NORTH CAROLINA
Department of Transportation









Requesting Project Mapping and Surveys - When, How and Why?

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Presentation Topics

- Objective/Background
- Roles / Responsibilities
- Process / When and How To Request Products
- Mapping & Surveys Products/Delivery Timelines
- Parameters to Aid Creating Mapping/Surveys Limits
- Question and Answer

Overarching Objective

- Ensure all projects have the needed mapping and survey products in a timely manner
- Develop and maintain a programmatic approach to correctly identify and request aerial photography, mapping, and surveying with established priorities that…
  - Meet all Division, Business Unit, and Consultant needs
  - Reduce changes and rework
  - Remove Photogrammetry, Location & Surveys, and consultants we utilize from the critical path for project delivery
  - Ideally, have mapping and surveys underway or completed “before the 12, 24, & 36 months clock starts” for project development

Background

- Project mapping and surveys require programmed funding, correct limits, and sufficient lead time to meet delivery schedules
- Seek to take advantage of leaf-off flight season
  - (mid-December to mid-April)
  - Ideal aerial photography period is February & March
- Insufficient coordination, incorrect project limits, and inadequate lead time resulting in late mapping and survey delivery
- Limited number of qualified PEFs with capacity to perform aerial photography, mapping, and surveys work

Roles / Responsibilities

Photogrammetry

- Perform flight and photo control planning for mapping and surveys that support NCDOT projects
- Acquire controlled aerial photography for majority of projects
- All mapping products generated using in-house staff
- Additional Mapping capacity is available through use of Limited Services Agreements with multiple firms
- Review and deliver mapping products

Equipment Used

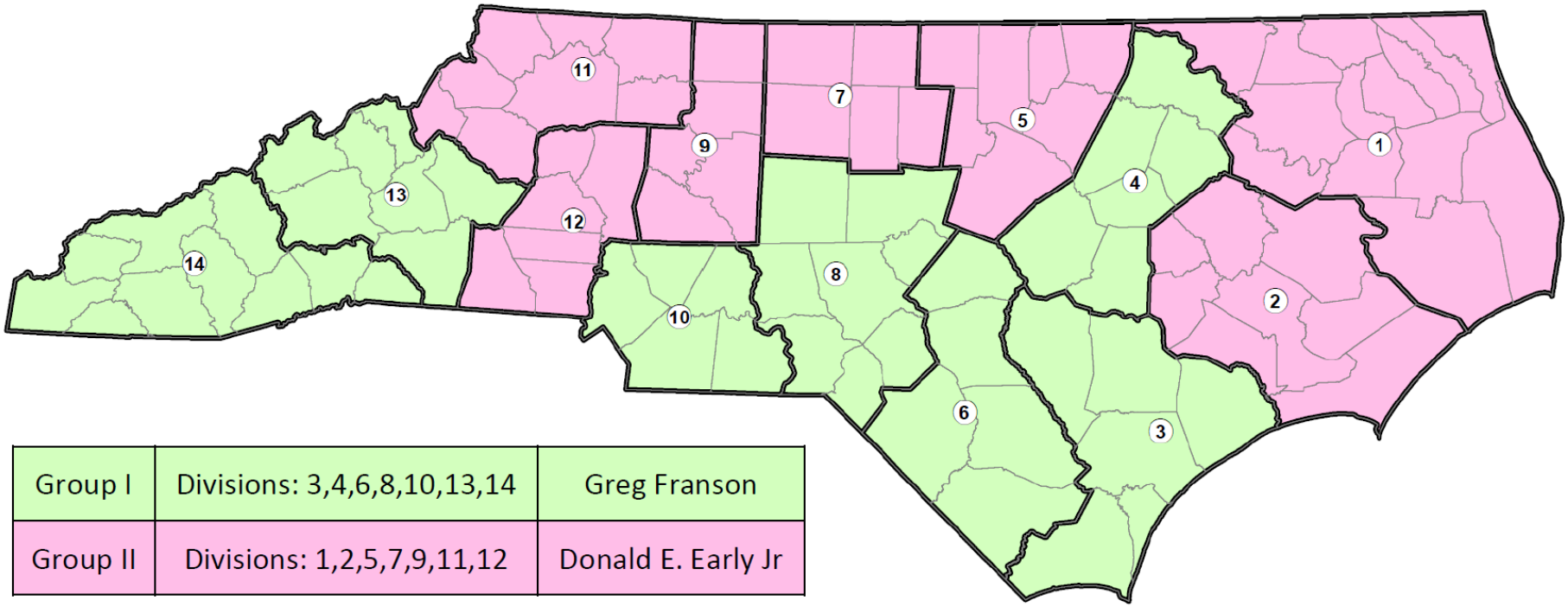
Location and Surveys

- Limited in-house resources to generate survey products
- Utilize in-house staff to establish project control since this is the basis for all subsequent mapping and surveys
- Use Limited Services Agreements with multiple firms to generate a variety of surveys used for transportation projects
- Assist Division Project Development Engineers by serving as the primary contact in requesting, coordinating, and scheduling the appropriate Surveys and Mapping Products with Photogrammetry

Division and Central Project Managers

- Acquire PE funding
- Establish project delivery schedule
- Identify needed mapping and surveys products
- Create and provide mapping and surveys limits
  - Submit mapping and surveys limits as a closed polygon in MicroStation dgn format

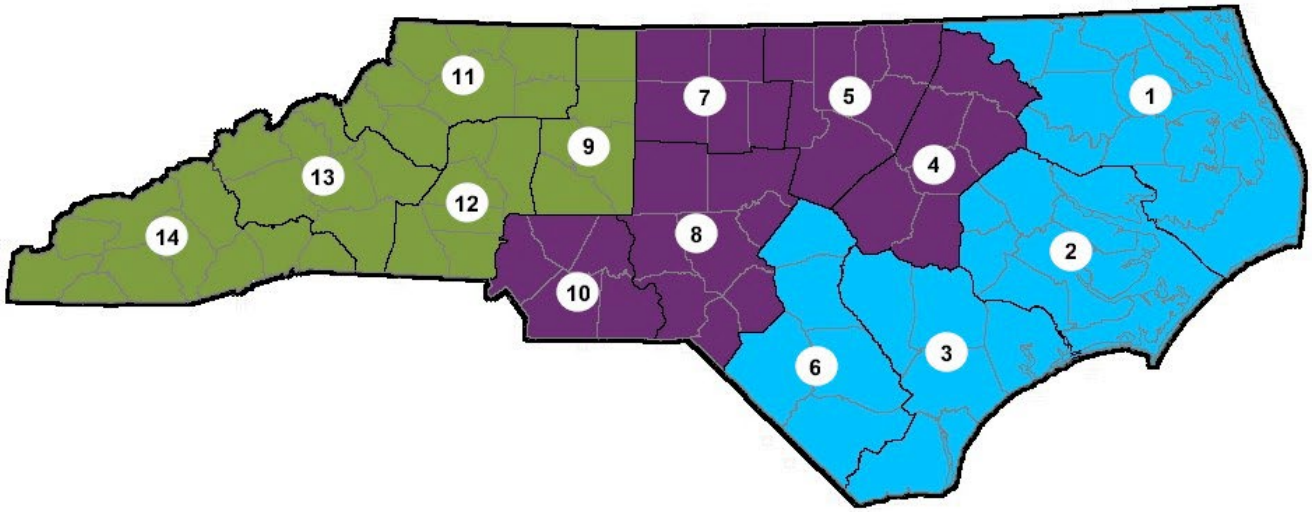
Photogrammetry Staff



Group I	Divisions: 3,4,6,8,10,13,14	Greg Franson
Group II	Divisions: 1,2,5,7,9,11,12	Donald E. Early Jr

For more information about the Photogrammetry Unit visit our website at [Photogrammetry (ncdot.gov)]

Location and Surveys Staff



West Region Delivery Team
(Divisions 9, 11, 12, 13 & 14)

Regional Team Lead

- Regional Engineer - Pat Tuttle, PE, PLS, CPM

Division Group Leads

- Division 9 - Mike Motsinger, PLS
- Division 11 - Larry Absher
- Division 12 - James Jeffreys, PE, PLS
- Division 13 - Richard Hensley, PE
- Division 14 - Joshua Gillett, PLS

Central Region Delivery Team
(Divisions 4, 5, 7, 8 & 10)

Regional Team Lead

- Regional Engineer - David Langston, PE

Division Group Leads

- Division 4 - Paul Woodard, PLS
- Division 5 - Mike Jackson, PLS
- Division 7 - Chris Lewter, PE
- Division 8 - Greg Myrick, PE
- Division 10 - Mojdeh Masihpour

East Region Delivery Team
(Divisions 1, 2, 3, 6, & Sonar)

Regional Team Lead

- Regional Engineer - Keith Honeycutt, PE, PLS, CPM

Division Group Leads

- Division 1 - Jimmy Liverman, PLS
- Division 2 - Jake Green, PE, PLS
- Division 3 - Chris Sawyer, PLS
- Division 6 - Chad Blackmon, PE
- Sonar Surveys Group - Mark Ward, PLS

Collaborative Effort

- The majority of mapping and surveys products used for planning and design are produced with work performed concurrently by Photogrammetry, Location & Surveys, and their respective consultants

Communication Is Crucial to Success

Process / When and How To Request Mapping & Surveys Products

Implementation Timeline

1. 08-18-23: Send Mapping Request / Documentation to Divisions and Central Project Delivery Teams
2. 08-21-23: Regional Mapping Meetings are scheduled in advance to be accomplished 10-02-23 to 10-20-23
3. 9-18- 23: Completed Mapping Request spreadsheet and DGN limits are submitted to Photogrammetry / Location & Surveys – Send to Richard G. Greene at rggreene@ncdot.gov, and Joel Gulledge rjgulledge@ncdot.gov
4. 10-02-23 to 10-20-23: Regional Mapping Meetings conducted with Division & Central Project Managers, Photogrammetry, and Location & Surveys
5. 10-24-23: Mapping products and limits with tentative delivery schedules are identified at Regional Meetings
6. 11-01-23: Photogrammetry / Location & Surveys submit revised delivery schedules to appropriate Division and Central staff for Prioritization
7. 11-09-23: Appropriate Division and Central staff establish final product delivery dates

Note: Out of Cycle requests should be directed to the Regional or Division Location & Surveys Team Lead who will evaluate the scope of the mapping and surveys and coordinate with Photogrammetry

Mapping & Surveys Request Spreadsheet

- TIP #
- Division
- Project Management
  - Division
  - Central
  - Rail
  - Structures
  - Other
- Requestor Name
- Date Needed
- WBS
- ROW Date and Let Date
- Mapping Product
  - Final Surveys
  - Preliminary Plan Sheets
  - Shell Plan Sheets
  - Topo
  - Ortho
  - Mosaic
  - Controlled Aerial Photography
  - Other (specify Special Notes)
- Mapping Scale (1” = 400’ to 20’)
- Description
- Special Notes/Link to Project Limits

Mapping & Surveys Request Spreadsheet

TIP	Division	Project Management	Requestor Name	Description	Special Notes / Link to Project Limits (If Mapping or Survey Limits Are Not Firm, You Will Need to Follow Up with the Regional L&S Engineer. Please Also Include Any Production ROW and / or Production Let Dates.)

- Submit mapping/surveys Limits as a closed polygon in MicroStation dgn format at time of request
- Work with Regional or Division Location & Surveys Team Leads to prepare mapping/surveys limits
- For Final Surveys involving Photogrammetry, if Project Manager wants Shell or Preliminary Plan Sheet Mapping, then use 2 rows to request 2 products

Regional Coordination

- Project Management Team A and Divisions 1, 2, 4
- Project Management Team A and Divisions 3, 6

- Project Management Team B and Divisions 5, 8

- Project Management Team C and Divisions 7, 9
- Project Management Team C and Division 10

- Project Management Team D and Divisions 11, 12
- Project Management Team D and Divisions 13, 14

- Structures will also be involved for Centrally managed bridge projects (Division managed bridge projects need to be included in spreadsheet submittal)

2023 Regional Meeting Preparation

- List of projects that the Division or Central Team will require mapping or surveys by June 2027 with…
  - STIP #
  - Product
  - Limits
  - Schedule
- Attendees:
  - Division project development engineers
  - Central project delivery team lead
  - Photogrammetry assistant unit head
  - Photogrammetry group manager
  - L&S regional project development engineer

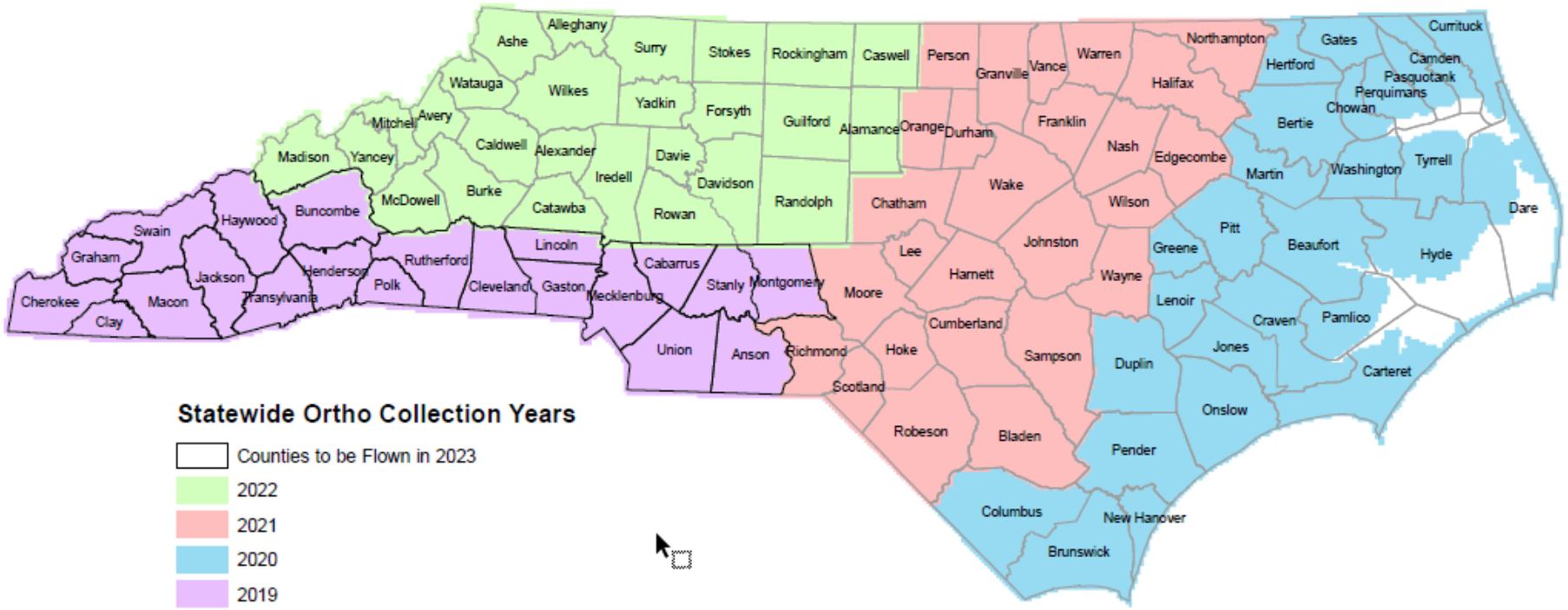
Mapping and Surveys Products

Mapping & Surveys Products to Support Planning and Design Activities

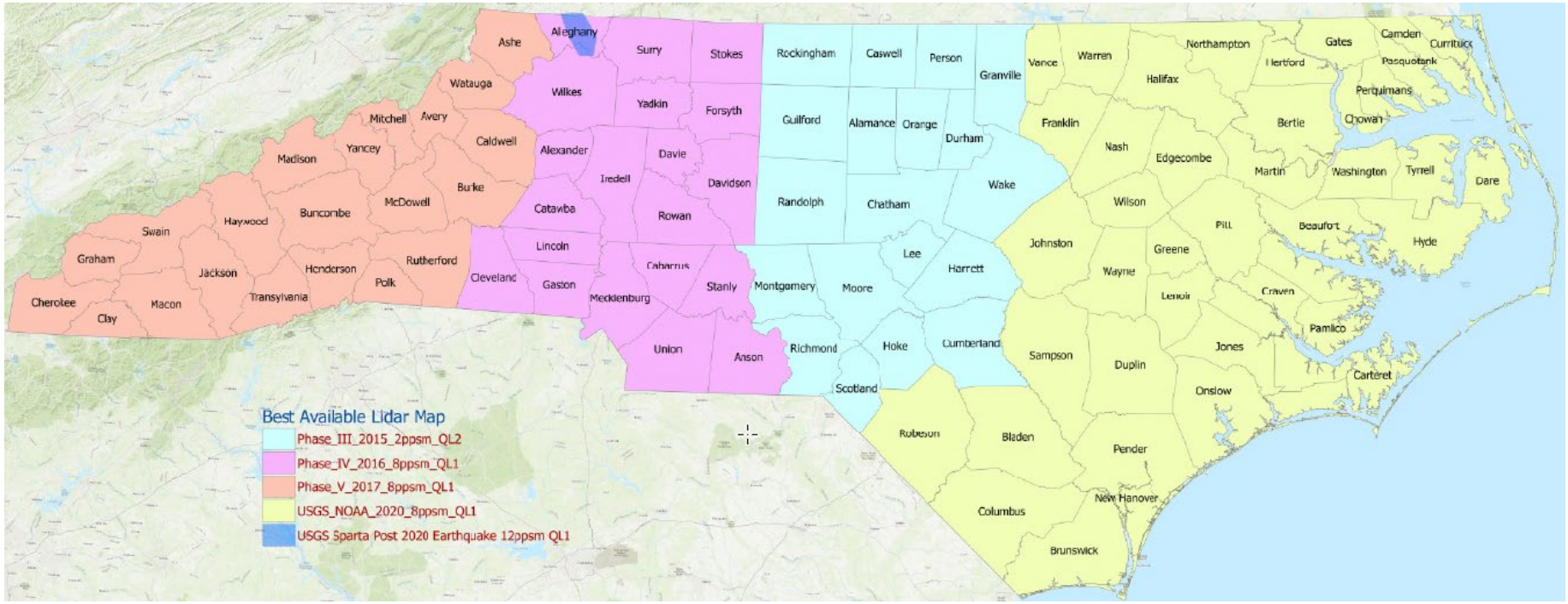
Existing Statewide Geospatial Data

- Available to ALL NCDOT users
- No PE funding required
- Good resource for corridor selection, limited design, creating mapping & surveys limits, and display purposes
- Contact your Division L&S Engineer or Photogrammetry for information on how to access this data

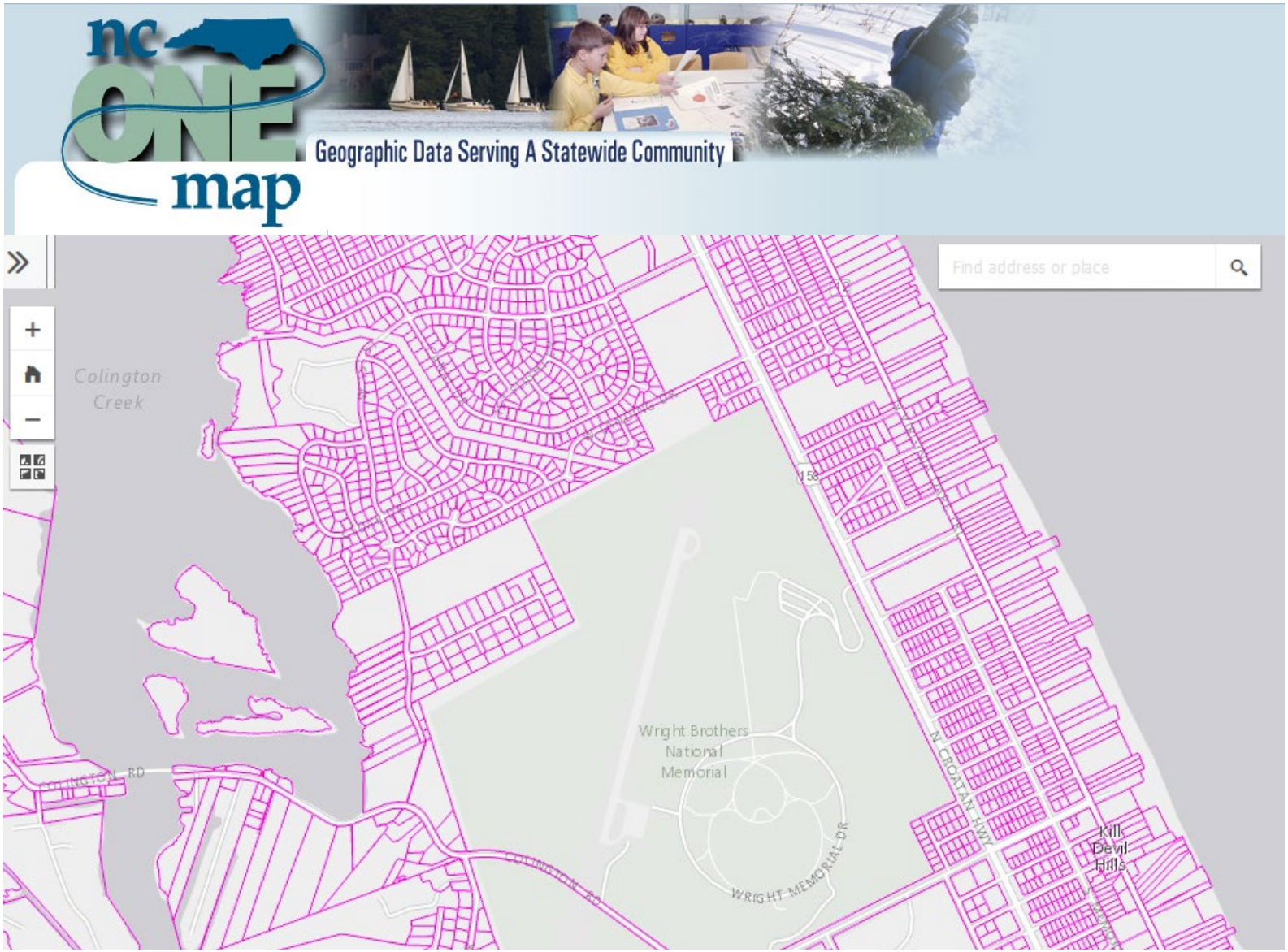
Statewide Digital Orthophotography Status Map



Statewide LiDAR Status Map



GIS Property Data (Photogrammetry can provide in Microstation DGN file with parcel numbers and a corresponding excel file with parcel information)



Mapping & Surveys Products / Timeframe

Product	Typical Scale	When is it typically ordered?	How long to deliver product?
Controlled Aerial Photography (individual photo frames)	Aerial photos are defined by coverage area, and planned mapping product. Use standard scale for planned mapping product.	Prior to or during leaf off flight season. When preferred corridor or alignment is selected outside of leaf off flight season. **Best Practice** Annual Mapping/Surveys Request Cycle **When Necessary** Out of Cycle	1-4 weeks from receipt of verified aerial photography limits.
Digital Mosaic (raster digital image mapping)	**Standard** 0.5 ft GSD (use 1”=100’ or 1”=200’) **Alternative** use 1”=400’ for 1.0 ft GSD use 1”=50’ for 0.25 ft GSD	Start of project development. Existing statewide orthophotos are old or do not reflect current land cover. **Best Practice** Annual Mapping/Surveys Request Cycle **When Necessary** Out of Cycle	1-3 months after aerial photography completed. Requires receipt of verified mapping limits in advance of photo mission.
Orthophotography (raster digital image mapping + DEM with TIN)	**Standard** 0.5 ft GSD (use 1”=100’ or 1”=200’) **Alternative** Upon request	Prior to functional and preliminary design activities. **Best Practice** Annual Mapping/Surveys Request Cycle **When Necessary** Out of Cycle	2-4 months after aerial photography completed and receipt of photo control. Requires receipt of verified mapping limits in advance of photo mission
Topographic (T) Mapping (graphic planimetric mapping including municipal property + DTM with TIN)	**Standard** 1”=200’ **Alternative** 1”=100’	Prior to preliminary design activities. **Best Practice** Annual Mapping/Surveys Request Cycle **When Necessary** Out of Cycle	2-4 months after aerial photography completed and receipt of photo control. Requires receipt of verified mapping limits in advance of photo mission.
Shell or Preliminary Plan Sheet (SPS) Mapping (graphic planimetric mapping + DTM with TIN)	**Standard** 1”=50’ **Alternative** 1”=30’ 1”=20’	Prior to preliminary or final design activities. **Best Practice** Annual Mapping/Surveys Request Cycle **When Necessary** Out of Cycle	2-4 months after aerial photography completed and receipt of photo control. Requires receipt of verified mapping limits in advance of photo mission.
Final Surveys (graphic planimetric mapping + DTM with TIN + supporting ground surveys)	**Standard** 1”=50’ **Alternative** 1”=30’ 1”=20’	Prior to final design activities. **Best Practice** Annual Mapping/Surveys Request Cycle **When Necessary** Out of Cycle	Varies. Requires receipt of verified surveys limits.

Note: All mapping is delivered in ORD 10.10 format until 10.12 is approved for delivery

Aerial Photography

Leaf On (August 5th)

Leaf Off (March 7th)

Mapping Scale

- 1” = 400’, 200’
  - Generally used for display purposes or functional design work for large study areas
  - Available from existing statewide geospatial data or can also be flown at high altitude for more current image (0.5 foot pixel mosaic)
- 1” = 200’, 100’
  - Generally used for preliminary design work for large projects
  - Topographic mapping or 0.5 foot pixel orthophoto
- 1” = 50’, 30’, 20’
  - Generally used for final design work or preliminary design for small projects
  - 1” = 50’ is considered “NCDOT standard”
  - 1” = 30’, 20’ useful for densely developed urban settings

Final Surveys Product Development

- Used for final design
- Usually produced jointly by Photogrammetry and Location & Surveys for larger projects where Shell or Preliminary Plan Sheet Mapping is converted to Final Surveys
- Can be completed solely by Location & Surveys for smaller projects (e.g. intersection improvement projects or bridge replacement projects)
- Timeframe: Photogrammetry needs 2-4 months after aerial photography completed and receipt of photo control. Depending on project complexity and length, L & S needs an additional 1-5 months after receipt of SPS or PPS data from Photogrammetry to complete Final Surveys.
- If numerous smaller projects are identified during the annual cycle prior to leaf-off flight season, it is usually most efficient to involve Photogrammetry and treat them as part of a statewide program

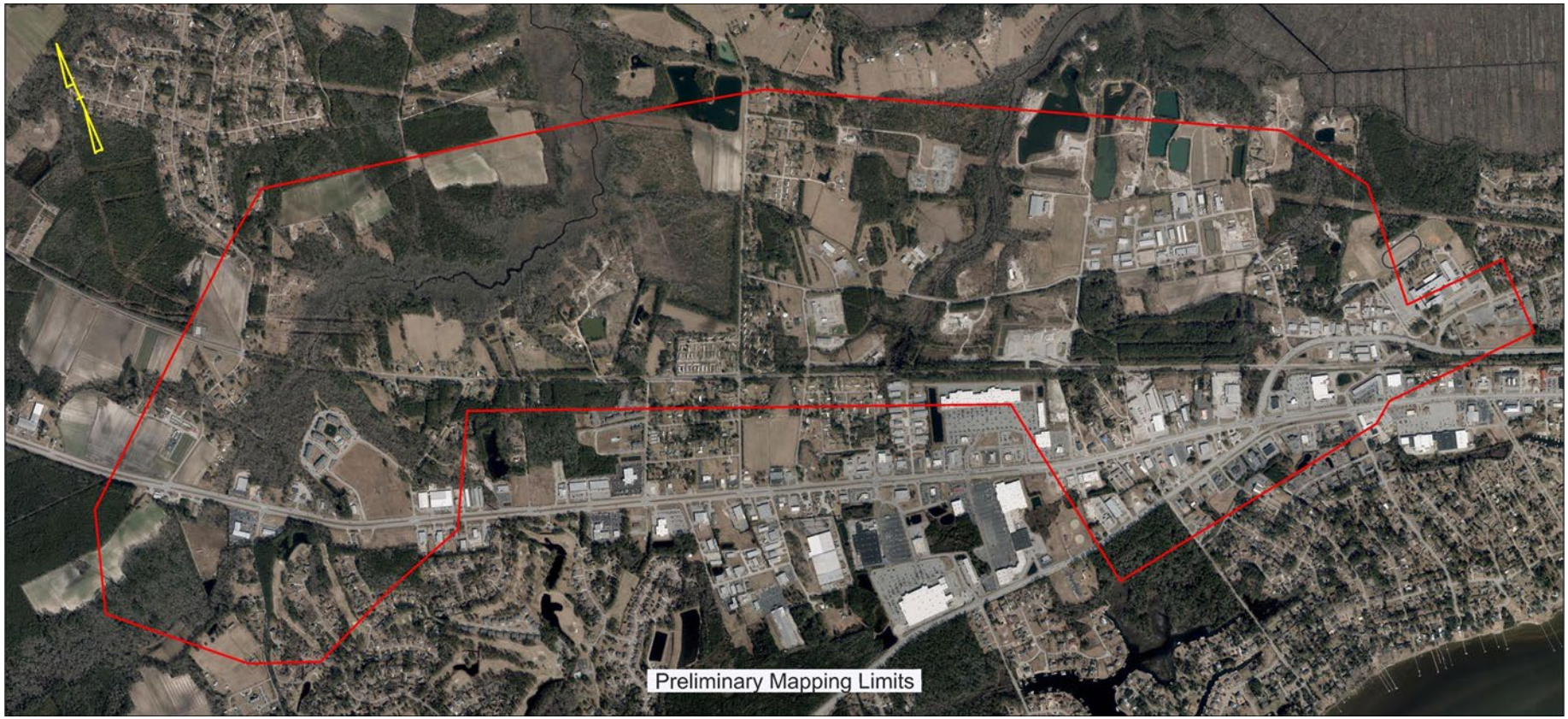
Components Included in Final Surveys

- Photogrammetric data
  - SPS and / or PPS
- Location & Surveys data
  - Establish Project Control (GPS, Baseline, Vertical Control)
  - Contact Property Owners
  - Property Owner Research / Compilation of Property Data (CADD, Deeds, Plats, Database, etc.)
  - Drainage Features (Natural and Man-made)
  - Utility Data (SUE, Gravity, Above Ground)
  - Pavement DTMs (Mobile LiDAR)
  - Additional Topographic Features & Obscured Areas
  - Merging of All Data Sources / Quality Control

Parameters to Assist Development of Mapping and Survey Limits

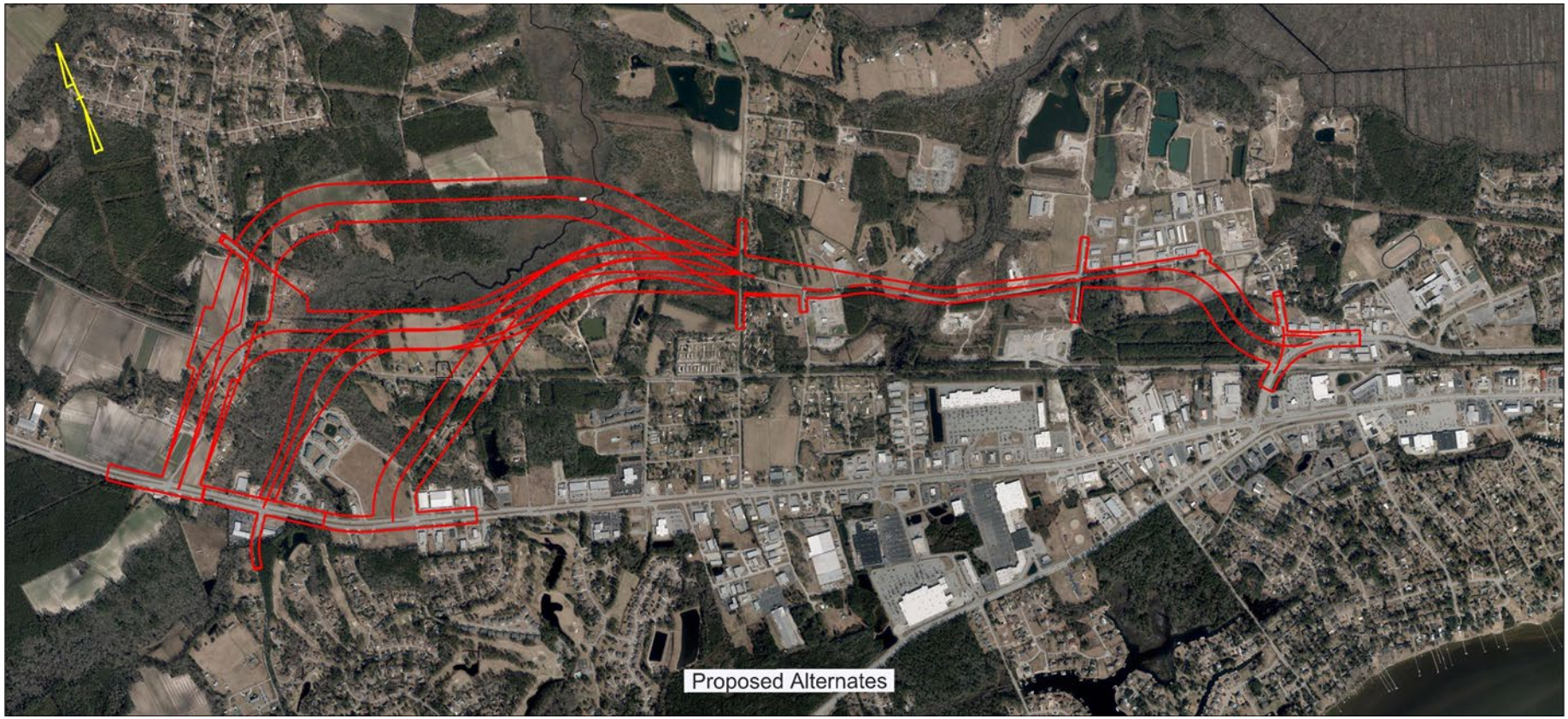
- Types of Limits
  - Study Area
  - Controlled Aerial Photography
  - Mapping
  - Surveys
- Types of Projects
  - Intersection
  - Interchange
  - Widening
  - New Location

Study Area Limits

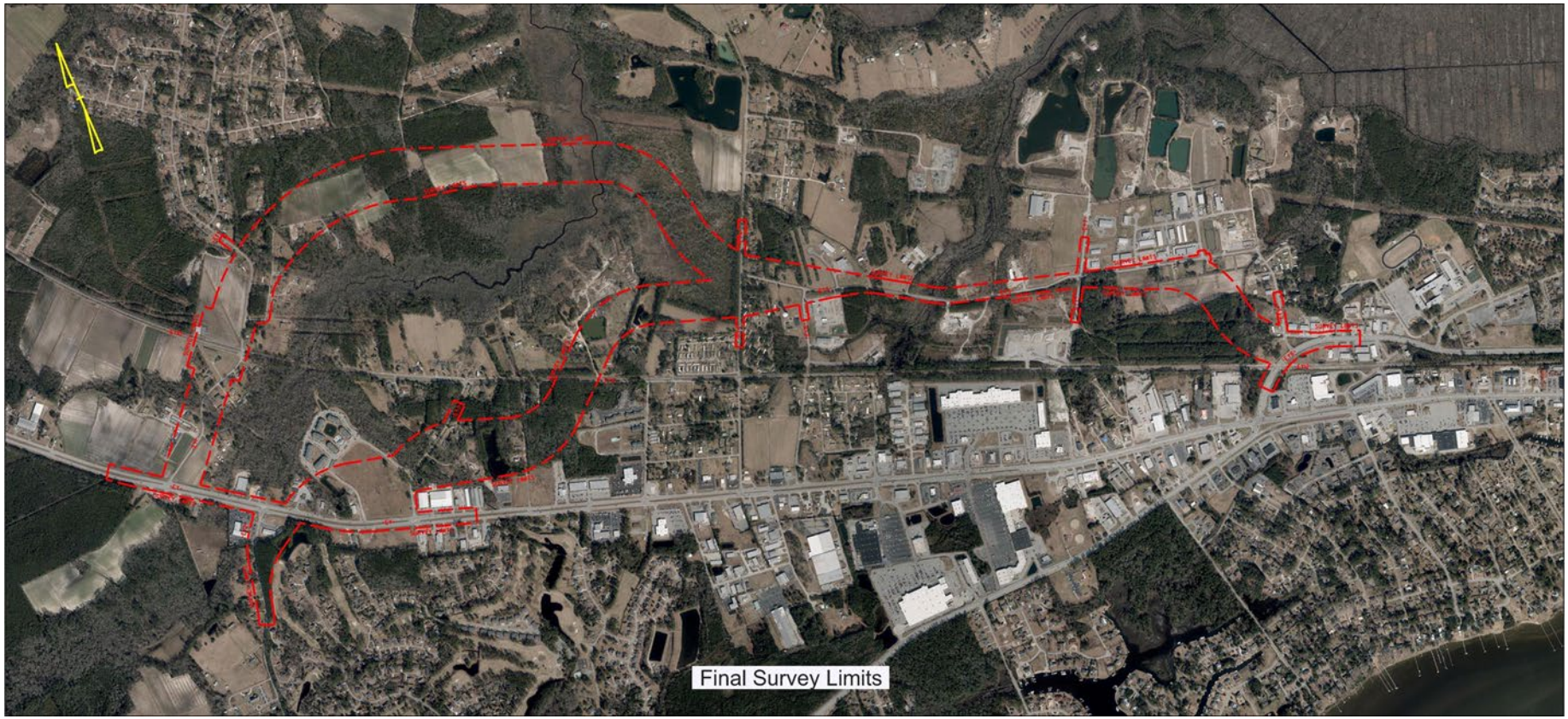


In certain cases, study area limits can be used to obtain leaf off controlled aerial photography prior to corridor selection to mitigate scheduling concerns

Mapping Limits



Final Surveys Limits



Parameters to Assist Development of Mapping and Survey Limits

- Types of Projects
  - Feasibility Studies Unit has been tasked to create initial mapping/surveys limits at completion of Express Design
  - Location & Surveys, Photogrammetry, and Feasibility Studies Units developed parameters for project managers to consider when delineating Mapping and Surveys limits.
  - 4 Project Types (as depicted on provided Mapping & Surveys “Cheat Sheet”)
    - Intersection
    - Interchange
    - Widening
    - New Location

Intersection Project

- **Mapping Limits** – Polygon that covers 1,500’ down each Y-Line and ~ 300’ to 500’ left and right of each centerline.
- **Survey Limits** – Roughly the same as above, may not require the same distance or width on each Y-Line.
- **Mapping/Surveys Product** – Typically goes straight to 1”=50’ Final Surveys.

Interchange Project

- **Mapping Limits** – a custom polygon that covers at least 100’ outside the existing ROW and all the proposed new ROW. May include multiple alternative designs.
- **Survey Limits** – Roughly the same as above but will only include area(s) that have been selected for final design
- **Mapping/Surveys Product** – 1”=50’ Shell or Preliminary Plan Sheet Mapping to support selection of the preferred design, then 1”=50’ Final Surveys on the existing and proposed ROW covering the selected design option.
- In cases where multiple interchanges constitute a project, designs and required limits behave like a widening project.

Widening Project

- **Mapping Limits** – a custom polygon that covers at least 100' outside the existing ROW and all the proposed new ROW and 500' beyond the proposed project termini. Additional limits down all Y-Lines range from 500' to 1000' depending on the facility (entrance into a subdivision vs major urban road).
- **Survey Limits** – Roughly the same project termini as above but limits will only include areas that have been selected for final design.
- **Mapping/Surveys Product** – 1"=50' Shell or Preliminary Plan Sheet Mapping to support selection of the preferred design, then 1"=50' Final Surveys on the existing and proposed ROW covering the selected design option.
- In cases of very large widening projects with new location options, the designs and required limits behave like a New Location Project.

New Location Project

- **Mapping Limits** – a custom polygon that covers at least 500’ outside the existing ROW and all the proposed new ROW and 1000’ beyond the proposed project termini. Additional limits down all Y-Lines range from 1000’ to 1500’ depending on the facility. Will include multiple alternative designs.
- **Survey Limits** – Specific limits developed for the selected corridor.

Mapping/Surveys Products

- Orthophotography and Digital Elevation Model (DEM) Mapping for corridor studies.
- 1”=100’ Topographic Mapping to support selection of the Least Environmentally Damaging Practicable Alternative (LEDPA).
- 1”=50’ Shell or Preliminary Plan Sheet Mapping on the selected corridor, limits roughly following criteria for a widening project.
- 1”=50’ Final Surveys on the selected corridor with limits possibly altered by preliminary design refinements.

Please direct any questions to
Richard G. Greene and Joel Gulledge