Geomorphic Indicator Ranking System (GIR)
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This document is a reference tool for consistent labeling of geomorphic landforms in QGIS.

Please note that the input is case sensitive, and everything must be capitalized when entered. If the symbol is entered correctly, it will display as a white circle. If the symbol is not entered correctly, the feature will plot as a 'red star' in QGIS as shown in the images below.

Remember: Map every occurrence of the feature along the fault trace. The same feature may appear more than once along a single segment (e.g. 3 beheaded drainages within 1-km)

SS (strike-slip), N (normal), and R (reverse) are prefixes to the feature symbology to indicate what type of faulting cause the feature to appear on the surface

Strike-Slip Geomorphic Indicator Ranking

Feature	Rank	Description	Justification as fault indicator
Offset Terraces (SSOT)	4	Laterally and obliquely offset fluvial terraces	Coseismic slip offsets terraces and terrace risers
Offset drainage channel (SSODC)	4	A channel with two ~90° bends that is otherwise straight	Offset caused by differential translation of a stream by a fault
Offset or cut Alluvial Fan Complex (SSAFC)	4	Series of fan-shaped alluvium deposits that are offset or cut by a fault	Faults can cut across and offset alluvial fans of different ages
Single Offset or cut Alluvial fan (SSAF)	3	A single fan-shaped alluvium deposit that is offset or cut by a fault	Faults can cut across and offset a single alluvial fan unit
Bedrock Scarp (SSBSP)	3	A linear cliff-like slope or face that breaks a bedrock unit	Produced by strike-slip faulting or lateral offset of sloping surfaces
Quaternary Scarp (SSQSP)	3	A linear cliff-like slope or face that breaks a quaternary unit	Produced by strike-slip faulting or lateral offset of sloping surface

Beheaded Drainages (SSBD)	3	Up- and down-stream channels are separated.	Fault-offset beheads down-stream channel
Deflected Stream (SSDS)	2	Diverted stream that runs parallel to the fault. Smaller than offset drainage and can be diverted at angles less than 90°	Fault capture or blockage alters the stream course
Depression/Sag Pond (SSDSP)	2	Low elevation between strike-slip or normal faults, sometimes filled with water	Produced by extensional bends or stepovers along strike-slip faults
Shutter ridge (SSSR)	2	A ridge that blocks or diverts a drainage	The ridge was translated by faulting
Surface Unit Offset (SSSUO)	2	The original deposition order is obscured	Faulting offsets units
Spring (SSSPR)	1	Upwelling of subsurface water	Caused by faulting that disrupts the groundwater and bedrock
Bench (SSBN)	1	A long, relatively narrow strip of relatively level or gently inclined land that is bounded by distinctly steeper slopes above and below it	Faults can produce linear, inclined land.
Fissures (SSFS)	1	Subvertical, downward-tapering zones bounded by sharp fractures, and filled with younger sediments. Infrequently preserved well enough to see in satellite imagery or DEM, DTM, DSM.	Form as tension cracks that opened coseismically
Pressure ridge (SSPR)	1	A linear or sinuous broken bulge on the surface	Form where lateral motions on a curving fault force bedrock or sediment into a smaller space, pushing them upward

Normal Geomorphic Indicator Ranking

Feature	Rank	Description	Justification as fault indicator
Triangular facet (NTF)	4	A broad base and a upward pointing apex	Often formed by erosion of the fault plane along range fronts
Beheaded Drainages (NBD)	3	Up- and down-stream channels are separated.	Fault-offset beheads down-stream channel
Offset or cut Alluvial Fan Complex (NAFC)	4	Series of fan-shaped alluvium deposits that are offset or cut by a fault	Faults can cut across and offset alluvial fans of different ages
Quaternary Scarp (NQSP)	3	A linear cliff-like slope or face that breaks a quaternary unit.	Produced by normal faulting or lateral offset of sloping surfaces
Bedrock Scarp (NBSP)	3	A linear cliff-like slope or face that breaks a bedrock unit.	Produced by normal faulting or lateral offset of sloping surfaces
Horst and grabens (NHG)	3	Topography consisting of alternating raised and lowered fault blocks. Large-scale feature.	Features are created by normal faulting and rifting caused by crustal extension
Single Offset or cut Alluvial fan (NAF)	3	A single fan-shaped alluvium deposit that is offset or cut by a fault	Faults can cut across and offset a single alluvial fan unit
Unit Offset (NOF)	3	Offset of bedrock or geomorphic units	Faulting is often responsible for offset
Over-steepened range front (NORF)	3	Dramatic change in slope near mountain base	Likely due to faulting when present along large topographic features
Depression/Sag Pond (NDSP)	2	Low elevation between strike-slip or normal faults, sometimes filled with water	Produced by extensional bends or normal faults.
Surface Unit Offset (NSUO)	2	The original deposition order is obscured	Faulting offsets units

Fissures (NFS)	1	Subvertical, downward-tapering zones bounded by sharp fractures, and filled with younger sediments. Infrequently preserved well enough to see in satellite imagery or DEM, DTM, DSM.	Form as tension cracks that opened coseismically
Spring (NSPR)	1	Upwelling of subsurface water	Caused by faulting that disrupts the groundwater and bedrock
Sackung (NSG)	1	Deep-seated gravitational spreading of mountain ridges and slopes considered a 'half-landslide'	Spreading is due to normal faulting that is located high on mountain slopes

Reverse Geomorphic Indicator Ranking

Feature	Rank	Description	Justification as fault indicator
Quaternary Scarp (RQSP)	4	A linear cliff-like slope or face that breaks a quaternary unit	Produced by dip-slip faulting or lateral offset of sloping surfaces
Bedrock Scarp (RBSP)	4	A linear cliff-like slope or face that breaks a bedrock unit	Produced by dip-slip faulting or lateral offset of sloping surfaces
Offset or cut Alluvial Fan Complex (RAFC)	4	Series of fan-shaped alluvium deposits that are offset or cut by a fault	Faults can cut across and offset alluvial fans of different ages
Over-steepened range front (RORF)	3	Dramatic change in slope near mountain base	Likely due to faulting when present along large topographic features
Single Offset or cut Alluvial fan (RAF)	3	A single fan-shaped alluvium deposit that is offset or cut by a fault	Faults can cut across and offset a single alluvial fan unit
Triangular facet (RTF)	3	A broad base and an upward pointing apex	Often formed by erosion of the fault plane along range fronts
Footwall Pond (RFP)	2	Pooling of water/ sediment along the footwall of the fault	Ponding occurs in the footwall due to relative subsidence

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Topographic Hills (RTH)	2	Half-cylindrical-shaped hills	Blind reverse faults create sinuous topography
Surface Unit Offset (RSUO)	2	The original deposition order is obscured	Faulting offsets units
Fissures (RFS)	1	Subvertical, downward-tapering zones bounded by sharp fractures, and filled with younger sediments. Infrequently preserved well enough to see in satellite imagery or DEM, DTM, DSM.	Form as tension cracks that opened coseismically
Rangefront sinuosity (RRS)	1	Parallel-like strike along the base of a mountain front	Fault plane can drop and mark the rangefront at the fault strike

Modifier Geomorphic Indicator Ranking

Modifiers are meant to be mapped only if they occur in conjunction with other, higher ranking geomorphic indicator features that are mapped along the proposed fault location.

Feature	Rank	Description	Justification as modifier
Alignment (ALMT)	+1	The repeated appearance of a geomorphic indicator feature within ~1 km	Locally repeated and offset features may be due to faulting
Cross cut (CCT)	+1	A lineation or other feature that cuts across the landscape	Faulting is responsible for some cross-cutting relationships
General Pond (GP)	+1	Small body of water formed apart from anthropogenic alteration	Ponds in alignment can help locate fault even if it is not a sag pond or depression.
Saddle (SDL)	+1	A depression located along the ridge crest	Due to a dropped hanging wall or differential erosion across a ridge
Vegetation lineament (VL)	+1	Natural lines between high and low vegetation densities.	Can be caused by faulting

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Wineglass canyons (WC)	+1	The cross sectional shape resembles a wine glass. The base is the alluvial fan that slopes down the mountainside	Indicates recent uplift
Landslides (LSP)	+1	Downward movement of sediment or rock	Form from coseismic shaking
Linear Valley/ Drainage (LVD)	+1	Extended linear patterns of streams, rivers, lakes, and valleys	Linear drainages often indicate faulting control.
Lineation in Topography (LT)	+1	Extended linear appearance of the topography on a basemap	Apparent extended lineation can help narrow down faulting features and location
Morphologic elements (ME)	+1	Features such as ridges, slope breaks, troughs.	Increase confidence of faulting
Pirated Chanel (PC)	+1	A channel diverted from its own path and joins a neighboring channel	Fault offset or weaknesses in the bedrock can lead to stream capture
Stream Knickpoint (SK)	+1	Abrupt change in channel slope (i.e., a waterfall)	Faulting or folding causes stream disequilibrium, forming a knickpoint
Anthropogenic Alteration (AA)	-1	Alteration from infrastructure e.g., roads, farming & buildings	Obscures a fault's precise location
Colluvial Cover (CLCR)	-1	Loose and unconsolidated rock on hillslope base	Can obscure evidence of a fault scarp
Erosion (ER)	-1	Sediment and rock are worn away by water and wind	Removes evidence of faulting
Landslides (LSN)	-1	Downward movement of sediment or rock	Cover faulting evidence
Proximity to active water (PAW)	-1	Fault traces located near active water	Water is an erosion agent and can remove the evidence of faulting

If you would like to add your own feature to the GIR shapefile, do the following:
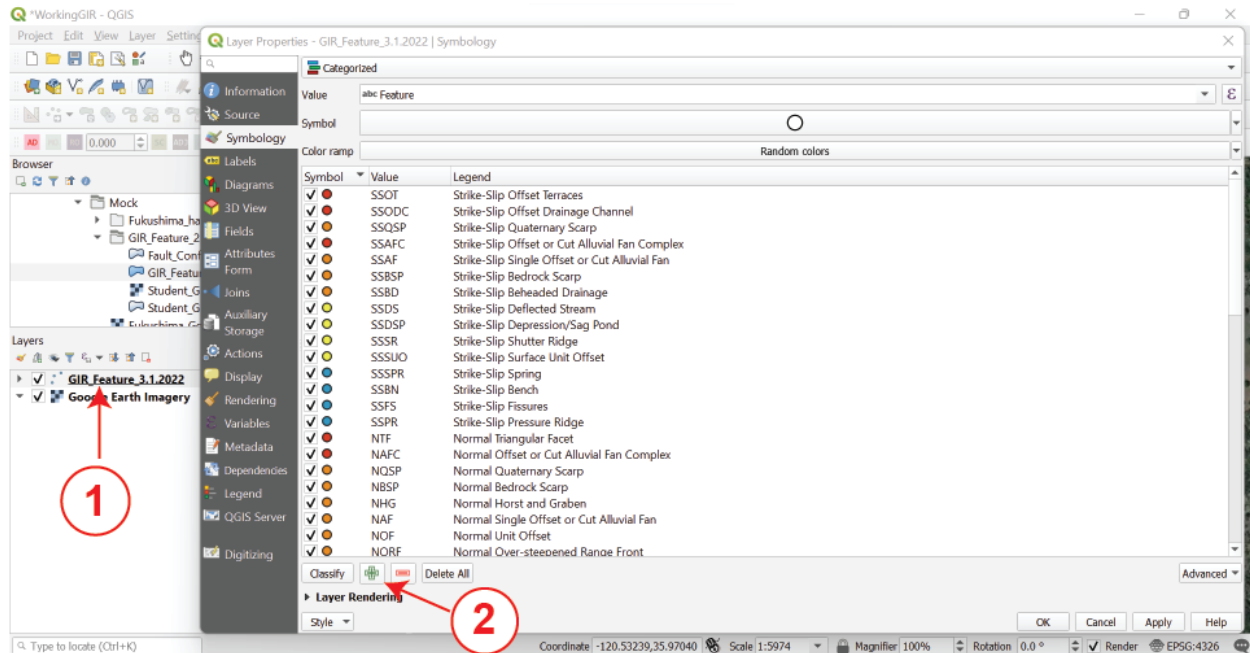
1. Double-click on the GIR_Feature layer and toggle to the symbology tab

2. Click the green (+) button to add a new feature
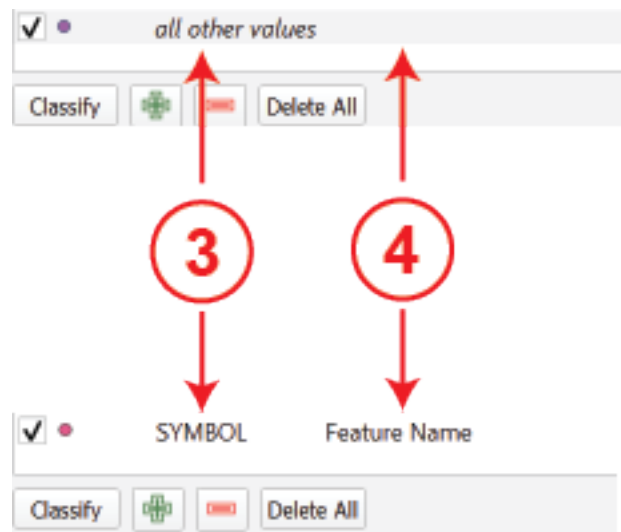
3. Input the symbol for the name of the feature. <mark>Remember, the input must be capitalized and should have prefix (SS, N, R) to indicate the type of faulting</mark>- unless it is a modifier- and a short two to three letter acronym for the feature.

4. Input the full name of the feature
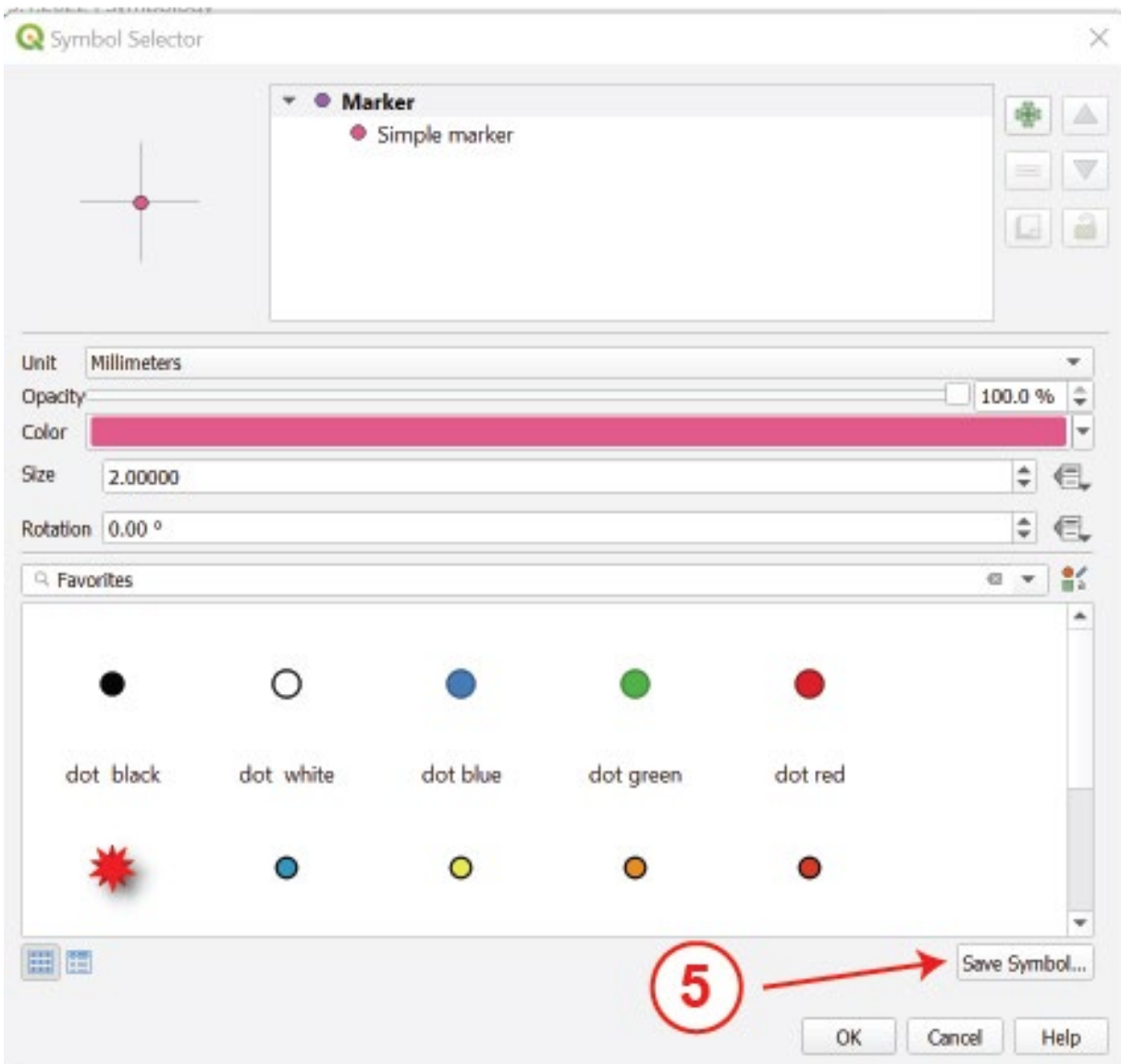
5. Double- click on the 'dot' symbol to open the Symbol Selector to change the symbology. You can try to match the style of the existing features, but an easier way to do this is to toggle to the same window of another feature (ex. SSBD) and click 'Save Symbol'. You can call that feature GIR_Rank3 and it will save the symbol with the color and size for all GIR Rank 3 features.

Save the symbol for the rest of the ranking symbols (Rank 1 – red, Rank 2 – Yellow, Rank 4- blue). Now, when you create a new feature, you can toggle to your now saved symbols for easy access and continuity.

==It will be up to you to decide what ranking you assign a new feature. Use your geologic intuition and knowledge to decide how strong of a feature it is to indicate a fault.==