Georeferencing a Map in QGIS: a Brief Tutorial

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OFWIM 2019 Annual Conference October 6th - 10th, 2019
National Conservation Training Center, Shepherdstown, West Virginia
Knowledge Is Power: Technology to Address Emerging Conservation Challenges

Georeferencing a Map in QGIS

Locational information is often collected on paper maps while in the field, or sometimes gleaned from other hardcopy map sources (such as printed maps in historical reports). This information can be captured and used in geographic information systems by scanning the maps, mosaicing multiple scans if necessary, and then 'geo-referencing' the digital images for use with other existing GIS layers. This brief tutorial outlines the steps to be performed when doing this procedure in Quantum GIS.

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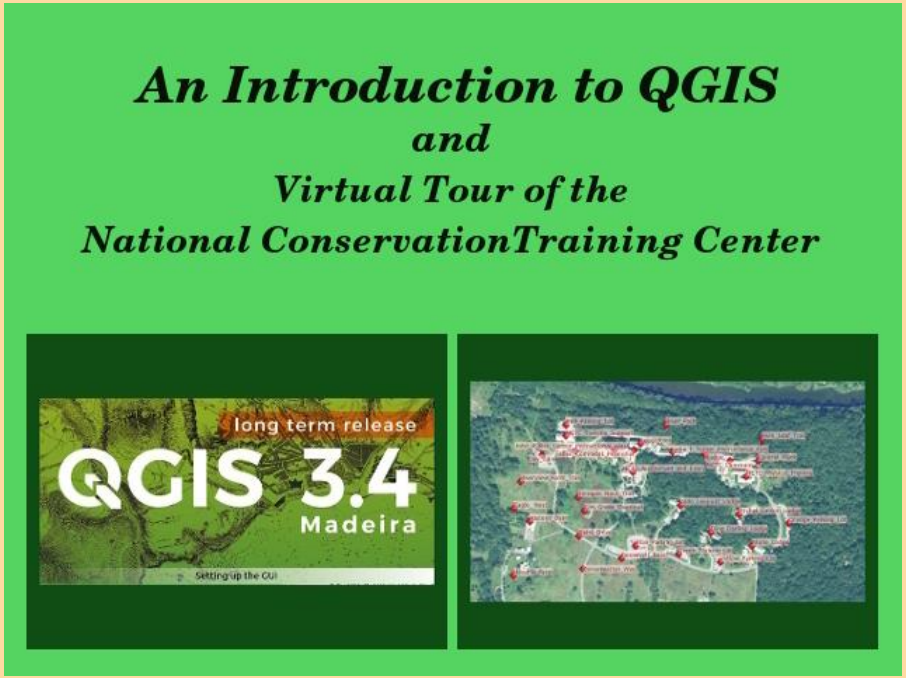
Georeferencing a Map in QGIS



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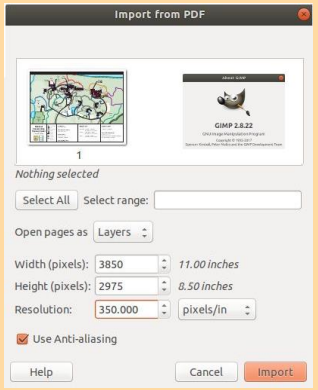
Georeferencing a Map in QGIS

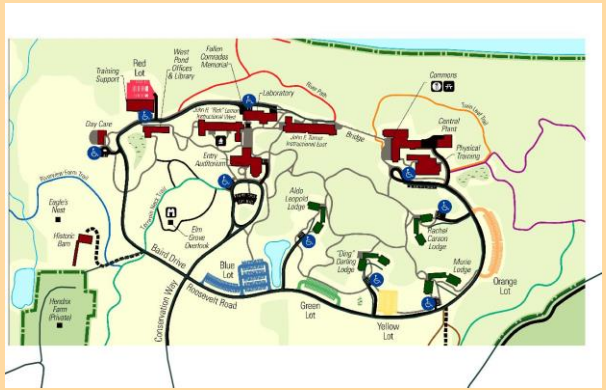
*** Capture the map to an image file (JPG, TIF, etc.)**
*** Load reference GIS files (target layers) to QGIS**
*** Select common geographic 'fit points' between the source image and the target map or image**
*** Digitize the target fit points to a new GIS file in QGIS (eg – a shapefile)**
*** Extract the target fit point coordinates to a text file (exported .shp file to .gml file)**
*** Run the 'GDAL Georeferencer' plugin – in QGIS**
*** Load the newly georeferenced map to the QGIS Project / Set CRS**

Georeferencing a Map in QGIS

*** Capture the map to a image file (JPG, TIF, etc.)**

Converted USFWS Campus Map from PDF to a JPG with GIMP:
https://training.fws.gov/campus/maps/NCTC-Campus-Map.pdf





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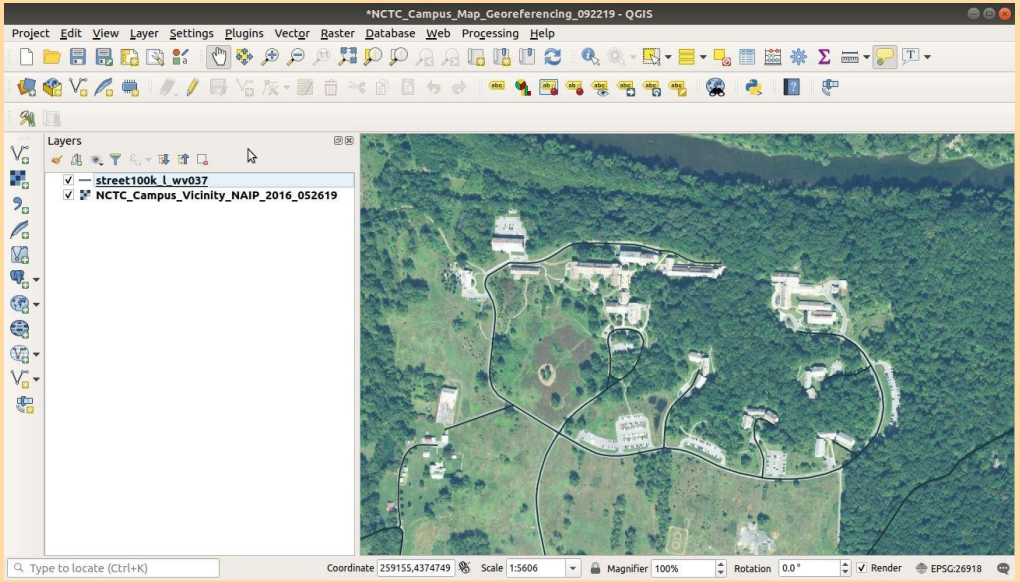
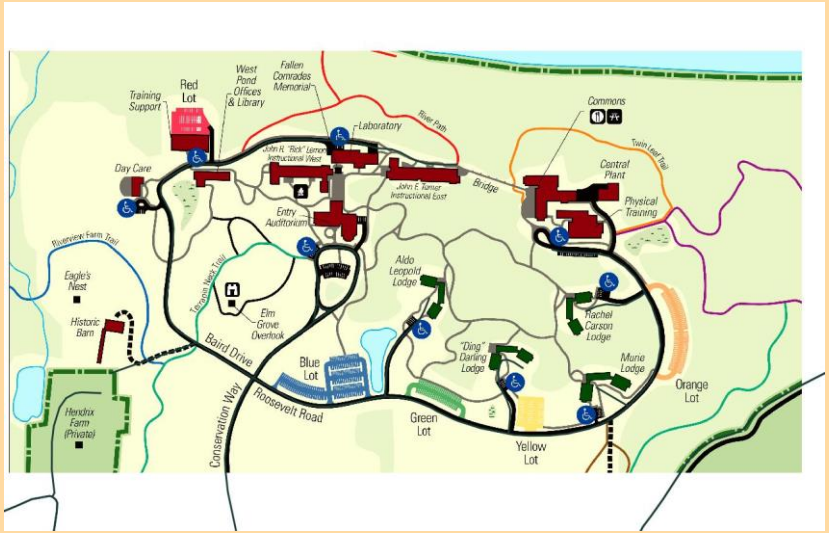


Georeferencing a Map in QGIS

*** Select common geographic ‘fit points’ between the source image and the target map or image**



Georeferencing a Map in QGIS

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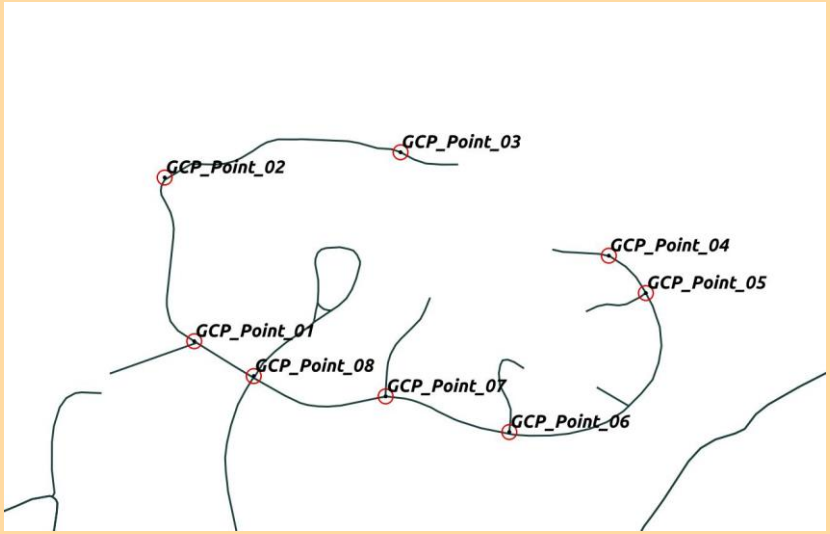
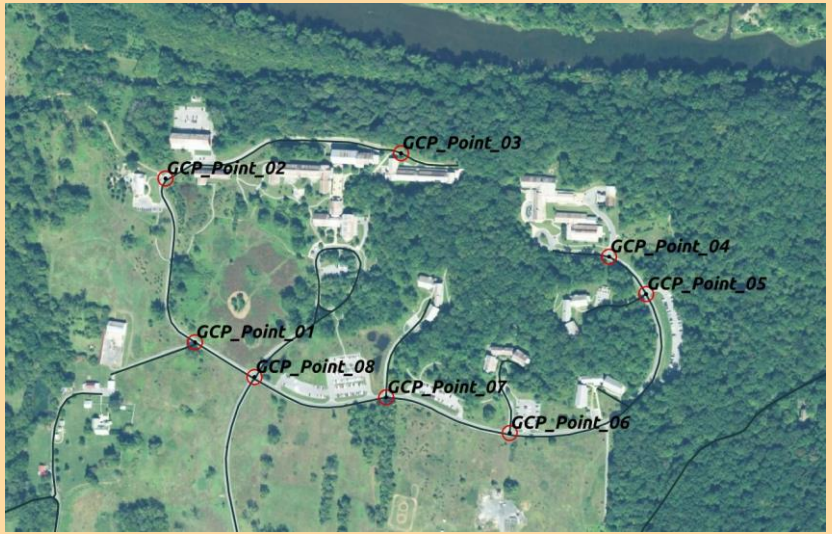
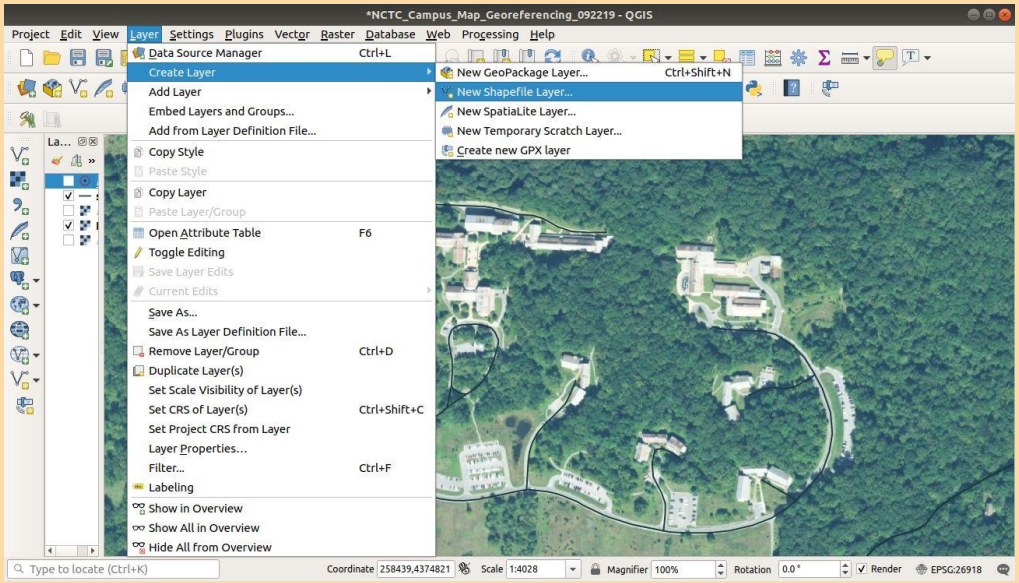
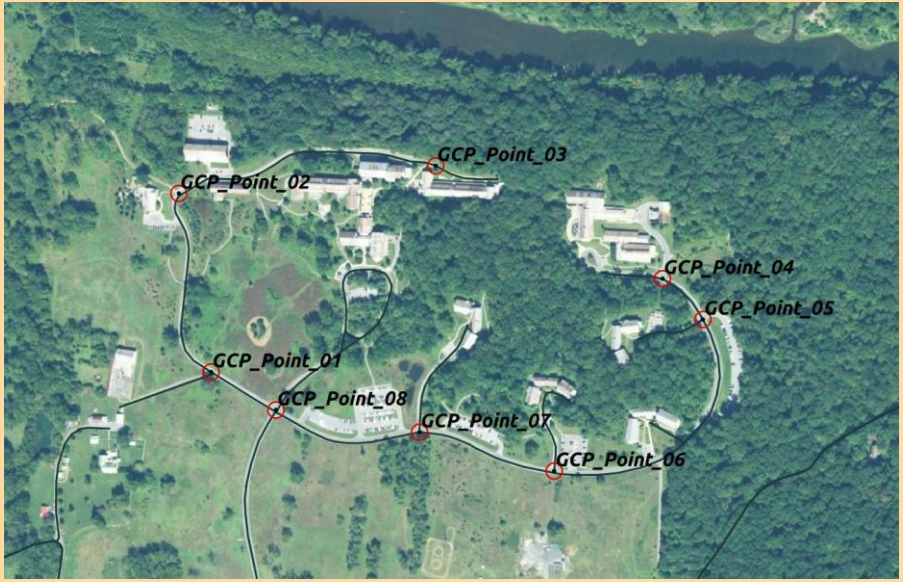




Georeferencing a Map in QGIS

*** Digitize the target fit points to a new GIS file (eg – a shapefile)**





Georeferencing a Map in QGIS

Description of Geographic Control Point Locations

GCP Point #01 – Intersection of Loop Road and Road to the Historic Barn
GCP Point #02 – Intersection of Loop Road and Road to the Day Care
GCP Point #03 – Intersection of Loop Road and Road East from Laboratory
GCP Point #04 – Intersection of Loop Road and Road South from the Central Plant
GCP Point #05 – Intersection of Loop Road and Road East from the Rachel Carson Lodge
GCP Point #06 – Intersection of Loop Road and Road South from the "Ding" Darling Lodge
GCP Point #07 – Intersection of Loop Road and Road South from the Aldo Leopold Lodge
GCP Point #08 – Intersection of Loop Road and Conservation Way

Georeferencing a Map in QGIS

*** Digitizing target fit points; if you're really, really lucky !**

Georeferencing a Map in QGIS

*** Digitize the target fit points to a new GIS file (eg – a shapefile)**

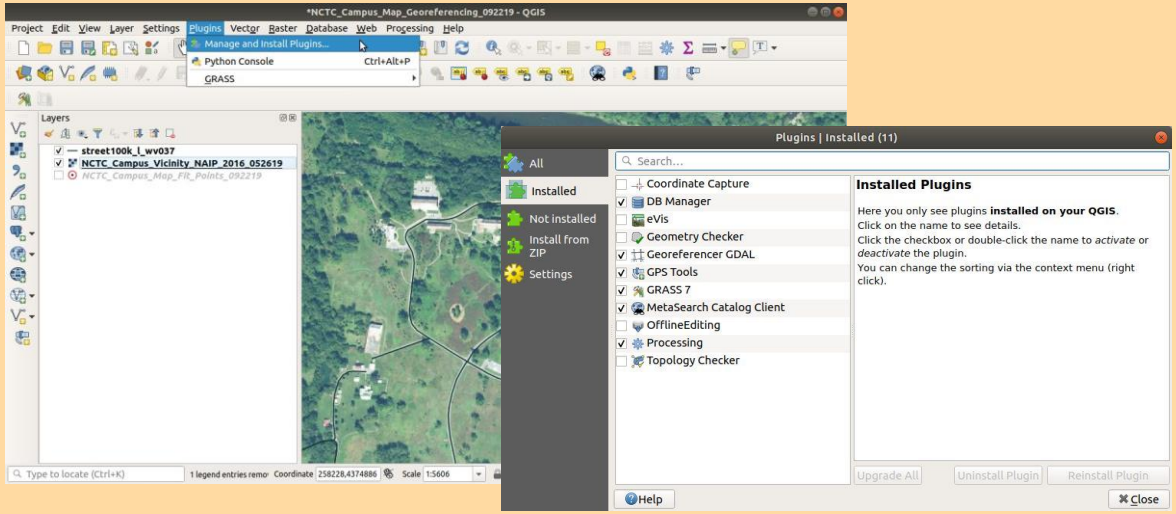
Georeferencing a Map in QGIS

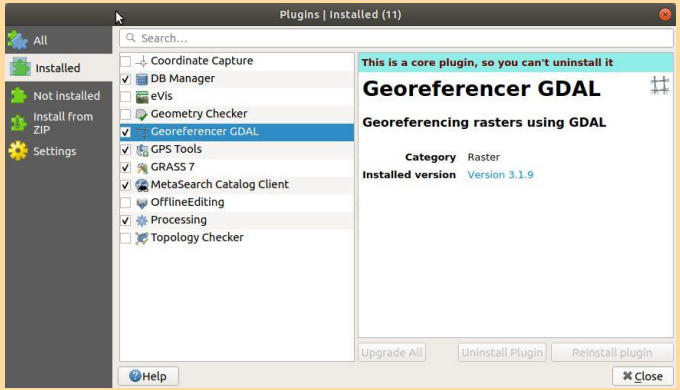
*** Extract the target fit point coordinates to a text file**
NOTE: Exported shapefile as .GML file (and edited it) . . .

GCP_Name: GCP_Point_01	Coordinates: 258513.12,4374421.73
GCP_Name: GCP_Point_02	Coordinates: 258468.26,4374670.08
GCP_Name: GCP_Point_03	Coordinates: 258826.04,4374708.43
GCP_Name: GCP_Point_04	Coordinates: 259141.99,4374551.52
GCP_Name: GCP_Point_05	Coordinates: 259198.20,4374494.81
GCP_Name: GCP_Point_06	Coordinates: 258991.06,4374284.03
GCP_Name: GCP_Point_07	Coordinates: 258803.41,4374338.13
GCP_Name: GCP_Point_08	Coordinates: 258603.37,4374368.92

Georeferencing a Map in QGIS

*** Run the ‘GDAL Georeferencer’ plugin – in QGIS.**
Make sure it is installed . . .





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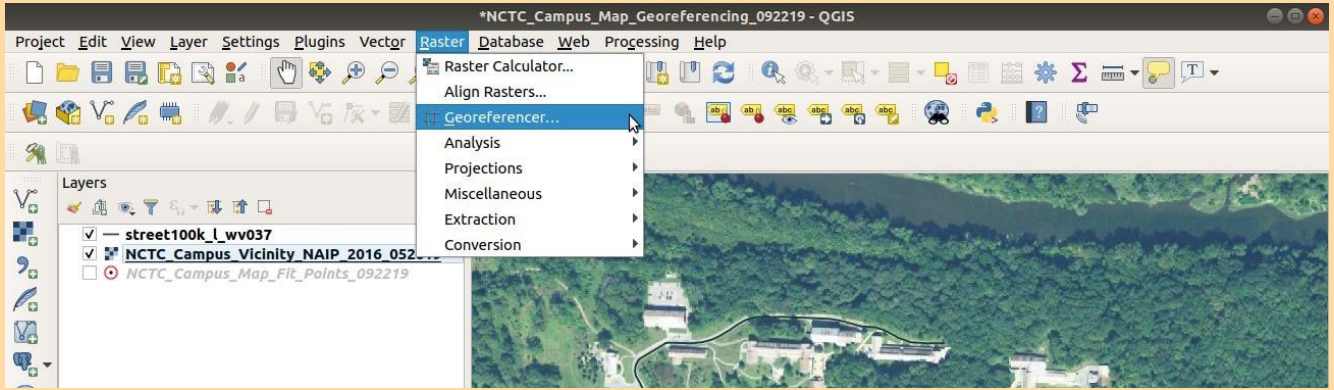
Georeferencing a Map in QGIS

*** Run the ‘GDAL Georeferencer’ plugin – in QGIS.**
Starting It . . .



Georeferencing a Map in QGIS

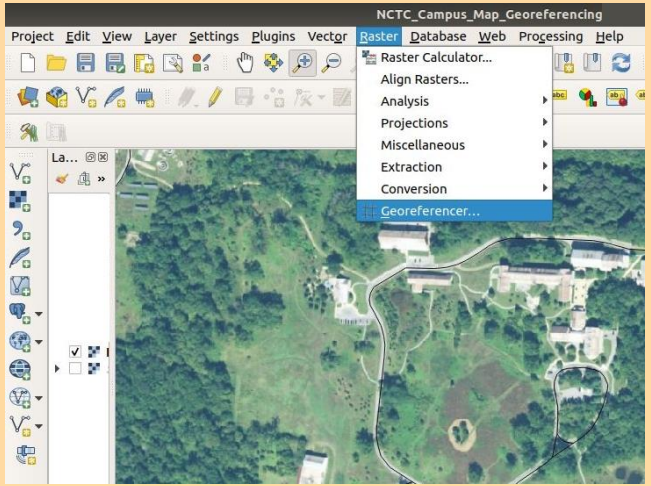
STEPS – in Running ‘GDAL Georeferencer’

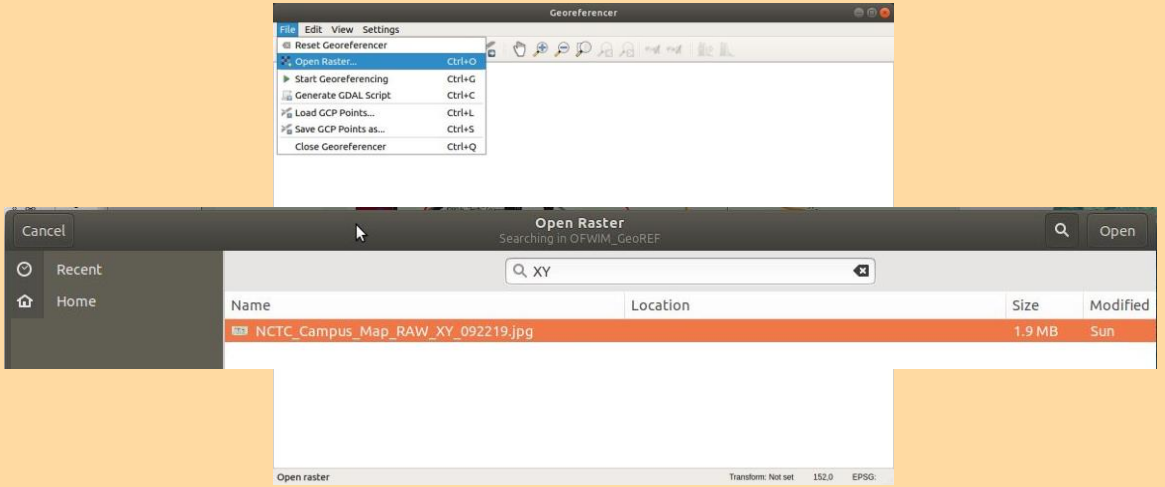
* Launch Georeferencer plugin
* Open the Raster (map in JPG format) in Georeferencer
  NCTC_Campus_Map_Raw_XY_092219.jpg
* Set the (target) Transformation [imagery CRS to be used]
  and output file names / locations
* Identify ‘source’ map GCPs to ‘fit’ to target GCPs (Add Points)
  Add Point / Enter Map Coordinates **[and repeat for all 8 GCPs]**
* Save GCPs to a file
* Select points to be used in georeferencing transformation
* Start georeferencing

Georeferencing a Map in QGIS

STEPS – in Running ‘GDAL Georeferencer’

* Launch Georeferencer plugin / Open Raster Layer . . .





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STEPS – in Running ‘GDAL Georeferencer’

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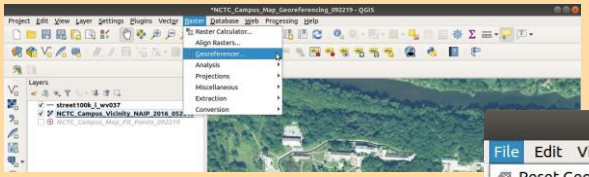
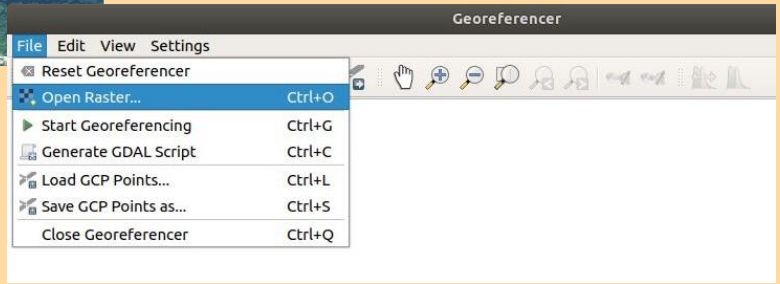
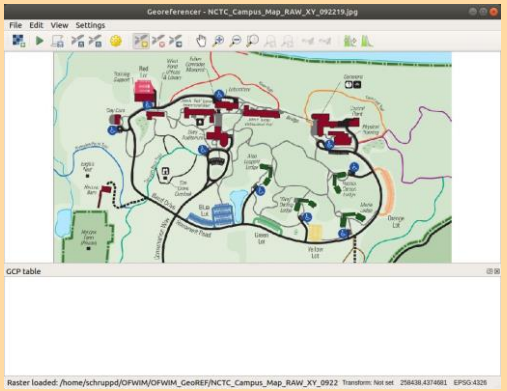


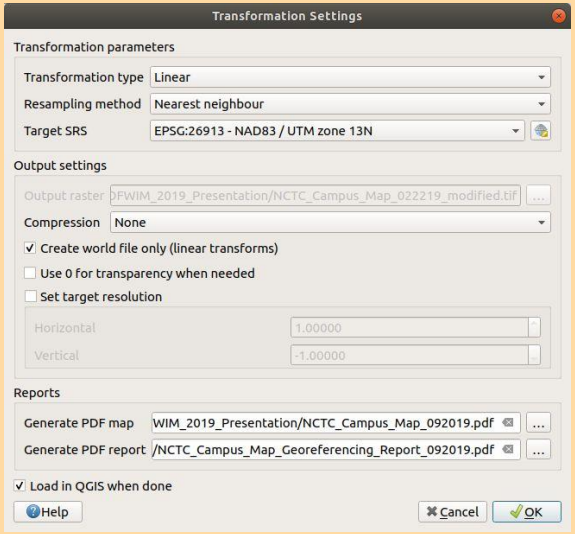




Georeferencing a Map in QGIS
STEPS – in Running 'GDAL Georeferencer'

* Set the (target) Transformation
  [imagery CRS to be used]

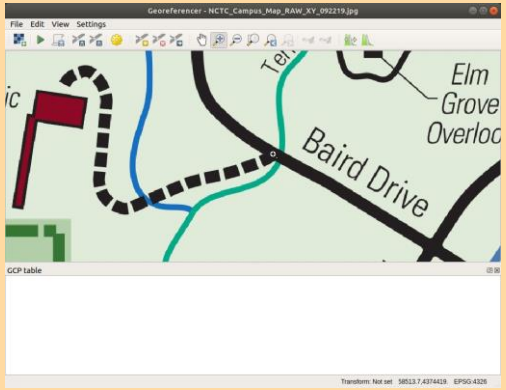
and output file names / locations

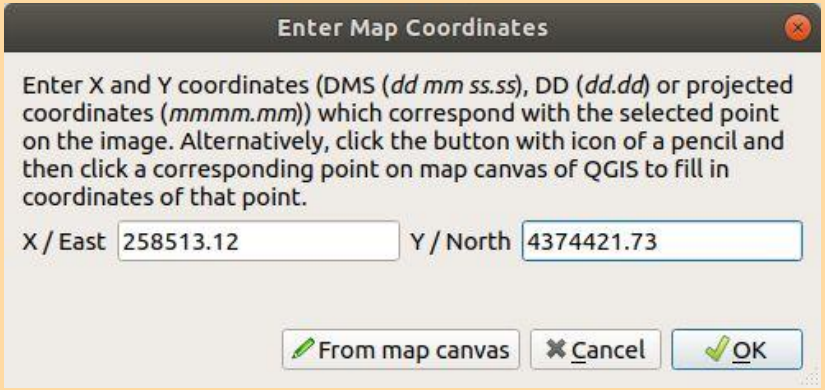


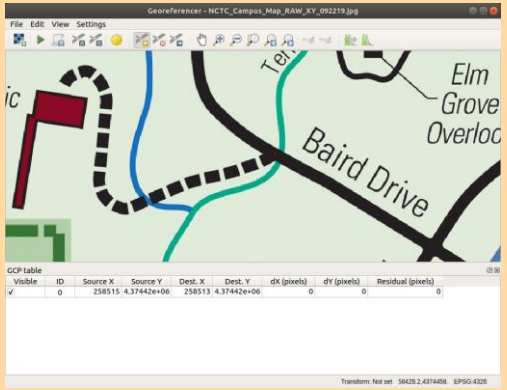
Georeferencing a Map in QGIS

STEPS – in Running ‘GDAL Georeferencer’

* Identify ‘source’ map GCPs to ‘fit’ to target GCPs (Add Points)
  Add Point / Enter Map Coordinates **[and repeat for all 8 GCPs]**





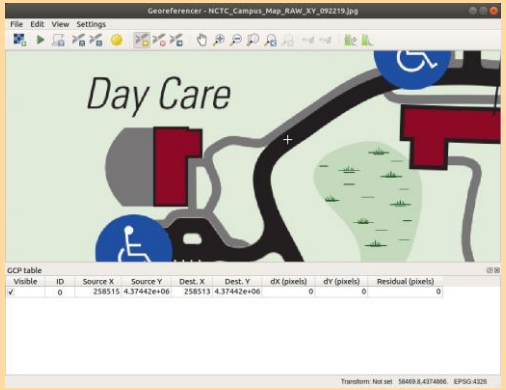


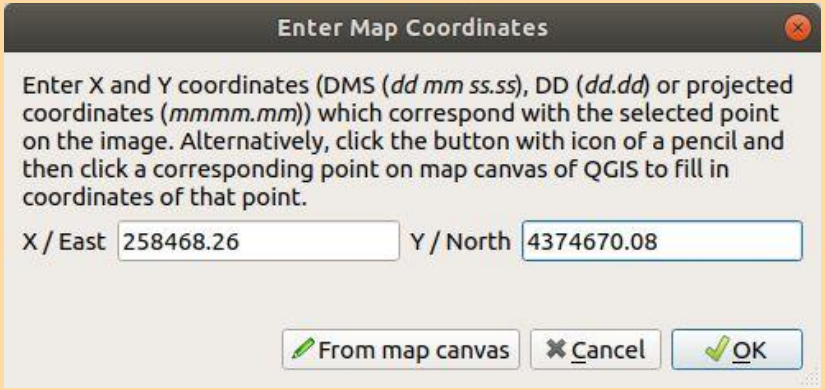
Georeferencing a Map in QGIS

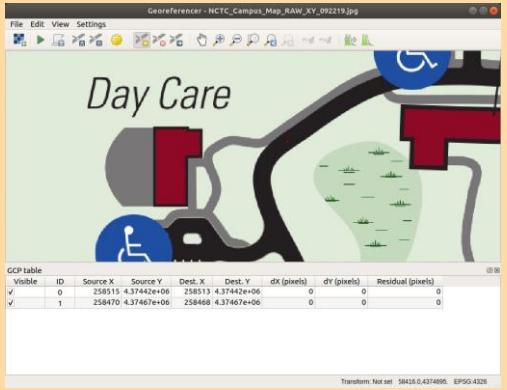
STEPS – in Running ‘GDAL Georeferencer’

* Identify ‘source’ map GCPs to ‘fit’ to target GCPs (Add Points)

GCP Point # 02





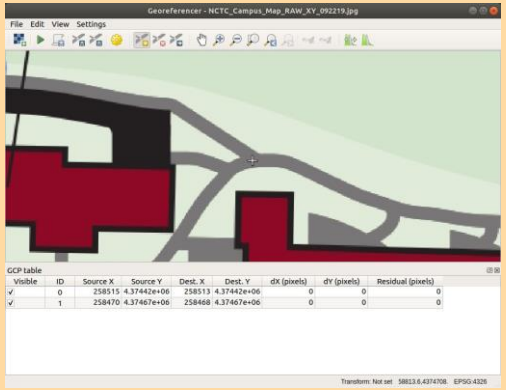


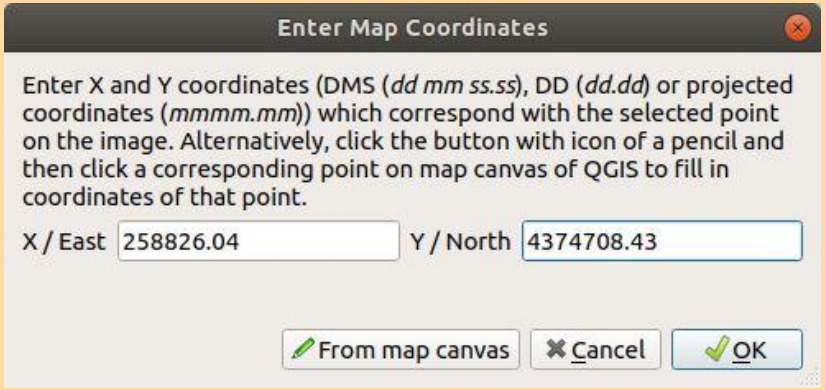
Georeferencing a Map in QGIS

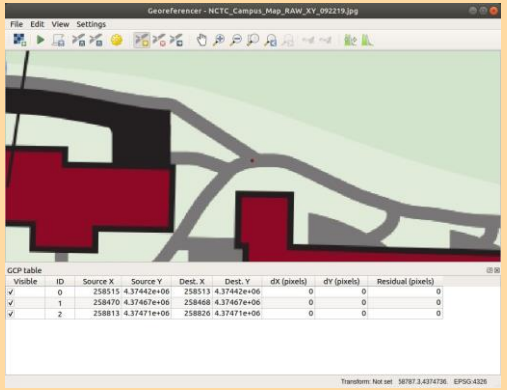
STEPS – in Running ‘GDAL Georeferencer’

* Identify ‘source’ map GCPs to ‘fit’ to target GCPs (Add Points)

GCP Point # 03





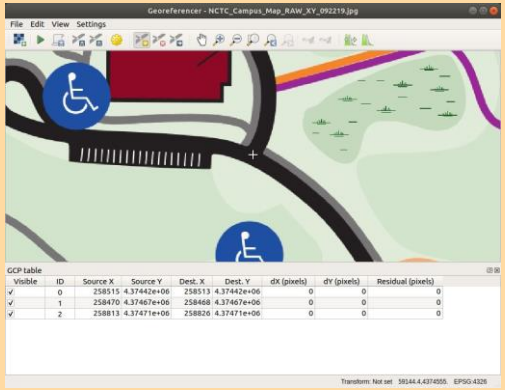


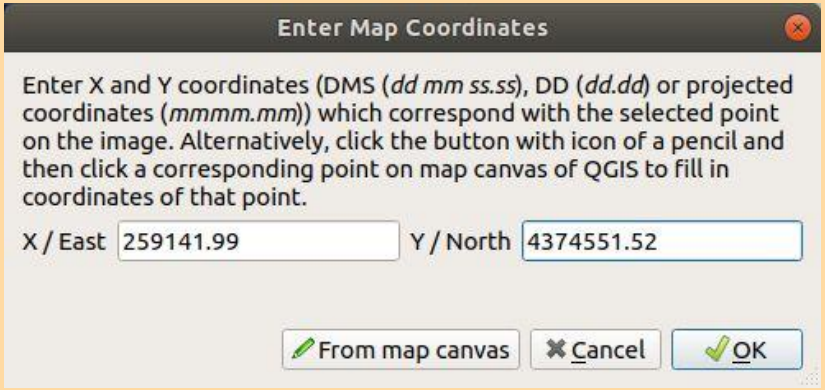
Georeferencing a Map in QGIS

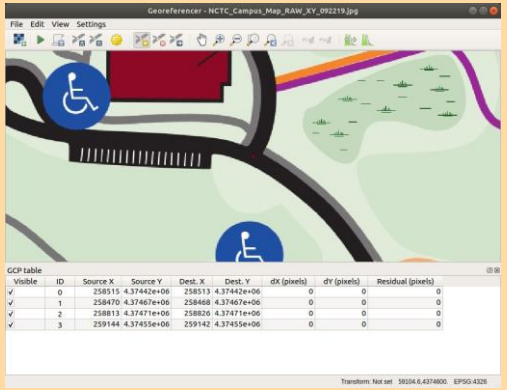
STEPS – in Running ‘GDAL Georeferencer’

* Identify ‘source’ map GCPs to ‘fit’ to target GCPs (Add Points)

GCP Point # 04





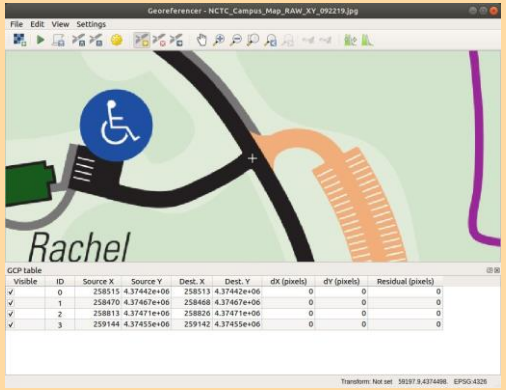


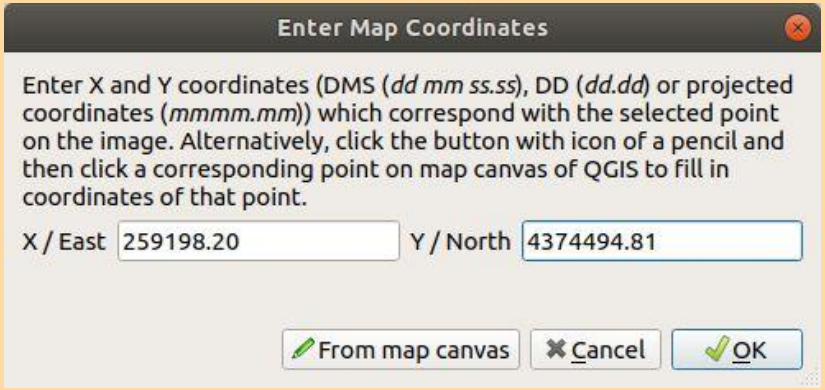
Georeferencing a Map in QGIS

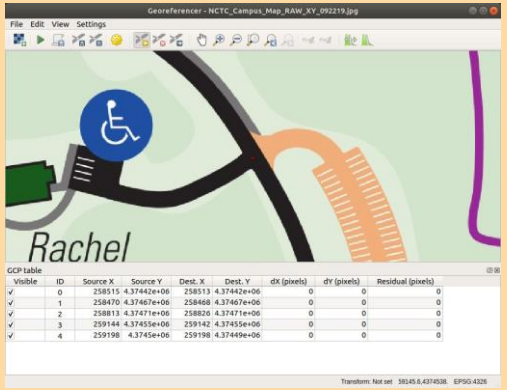
STEPS – in Running ‘GDAL Georeferencer’

* Identify ‘source’ map GCPs to ‘fit’ to target GCPs (Add Points)

GCP Point # 05







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STEPS – in Running ‘GDAL Georeferencer’

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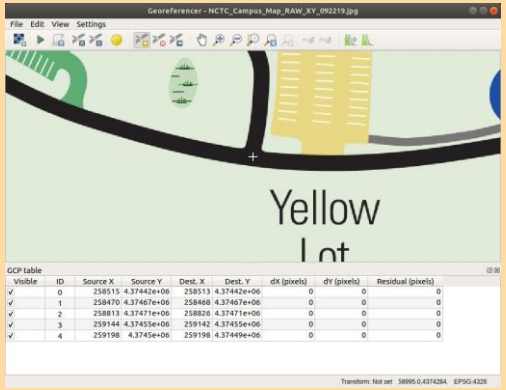
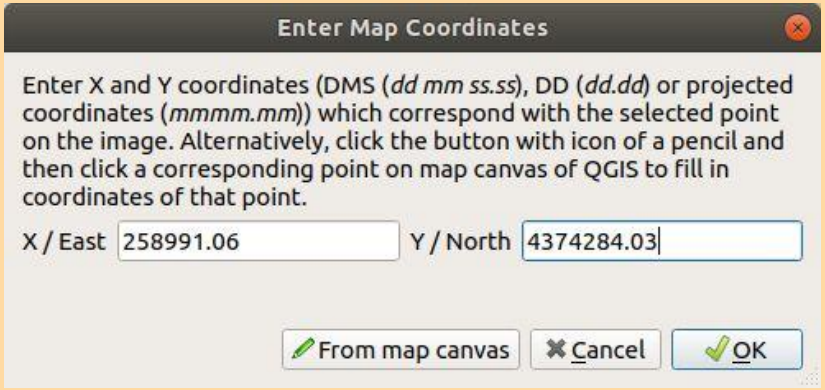
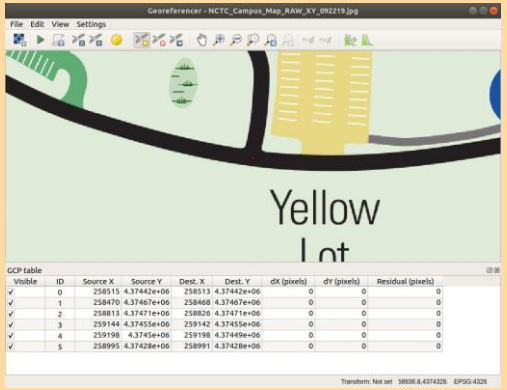
GCP Point # 06







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STEPS – in Running ‘GDAL Georeferencer’

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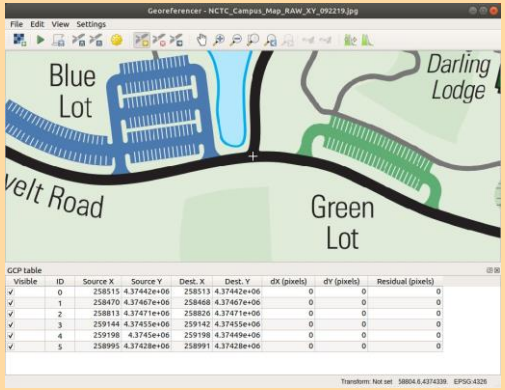
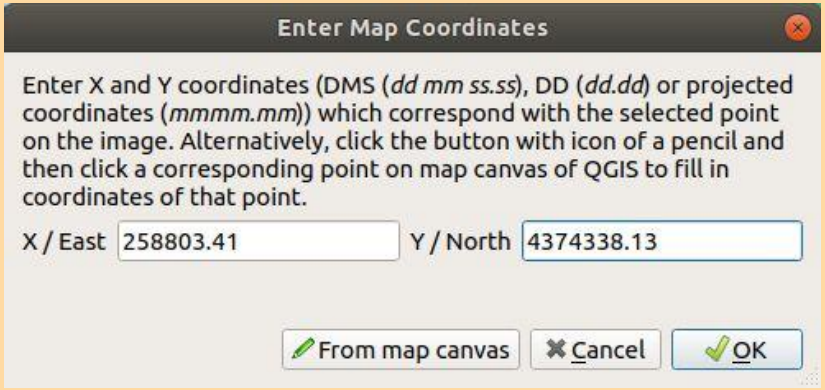
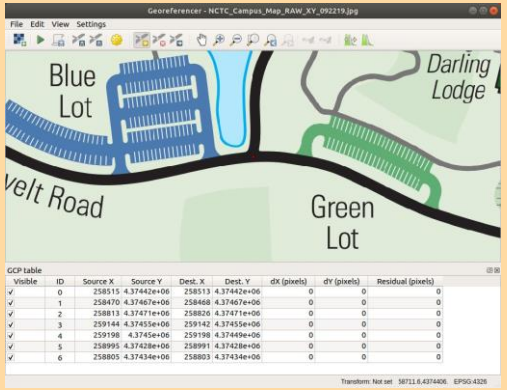
GCP Point # 07







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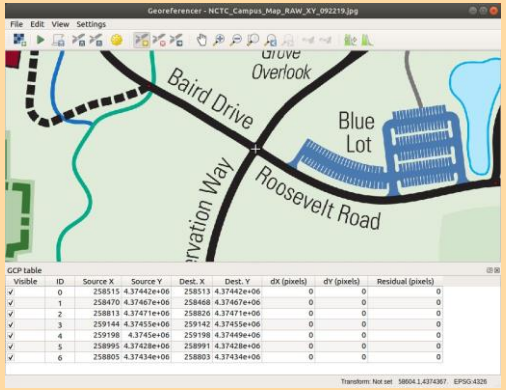
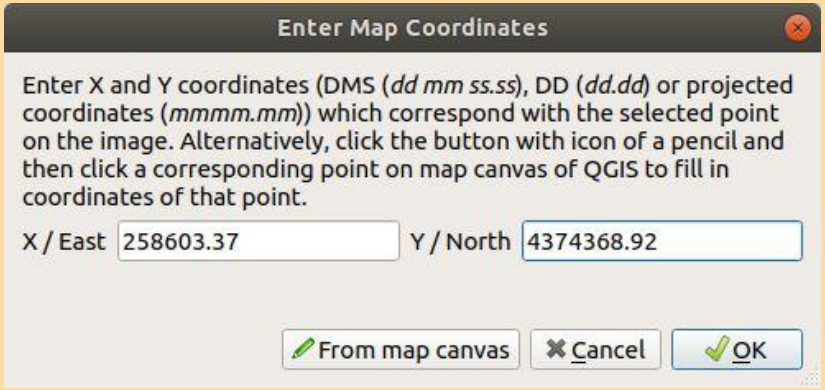
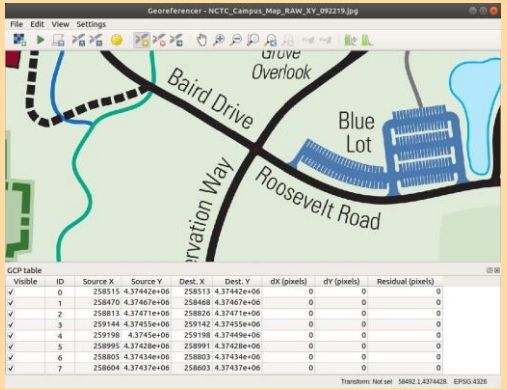
STEPS – in Running ‘GDAL Georeferencer’

* Identify ‘source’ map GCPs to ‘fit’ to target GCPs (Add Points)

GCP Point # 08







Georeferencing a Map in QGIS

STEPS – in Running ‘GDAL Georeferencer’

GCP Table, Differentials and Residuals for All 8 GCPs

GCP table

Visible	ID	Source X	Source Y	Dest. X	Dest. Y	dX (pixels)	dY (pixels)	Residual (pixels)
☑	0	859.21	-1362.69	258513	4.37442e+06	-11.762	-18.2623	21.7223
☑	1	725.77	-600.557	258468	4.37467e+06	-21.8149	-28.4387	35.842
☑	2	1772.81	-473.687	258826	4.37471e+06	110.795	-1.70803	110.809
☑	3	2779.16	-947.088	259142	4.37455e+06	-21.1849	29.7467	36.5193
☑	4	2943.84	-1117.7	259198	4.37449e+06	-0.89256	42.5998	42.6091
☑	5	2323.2	-1780.03	258991	4.37428e+06	-33.6515	3.49146	33.8322
☑	6	1743.64	-1612.78	258803	4.37434e+06	-10.5449	5.07741	11.7036
☑	7	1134.03	-1527.98	258603	4.37437e+06	-10.9448	-26.0726	28.2767

Transform: Linear Translation (342951, 5.79432e+6) Scale (0.107632, 0.105273) Rotation: 0 Mean error: 56.6648 258156,4374821 EPSG:4326

Georeferencing a Map in QGIS

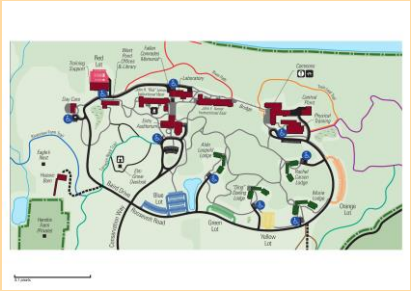
STEPS – in Running ‘GDAL Georeferencer’

*** Start georeferencing . . .**

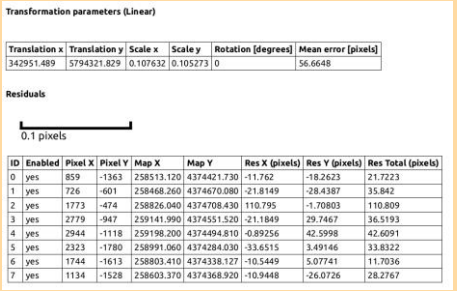
Georeferenced map produced (with option to add to QGIS Project)

Transformation Report Generated (optional)

PDF of Georeferenced Map Produced (optional)



.tif (GeoTIFF)



Transformation parameters (Linear)

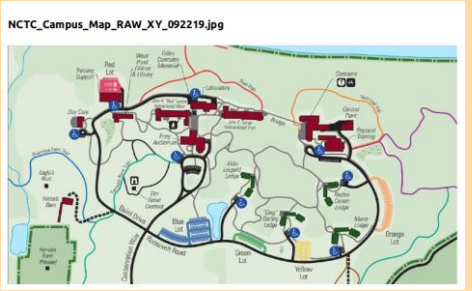
Translation x	Translation y	Scale x	Scale y	Rotation [degrees]	Mean error [pixels]
342951.489	5794321.829	0.107632	0.105273	0	56.6648

Residuals

0.1 pixels

ID	Enabled	Pixel X	Pixel Y	Map X	Map Y	Res X (pixels)	Res Y (pixels)	Res Total (pixels)
0	yes	859	-1363	258513.120	4374421.730	-11.762	-18.2623	21.7223
1	yes	726	-601	258468.260	4374670.080	-21.8149	-28.4387	35.842
2	yes	1773	-474	258826.040	4374708.430	110.795	-1.70803	110.809
3	yes	2779	-947	259141.990	4374551.520	-21.1849	29.7467	36.5193
4	yes	2944	-1118	259198.200	4374494.810	-0.89256	42.5998	42.6091
5	yes	2323	-1780	258991.060	4374284.030	-33.6515	3.49146	33.8322
6	yes	1744	-1613	258803.410	4374338.127	-10.5449	5.07741	11.7036
7	yes	1134	-1528	258603.370	4374368.920	-10.9448	-26.0726	28.2767

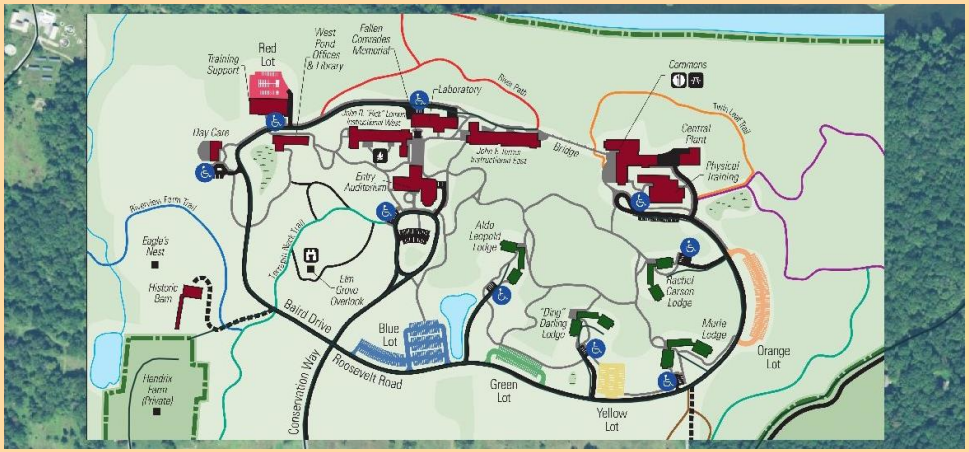
.PDF (tables)



.PDF (map of residuals)

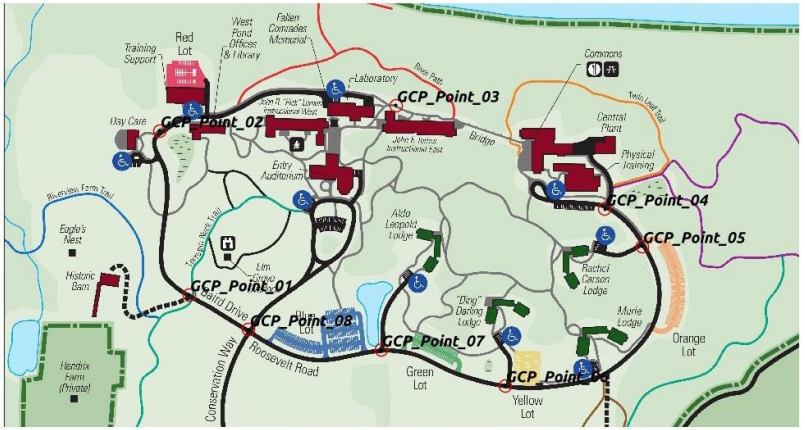
Georeferencing a Map in QGIS

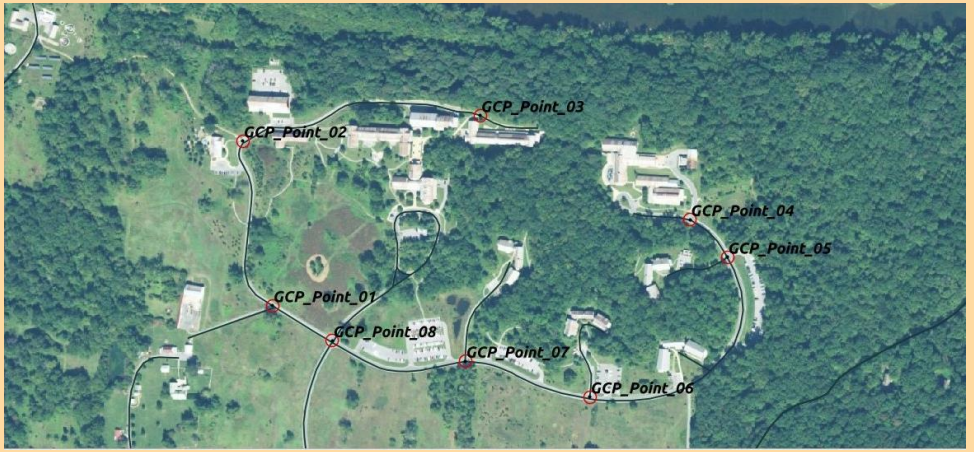
*** Load the newly georeferenced map to the QGIS Project / Set CRS**



Georeferencing a Map in QGIS

*** Load the newly georeferenced map to the QGIS Project / Set CRS**





Thanks to . . .

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Questions ?