Public Works
LOS ANGELES COUNTY

LiDAR-Based Watershed Delineation Process

By: Hormoz Nikolay

Part 1

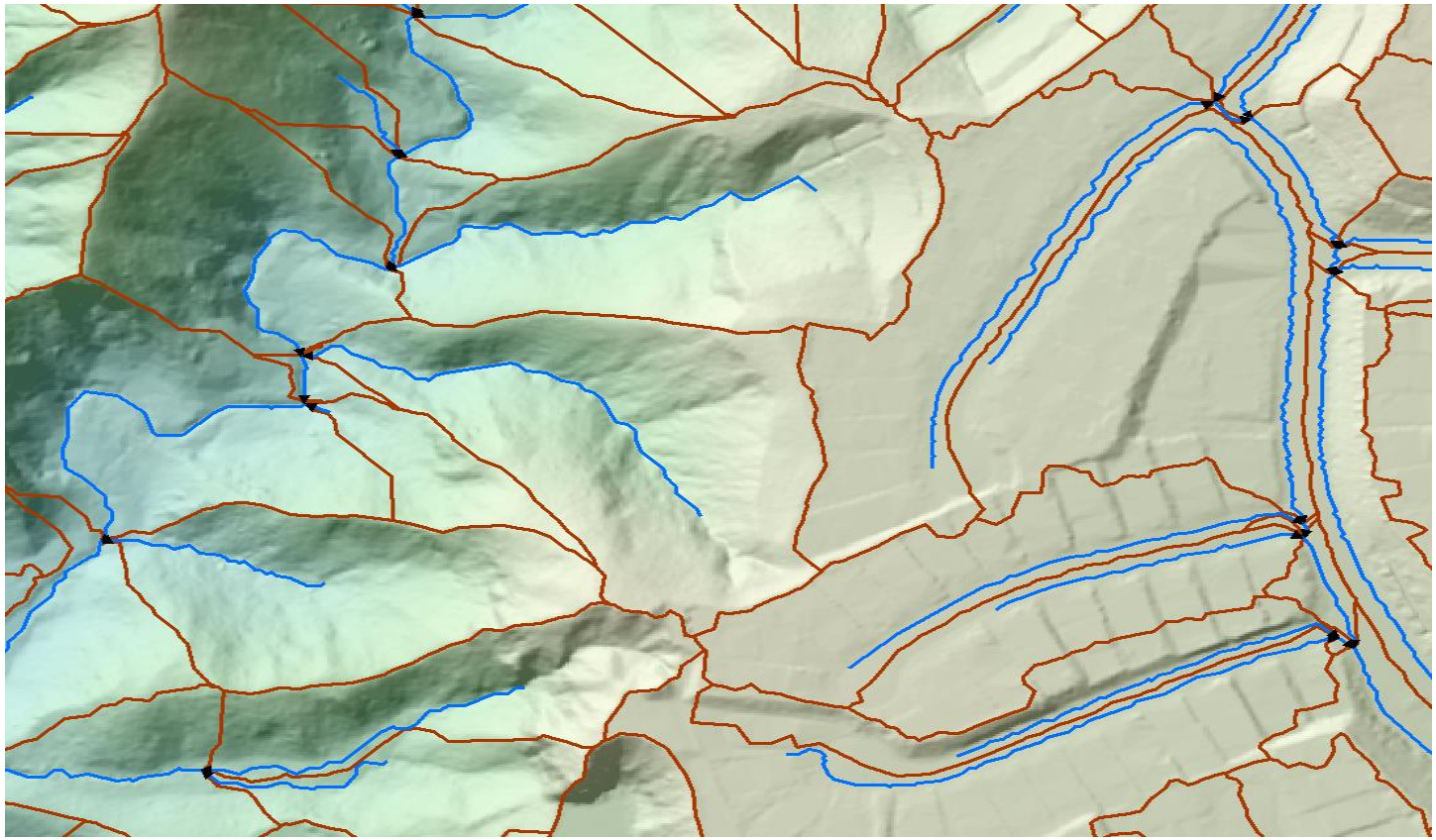
Introduction

Topics

- Partners
- What is LiDAR-Based Watershed Delineation?
- What is LiDAR?
- History
- Purpose
- Traditional Method
- Methodology

Partners

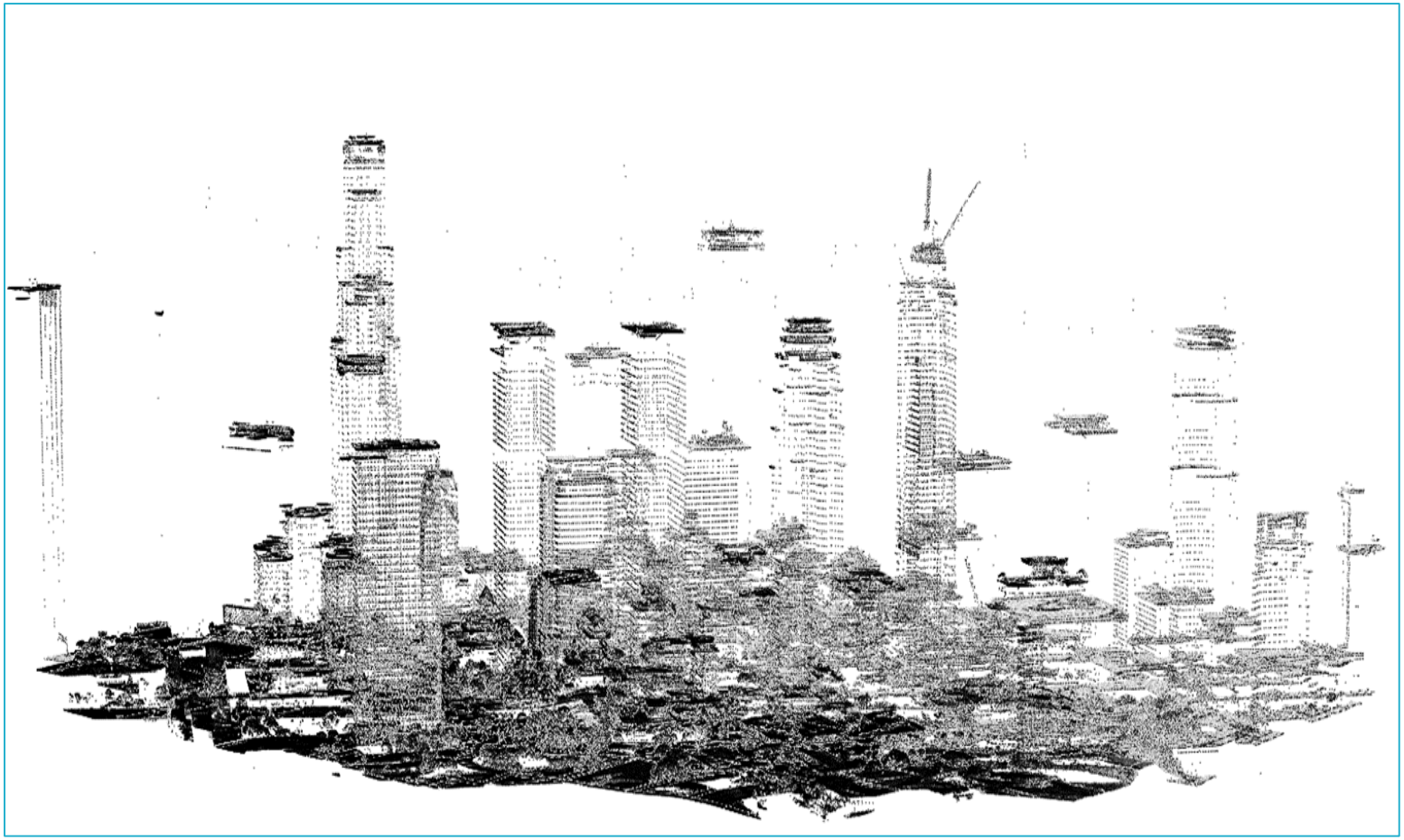
What is LiDAR-Based Watershed Delineation?



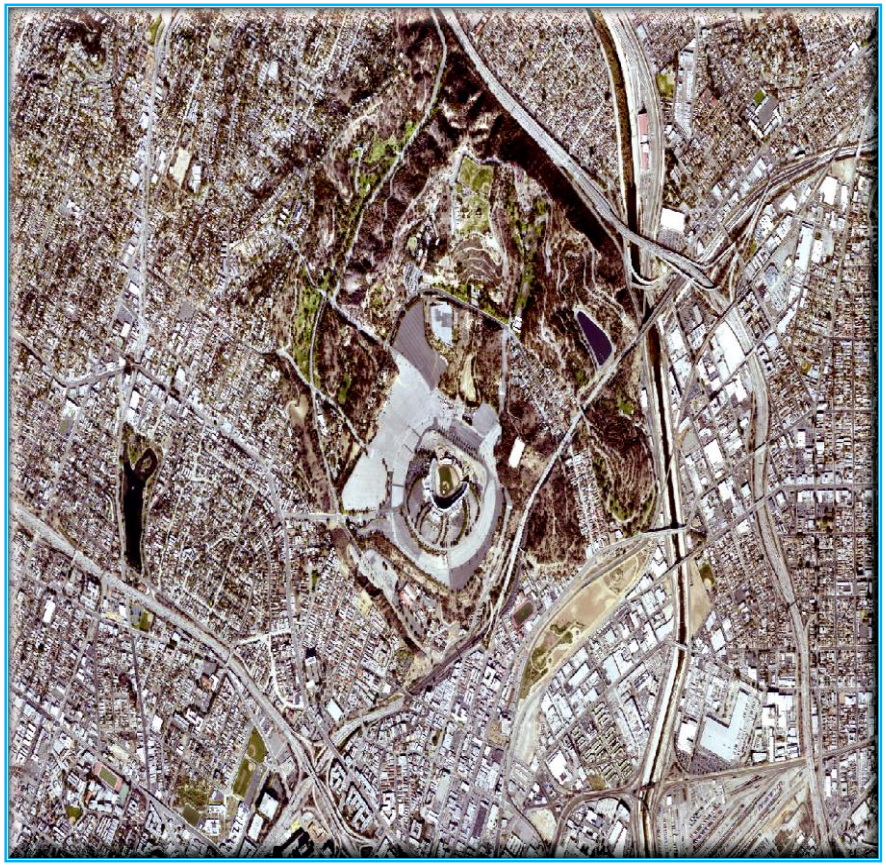
What is LiDAR?

Light Detection and Ranging

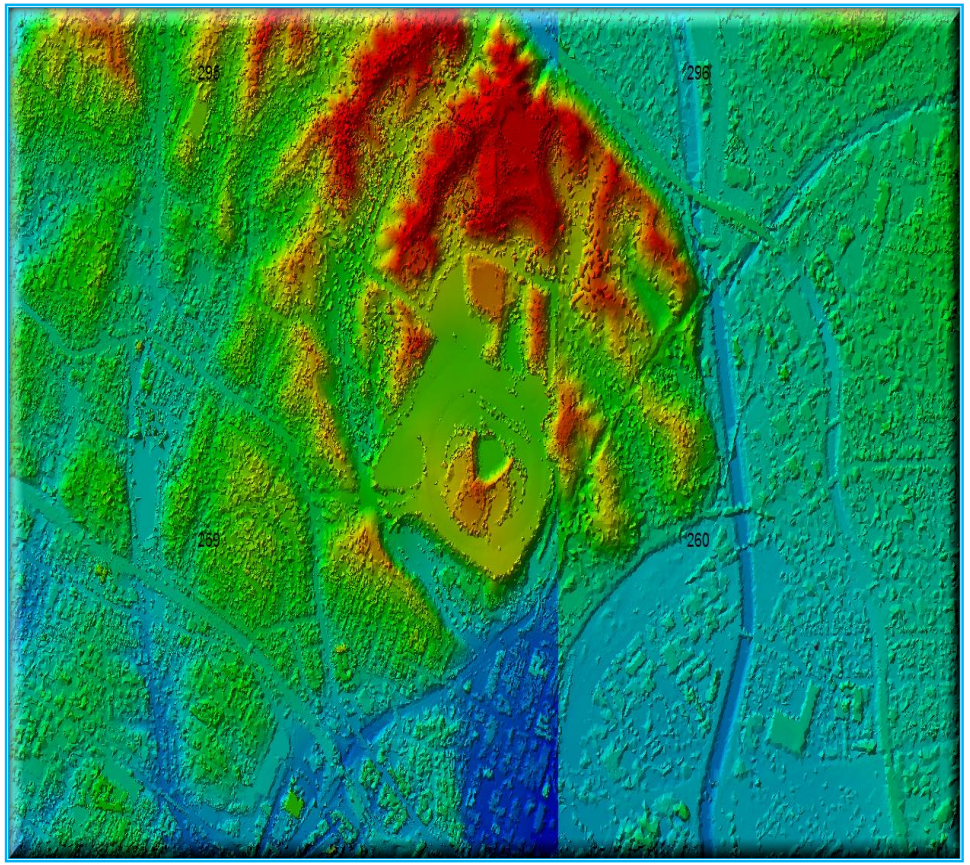
LiDAR



AERIAL



LiDAR



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LiDAR Data Accuracy

National Enhanced Elevation Assessment Report Table

QL	*Density (pts/m²)*	*NPS (m)*	*Vertical RMSE (m)*
QL1	8	0.35	0.0925
QL2	2	0.7	0.0925
QL3	1 – 0.25	1-2	0.185
QL4	0.04	5	0.463 – 1.390
QL5	0.04	5	0.927 – 1.850

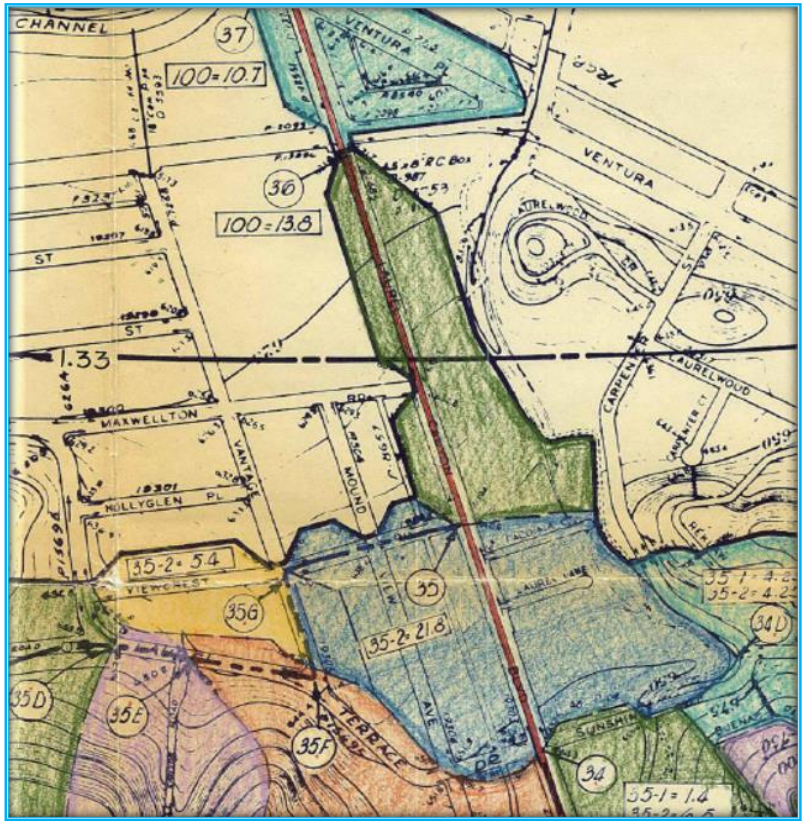
History

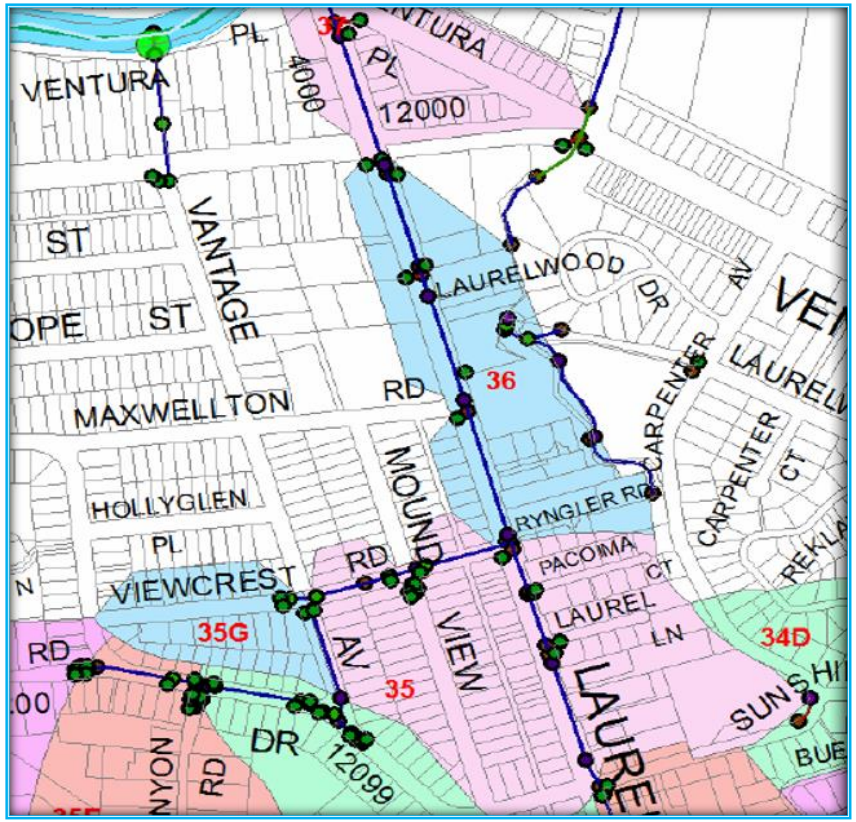
- 1948 – The Federal Water Pollution Control Act
- 1972 – The Clean Water Act
- 2012 – NPDES MS4 required LACFCD to provide Catchment Areas of all major outfalls that it maintains

Purpose

- Support the County's NPDES MS4 Storm Water Permits
- Provide data for hydrology studies
- Improve upon existing method

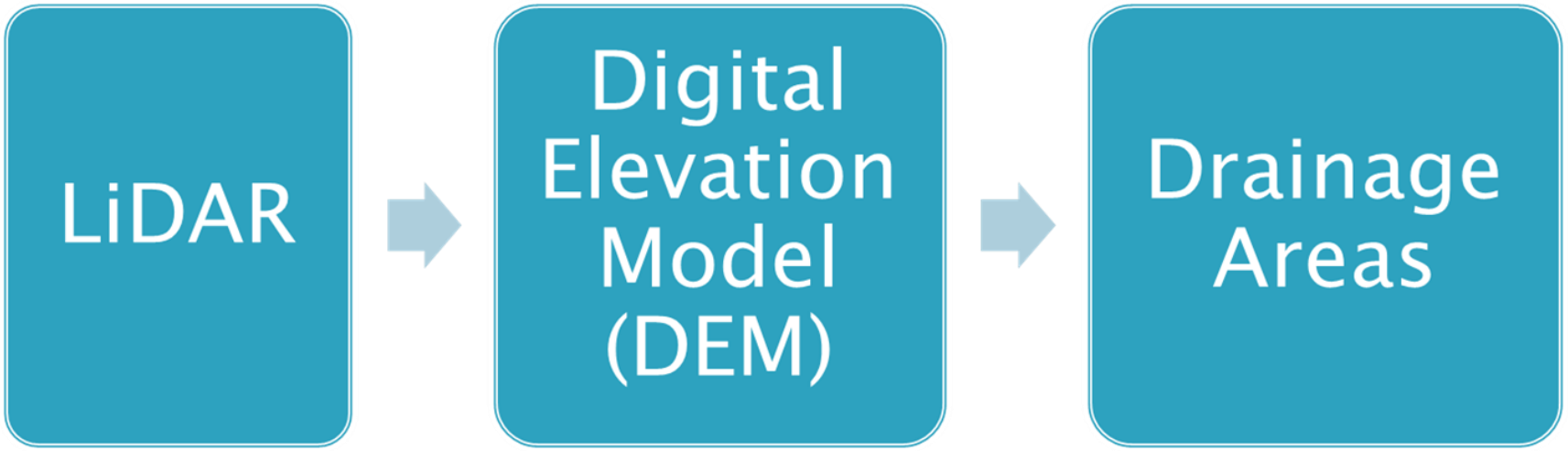
Creating watershed polygons driven from as-built





- Required Site Visit
- Time Consuming
- Labor Intensive
- Digitize Paper Map

Methodology



Part 2

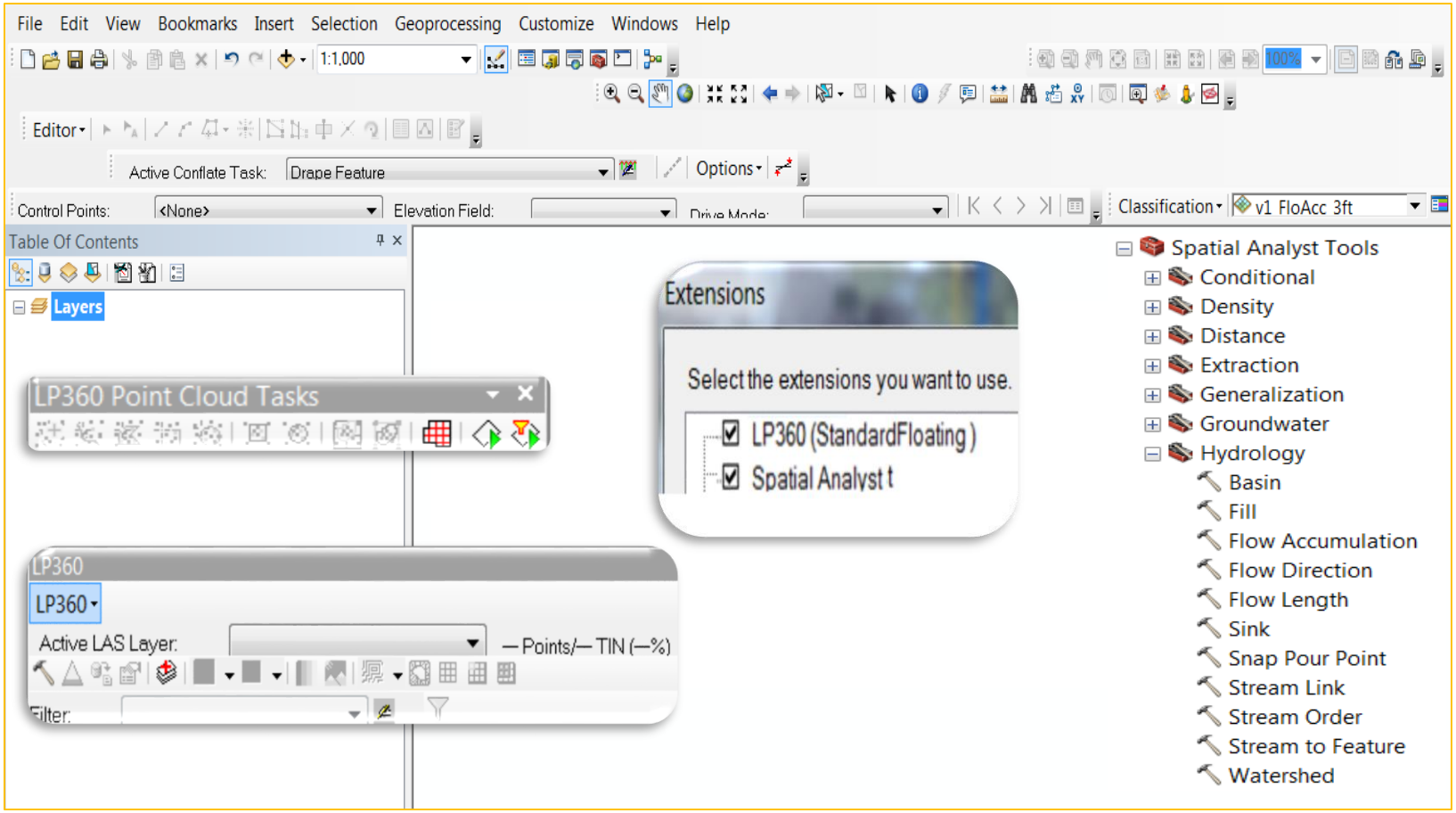
Technical Procedure

LiDAR-Based Watershed Delineation Process

Topics

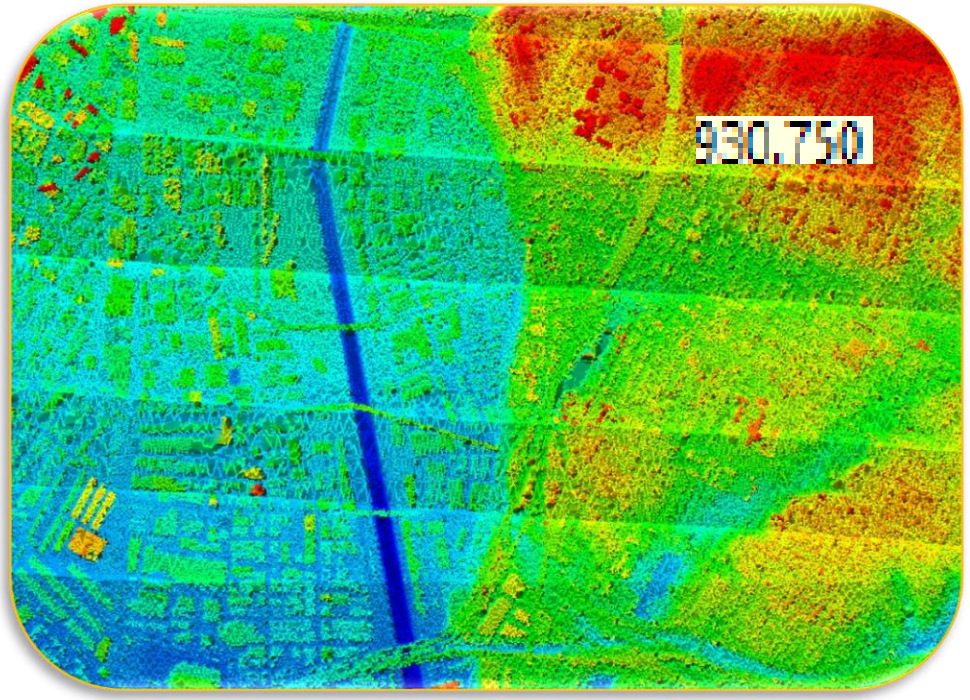
- Prepare MXD File and LIDAR Data Setup
- Export LiDAR to DEM and Generate Raster Layers
- How Sink, Flow Direction and Accumulation Work
- BreakLines
- Workflow Plan
- Generating Catchment Polygons and Streamlines
- LA County Watershed Management Boundaries
- Merging Tiles

Prepare MXD File



LiDAR Data Setup

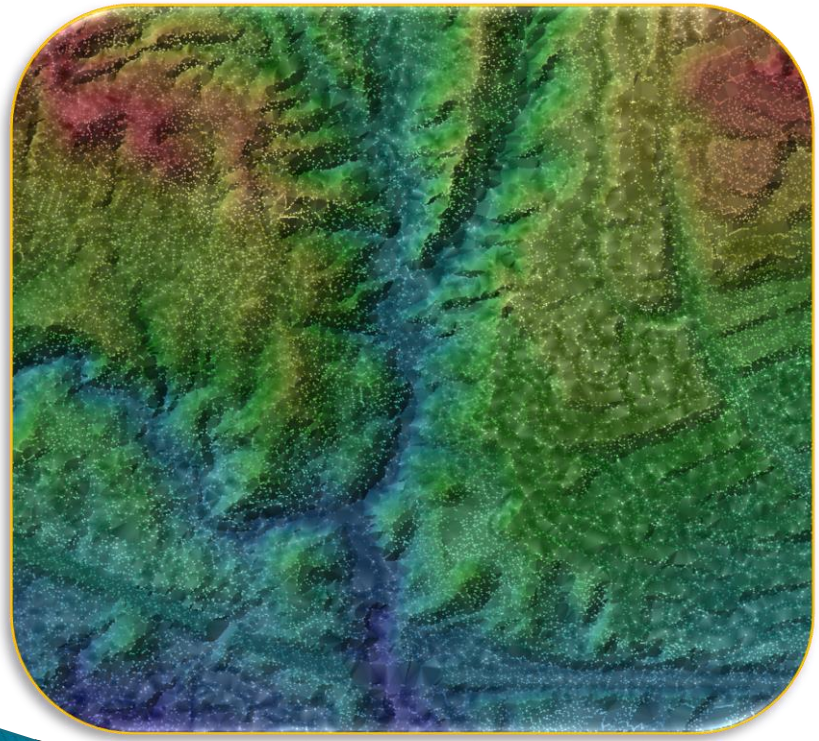
- Add LiDAR data layer
- Open files for read/write
- Set-up LAS layer properties
- Add predefined breaklines
- Point cloud task
- Export LiDAR data to create DEM

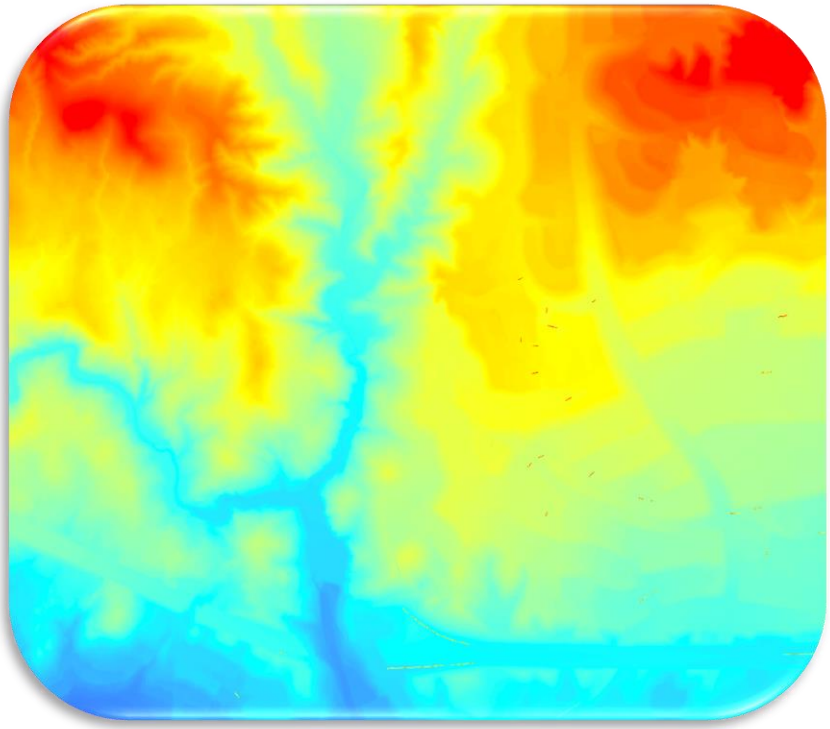


Export to DEM (Digital Elevation Model)

- 3-D Representation of a Terrain Surface
- Created from Elevation Data
- Slope and Aspect Values

LiDAR → DEM

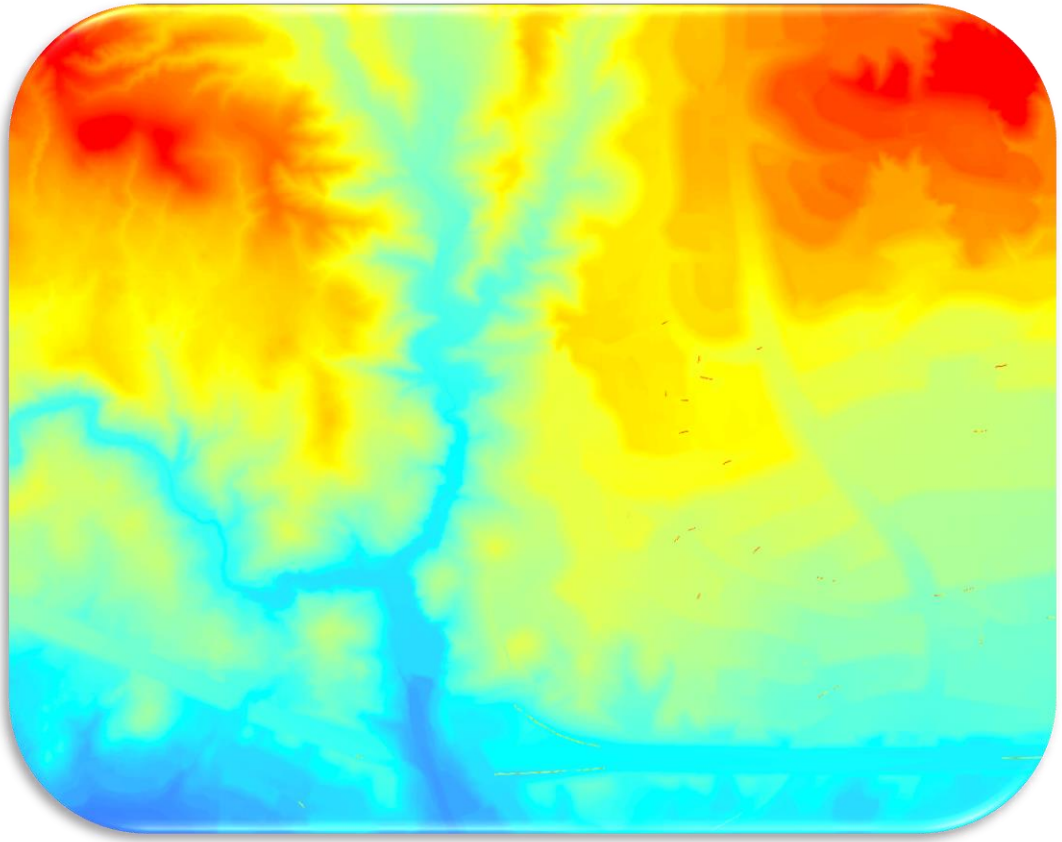




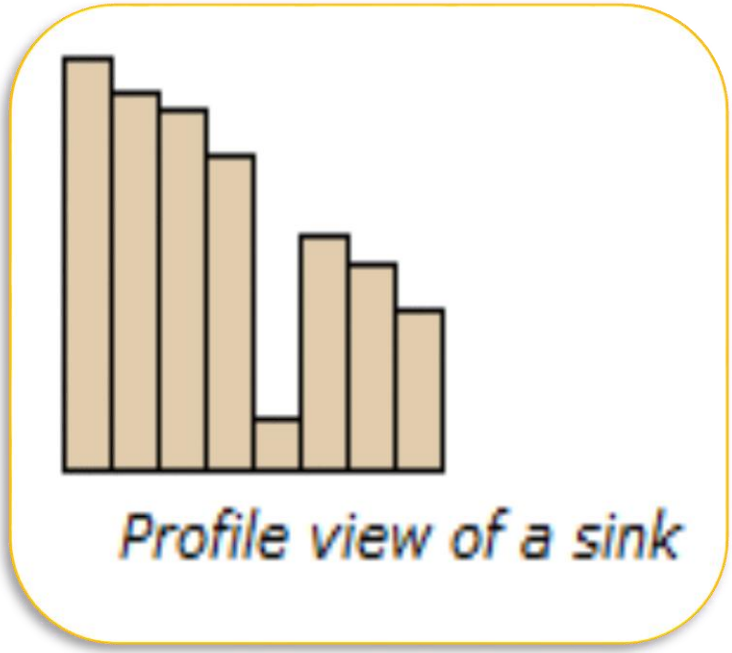
Generating Raster Layers From DEM

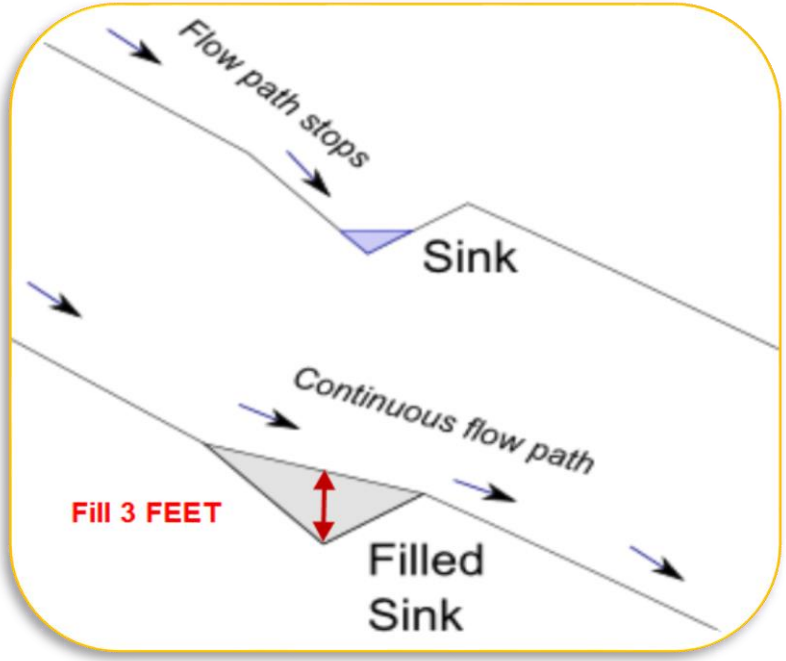
Generate the following raster layers:

. Hill shade
. Flow Direction
. Flow Accumulation
. Sink
. Filled DEM



How Sink Works





Legitimate Sinks: Not Filled.
Non-Legitimate Sinks: Filled (caused by artifact or barriers).

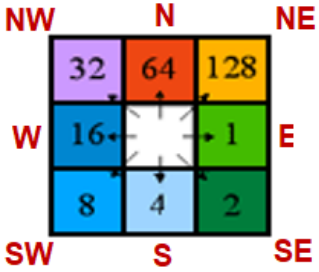
How Flow Direction Works

78	72	69	71	58	49
74	67	56	49	46	50
69	53	44	37	38	48
64	58	55	22	31	24
68	61	47	21	16	19
74	53	34	12	11	12

Elevation surface

2	2	2	4	4	8
2	2	2	4	4	8
1	1	2	4	8	4
128	128	1	2	4	8
2	2	1	4	4	4
1	1	1	1	4	16

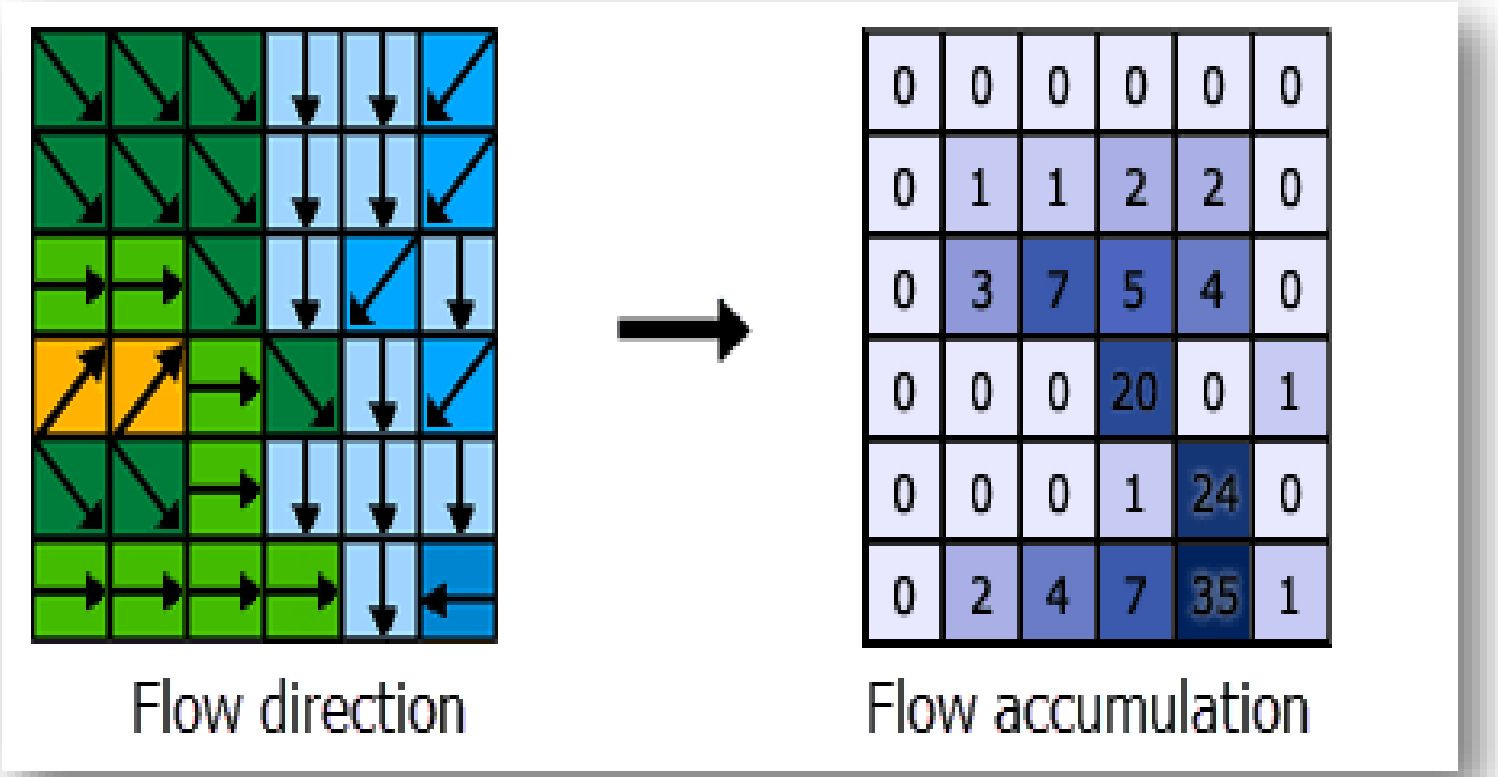
Flow direction



Direction coding

How Flow Accumulation Works

The value of cells in the flow accumulation raster is the number of cells that flow into each cell.

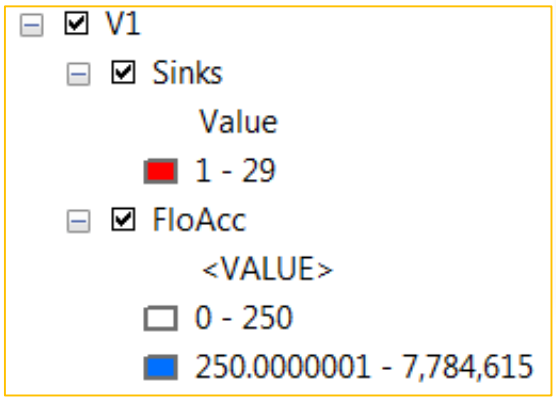


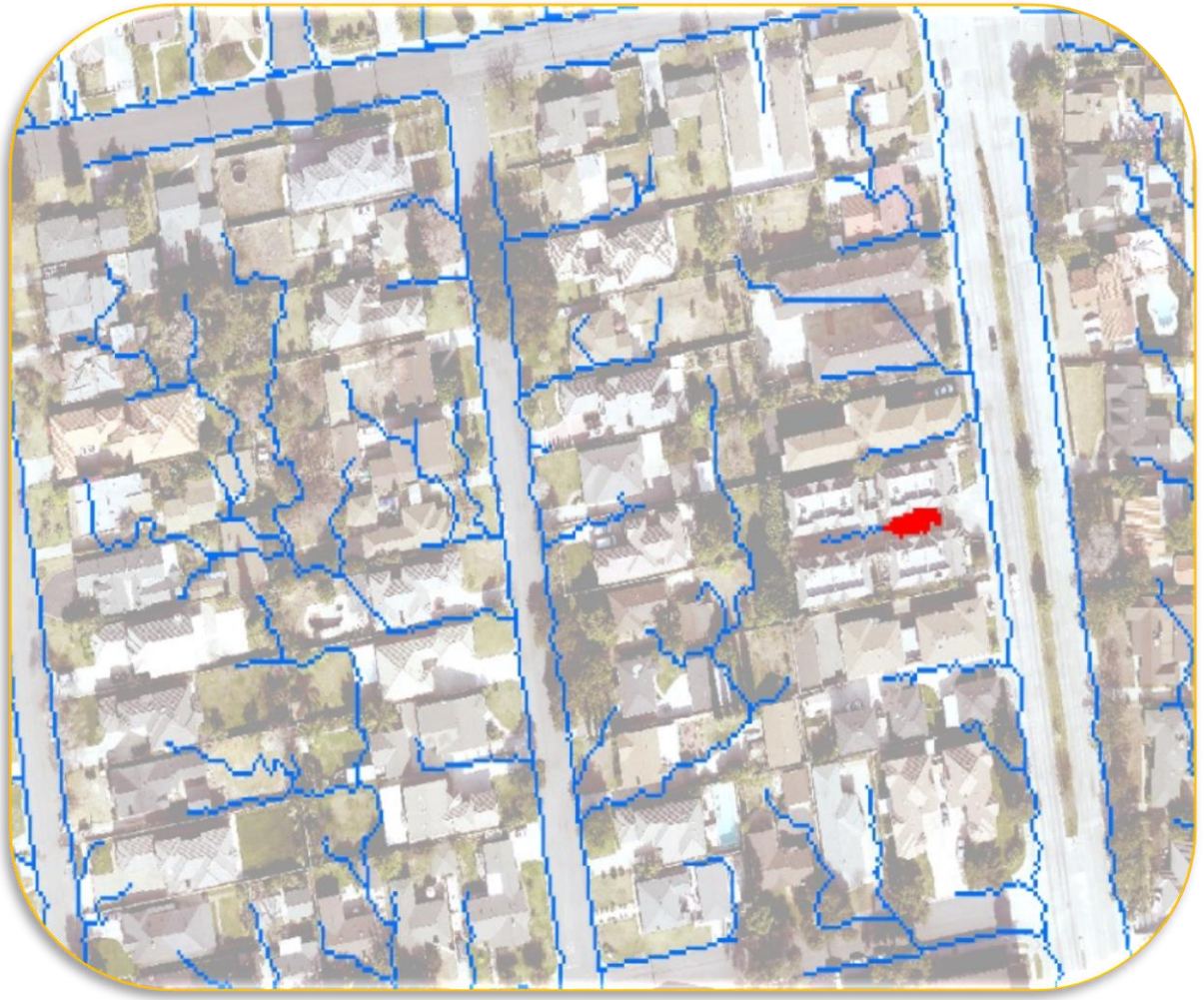
Raster Layers Needed

Layers:

- Flow Accumulation
- Sink

Update Symbology





BreakLines

Berms : For redirecting flow

Culvert Trench : For bridging road

Deep Trench : Enforcing a sink

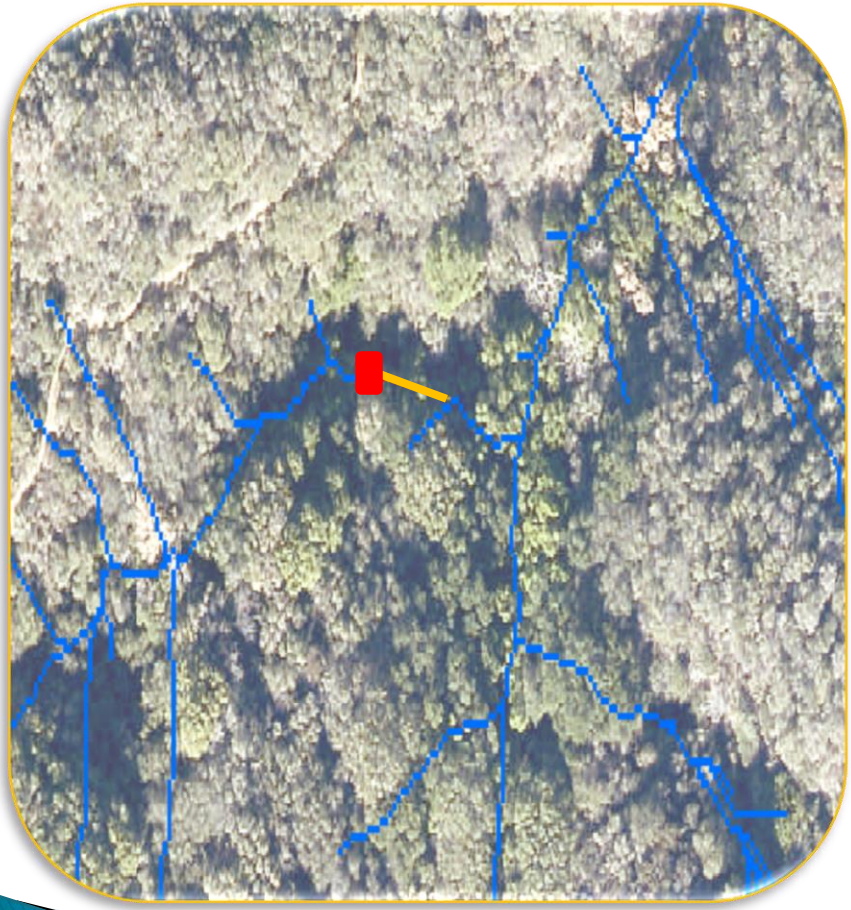
Applying Berm

Before

After

Applying Deep Trench

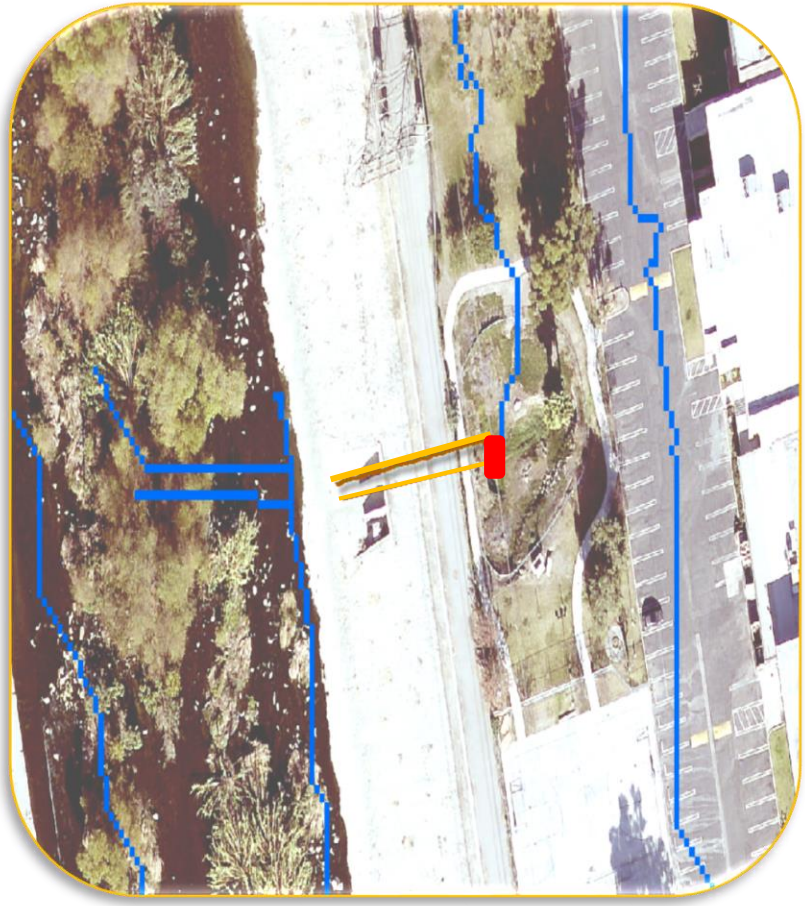
Before



After

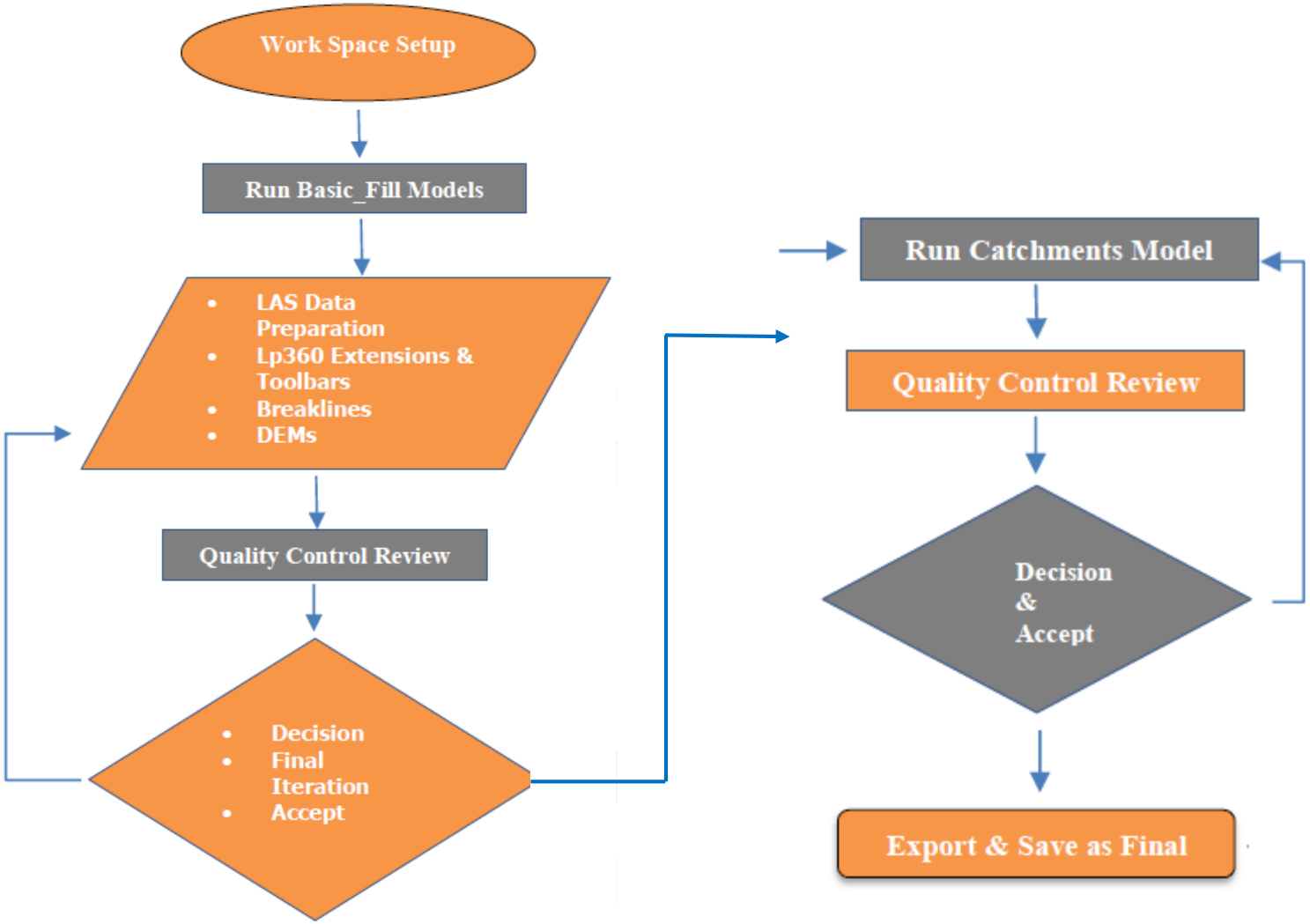
Applying Culvert Trench

Before

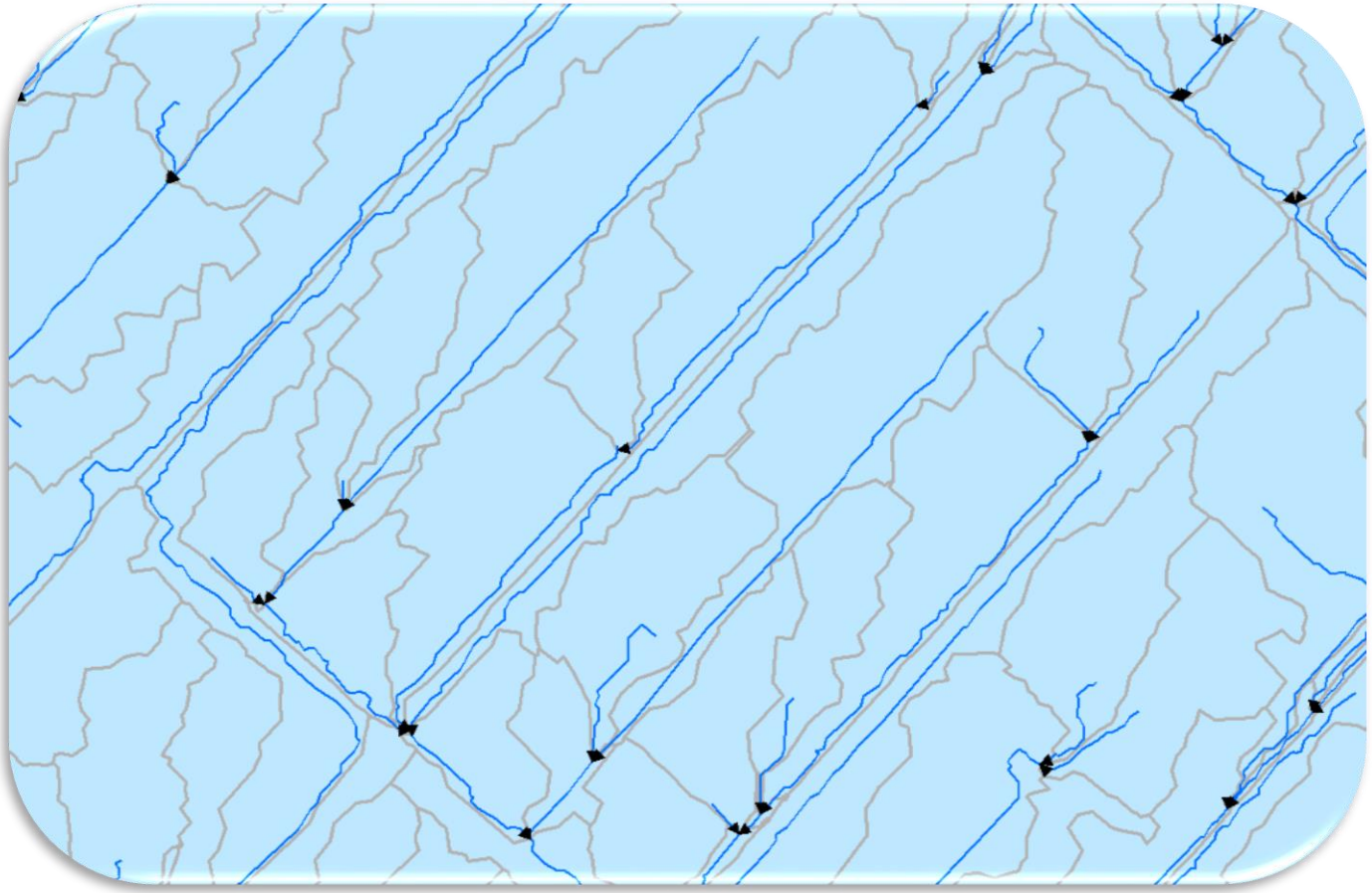


After

Workflow Plan



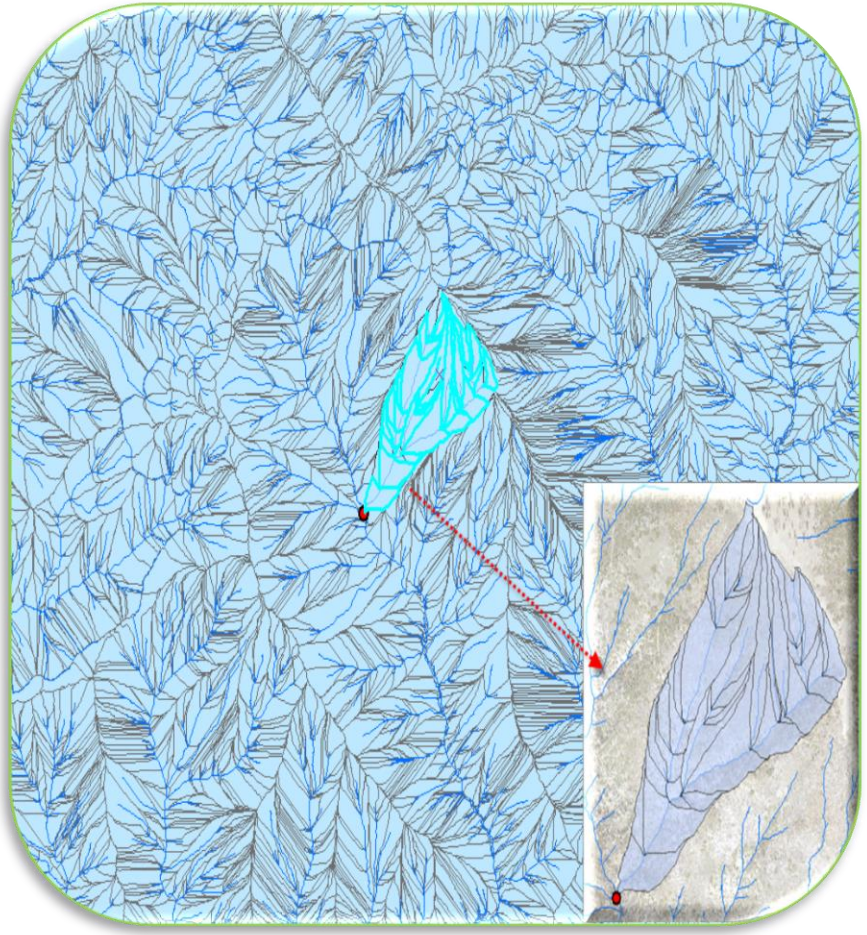
Catchment Polygons



Catchment Polygons

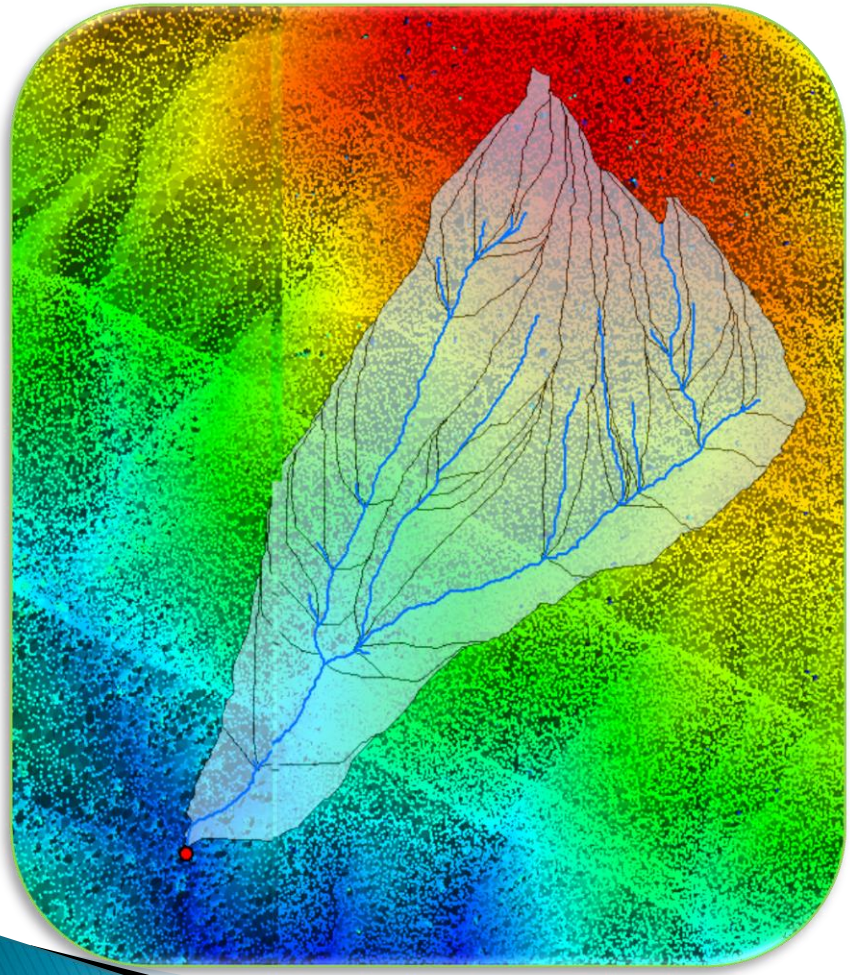
Streamlines

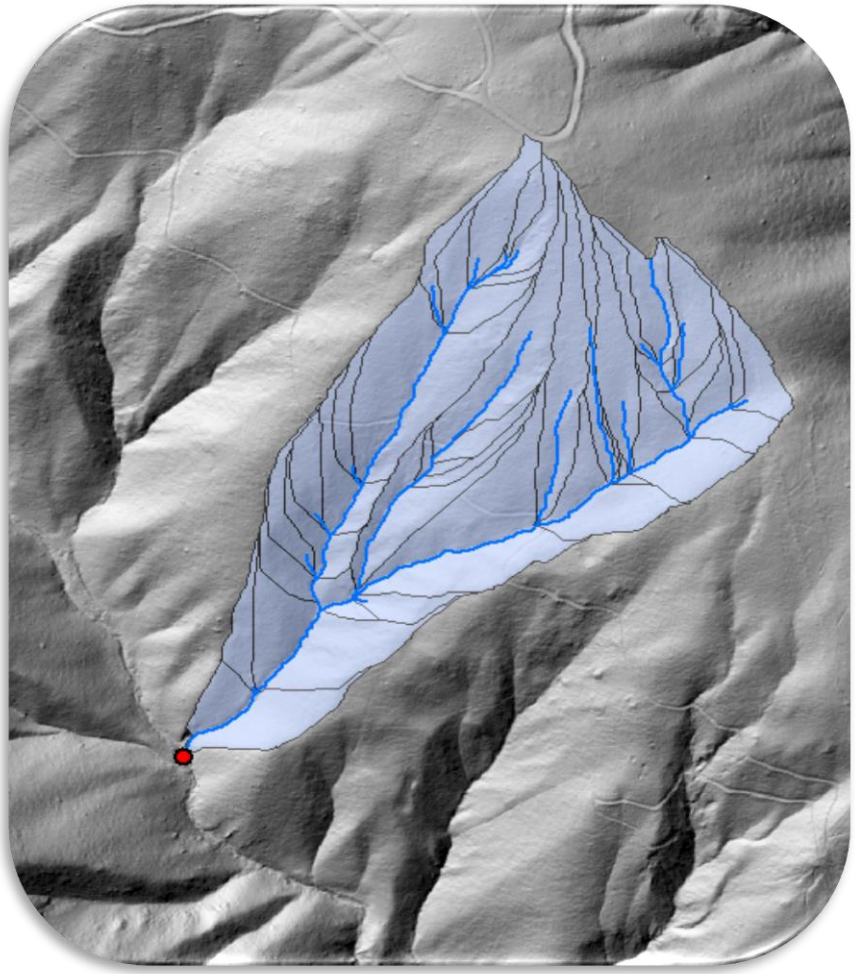
Catchment Polygons



Procedure Overview

LiDAR → Catchment Polygons

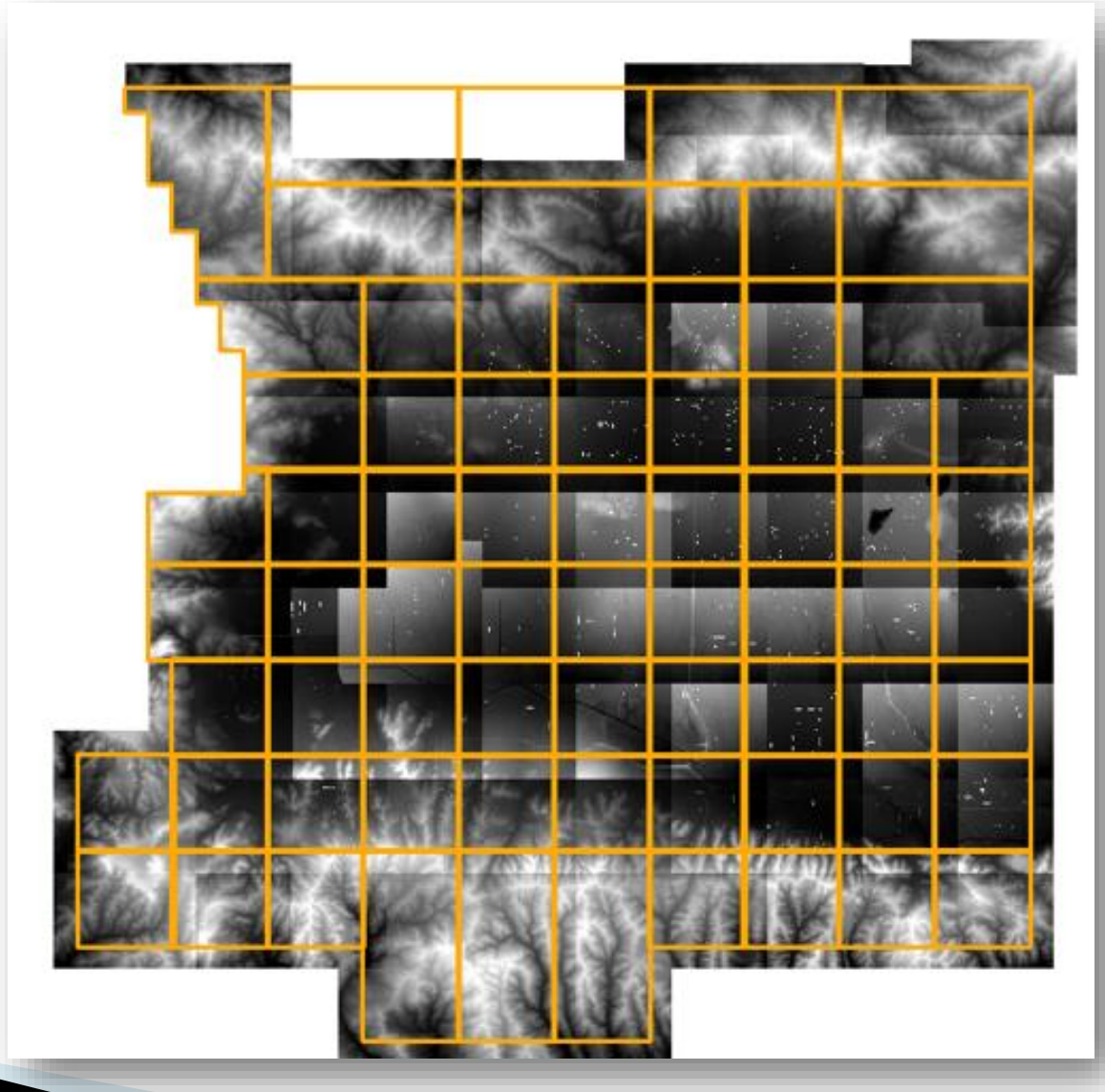




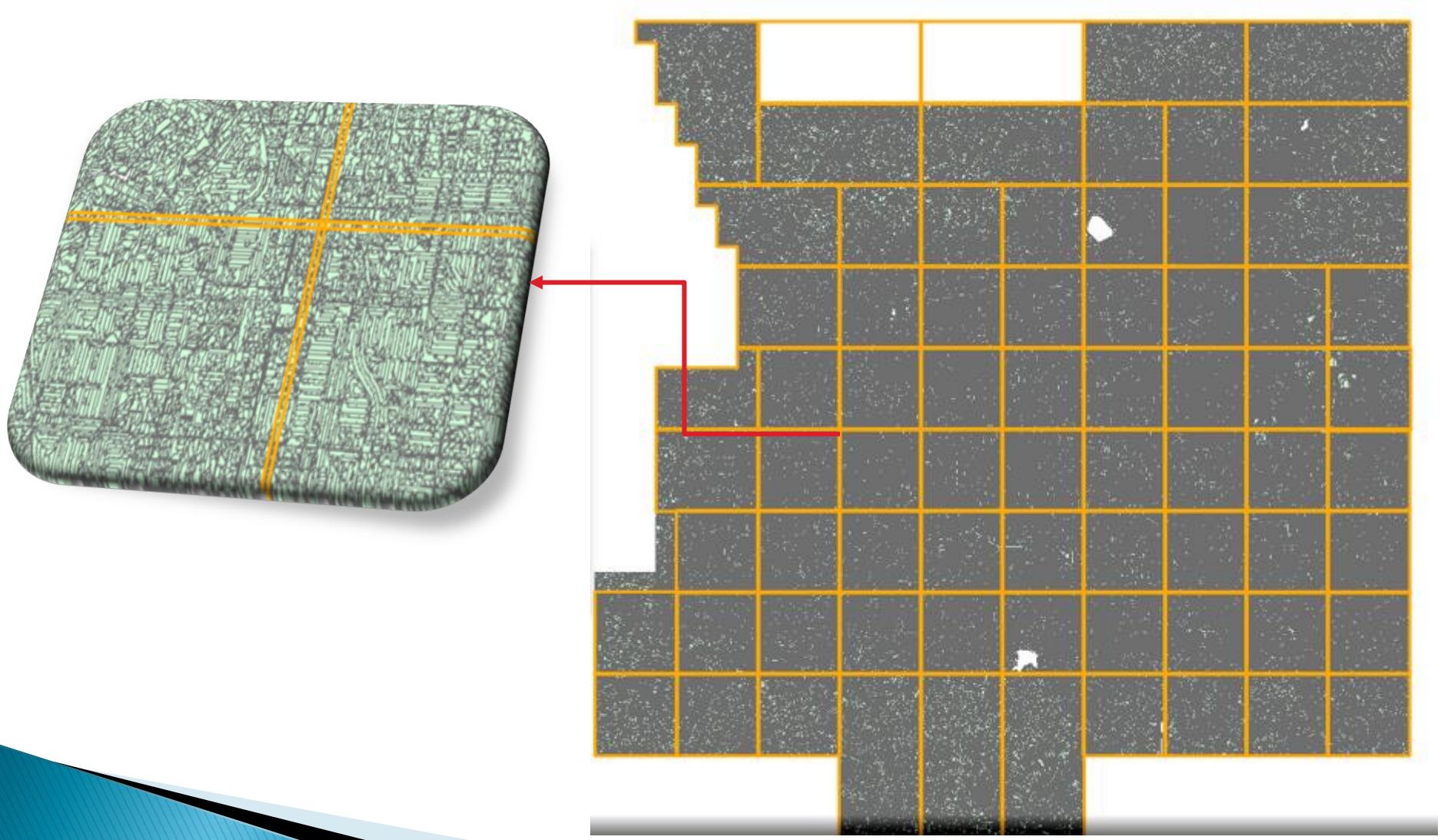
Watershed Management Boundaries

- Los Angeles River
- San Gabriel
- Dominquez Channel
- Santa Monica
- Santa Clara

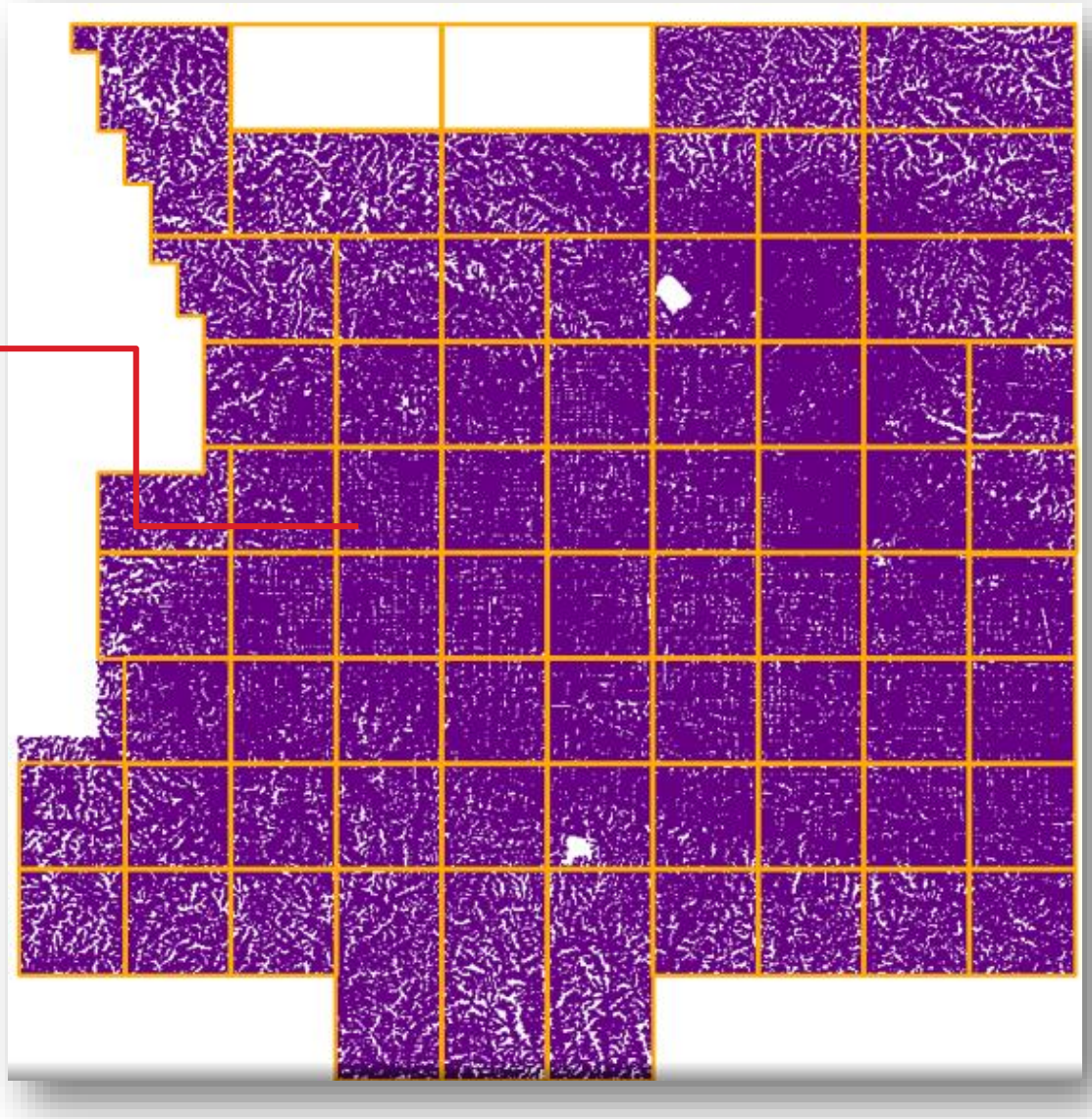
Merging DEM Tiles



Merged Watershed Polygon



Merged Streamlines

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