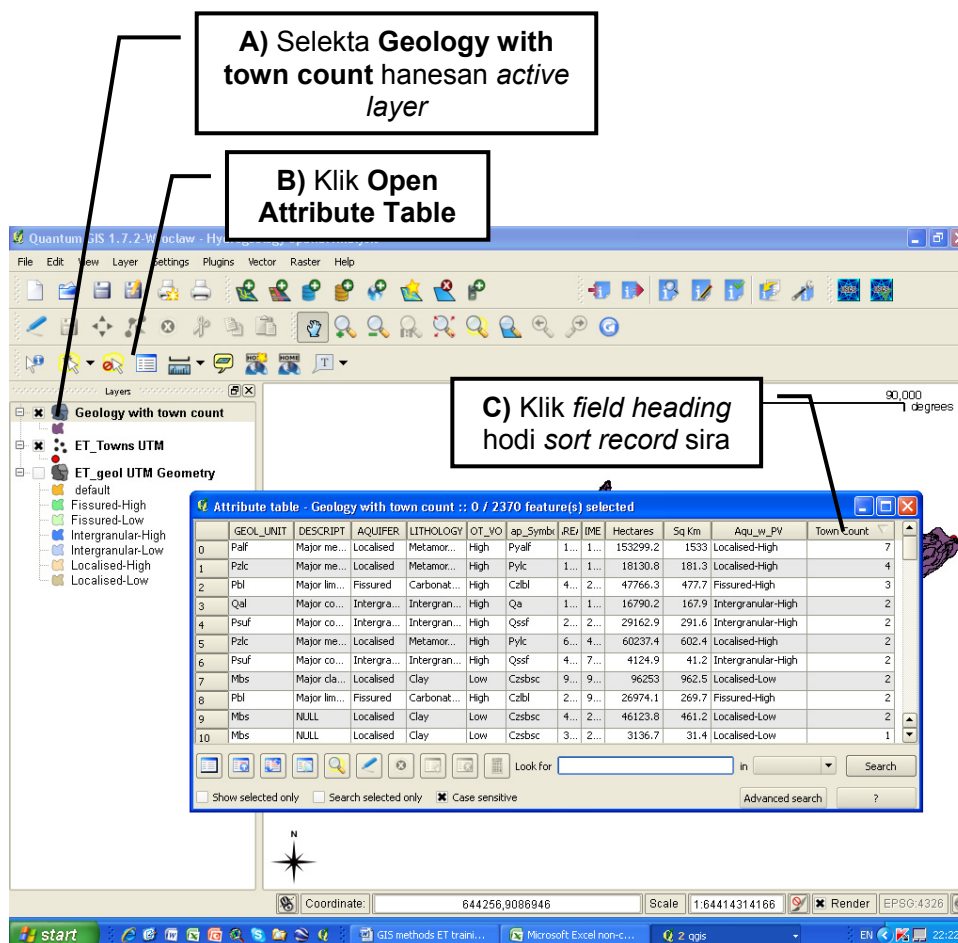


7. Taka window *Count Points in Polygon*



8. *Layer foun, Geology with town count*, sei load ba iha Quantum GIS no hatudu iha panel *Layers*. Selektá *Geology with town count* atu halo ne'e sai *layer* ativa, no hafoin klik **button Open Attribute Table**. *Scroll* too ba rohan liman-loos. *Field* foun ne'ebé mak ita-boot foin kria *appended next* ba *field* Aqu_w_PV.

9. Klik iha *field heading* **Town Count** hodi *sort* baze dadus iha valor sira iha *field* ne'e. Klik dala ida hodi *sort* husi okos ba leten; klik ba dalas rua atu *sort* husi leten hodi tuun.

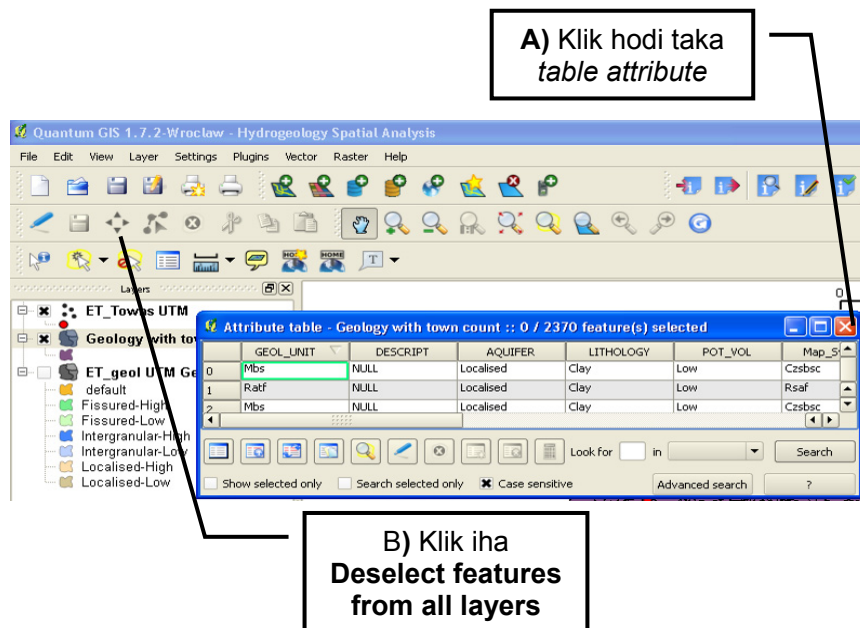


Observasaun no interpretaun:

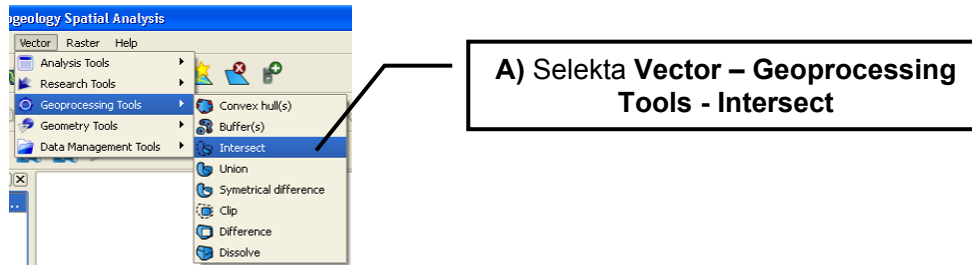
- Husi unidade mapeamentu jeolojikal sanulu ho hela fatin 2 ka liu husi sira, iha 8 mak hetan volume bee-rai-okos potensial as no 2 hetan volume bee-raio-okos kiik.
- Husi tatál unidade mapeamentu jeolojikal 2,370, 51 iha sidade laran. Husi unidade 51, 27 iha volume bee-rai-okos potensial as no 24 iha volume potensial kiik.
- Husi unidade mapeamentu jeolojikal 51 ho besik sidade, 9 mak fizuradu, 22 intergranular no 20 mak lokalizadu.

Intersect sei determina unidade mapeamentu jeolojikal ida ne'ebé mak husi fatin 69 mak lokaliza ba. Ida ne'e sei afixu korespondensia *attribute values* husi ET_geol UTM Geometry ba kada rejistu iha tabela attribute ET Towns UTM.

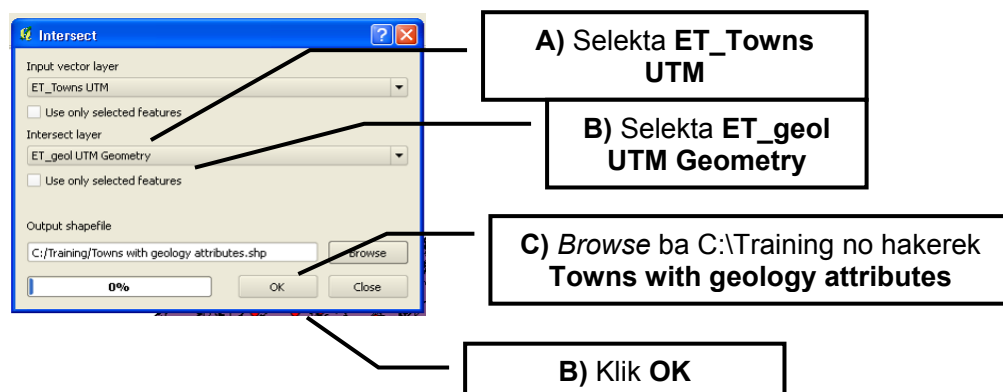
10. Taka Jeolójia ho *town count attribute table* no klik **Deselect features** husi all layers



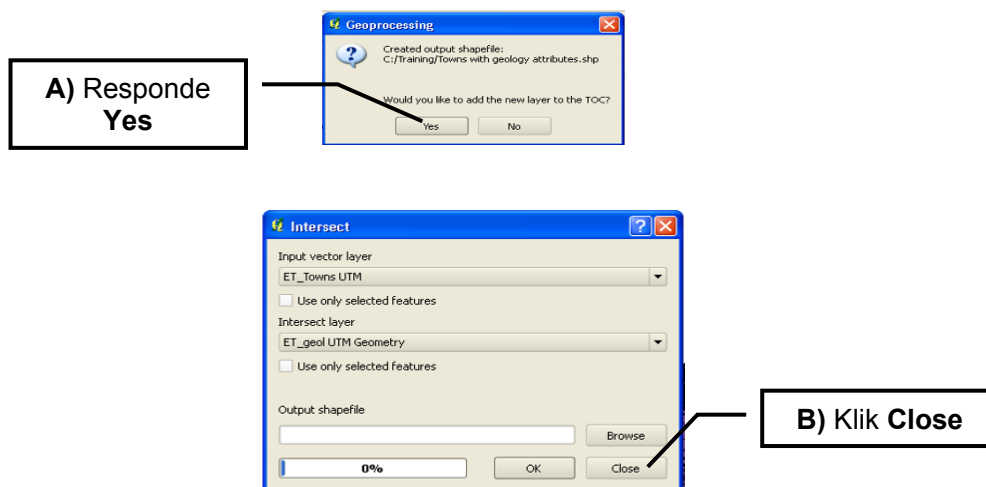
11. Husi *main menu* iha window main Quantum GIS, selekta **Vector – Geoprocessing Tools – Intersect**



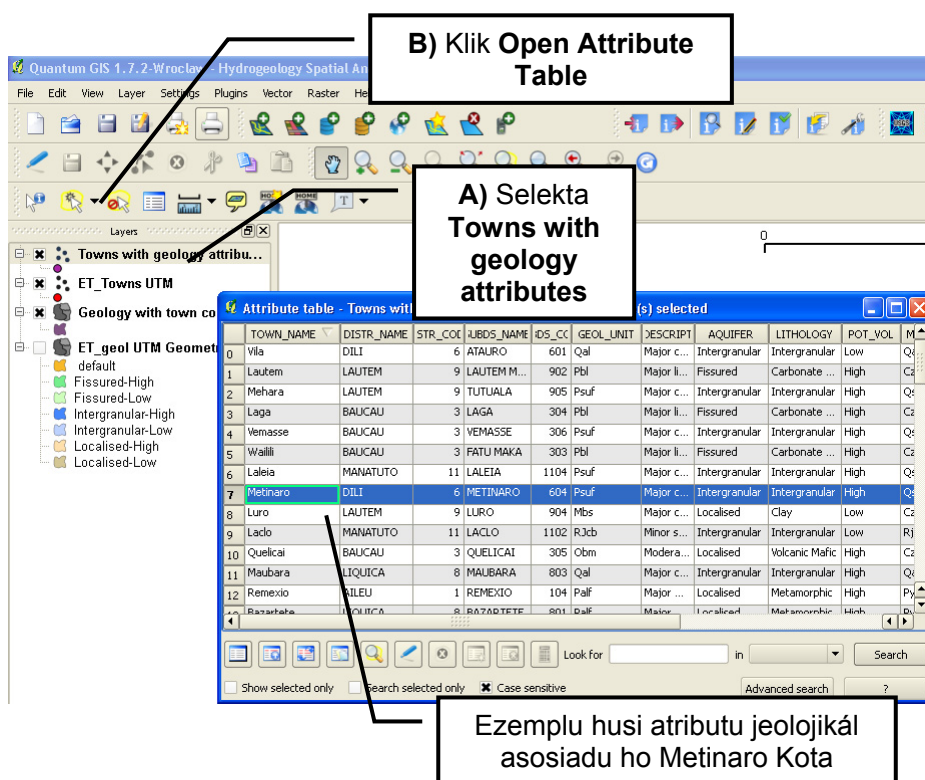
12. Iha *window Intersect*, selekta **ET_Towns UTM** hanesan *layer Input vector* no **ET_geol UTM Geometry** hanesan *layer Intersect*. *Browse* ba **C:\Training** no hakerek **Towns with geology attributes** hanesan nara husi *Output shapefile*.



13. Responde **Yes** ba pergunta, *Would you like to add the new layer to the TOC?* Hafoin **Taka window** Intersect.



14. Layer foun, Towns ho atributu jeolójia, sei *load* ba iha Quantum GIS no hatudu iha panél *Layers*. Selektá **Towns with geology attributes** atu halo *layer* átiu, no hafoin klik *button Open Attribute Table*. *Scroll* ba parte liman-loos. *Field* foun ne'ebé ita-boot foin kria afíksu ba *field Aqu_w_PV*.



Observasaun no Interpretasaun:

- *Layer* foun, **Towns with geology attributes**, iha fiatrua 69, reprezenta Timor-Leste nia sidade Distritu no subdistritu sira. *Attributes* husi unidade mapeamentu jeolojikál aneksa ba kada sidade nia rejistu iha tabela attribute. Ida ne'e signifika katak ita bele agora asesu fasil no apriênde karakterístika rai husi kada nasaun nia ema sira-nia hela fátin, direktamente husi ita *GIS database*. Pur Ezemplu, ita bele haré katak Metinaro Kota ne'e lokalizadu iha depozita aluviál fundamentu (Qssf) no ne'ebé mak iha aquíferu intergranulár ho potenciál ba volume bee-rai-okos ás.
- Husi sidade 69, **43** mak iha unidade jeolojikál ho volume bee-rai-okos potenciál **ás** no **26** mak unidade jeolojikál ho volume bee-rai-okos potenciál kiik.
- Barak husi sidade boboot sira iha nasaun ne'e – Dili, Baucau, Maliana, Los Palos, Gleno, Suai no Aileu – mak iha unidade jeolojikál ho volume bee-rai-okos potenciál ás.
- Sidade boboot sira ne'eb'e mak iha unidade jeolojikál ho volume bee-rai-okos potenciál kiik inklui Viqueque, Manatuto, Ainaro, no Maubisse. Tan sira-nia populasauun aumenta, sidade sira hanesan ne'e bele kauza preokupasaun kona-bá atu responde sira-nia nesesidade ba bee iha futuru.

Liu-hosi analiza espasiál ita bele kria daduskoletanea foun rua ne'ebé mak informativu, fasil atu hetan asesu no bele manipula, no tau iha estrutura ne'ebé mak halo sira sai rekursu importante ba halo peskiza, analiza no relatóri.

Ida ne'e halo kompleta ona analiza espasiál. Ita sei muda ita-nia atensaun ba *metadata*.

5 Metadata

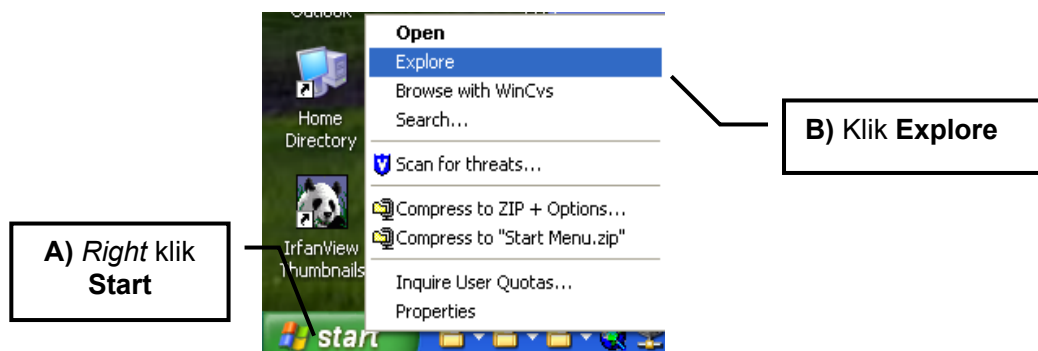
Objetivu husi ezersisiu ne'e mak atu a) hatudu ba ita-boot oinnusa atu *expand* Quantum GIS nia funcionalidade liu-hosi instala jestaun metadata *plug-in*, b) esplika ba ita saida mak metadata ne'e no tansa mak nia importante; no c) fó ba ita-boot oportunidade atu hatama no asesu ba ezemplu simples balun husi *metadata*. Ezersisiu ida ne'e hanesan ezersisiu baziku liu ona ba konseitu *metadata*. Ida ne'e la posível durante kursu treinamentu badak ida ne'e atu fó ba ita-boot ho metadata ne'ebé komprehensivu no loloos ba dadus jeografiku ne'ebé mak ita utiliza. Tempu limitadu, *dataset* jeralmente oitoan liu mak dokumenta, no iha kazu barak ita siplesmente la hatene provenansia husi dadus sira ne'ebé mak ita utiliza.

Iha nia forma orijinal, dadus fó ba ita-boot iha treinamentu ne'e la iha aneksu metadata. Iha etapa sira tuir-mai, ita sei haturu ba ita-boot oinnusa atu hatama metadata utza *Metatools plug-in* ba Quantum GIS. Padraun FGDC (Komisaun Federál Dadus Jeografiku) sei atu bele utiliza.

5.1 INSTALA METATOOLS PLUGIN

Atu instala *plug-in* ita-boot presiza atu kopia *folde metatools* (lokaliza iha *folder training*) ba iha *QGIS install directory*.

1. Iha *Window Desktop*, right klik iha *button Start* no klik **Explore**.

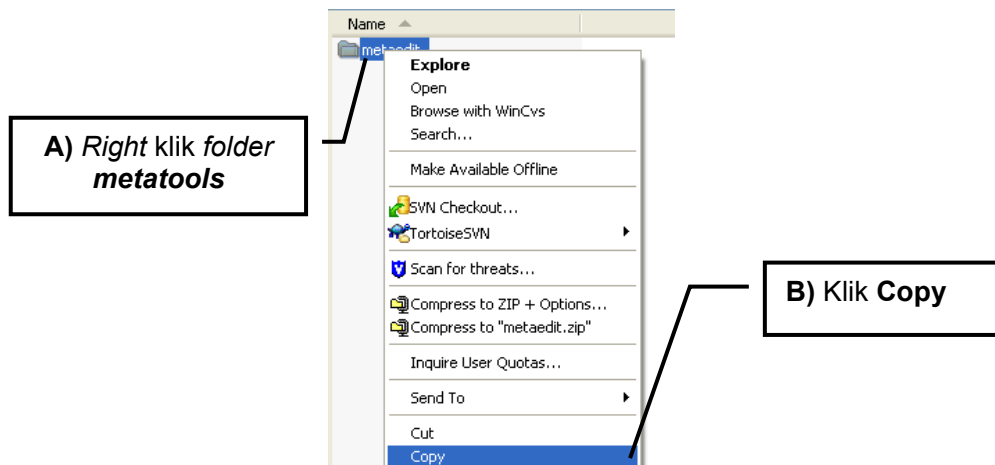


2. Iha *window* ne'ebe nakloke, naviga ba iha *folder Training* nia fatin no ba iha *folder plugins*.

Name	Size	Type	Date
plugins		File Folder	17/11
ET_Geol.dbf	1,151 KB	DBF File	7/11/11
ET_Geol.prj	1 KB	PRJ File	3/11/11
ET_Geol.sbn	24 KB	SBN File	3/11/11

Iha *folde plugins* nia laran iha *folder* ida naran **Metatools**.

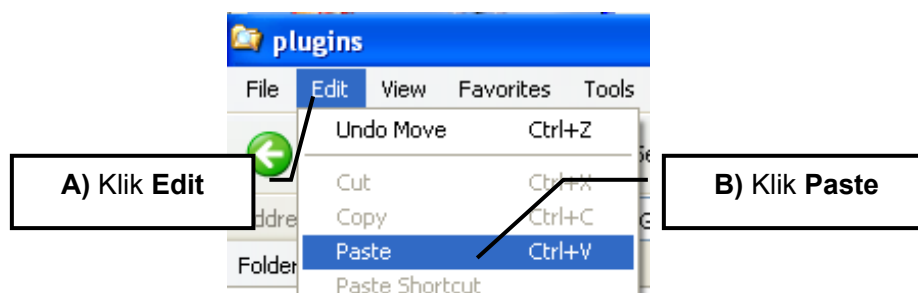
3. *Right* klik *folder Metatools* no klik **Copy**.



4. Navega ba direktoria;

C:\Program Files\Quantum GIS Wroclaw\apps\qgis\python\plugins

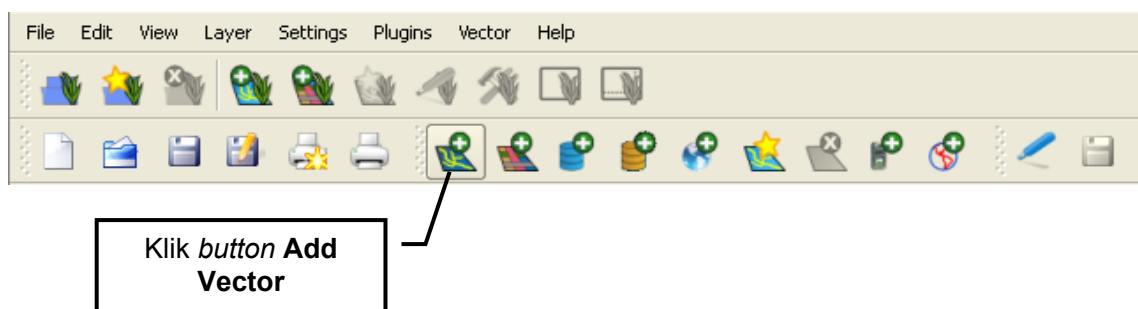
5. *Paste* *folder Metatools* ba iha direktoria liu-hosi klik *menu Edit > Paste*.



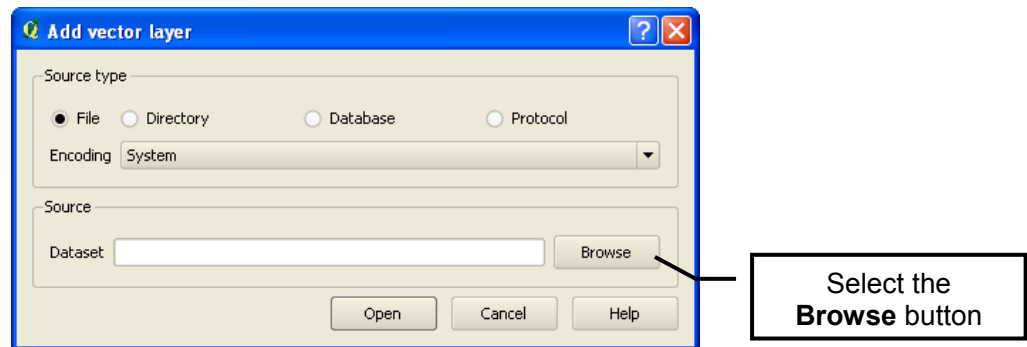
Folder **Metatools** tenke nakloke ona iha *folder plugins*.

6. **Hahú Quantum GIS**

7. Klik *button Add Vector Layer*.

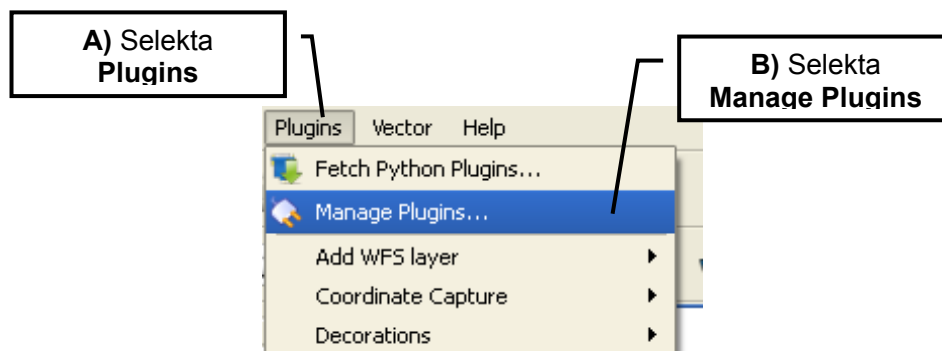


8. Klik *button* **Browse** no naviga ba **C:\Training folder**.



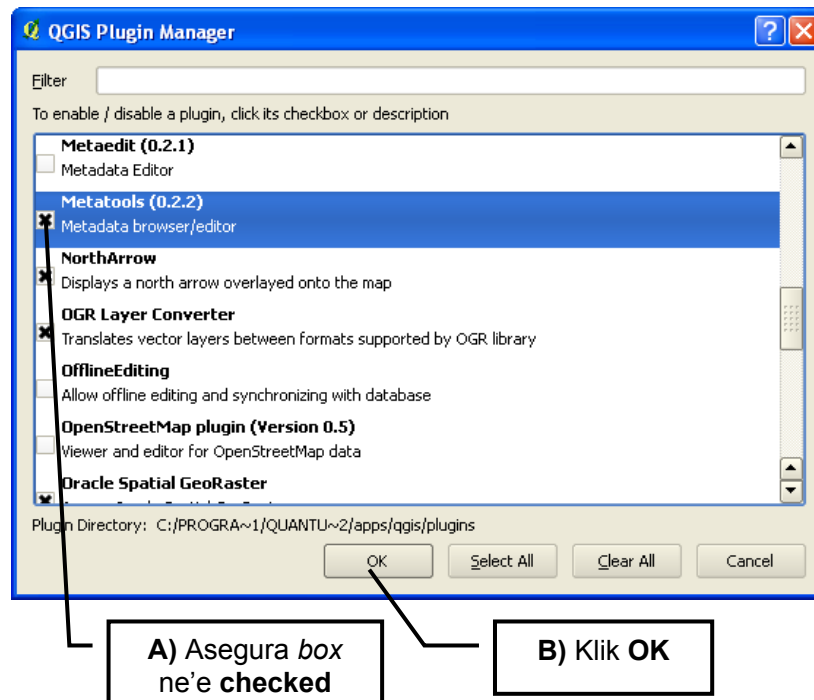
9. Selektá *jeolójia shape file* (**ET_geol UTM Geometry.shp**) no klik **Open**.

10. Husi *main menu*, selektá **Plugins - Manage Plugins**

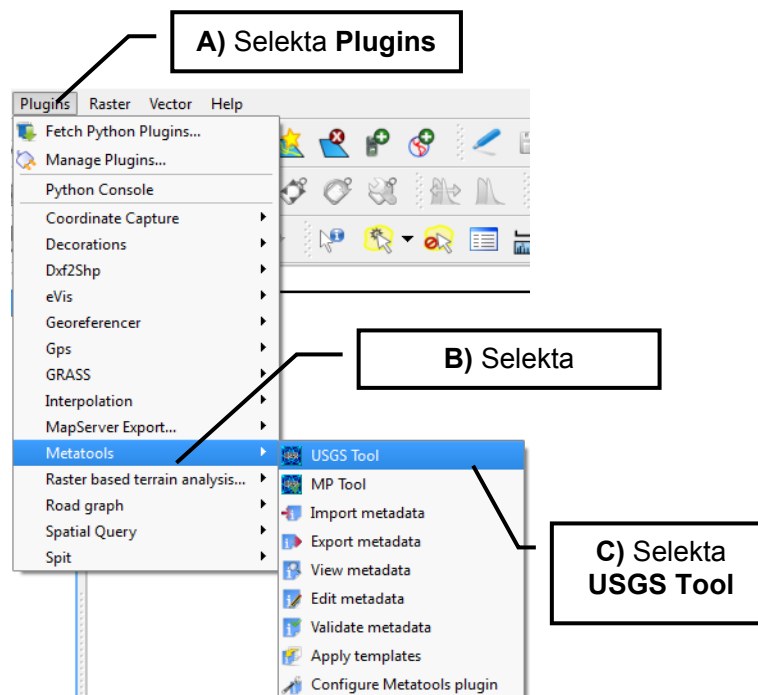


11. Iha *window* **QGIS Plugin Manager**, klik box besik **Metatools (0.2.2)**.

12. Klik OK.



13. Husi main menu, selekta Plugins - Metatools - USGS Tool



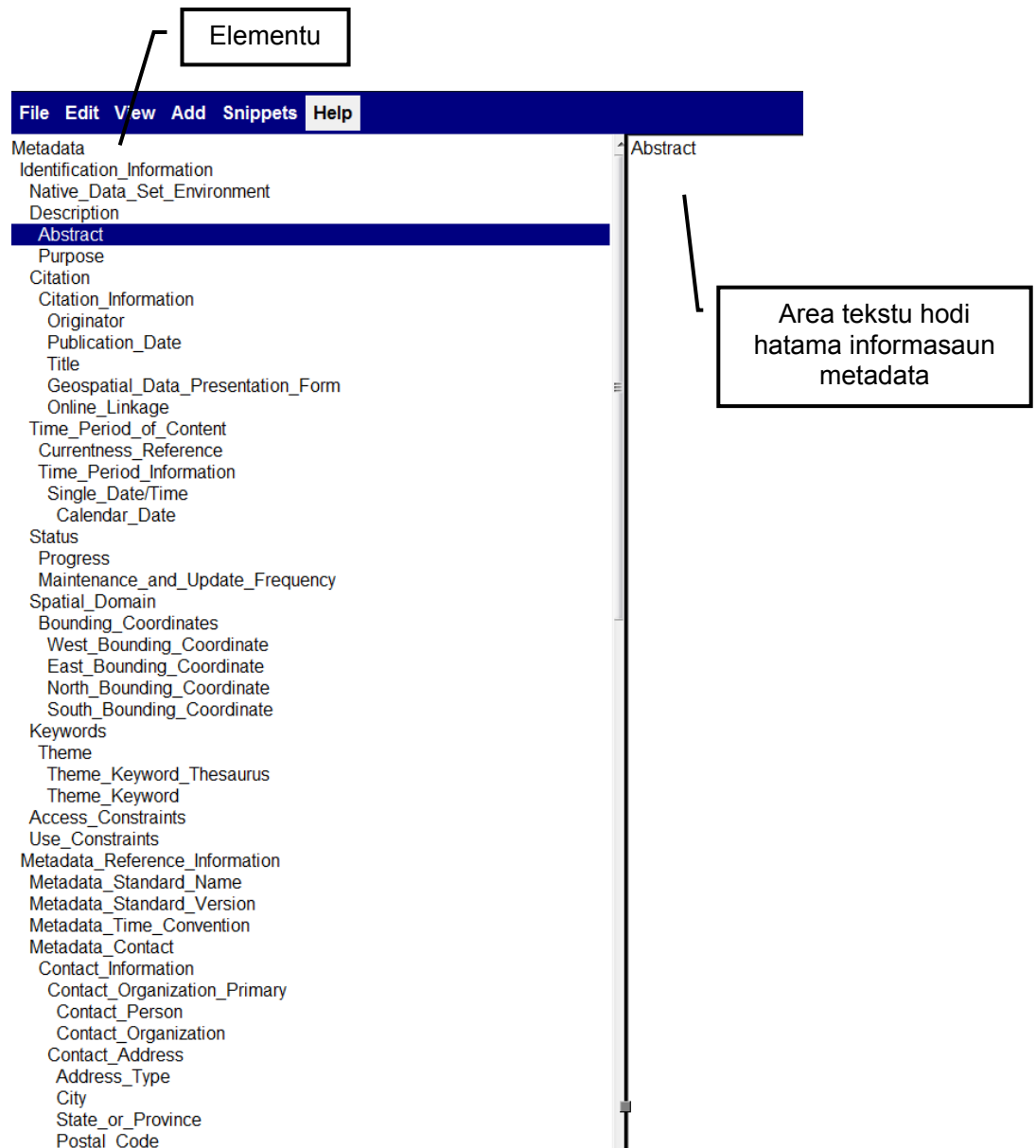
5.2 HATAMA METADATA

Window **USGS** sei nakloke. Iha ne'e mak fatin ba ita atu hatama ita-nia metadata.

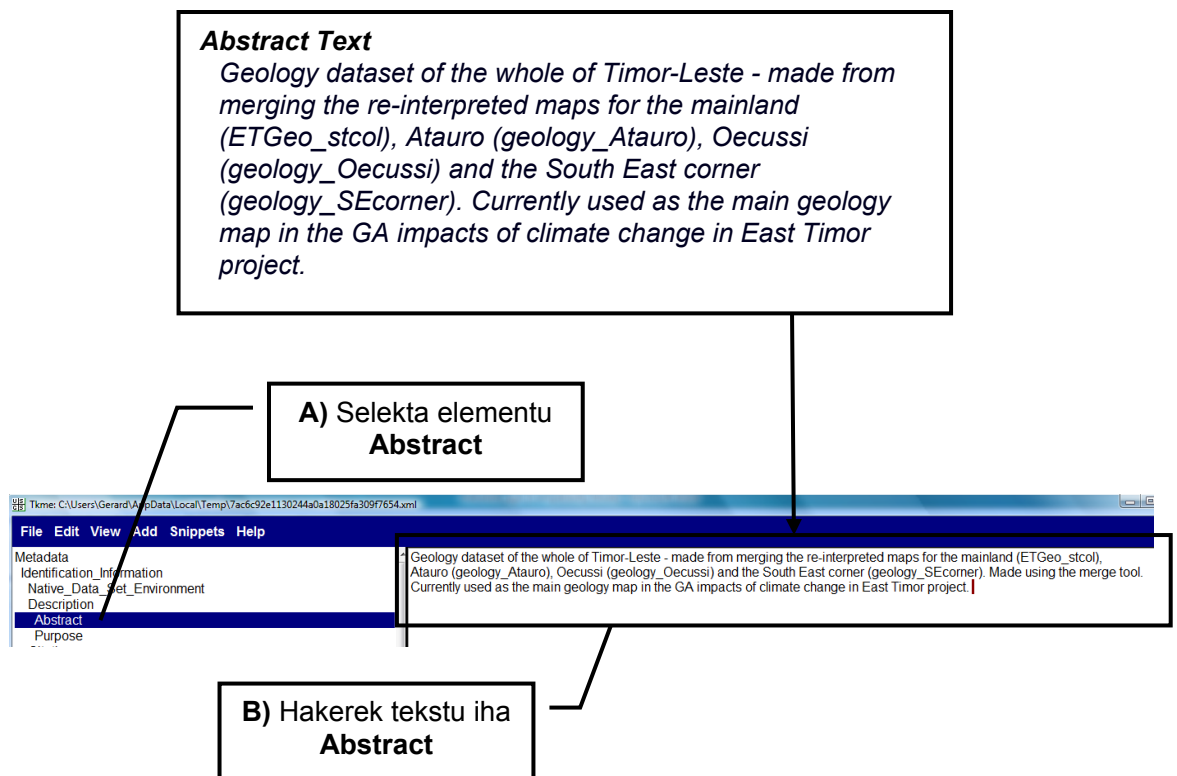
Panel iha liman-karuk kontein element ka kategoria metadata diferente. Atu popula element ida, simplesmente selekta nia no hakerek informasaun iha panél liman-los.

Ba ezersisiu iha treinamentu ne'e ita sei atualiza element sira;

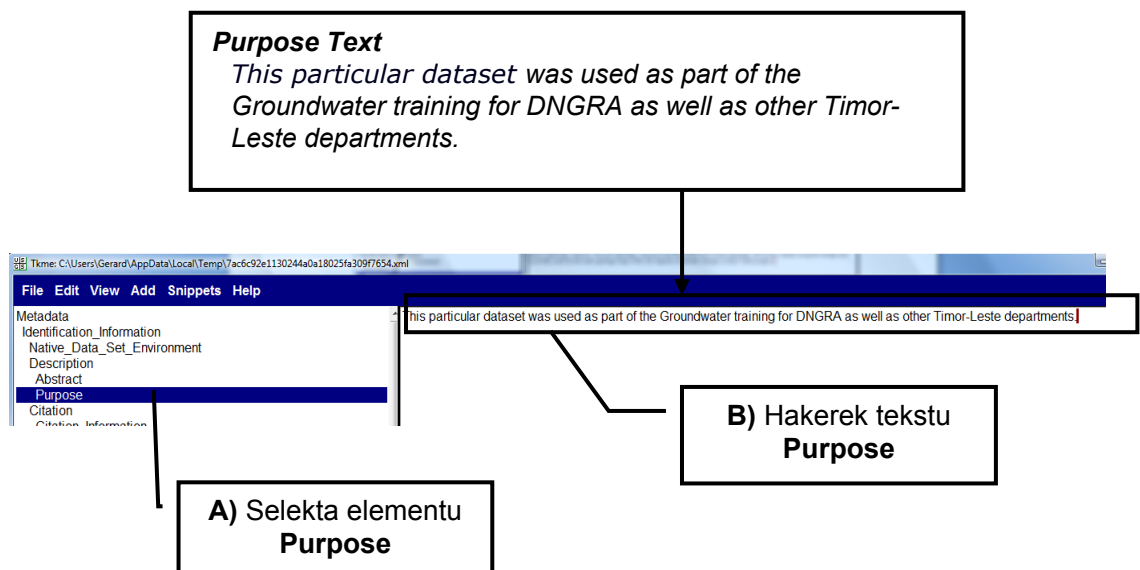
- Abstract
- Purpose
- Use_constraints
- Contact_person
- Contact_organization
- Address_type
- City
- State_or_Province
- Postal_Code
- Contact_Voice_Telephone



1. Klik iha elementu **Abstract** Element.
2. Iha panél liman-loos kakerek tesktu hanesan tuir-mai.

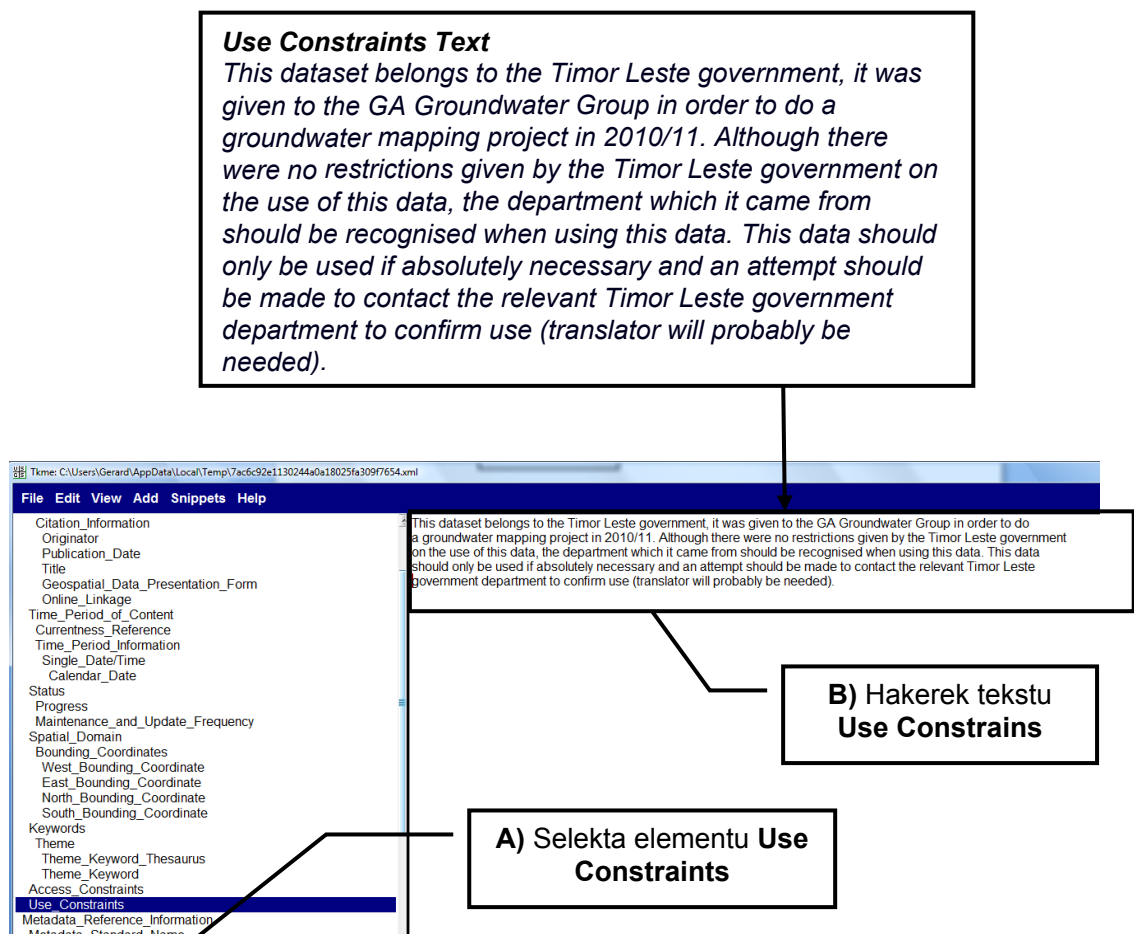


3. Klik iha Elementu **Purpose**.
4. Iha panél liman-los hakerek tekstu hanesan tuirmai.



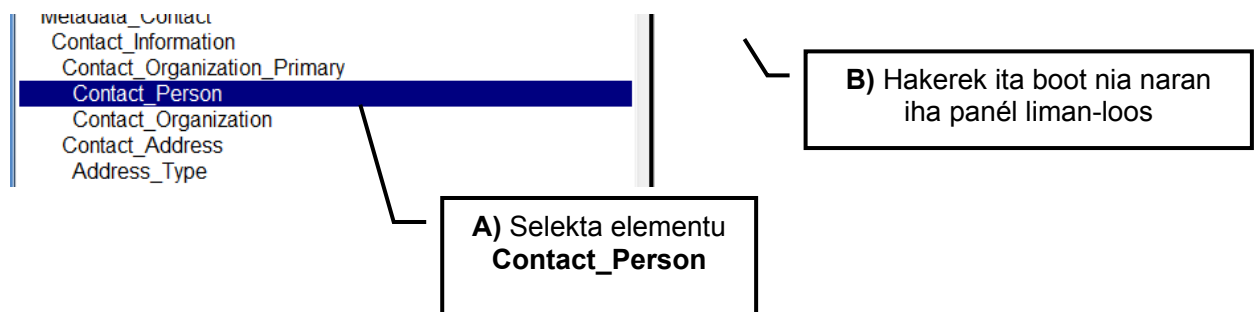
5. Klik iha elementu **Use Constraints**.

6. Iha panel liman-loos hakerek tekstu sira hanesan tuir-mai.



7. Klik iha element **Contact Person**.

8. Iha panel liman-loos hakerek ita-boot nia naran hanesan *contact person*.

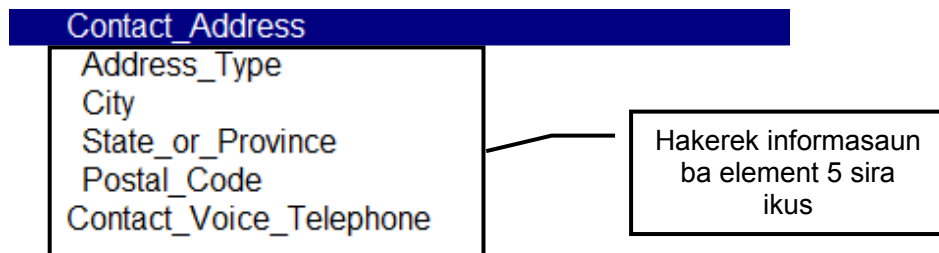


9. Klik iha elementu **Contact_Organization**

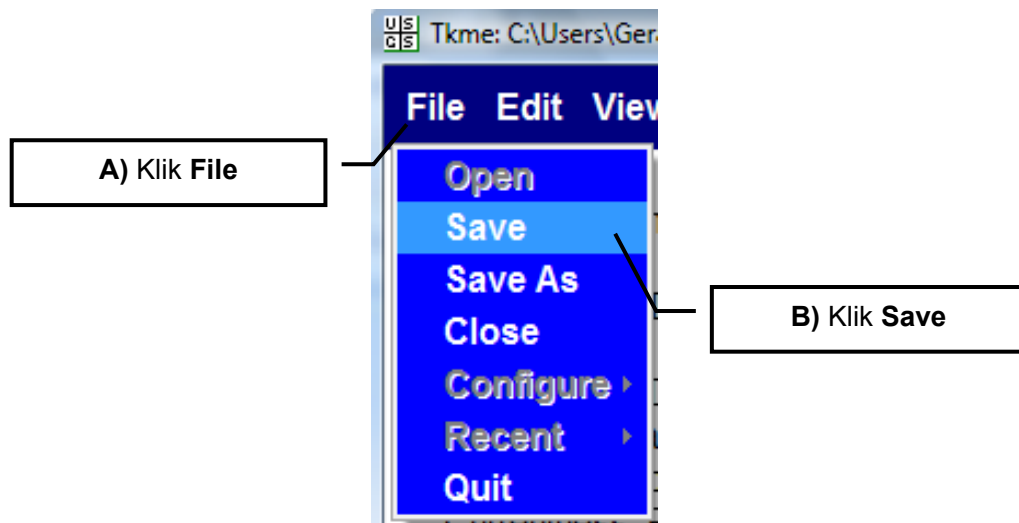
10. Iha panel liman-loos **hakerek naran organizaun** ita-boot nian.

11. Kontinua prosesu ne'e ba element 5 ikus;

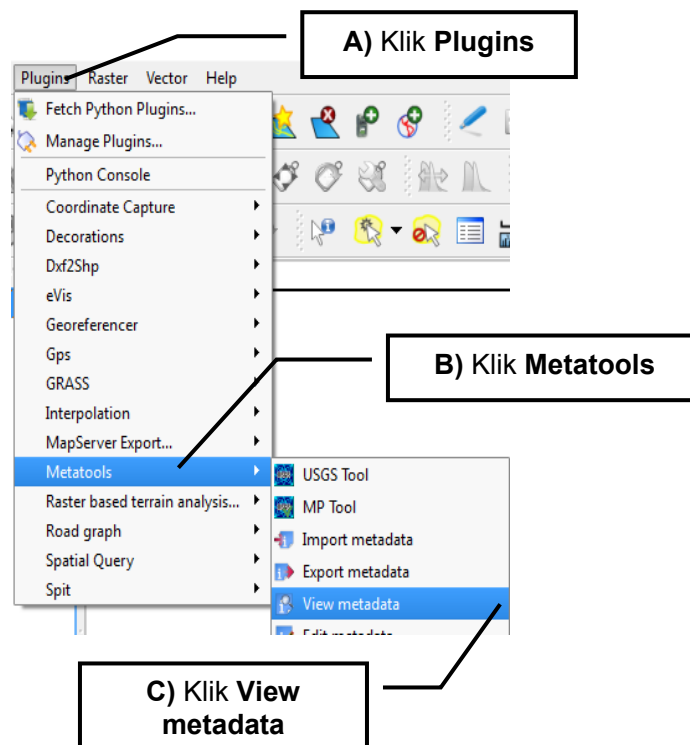
- Address type
- City
- State_or_Province
- Postal_Code
- Contact_Voice_Telephone



12. Wainhira ita-boot hatama ona informasaun ba elementu sira iha leten, iha parte kuaruk leten klik *menu* **File > Save** hodi *save* ita-boot nia metadata.



13. Iha QGIS klik *menu Plugins > Metatools > View metadata*.



Window viewer metadata sei nakloke hatudu metadata ne'ebé ita hatama ona.

Ita-boot presiza atu klik iha kada *heading* hodi haluan sira no haré informasaun sira iha okos.



Ita-boot hatama hotu ona sampel metadata balun. Frankamente wainhira ita-boot iha informasaun barak ita bele koko no atuliza elementu sira selseluk wainhira posível.

14. Taka *viewer metadata* no taka QGIS.

ANÉXU I – GUIA KONVERSAUN SIMBULU MAPA JEOLÓJIA

MAP_SYMBOL	GEOL UNIT ORIJINÁL
Czb	Qvba
Czbbf	Obm
Czbmf	Tmm
Czf	Qvd
Czf2	Ted
Czlal	1a
Czlbl	Pbl
Czlcl	Mcl
Czldl	Edl
Czllgl	Mlgl
Czlpl	Ppl
Czs	W
Czsag	Plag
Czsbsc	Mbs
Czsdc	Pldc
Czssbc	Plsc
Czsvf	Mvf
KCzssf	KTsf
Klbl	Kbl
Kswbf	Kwf
Pe	Ub
Pealf	Palf>v
PJewlf	RJwf>s
Plmf	Pmf
Pmalf	Palf>m
PRbmf	TRmv
PRlmf	TRPm
Ptalf	Palf>a

MAP_SYMBOL	GEOL UNIT ORIJINÁL
Ptmalf	Palf>as
Pyalf	Palf
Pyatf	Patf
Pycf	Pcf
Pylc	Pzlc
Pysalf	Palf>qs
Qa	Qal
Qa2	Qt
Qdc	Qb
Qs	Qa
Qssf	Psuf
Qt	Ql
RJb	RJlb>v
RJewlf	RJwf>s
RJl	RJlb>l
RJl2	RJlb>lb
RJls	RJlb
RJrwlf	RJwf>hp
RJs	RJcb
RJswlf	RJwf
RJszwlf	Shear
RJtwlf	RJwf>p
Rlaf	Raf
Rsaf	Ratf

ANÉXU II – PADRAUN VALOR RGB SIRA BA SIMBULU JEOLÓJIA & HÍDROJEOLÓJIA

SIMBULU JEOLÓJIA	R	G	B
Czb	255	110	10
Czbbf	255	143	46
Czbmf	255	161	102
Czf	255	102	142
Czf2	255	51	104
Czlal	208	246	255
Czlbl	211	235	251
Czlcl	188	217	235
Czldl	188	221	255
Czllgl	233	243	248
Czlpl	223	246	255
Czs	255	255	160
Czsag	255	228	179
Czsbsc	249	229	153
Czsdc	255	255	208
Czssbc	255	241	179
Czsvf	237	215	153
KCzssf	171	255	194
Klbl	144	204	245
Kswbf	173	255	229
PJewlf	169	133	255
PRbmf	255	60	10
PRlmf	77	165	221
Pe	184	61	255
Pealf	148	82	255
Plmf	33	143	212
Pmalf	183	163	102
Ptalf	219	209	179
Ptmalf	214	210	166
Pyalf	186	181	133
Pyatf	174	150	116

SIMBULU JEOLÓJIA	R	G	B
Pycf	198	180	156
Pylc	195	158	128
Pysalf	174	140	128
Qa	255	255	231
Qa2	245	255	230
Qdc	255	255	42
Qs	255	246	230
Qssf	252	248	230
Qt	240	255	230
RJb	255	80	35
RJewlf	201	169	255
RJI	144	193	222
RJI2	122	188	229
RJls	100	184	241
RJrwlf	223	195	195
RJs	94	255	179
RJswlf	102	227	186
RJswwlf	114	255	181
RJtwlf	211	175	167
Rlaf	100	168	209
Rsaf	74	255	171

SIMBULU HÍDROJEOLÓJIA	R	G	B
Fizuradu - Luan	117	240	140
Fizuradu - Klot	207	255	189
Intergranulár - Boot	69	135	255
Intergranulár - Kiik	190	210	255
Lokalizadu – Ás	255	227	171
Lokalizadu - Tuun	214	199	150