

**HURON – MANISTEE NATIONAL FORESTS CADASTRAL SURVEY:
END-RESULT SPECIFICATIONS**

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HURON – MANISTEE NATIONAL FORESTS CADASTRAL SURVEY: END-RESULT SPECIFICATIONS

3000 SCOPE OF CONTRACT

The intent of this contract is to procure surveying services on an “as needed” basis for a period of up to five years from date of initial award.

3100 PROJECT DESCRIPTION AND LOCATION

All work performed under this contract shall be under the direct supervision of a Professional Surveyor licensed in Michigan. All surveys shall comply with applicable state laws and regulations, as well as applicable portions of the appropriate GLO/BLM Manual of Surveying Instructions.

The work to be performed under this contract involves retracement surveys of the Public Land Survey System (PLSS). The surveys will be performed between recovered and/or accepted controlling corner positions to reestablish lost or obliterated General Land Office (GLO) corners and to establish section subdivisional corners designated by the Contracting Officer’s Representative (COR). Government property boundaries will be designated for posting to Forest Service standards. A Certificate of Survey may be required to be prepared for recordation. Topographic surveys may be requested either in conjunction with boundary surveys or as a stand alone item.

The Huron-Manistee National Forests project zones are located on the project vicinity map (Exhibit 2). Actual work locations and services to be performed have not been determined at this time. These will be specified by delivery/task order(s), issued when the Government determines its specific surveying needs.

The following specifications are specific requirements of the work performed under this contract in addition to (or as a clarification of) the professional services listed above.

3122 SURVEY METHODS AND PROCEDURES

The Contractor shall select the methods and instruments to be used for field data collection and boundary location. Methods such as remote sensing, traverse, and Global Navigation Satellite Systems (GNSS) may be used. The system selected shall meet the accuracy standards prescribed by the State of Michigan. Where state standards are less restrictive than the specifications contained herein, the specifications contained herein shall apply.

All work shall be performed in a safe manner and in accordance with OSHA regulation. Refer to Exhibit 3, the Land Surveying Job Hazard Analysis (JHA), for examples of work hazards and abatement actions that may be taken to prevent accidents. Note that federal law requires at least a Class 2 high visibility safety vest be worn by workers within the right-of-way of federally funded highways. For the scope of this contract safety vests are required to be worn for any work performed along county maintained roadways. The Contracting Officer may, in writing, require the Contractor to remove from the work any employee found to be working in an unsafe manner.

3122.1 Survey Standards

The position of each corner and/or piece of evidence (BT stumps, topo calls, etc.) reestablished, established or found must be determined as part of a closed traverse loop, an acceptable radial tie, or a point positioning procedure designed to meet the standards prescribed by the State of Michigan and/or the specifications contained herein. Proposed procedure for performing radial ties shall be included in the Contractor's Quality Control Plan and submitted to the COR at the post award conference. The precision of each traverse loop shall be demonstrated in the field notes and closure report required in Section 3160. An appropriate adjustment is required to be performed on all traverse loops with errors $> 0.20'$, but may be performed on all loops. The standard for locating the boundary line between corners is specified in Section 3146.

3122.2 Determination of Bearing

The method used to determine a bearing base for each project must be capable of establishing astronomic, geodetic, or state plane grid azimuth to within 1 minute of arc. Assumed bearings will not be accepted.

3122.3 Use of Global Navigation Satellite Systems (GNSS)

Geodetic/survey grade GNSS equipment and methods may be utilized for measurements and staking by contractors having that capability when it saves cost and/or time compared to conventional methods, but only in situations where appropriate relative accuracy standards can be achieved at the 2σ (95%) confidence

interval. It is the contractor's responsibility to be aware of the limitations of any measurement/staking tool used and be able to demonstrate that relative accuracy standards have been achieved. The use of GNSS to measure a line does not relieve the Contractor from the responsibility to search and evaluate all evidence of GLO and/or subsequent surveys and to tie evidence of encroachment and occupation onto Government land.

If field procedures include the use of GNSS equipment, clearing the site location is limited to shrubs and trees under 6 inches in diameter **except in areas of forest disease mitigation outlined in the project scope**. The COR must approve all other clearing by the Contractor on National Forest System lands. All clearing on privately owned lands must be approved in writing by the property owner.

All GNSS work shall conform to the Forest Service "Standards For the Positional Accuracy of Cadastral Surveys When using Global Navigation Satellite Systems (GNSS)". Note that these standards refer to 3-dimensional position solutions at the 2σ (95%) confidence level. If Real Time Kinematic (RTK) techniques are used, ensure that repeat measurement tolerances are set in both field and office software at or below required positional accuracy at the 95% confidence level. A minimum of 3 independent measurements of at least 30 epochs of data shall be collected for each RTK point. Any station with uncertainties greater than those outlined in these standards will either need to be re-occupied or made part of a conventional traverse to confirm the coordinate values. Distances between intervisible pairs of project GNSS control points shall be checked by EDM measurement to verify relative positional accuracy prior to utilizing control to perform additional conventional traverse or radial ties.

3122.4 Records Research

It is the Contractor's responsibility to research the records of public agencies, and private records to the extent necessary, to obtain the survey history of the subject property and relevant adjoining properties. The Contractor shall provide the results of any records research to the COR prior to the start of field work. Copies of any subsequent research shall also be provided to the COR as they are acquired.

The Government will provide the Contractor information in their possession: Government title records, any corner recovery information and previous survey records at the time of Request for Services. It is the Contractor's responsibility to evaluate corner and survey records for accuracy and completeness as well as relevance to survey decisions made in determining Government property boundaries.

3122.5 Adjoiner Notification

Prior to the start of field work, the Contractor shall develop a list of adjoining property owners and notify the affected adjoiners of the pending survey in writing

(see Exhibit 8 for example). In addition to notification, the letter will address the necessity for access, marking of accessories and minor clearing of line on private land if necessary. A list of adjoiningers, including property descriptions, shall be provided to the COR prior to the start of field work.

3122.6 Conflicts and Encroachments

The Contractor is not required to resolve title or possession conflicts, but shall accurately report the facts and any professional opinions that are relevant to the conflict prior to posting boundary lines. The Contractor shall identify, by survey, any encroachments or lines of occupation along the boundaries of National Forest System (NFS) lands. The nature and extent of the encroachment or lines of occupation shall be documented in a narrative as part of the Report of Survey as well as graphically on the Control Diagram and Certificate of Survey drawings. **When encountering fences, please be specific as to the condition of the fence and whether it is being maintained.**

3122.7 Field Notes and Point Numbering

During the field work, the contractor will keep a record of the survey in a field book with sufficient detail to provide verification of the final survey record. Field notes should be well organized, accurate, neat, legible, detailed and complete (see Exhibit 11 for example). On multi-section projects, field notes shall be organized, labelled and separated by section. This can most easily be achieved by utilizing loose leaf field books. Field notes should contain sketches roughly to scale that accurately depict and clarify the ground survey and contain neatly printed annotation and a north arrow. Avoid crowding too much information onto a page.

Field data should be recorded in such a manner as to allow another technically qualified person to readily retrace the survey without consultation with the Contractor. Field notes shall include information on all monuments recovered and set, including: monument size and type, height above or below ground, reference to occupation lines and roads, and accessories listed in clockwise order from North. Bearings and distances to accessories and any conflicting monumentation should be measured with a compass and tape. Monument dimensions shall also be measured with a tape and not estimated.

If the Contractor uses an electronic data collector, the raw data file shall contain all measurements and error checks and be submitted as part of the Report of Survey. Hardcopy field notes are also required as summary documentation of field measurements and monument information as required above.

In an effort to maintain clarity and consistency of Forest Service survey records, the contractor shall adhere to the following point numbering scheme:

| | |
|------------------|---|
| 1-2999 | Survey control, including recovered monuments, recovered evidence, GPS control and intermediate traverse points. |
| 3000-3999 | Computed controlling or property corner positions. |
| 4000-4999 | Check shots on set corner monuments. Should correspond to computed point number, i.e. check on 3012 should be 4012. |
| 5000+ | Topographic ties, property line offset points, encroachment/occupation ties, etc. |

All descriptive codes used for points should be concise, consistent, and easy to interpret.





3122.8 Clearing for Control Survey

Clearing shall be kept to the minimum necessary for the survey and may be limited in the project scope to mitigate spread of forest diseases. Survey operation should be kept on Government land whenever possible. No timber or brush of scenic or commercial value shall be cut along control traverse lines. In an effort to preserve homes for various wildlife, please refrain from cutting standing dead trees unless they pose a safety hazard. The contractor is responsible for obtaining permission from landowners prior to clearing line on private land.

3125 CONTROL DIAGRAM

The Contractor shall electronically provide a control diagram in an AutoCAD 2020 (or previous release) compatible .dwg file showing reduced data of the control survey and any survey computations made to determine property boundaries. If the project is within a township that the Contractor has previously performed work for the Government, then the AutoCAD file shall contain both the previous work as well as the current project work.

Control diagrams shall be drawn to a scale of 1"=800' with dimension text at a height of 64. Orientation of all text shall be to read from the top or left side of the sheet. Diagrams should be configured to plot on no larger than an "E" size sheet. A surveyor's legend shall be included to identify record measurements by the 3 initials of the surveyor's name. Distance measurements shall be shown in reverse chronological order, with current measurement shown first and adjacent to line (see Exhibit 9 for example). The following standard symbols shall be used on all drawings:

-  EXISTING PLSS CORNER POSITION ACCEPTED
-  PLSS CORNER POSITION MONUMENTED
-  SECTION SUBDIVISIONAL CORNER SET
-  SECTION SUBDIVISIONAL CORNER FOUND

The legend shall also state monument type for section subdivisional corners set (i.e., ½”X18” rebar with cap #12345). All diagrams shall also contain statements regarding the project combined grid factor and conversion to ground units, the method of section subdivision, and a concise narrative of any existing conflicting monumentation found and why it was not accepted. The following CAD layer standards shall also be followed and a drawing template shall be submitted to the COR at the post award conference:

| Layer Name | Linetype | Color |
|--|--------------------------|---------|
| BUILDING | Continuous | Cyan |
| CENTERLINE | Center2 | Green |
| DRIVE-TRAIL | Continuous | Red |
| EASEMENT | Dashed2 | Yellow |
| FENCE | Fence --x-- | Yellow |
| POINTS CONTROL | Continuous | White |
| POINTS COMP | Continuous | Green |
| POINTS CHECK | Continuous | Yellow |
| POINTS TOPO | Continuous | Cyan |
| PROPERTY LINE | Continuous | Magenta |
| RIGHT-OF-WAY | Hidden2 | White |
| SECTION LINE | Phantom2 | Red |
| SYMBOLS | Continuous | White |
| TEXT-DIMENSION | Continuous | Green |
| TEXT-SMALL | Continuous | Red |
| TEXT-LARGE | Continuous | Cyan |
| TOPO FEATURES | Continuous | Cyan |
| TREELINE | Treeline_L or Treeline_R | Green |
| VIEWPORT | Continuous | Gray |
| Minimal additional layers needed for drawing border. | | |

A preliminary control diagram and Land Corner Recordation Certificates (LCRC’s) for all GLO corners requiring monumentation shall be provided to the COR prior to the posting or monumentation on any project. A narrative report shall be included with the control diagram and shall describe the basis for the survey decisions made and a discussion of the evidence, methods, and procedures used in determining the location of all controlling corners within the survey.

The COR will be allowed 5 working days to review the submitted documentation. A comma delimited text file of coordinates with descriptors for each point shall be provided with all diagrams. If the control diagram contains previous work within a township, then point numbers shall not be reused within the current project work (see Section 3122.7 for point numbering standards). A final control diagram showing all survey control shall be included in the Report of Survey as specified in Section 3160.

3130 CORNER MAINTENANCE AND ACCESSORIES

For all controlling corners measured as part of the control survey, all existing bearing trees that falls on NFS lands shall have a 4” red band painted at a height shown in Exhibit 5. All other maintenance of existing corners must be approved by the COR and shall only be performed when requested through a delivery/task order. When maintenance is performed, the Contractor shall ensure that existing monuments are firmly and securely set in their original location. The Contractor shall also ensure that existing signs on posts and trees are securely attached and legible. Signs that are damaged or deteriorated shall be replaced. The Contractor shall establish new bearing trees or objects to replace dead, damaged, dying, or missing bearing trees or objects in accordance with Section 3137. Signs to be used are shown in Exhibit 4. Sign placement shall be in accordance with Exhibit 5.

3130.1

Brush and debris within a 3-foot radius of the corner shall be cleared away.

3130.2

The Contractor shall notify the COR of any damaged or missing monuments.

3135 CORNER MONUMENTATION AND ACCESSORIES

3136 Monumentation

All original GLO corners requiring monumentation under this contract shall be perpetuated or reestablished using a monument provided by the Government. Section subdivisional and other corners will be marked with a monument that meets State of Michigan requirements and will be supplied by the Contractor and monument type will be included in all drawing legends. If a conflicting monument is found at a C $\frac{1}{4}$ corner, then the C $\frac{1}{4}$ corner may be established using a monument provided by the Government. An appropriate measuring tool that can achieve required relative accuracy standards shall be used to establish the position where each monument will be set.

Corner positions that fall in non-hard surface roadways shall be set 10-12” below the surface of the road. GLO corner positions that fall in hard surface roadways shall be contained within a visible protected enclosure and shall comply with any requirements of the agency having jurisdiction over the roadway. Per Act 132 of 1970 and Act 283 of 1909, the intersections of boundary lines with year round state/county maintained road rights-of-way shall be monumented. If a road generally follows a section or $\frac{1}{4}$ line, then that shall be held for the centerline. The COR shall be contacted prior to monumenting a right-of-way other than 2 rods from a section or $\frac{1}{4}$ line. All corner positions reestablished/established shall meet the specifications in Section 3122.1.

3136.1 Monument Stamping

All original GLO and C ¼ corners monumented under this contract using a monument provided by the Government shall be stamped in accordance with the current BLM Manual of Surveying Instructions (limited examples shown in Exhibit 5). The Contractor should make examples of proper stamping readily available to field staff to avoid incorrect stamping. Monuments that are incorrectly stamped by the Contractor will be replaced with a properly stamped monument at the Contractor's expense. In addition to the corner designation and year the monument was set, the surveyor's license number shall be stamped near the lower perimeter of the cap. A 1/8" stamp set shall be used for all monument and sign stamping.

3136.2 Signing

Signs to be used are shown in Exhibit 4. Sign placement and attachment shall be in accordance with Exhibit 5. All metal or fiberglass posts and signs will be provided by the Government. Each bearing tree requires a sign 54-3. All other accessories such as posts or poles require a sign 54-5. Posts or poles should only be used as accessories as a last resort.

Each corner monument set and/or accepted under this contract shall have a metal post with sign 54-9 attached or fiberglass post with decal P71-10 affixed, placed within 1 foot of the monument *and* along the property line where the corner does not fall in a roadway, if one does not already exist. For corners that fall in a roadway and a line originating from the corner is being posted, then a fiberglass post with decal P54-1 will be set along the line at the approximate road right-of-way limit, if one does not already exist. For corners that fall in a roadway and a line originating from the corner is *not* being posted, then a fiberglass post with decal P71-10 will be set at the approximate road right-of-way limit and facing the corner, if one does not already exist. For forest roads of unknown right-of-way width, posts shall be placed at an appropriate distance from the corner as to not sustain damage from road use and/or maintenance activities.

3137 Bearing Trees and Accessories

All corners established, reestablished and/or maintained in this contract shall have a minimum of four accessories marked in accordance with Exhibit 5, unless otherwise directed by the COR. Bearing trees should *typically* be greater than 30 feet from the corner, outside of road right-of-ways, greater than 30° apart, and be selected based on their durability (refer to Exhibit 7 for excerpts from BLM training publication "Durability of Bearing Trees"). If historical bearing trees are found to not meet the above criteria, they should still be remeasured and included as an additional accessory to the corner. If historical bearing trees are either in poor condition or within 10 feet of the corner, they should be shown in addition to the minimum four "good" accessories.

Bearing, to the center of the base of accessories, shall be referenced to true North and have a tolerance of $\leq 3^\circ$. Note that metal objects, such as watches, pencil clips, spikes, hammers, etc. should not be in or near hands when obtaining bearings using a magnetic compass. To ensure an accurate compass reading the compass must be held level so the needle swings freely and independent readings should be taken at least twice (refer to Exhibit 13 for excerpts from Basic Land Navigation). Accessories shall always be listed in clockwise order from North. Note that posts identifying the corner are not considered accessories for the purpose of reestablishing the corner position and should be listed last. Location of reference nails in accessories shall be reported as well as horizontal distances to the nearest 0.01 feet. Note that it typically requires two people to effectively tape an accurate *horizontal* distance, slope distance is not acceptable. Also, distances obtained by inverting between GNSS measurements generally will not meet relative accuracy standards and should always be verified with a tape.

3138 Recordation of Corner Certificates

For each GLO and C $\frac{1}{4}$ corner position monumented or maintained under this contract, a corner certificate meeting the requirements of Act 74 shall be prepared. Additional requirements for submitting corners through the county remonumentation program may also be required when part of a project scope. Corner certificates may be required for section subdivisional corners when part of a project scope. The certificates will document the entire survey history of the corner position, including method of any previous restoration and measurements made to adjacent controlling corners. The current condition of all previous accessories for the corner shall also be noted and all existing accessories in good condition shall be included in Part C. For clarity and consistency, the format of information to be included on submitted LCRC's shall be similar to that shown in Exhibit 10.

If conflicting monumentation is recovered at a corner position, this shall be documented on the LCRC. Rationale for accepting and rejecting positions when conflicting monumentation exists shall be presented in a *concise* but detailed and defensible manner. A detailed list of all collateral evidence supporting the decision for acceptance or rejection shall be included in Part B (see Exhibit 10 for example). In order to maintain clarity for the reader, it is imperative that the narrative be as concise as possible and focus on the evidence recovered, not necessarily on *how* it was recovered, although the extent of search area/effort should be included.

Preliminary LCRC's for all GLO corners requiring monumentation along with a preliminary control diagram shall be provided to the COR prior to the posting or monumentation of any designated project. The COR will be allowed 5 working days to review the submitted documentation. A maximum of 1 GLO or 2 section subdivisional corners shall be documented per form. Prior to recordation, the final certificate(s) will be submitted to the COR for review.

3140 PROPERTY LINE MAINTENANCE AND REPOSTING

Maintenance and/or reposting of previously surveyed and marked property line may be requested to be performed through a delivery/task order.

3141 Property Line Maintenance

Maintenance shall consist of repainting existing line and corner posts, line and off line trees, and corner accessories. If fiberglass posts are found along property lines, then orange flagging shall be tied along the tops. If *corner* posts are found to be missing or in poor condition, they shall be replaced.

A report shall be submitted noting the density of vegetation along the lines, the general condition of the line posts, and condition of each corner accessory, including current diameter and if tags are missing. If line posts are found to be missing or moved, specific information shall be provided regarding the location and number of posts. The report shall also include information regarding any encroachments or other unauthorized uses occurring along the lines being maintained. The report can consist of neat and legible notations on survey documents of record or a more formal report format. If the prior survey documents of record include identified encroachments, the report shall include the status of those encroachments (ex. resolved, still exist, expanded).

3142 Property Line Reposting

If the condition of a previously marked line(s) is reported to be extremely over grown and/or no longer adequately posted, then reposting of the line may be requested through a delivery/task order. Reposting shall consist of clearing the property line, painting and reflagging of existing posts, placing additional posts and signs, and blazing and painting trees in accordance with Sections 3146 thru 3147.4.

3145 PROPERTY LINE LOCATION AND POSTING

The Contractor shall locate and post the property lines in accordance with the following specifications.

3146 Locating the Property Line

The position of property corners controlling the location of the property line shall be based on the deeded ownership of the USA along with controlling corners that were relied upon at the time of acquisition. All property corners shall be located by survey methods that ensure that they meet or exceed the accuracy requirements set forth in Section 3122. If a conflict is discovered between deeded ownership of the USA and 1 or more adjoining, this shall be brought to the attention of the COR prior to any

marking or posting. Documentation of conflicting title lines shall be included as part of the Report of Survey as specified in Section 3160.

3147 Posting the Property Line

Posting is the act of placing posts and signs along the property line so that it is readily identifiable. The posts and signs defining the property line shall have a positional error tolerance of ± 0.5 feet in relation to the boundary line being posted. Some of the signs that are available are shown on Exhibit 4. All signs and posts will be provided by the Government. Temporary lath may be left in place between posts, however, all other temporary lath should be removed and reused as a cost control measure.

3147.1 Clearing Property Line

Line clearing shall be limited in areas of forest disease mitigation when outlined in the project scope. When not specifically limited in the scope the property line will be cleared of small trees, brush, and debris to allow easy foot travel, unless the line is defined by a feature such as a hedge. In an effort to preserve necessary homes for various wildlife, please refrain from cutting standing dead trees when clearing National Forest property lines unless they pose a safety hazard. It is not necessary to disturb or remove existing large down logs from the line. Trees over 6 inches in diameter shall not be cut along property lines. All cutting debris shall be placed on the government side of the line. If greater than 50% of the property lines for a designated project cross densely vegetated wetland, the Forest Service may provide a sawyer, if available, upon request of the Contractor.

If a chainsaw is used for line clearing, the following personal protective equipment (PPE) is required for the operator: Forest Service approved hardhat (ANSI Z89.1, Type1, Class E), eye protection, hearing protection (85 dB and above), appropriate gloves (cut-resistant for chain filing), long sleeved shirt, chainsaw chaps, heavy duty, cut resistant or leather 8" high laced boots with nonskid soles.

3147.2 Boundary Sign Placement

Posting the property line shall include placing fiberglass line posts along the true property line located to the standard specified in Section 3147. A properly designed driver shall be used to install posts to a minimum depth of 24". Orange flagging shall be tied to the top of each post to increase their visibility along the line.

Line posts shall be placed at ridge, stream, road, and trail crossings (see Exhibit 6). Where Forest Service trails and roads are intersected, posts shall be placed 5-10 feet either side of the traveled roadway. Where county/state roads are intersected, posts shall be placed on each side at approximate right-of-way limits. Please be specific in describing the type of road or trail that crosses a NFS property line. Examples are;

year-round county maintained, county seasonal, FR #1234, access drive to private, user created road or ATV trail accessing NFS.

Posts shall be placed 75-125 feet from each corner controlling the location of the property line where the corner does not fall in a roadway. Where corners fall in a roadway, the first post shall be placed as directed above then the second post shall be placed 75-125 feet from the first. Additional posts shall be placed at not more than 250 foot intervals elsewhere along the line. Exact interval between posts will be dependent upon terrain. Posts shall be placed so as to be intervisible, if the trees and brush were removed. Sign 54-2, "Property Boundary", may be placed on line trees where they fall approximately mid-way between line posts when required by the project scope.

3147.3 Blazing and Painting Property Line

Posting the property line shall include blazing all trees (over 4 in. dia.) on National Forest lands within arm's reach ($\pm 3'$) of the property line. If a situation is encountered where many closely spaced trees fall within arm's reach of the property line, then trees may be blazed at ± 30 foot intervals. The only acceptable tool for blazing is a sharp long handled axe. New blazes should be narrow and just through the bark into the live wood tissue. Old blazes along the property line shall not be reopened, just repainted. Trees located on private lands will not be marked but may be repainted if previously blazed. See Exhibit 6 and 14 for blazing specifications.

A durable, oil-based red enamel paint shall be applied to all blazes, new and old, on trees used to mark the property line and bearing tree blazes and bands. Oil-based paint is to be applied only with a disposable brush and shall be applied in sufficient quantity to completely cover the entire surface of the blaze. All use of oil-based paint shall be in accordance with the manufacturer's material safety data sheet.

3147.4 Visually Sensitive Areas

Visually sensitive areas near homes and public use areas should be posted in a less visible manner. The COR shall be contacted if the visually sensitive nature of an area is in question. Areas determined to be visually sensitive shall only be posted using fiberglass posts with decals P54-1 and P71-10. Tree blazes and paint will be limited to areas outside of the visually sensitive areas.

3150 CERTIFICATE OF SURVEY

The Contractor shall prepare a recordable Michigan PA 132 of 1970 Certificate of Survey drawing similar to that shown in Exhibit 9 when included as part of the scope of work. The control diagram should not be included as part of the certificate. The certificate(s) shall show the relationship of recovered, reestablished and established corner positions used for the survey. This may also include corner positions

measured under previous delivery/task orders. A description of all monuments recovered, reestablished and established along with their accessories shall be included on the certificate(s). Any monuments found near a corner position and rejected shall also be described and shown. Distance from monument to any line(s) of occupation shall be included in the description.

The National Forest property boundary posted shall be shown with a heavier solid line. All overlaps, hiatus, lines of occupation and/or encroachments will be clearly shown on the drawing (may require separate detail), whether created by deed calls, man-made features or monumentation.

All certificates of survey will display measured distance, as well as previous record data, in feet. Distance measurements shall be shown in reverse chronological order, with current measurement first and adjacent to line (see Exhibit 9 for example). Projects performed using a state plane grid system shall display distances as grid in international feet. The certificate shall include a statement describing the distance units, mean project combined grid factor, and a conversion formula from grid to ground distance. All certificates shall also contain statements regarding the method of section subdivision and a concise narrative of any existing conflicting monumentation found and why it was not accepted. The certificate shall also include a data table listing the geodetic and grid coordinates, to at least 3 decimal places, for all GLO corner positions recovered, reestablished and established.

The survey drawing shall be prepared using a CAD system and shall be of high quality and to professional standards. Drawings should be sharp, clean, distinct, and legible. The drawing shall utilize the symbol, layer and surveyor's legend standards outlined in Section 3125. Submission of the certificate is required in both hard copy and an AutoCAD 2020 (or previous release) compatible .dwg file. The AutoCAD file shall include all point data, including descriptors for each point, but need not include the Contractor's drawing border.

All Contractor produced AutoCAD drawings shall become the property of the Government and the Government shall have the right to reuse these items in future projects as it sees fit without further compensation to the Contractor.

3151 Conflicts and Encroachments

Information regarding visible signs of encroachment, trespass, or lines of occupation shall be shown and described on the certificate of survey. The extent of all encroachments shall be detailed on the certificate. If a project does not require a certificate of survey, the extent of all encroachments shall be detailed on the control diagram. When reporting fences, please be specific as to the condition of the fence and whether it is being maintained.

3152 Filing or Recording of Certificates and LCRC Forms

The Contractor shall file or record the certificate of survey and the applicable LCRC forms in the appropriate jurisdiction in accordance with local and state statutes. Prior to filing or recording, one hard copy of the certificate and any land corner recordation forms shall be submitted to the COR for final review and acceptance. The Contractor may be asked to present/defend their corner position(s) before a county remonumentation peer review group. After acceptance and recordation, a copy of the recorded data with county filing information shall be furnished to the Government.

3155 TOPOGRAPHIC MAP

When topographic surveying is requested, the size and scale of the drawing will be specified in the scope of work. The survey drawing shall be prepared using a CAD system and shall be of high quality and to professional standards. Drawings should be sharp, clean, distinct, and legible. Submission of the topographic map is required in both hard copy and an AutoCAD 2020 (or previous release) compatible .dwg file. The AutoCAD file shall include all point data, including descriptors for each point, but need not include the Contractor's drawing border.

3160 SUMMARY OF SURVEY SUBMITTALS

The following is a summary of the items to be furnished to the Government during the course of executing a project. Items 3160.5 thru 3160.12 shall be submitted in a report format with cover page and table of contents:

- 3160.1 Records research acquired during course of project.
- 3160.2 List of adjoining landowners with legal descriptions.
- 3160.3 Electronic preliminary control diagram with points and narrative report describing basis for and survey decisions made.
- 3160.4 Preliminary LCRC's for all GLO corners requiring monumentation (see Exhibit 10 for required format).
- 3160.5 Report of Survey narrative to include conflicts and encroachments, contact with adjacent landowners regarding conflicts, and quality control checks performed by the Contractor.
- 3160.6 Final Control Diagram and/or Topographic map with all points in both hard copy and AutoCAD 2020 (or previous release) compatible .dwg file.
- 3160.7 Certificate of Survey drawing (if required) in both hard copy and AutoCAD 2020 (or previous release) compatible .dwg file (see Exhibit 9 for example format, also include statements required under 3150-1).
- 3160.8 Final Land Corner Recordation Certificates for all monumented and maintained corners.

- 3160.9 Report of closure for all traverse loops and/or report of relative accuracies obtained by methods other than a closed loop.
- 3160.10 Copy of field notes and raw data files that include all error checks.
- 3160.11 Project coordinate listing including descriptors for each point in hard copy and a comma delimited text file.
- 3160.12 GNSS measurement report to include how state plane coordinates were established for the project and OPUS solution reports. Survey measurements performed using RTK GNSS techniques shall include a summary report showing all independent measurements observed for each point. The difference between multiple independent measurements shall be within acceptable tolerance according to state statute and Forest Service standards.

3170 PERFORMANCE OF SERVICES

(A) Quality Control:

The Contractor shall provide adequate internal controls and review procedures to eliminate conflicts, errors and omissions, and to insure the technical accuracy of all services and products. The Contractor should review their Quality Control Plan prior to commencing work on each project. All submittals shall be reviewed for contract compliance prior to delivery.

(B) Site Visits, Inspections, and Investigations:

The Contractor shall notify the Government of all project site visits, inspections, meetings, or conferences. The Contractor shall visit and inspect/investigate the identified project site(s) as necessary and as required during the preparation and accomplishment of the work.

(C) Meetings and Conferences:

Periodic meetings shall be held, whenever requested by the Government or the Contractor, to resolve questions and problems relating to the work required under each delivery/task order.

The Contractor shall be required to attend and participate in all conferences. These conferences may be located at the project site, Contractor's Office, a Forest Service Office, or other locations.

(D) Coordination and Execution of the Work:

The Contractor shall furnish sufficient technical, supervisory, and administrative personnel to insure execution of the work in accordance with the schedule in the delivery/task order.

During the execution of the work, the Contractor shall keep in close liaison with the Government Project leader.

Work beyond the original scope of work shall be accomplished only at the direction of the Contracting Officer or designated representative.

(E) Submission of Project Data:

The Contractor shall submit all documentation as required under Section 3160 for review by the Contracting Officer or designated representative by the negotiated delivery date as specified in the delivery/task order.

3180 SELF INSPECTION AND QUALITY CONTROL PLAN

The Contractor shall prepare a proposed inspection and quality control plan and submit to the COR for review and discussion at the post award conference. The plan should include the steps the Contractor will take to ensure that all work performed meets the requirements of the contract. At a minimum, the plan shall address the following items:

(a) The Contractor shall be responsible for performing self-inspection for quality control on all measurement, corner monumentation and line posting of Forest boundaries. This shall include:

1. Utilizing proper tools and field techniques to achieve required positional accuracy of measurements and staking.
2. Checking all bearings and distances to evidence and accessories.
3. Proper stamping and setting of monuments.
4. Proper marking and posting of lines and accessories.

(b) The Contractor shall be responsible for performing quality control checks to ensure acceptable error of closure is met for all survey work performed. The results of these quality control checks shall be included in the Report of Survey narrative as required in Sections 3122.1 and 3160.

(c) The Contractor shall be responsible for performing quality control checks on all survey documents prior to their submittal to the COR for review and acceptance. The Contractor's Quality Control Plan shall include a project submission checklist.

3190 DEFINITIONS:

The Definition of Work Items shown below establishes and defines the work that may be performed under this contract. Project locations and specific work items have not been determined at this time. Delivery/task orders, issued in accordance with the contract specifications, will be used to specify project locations and work items to be performed.

Negotiated cost for services performed under this contract will be based upon the Definition of Work Items and scope of each project.

Definition of Work Items:

- A. Corner Search – To include all records search and field work (except line measurement) associated with corner evidence evaluation necessary to perpetuate or reestablish a historical corner position. The rate for this item is typically related to the complexity of the corner history and/or recoverability of record evidence. This item does not pertain to obtaining ties to monumentation established during post ± 1970 surveys. Ties to these monuments are considered an incidental part of the survey and are required to be shown on the control diagram and certificate of survey. This item of work may only be performed during snow free periods.
- B. Corner Maintenance – To ensure that existing monuments are firmly and securely set in their original location and that existing signs on posts and trees are securely attached and legible. Signs that are damaged or deteriorated shall be replaced. Also to replace dead, damaged, or destroyed bearing trees or objects with new references marked to BLM Manual and Forest Service standards so that the corner has 4 good accessories. Includes the documentation and filing of a Michigan Land Corner Recordation Certificate (LCRC).
- C. Corner Monumentation – To place a monument and establish accessories at each position recovered from evidence, reestablished and established when a substantial monument does not already exist and typically includes the documentation and filing of a Michigan LCRC. This item may include original GLO corner positions and $C \frac{1}{4}$ corners where a conflicting monument exists to be submitted through the county remonumentation program and also time to attend a peer review meeting. Section subdivisional corners of $1/16$ or less or other National Forest System (NFS) land property corners may not require establishing accessories and filing a LCRC.
- D. Property Line Measured – The measuring of Government property lines on exterior or interior of sections. Measurement of the line can be performed by conventional traverse, GNSS, or a combination of the two methods. This item includes locating of traverse routes, all line clearing, measurements, data collection, reduction, and reporting.

- E. Control Measurement – Measurements resulting in the straight horizontal line derived by inverting between controlling and monumented corner positions along the original survey. The total miles of control measurement will not include measurement along property lines designated under the Property Line Measured. Measurement of the line can be performed by conventional traverse, GNSS, or a combination of the two methods. This item includes locating of traverse routes, all line clearing, measurements, data collection, reduction, and reporting. It also includes painting of red bands on all controlling corner bearing trees falling on NFS lands.
- F. Property Line Posted – The horizontal line between controlling and monumented corner positions posted as property line with posts and signs according to the specifications in Section 3147.
- G. Property Line Maintenance - The horizontal line between controlling corner positions previously surveyed and posted requested to be maintained in accordance with the specifications in Section 3141 and includes reporting.
- H. Property Line Reposted - The horizontal line between controlling corner positions previously surveyed and posted requested to be reposted in accordance with the specifications in Section 3142 and includes reporting.
- I. Certificate of Survey – A multi-page drawing, meeting the specifications as defined in Section 3150. This item pertains to a drawing showing the retracement and subdivision of a single section within a township. This shall include ties to all controlling corners used to reestablish GLO corner positions. A multi-section project may require additional drawings of sections within the same or a different township. This item may not be payable until the COR has approved the Certificate of Survey.
- J. Topographic Survey – A survey that determines ground relief and location of natural and man-made objects and delineates those features on a drawing. This item includes the combination of field and drafting work required to complete the survey and drawing.
- K. Monument Box Installation – Provide a monument box (visible protected enclosure) with lid that has approximate opening size of 6 ½” and height of 10”. Provide labor and other tools and materials necessary to install the monument box in accordance with county/state road agency standards.

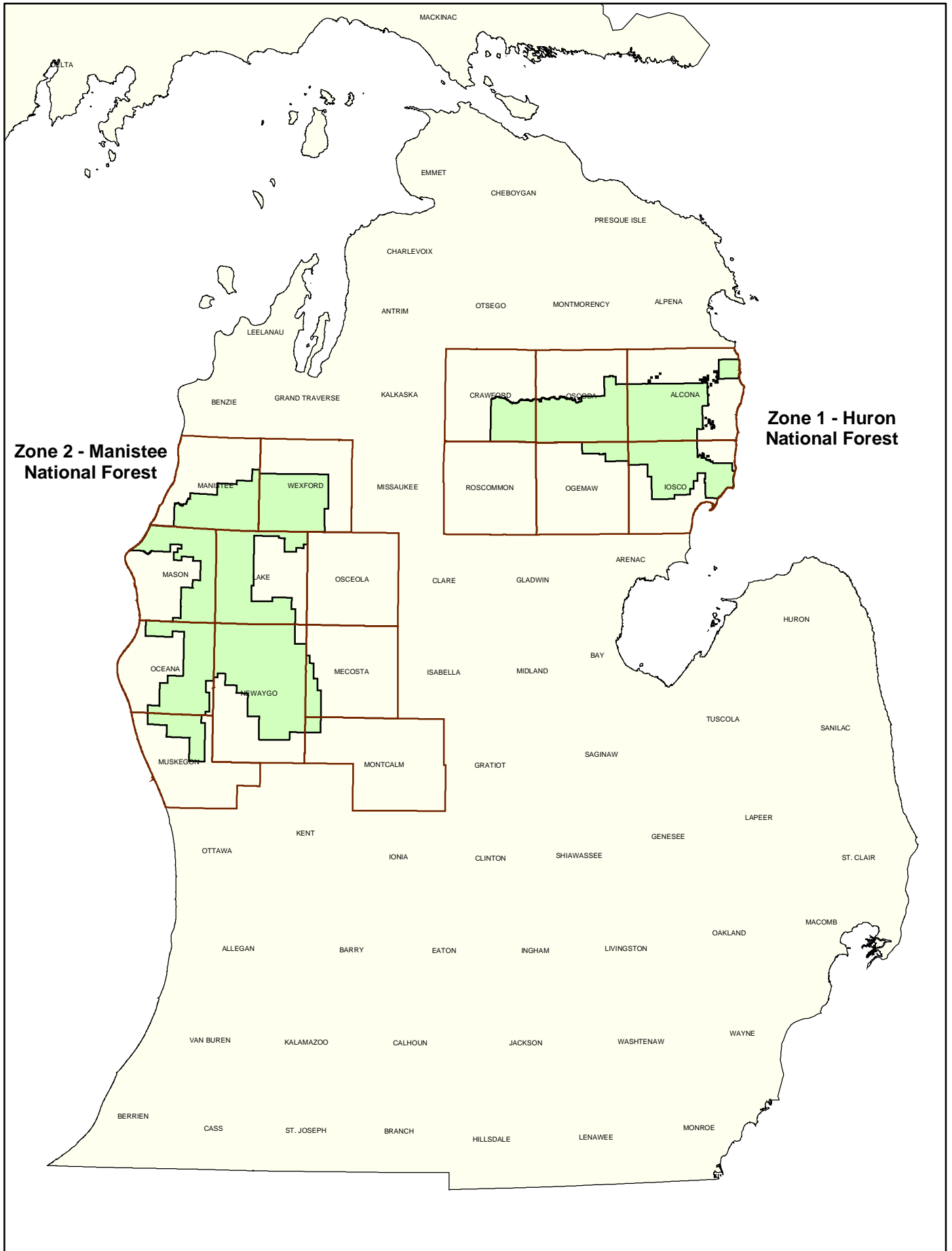


Exhibit 2 - Huron-Manistee National Forests Vicinity Map

| | | | |
|--|--|--|---|
| U.S. Department of Agriculture Forest Service | 1. WORK PROJECT/ACTIVITY Land Surveying | 2. LOCATION Huron-Manistee National Forests | 3. UNIT Huron-Manistee N.F. |
| JOB HAZARD ANALYSIS (JHA) References-FSH 6709.11 and -12 (Instructions on Reverse) | 4. NAME OF ANALYST Carol A. Waite | 5. JOB TITLE Forest Land Surveyor | 6. DATE PREPARED January 2008 |
| 7. TASKS/PROCEDURES | 8. HAZARDS | 9. ABATEMENT ACTIONS Engineering Controls * Substitution * Administrative Controls * PPE | |
| <p>Driving to, from and at Site</p> <p>Corner search, monumentation, and traversing</p> <p>Power Tool Use: Brush Cutter, Chain saw</p> <p>Hand Cutting Tool Use: Axe, Sandvik, Machete</p> <p>Posting and Painting</p> | <p>Vehicle Accidents</p> <p>Highway Traffic, Flying Objects, Flammable Substance, Heavy Loads</p> <p>Cutting self or others, Flying Objects, Fires, Kick out</p> <p>Cutting self or others</p> <p>Impacts from posts or driver, splash or spray of paint</p> | <p>Perform safety checks on vehicle before driving, wear safety belt, use defensive driving techniques, at work site park vehicle in a location that will not impede the normal flow of traffic and facing in the direction of departure. When backing, always use a spotter if available. When a spotter is not available, the driver shall make a visual inspection around vehicle prior to backing. When turning around, always face the danger. FSH 6709.11, 12.</p> <p>Post signs and safety cones when working along roads. Wear high visibility safety vest. Use spotter on hills and curves. Wear hardhat, eye protection and gloves when digging in roadways. Follow manufacturer's safety guidelines for use of chipping hammer and torch to thaw gravel roads in winter and proper outside storage of portable propane tank. Make additional trips instead of carrying too many pieces of equipment or materials.</p> <p>Wear proper PPE: Chaps, hardhat, long sleeved shirt, leather gloves, hearing protection, eye protection heavy-duty non-slip leather boots or waterproof rubber boots with steel toes. Utilize spotter when falling trees. Maintain safe working distance from operator of at least 2 ½ tree lengths for chainsaw and 50ft for brush cutter. Predetermine escape routes and use safety zone concept when falling. Follow manufacturer's safety guidelines for proper use and storage of power tools. Ensure proper maintenance of equipment and perform daily checks. Set <i>HOT</i> power tools in litter free area to avoid the chance of fire and avoid skin contact with hot parts. Be aware of environmental conditions; (i.e., terrain, footing, weather conditions, time of year - foliage, nearby objects such as fence wire). Fatigue: Take regular breaks. Slow pace in hot weather. Drink plenty of fluids. ALL chainsaw operators must be certified as a faller (see FSH 6709.11, 22.48).</p> <p>Wear proper PPE: Hardhat, leather gloves, leg protection, eye protection, heavy-duty non-slip leather boots or cut-resistant waterproof rubber boots. Cut away from one's body. Maintain firm grip on tool. Place tool in proper sheath when not in use. Maintain proper work spacing - minimum 10 feet. Keep tools sharp and well maintained. When sharpening tools, use proper technique to prevent cuts, wear gloves, eye protection and use file guards.</p> <p>Wear proper PPE - hardhat, gloves, eye protection, heavy duty non-slip leather boots or waterproof rubber boots. Inspect driver for chips or broken welds. Upstroke of driver should not be greater than 2/3 the length of the driver.</p> | |

Exhibit 3 – Land Surveying Job Hazard Analysis

| | | |
|--|---|---|
| <p>Driving ATV and Snowmobile</p> <p>Working Conditions</p> <p>Emergency Evacuation Plan</p> | <p>Accidents, breakdowns</p> <p>Slips, falls, cuts, bee stings, insect bites, sun exposure, lightning, falling objects, electric shock, fatigue and heat stress, frostbite</p> <p>Illness or Injury</p> | <p>Avoid skin contact with paint, follow manufacturer's Material Safety Data Sheet for cleanup procedures.</p> <p>Only certified personnel will operate. Wear helmet, gloves and eye protection. Watch for holes, steep terrain, slow down when visibility is poor. Make sure machines are in good working order and perform daily checks. Be aware of how far away from your vehicle you are in case of breakdown, always carry a portable radio. FSH 6709.11, 13.</p> <p>Be aware of weather conditions; (i.e., slipping because of dampness - snow or rain, wind conditions, taking breaks and drinking 1 liter of water per hour on hot, humid days, seek shelter when storms approach). Keep hydrated in all conditions. Be aware of footing at all times and terrain you are walking on. Wear non-slip leather boots on upland, rubber boots in swamps, and insulated non-slip boots in winter. Wear proper clothing in the summer and dress in warm layers in the winter. Carry multiple pairs of gloves in wet, cold weather. Have first aid and bee sting kits available. Watch for sting reactions. Watch for other insects, animals, and plants which could pose a danger. Maintain First Aid and CPR certifications. Use sunscreen and/or insect repellent when appropriate. Minimize UV exposure. Be aware of power lines overhead, even running through the forest. FSH 6709.11, 54.</p> <p>Inform office of your destination and proposed return time. If working alone, follow Forest check-in/check-out procedure. Carry portable radio and stay in contact at all times. In case of serious illness or injury, notify office by radio or phone to request EMS. Use Bloodborne Pathogens precautions. Notify your supervisor as soon as possible of the incident and complete necessary paperwork.</p> |
| <p>10. LINE OFFICER SIGNATURE</p> | <p>11. TITLE</p> | <p>12. DATE</p> |

Previous edition is obsolete

(over)

HA Instructions (References-FSH 6709.11 and .12)

The JHA shall identify the location of the work project or activity, the name of employee(s) writing the JHA, the date(s) of development, and the name of the appropriate line officer approving it. The supervisor acknowledges that employees have read and understand the contents, have received the required training, and are qualified to perform the work project or activity.

Blocks 1, 2, 3, 4, 5, and 6: Self-explanatory.

Block 7: Identify all tasks and procedures associated with the work project or activity that have potential to cause injury or illness to personnel and damage to property or material. Include emergency evacuation procedures (EEP).

Block 8: Identify all known or suspect hazards associated with each respective task/procedure listed in block 7. For example:

- a. Research past accidents/incidents
- b. Research the Health and Safety Code, FSH 6709.11 or other appropriate literature.
- c. Discuss the work project/activity with participants
- d. Observe the work project/activity
- e. A combination of the above

Block 9: Identify appropriate actions to reduce or eliminate the hazards identified in block 8. Abatement measures listed below are in the order of the preferred abatement method:

- a. Engineering Controls (the most desirable method of abatement).
For example, ergonomically designed tools, equipment, and furniture.
- b. Substitution. For example, switching to high flash point, non-toxic solvents.
- c. Administrative Controls. For example, limiting exposure by reducing the work schedule; establishing appropriate procedures and practices.
- d. PPE (least desirable method of abatement). For example, using hearing protection when working with or close to portable machines (chain saws, rock drills portable water pumps)
- e. A combination of the above.

Block 10: The JHA must be reviewed and approved by a line officer. Attach a copy of the JHA as justification for purchase orders when procuring PPE

Blocks 11 and 12: Self-explanatory.

Emergency Evacuation Instructions (Reference FSH 6709.11)

Work supervisors and crew members are responsible for developing and discussing field emergency evacuation procedures (EEP) and alternatives in the event a person(s) becomes seriously ill or injured at the worksite.

Be prepared to provide the following information:

- a. Nature of the accident or injury (avoid using victim's name).
- b. Type of assistance needed, if any (ground, air, or water evacuation)
- c. Location of accident or injury, best access route into the worksite (road name/number), identifiable ground/air landmarks.
- d. Radio frequency(s).
- e. Contact person.
- f. Local hazards to ground vehicles or aviation.
- g. Weather conditions (wind speed & direction, visibility, temp).
- h. Topography.
- i. Number of person(s) to be transported
- j. Estimated weight of passengers for air/water evacuation.

The items listed above serve only as guidelines for the development of emergency evacuation procedures.

JHA and Emergency Evacuation Procedures Acknowledgment

We, the undersigned work leader and crew members, acknowledge participation in the development of this JHA (as applicable) and accompanying emergency evacuation procedures. We have thoroughly discussed and understand the provisions of each of these documents:

SIGNATURE

DATE

SIGNATURE

DATE

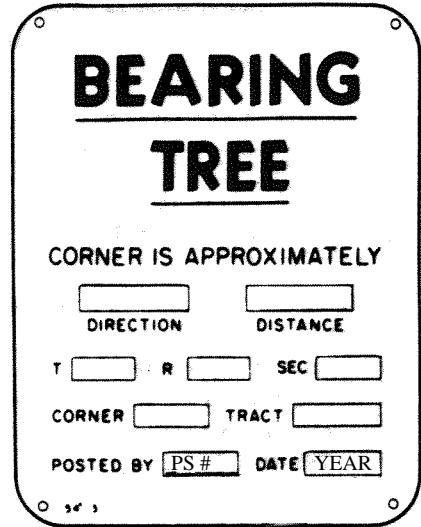
Work Leader



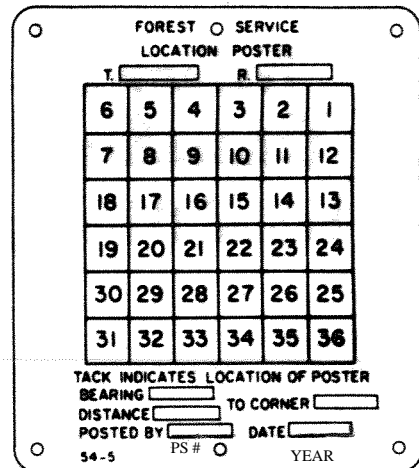
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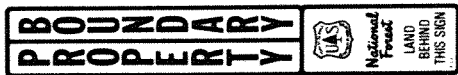
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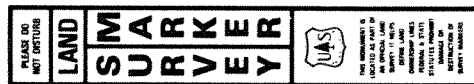
54-3 4 1/2" x 5"
Black on yellow (the small rectangular areas denoted by direction, distance, T, R, etc. on the illustration are not primed or painted)
FSN 9905-00-890-4867



54-5 4 1/2" x 5"
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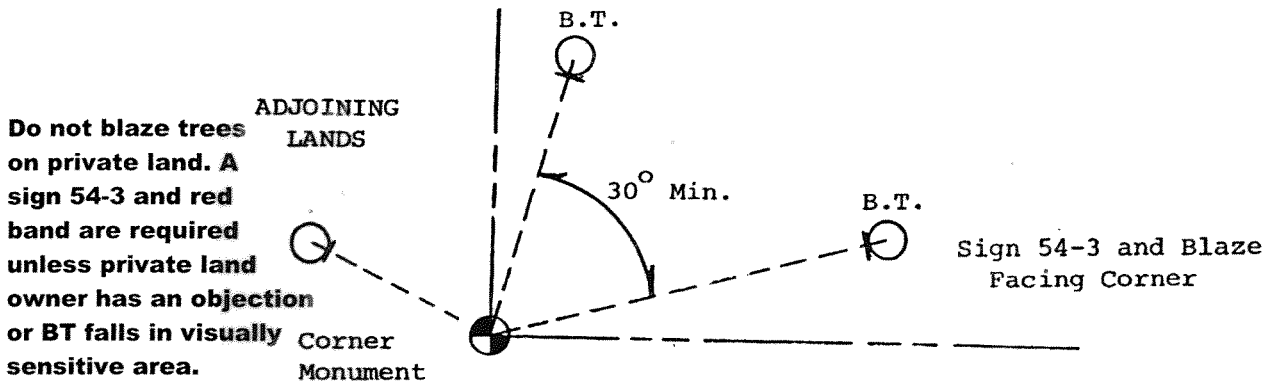


P54-1 2 1/2" x 15"
Black on yellow (decals). For use on standard line post.



P71-10 2 1/2" x 15"
Black on yellow (adhesive-backed)

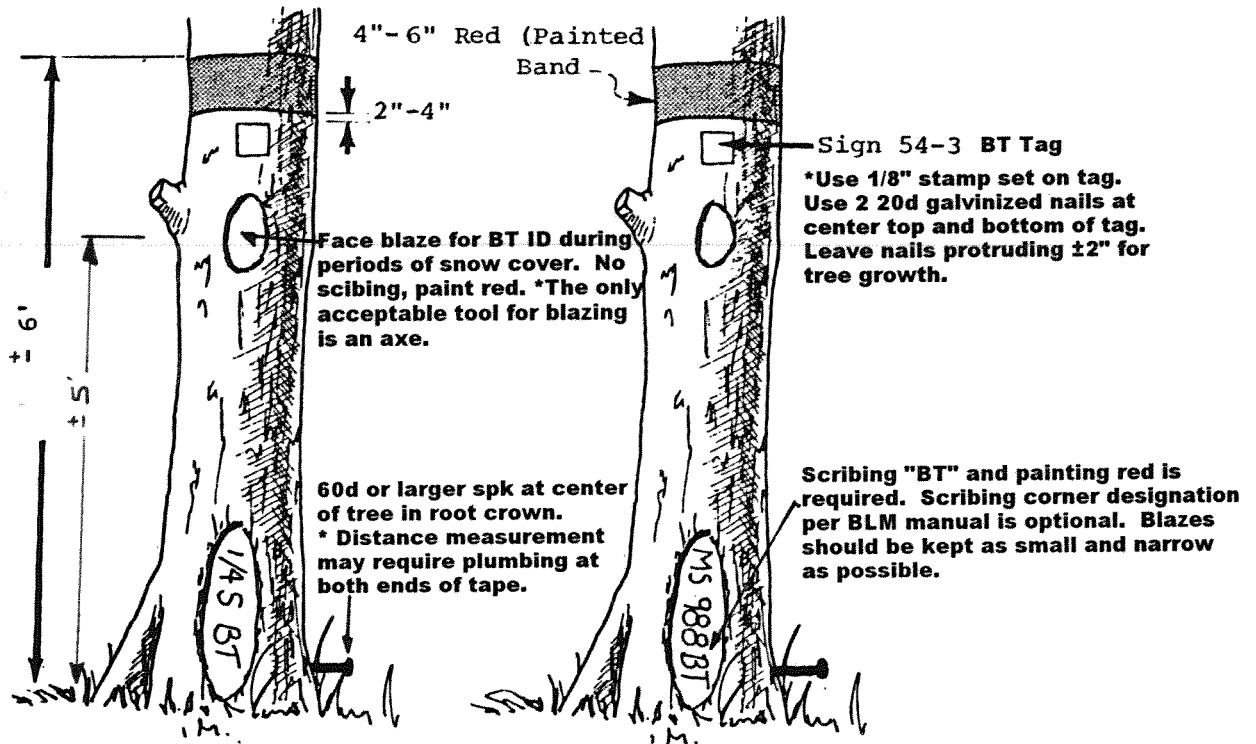
NATIONAL FOREST LAND



TYPICAL PLAN VIEW OF BEARING TREE LAYOUT
 *See BLM "Durability of Bearing Trees" guide for BT selection.

Sectionalize Lands

Metes And Bounds



TYPICAL BEARING TREE ON NATIONAL FOREST LAND

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

IDENTIFICATION OF CORNERS ON SUBDIVISION OF SECTION LINES

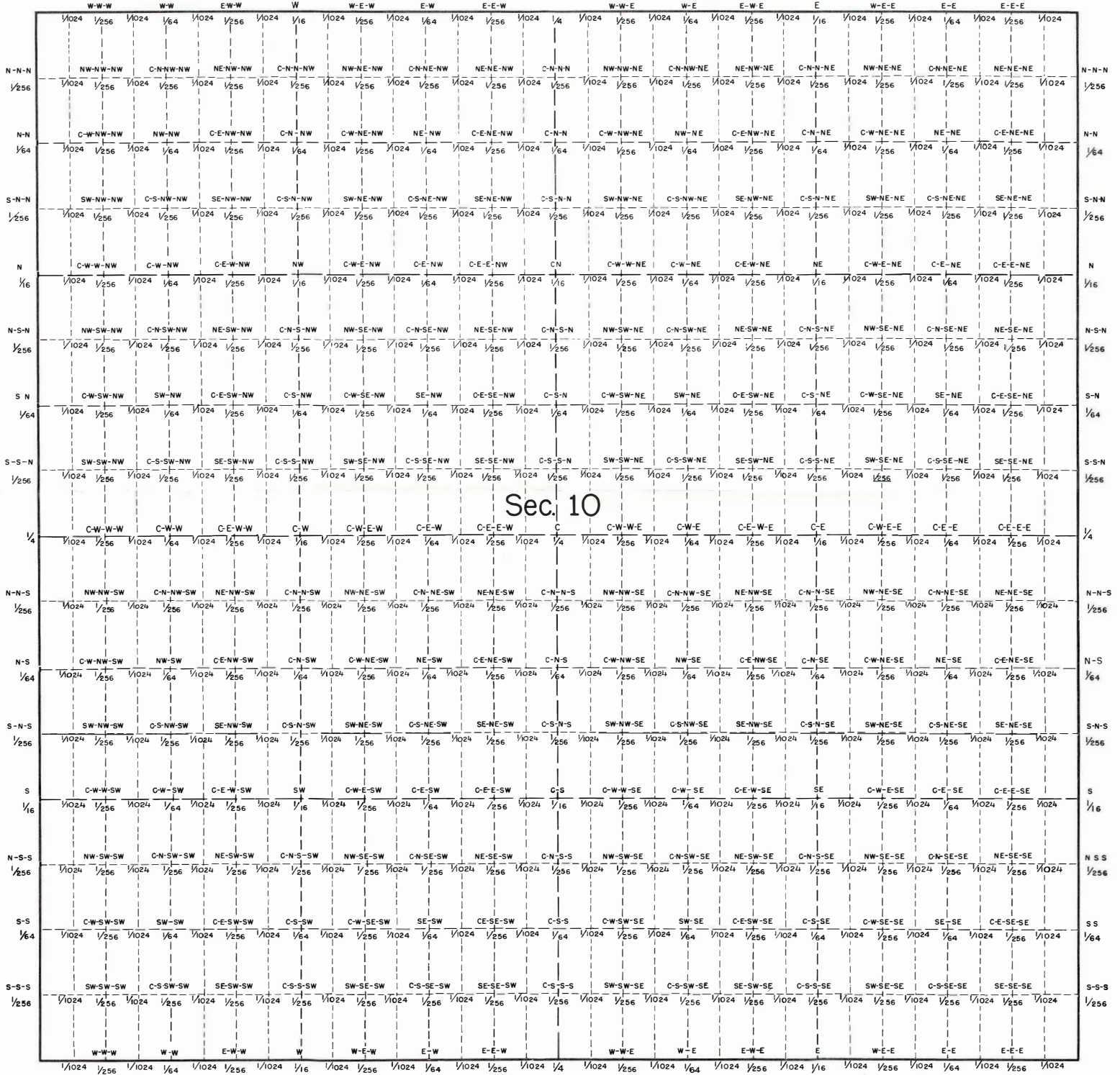
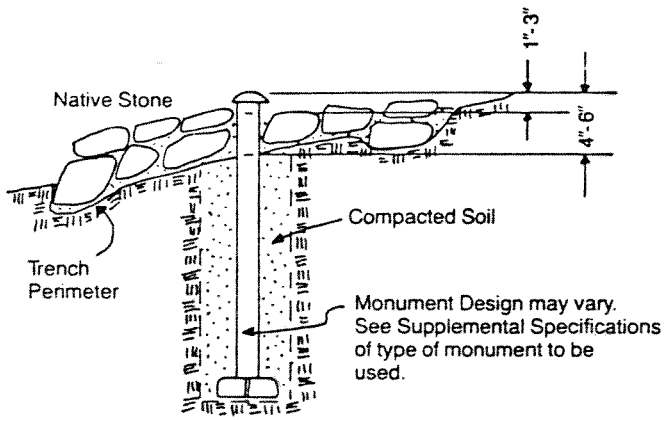
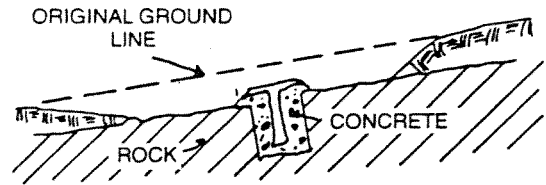


Exhibit 5 - Corner Monumentation and Bearing Trees



TYPICAL SECTION VIEW

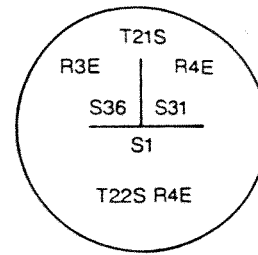
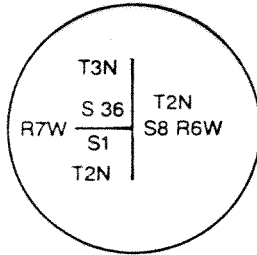
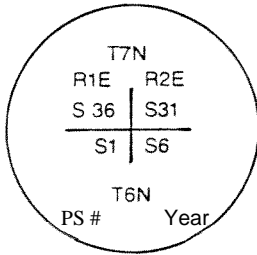


TYPICAL ROCK TABLET INSTALLATION

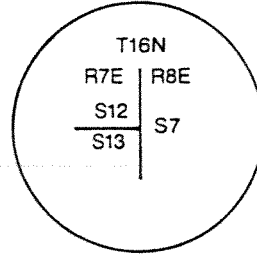
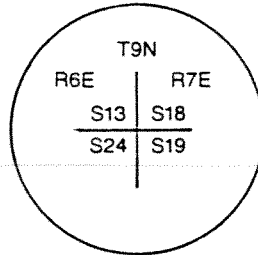
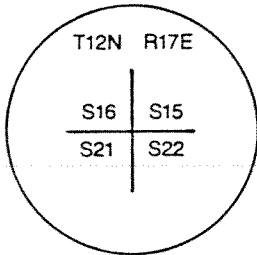
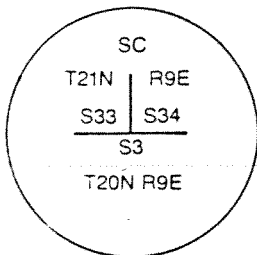
NOTES:

1. Rock Tablets shall be used in solid rock or in large planted stones impractical to remove.
2. The Contractor shall clean the rock surface and provide for drainage.
3. Rock tablets shall be flush to surface.

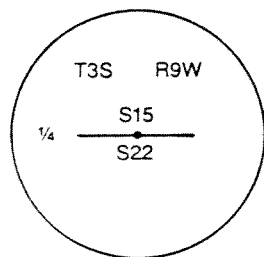
TOWNSHIP



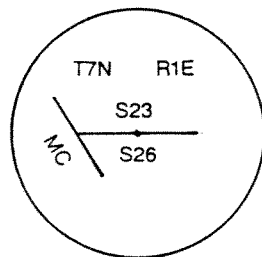
SECTION



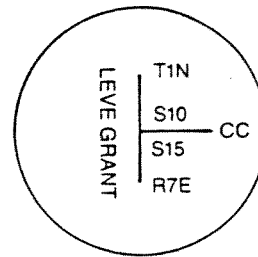
QUARTER CORNER



MEANDER CORNER



CLOSING CORNER



Notes:

1. The markings on the cap shall be made to read from the south side of the monument.
2. In addition to the markings shown, the land surveyor's registration number and the year the monument is established shall be stamped on the cap.
3. See the Manual for specific corner markings.

In addition to year set, also stamp PS number along lower perimeter of cap.

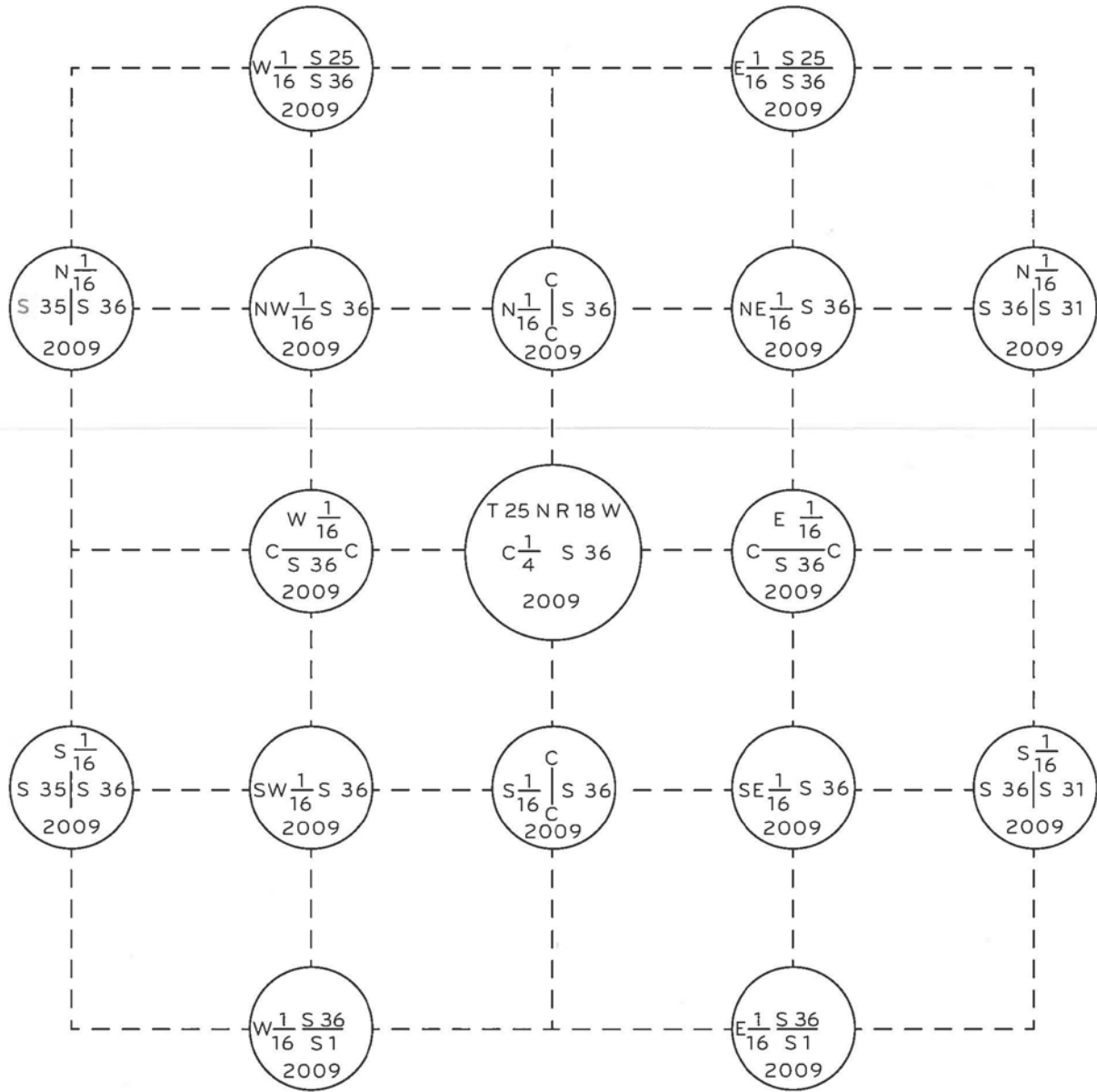
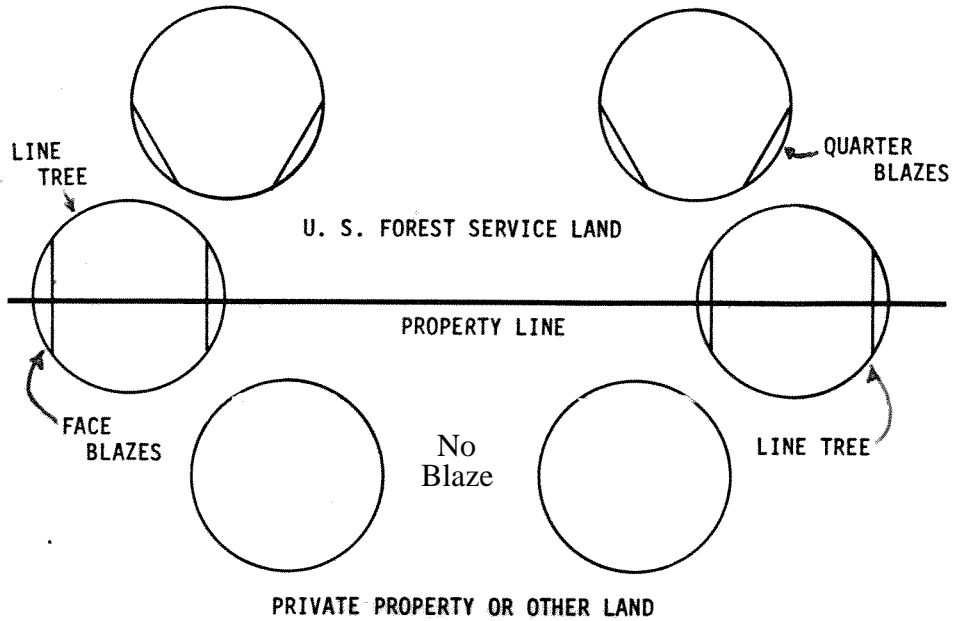
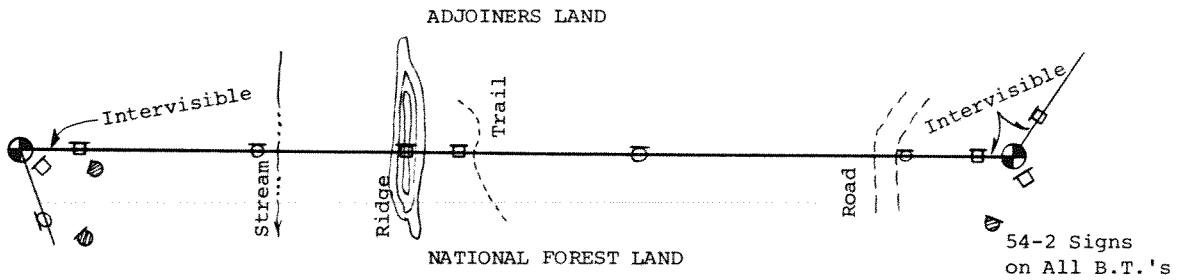


Exhibit 5 – Subdivision Corner Monumentation Stamping

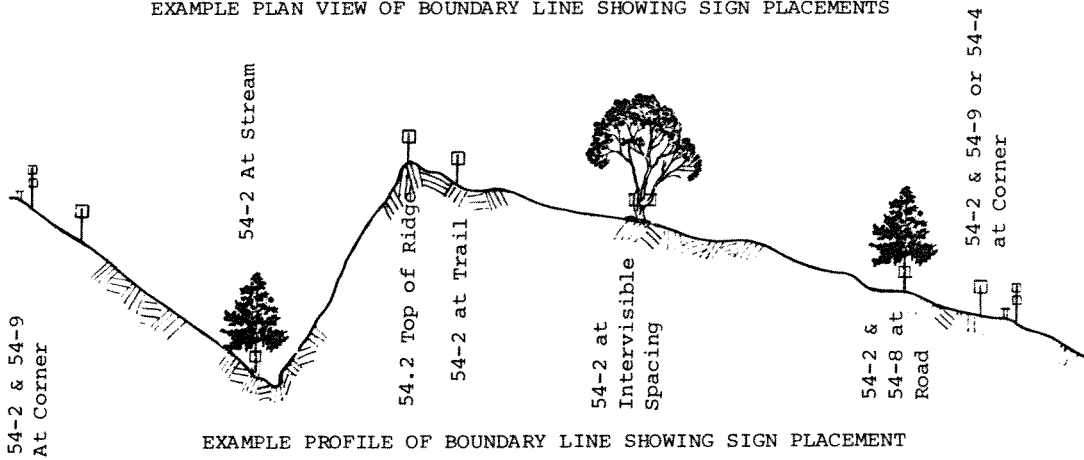
USE OF FACE AND QUARTER BLAZES



TYPICAL SIGN AND POST INSTALLATION



EXAMPLE PLAN VIEW OF BOUNDARY LINE SHOWING SIGN PLACEMENTS



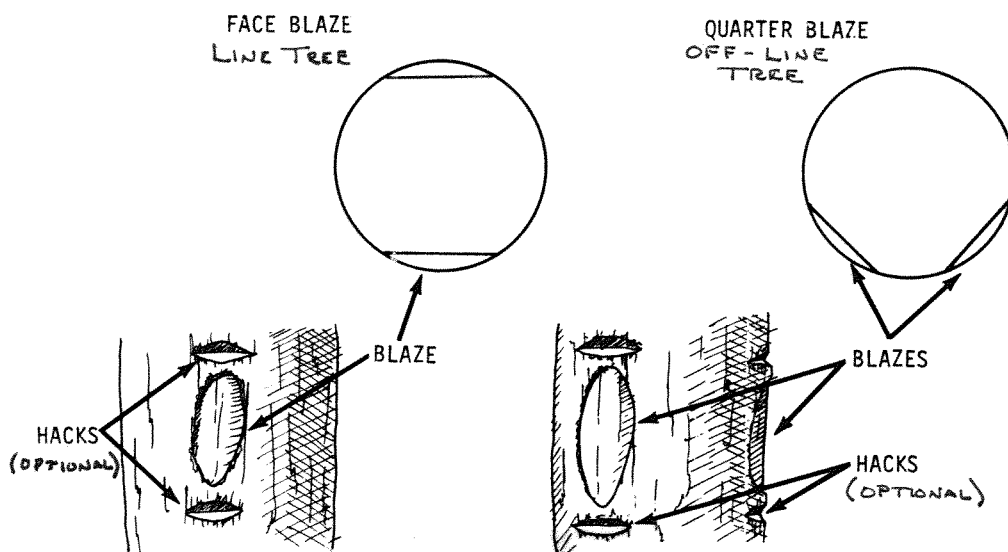
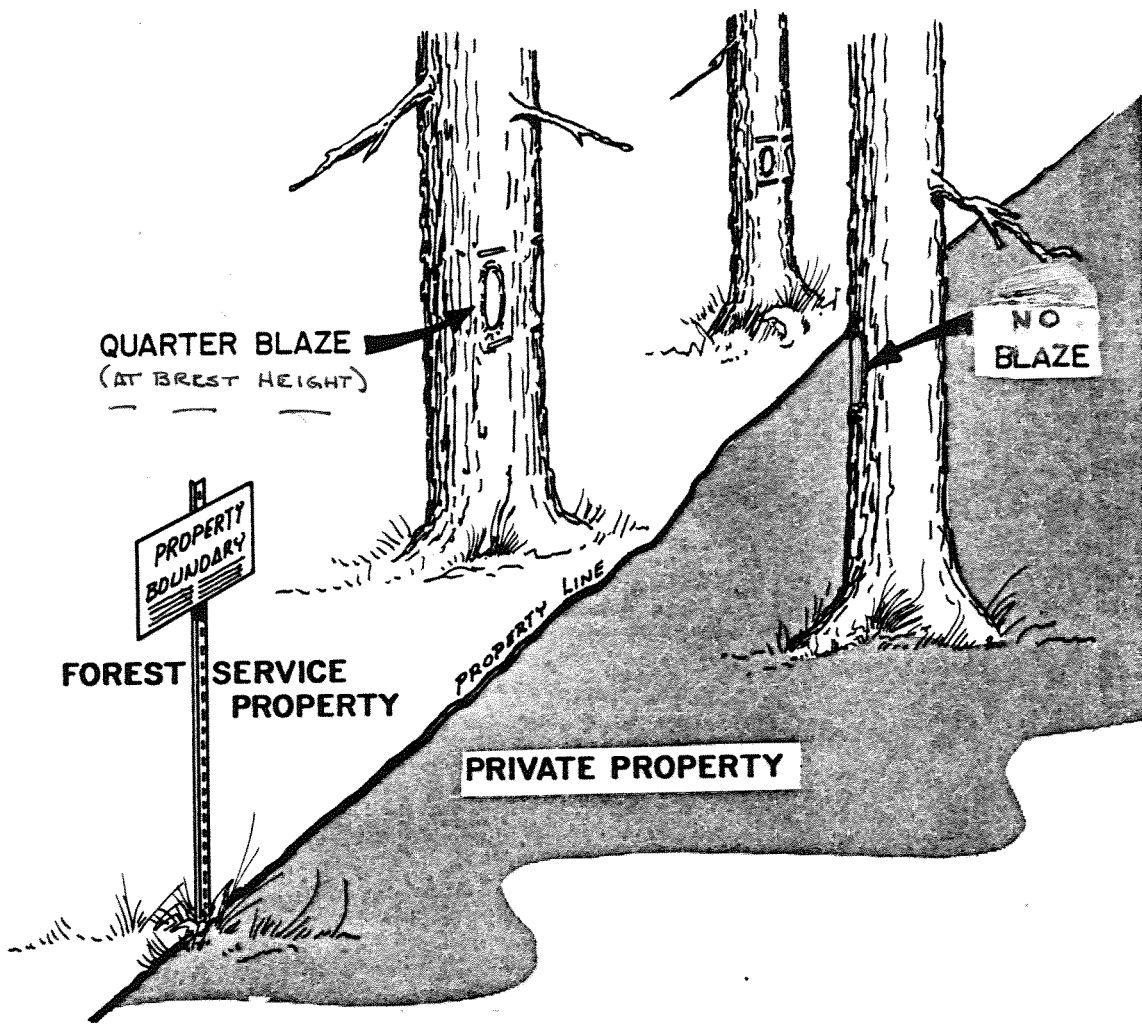
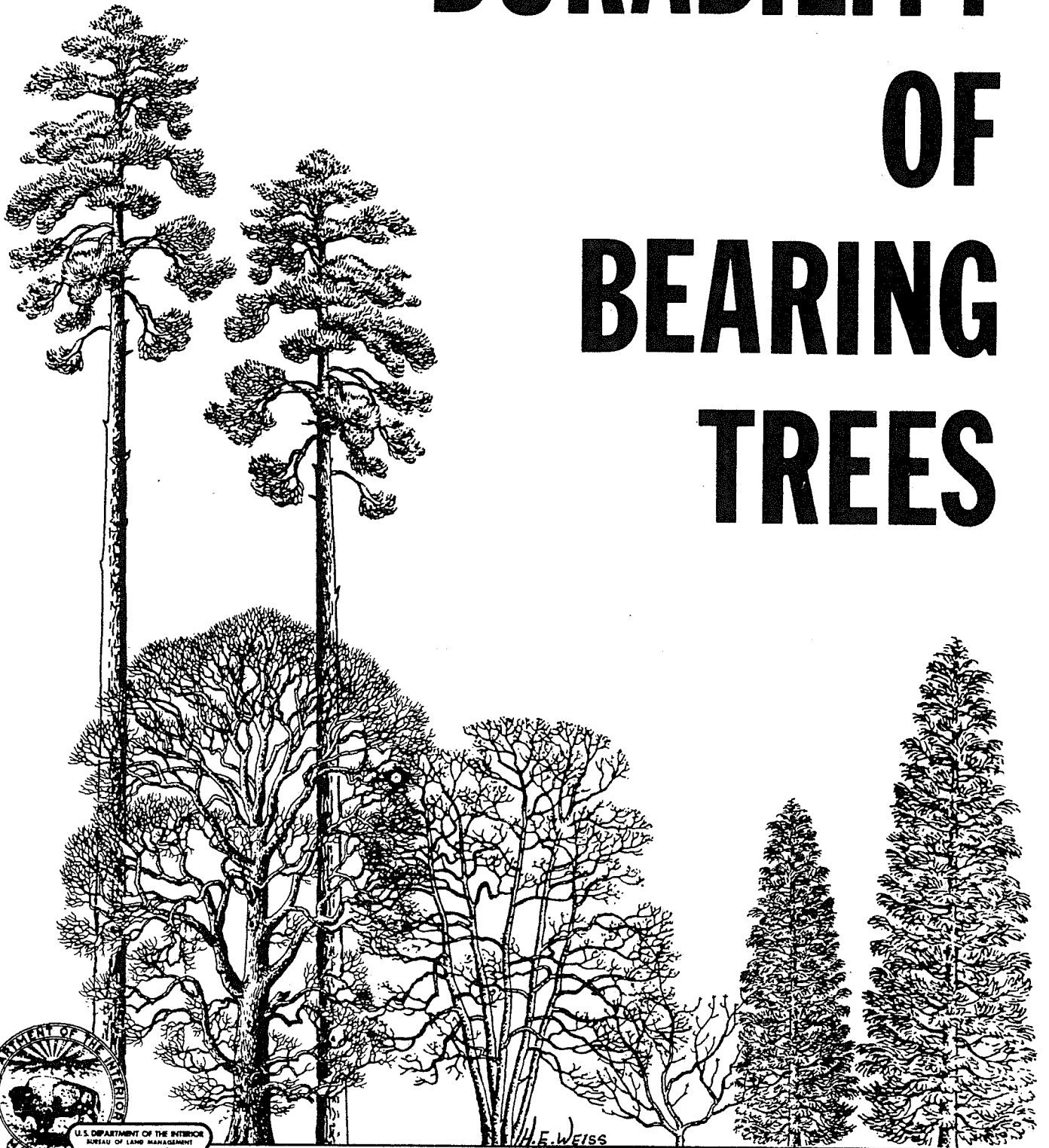


Exhibit 6—Property Line Marking

DURABILITY OF BEARING TREES



CADASTRAL SURVEY TRAINING STAFF

INTRODUCTION

This booklet is prepared as a guide, to aid in the search for old bearing trees as well as in marking new trees.

TREE SPECIES AND GENERAL DURABILITY

It is impossible to make a firm statement concerning the durability of trees by type or species. Generally speaking the most durable trees are the non-resinous conifers: yew, cedar and redwood. The hemlocks are non-resinous but are very inferior to the previous three. Next in order are the resinous conifers: pines, firs, spruce and tamarack or larch. But lodgepole pine is inferior in most cases to fir and white fir inferior to spruce. The deciduous hardwoods are the least desirable: maple, alder, birch, willow. Exceptions are some of the desert species, such as ironwood, and the white oak and live oak types.

The durability of a tree when marked for a bearing tree is of great importance to the Cadastral Surveyor. The original bearing trees are one of the primary methods used to determine the position of an original corner point. The surveyor must be able to identify the many tree species for which he is searching, not only by the proper common name but also by the common name used by the original surveyor. He should know what to expect in his search because of the widely divergent growth habits, growth rate, life span and resistance to decay of the many tree types. The methods of blazing and marking the trees by the original surveyor will play a large part in the search also. When marking new bearing trees judgement must be made in selecting the most durable species available and proper method of marking to prevent excessive injury, or even destruction of the tree.

When marking a bearing tree be sure of the identification and enter the correct common name in the field notes. Distinguish between the various species in the tree family. There is a world of difference between a Ponderosa pine and a Knob cone pine; or a California live oak and a California black oak!!

EFFECTS OF MATURITY

The normal life span of a tree is of primary importance. The black locust is highly resistant to decay but has a normal life span of only about 100 years, though some may attain a greater age. On the other hand the wood of Douglas-fir is considered only moderately resistant to decay but the tree may live over a thousand years (left unmolested) and is known to be an excellent bearing tree. Another contradictory example is the California black oak; this tree may live to over 300 years of age, yet is so susceptible to decay when injured that it is a poor choice for a bearing tree. Thus the life span is only an indication of what may be a good tree for witnessing a corner.

When searching for original bearing trees the size at maturity, expected life span, and growth rate are very important. If a tree which has an expected life span of 200 years and 24 inches diameter at maturity was marked when 20 inches diameter the tree was already near maturity. The blaze would be slow to heal, decay sets in and the tree soon dies, falls and disappears. If the field notes call for a mature tree the chances of recovery after 100 years or more are then greatly reduced.

In some cases the season of the year when marked is important. With deciduous hardwoods the dormant season is the most desirable time for blazing. The wound has a chance to heal and harden before insects and fungus are active and attack. In the northern states this will play a part in recovery possibilities. A tree marked in fall or winter would be more likely to survive than one marked in spring or summer. This will be especially true of trees with a high sugar content in the sap, such as maple and birch.

METHOD OF BLAZING

The methods of blazing and marking by the original surveyor are also very important. If the original surveyor made large blazes, cutting deeply into the tree, the loss is much greater from decay. If the blazes were made high on the tree logging will remove the entire blaze. Fortunately many of the original surveyors used a "double blaze"; the township, range and section on a blaze at breast height and a smaller "BT" blaze nearer the root crown. When logged the lower blaze frequently remains on the stump. The smooth barked trees and those with very thick bark were often bark scribed. The bark scribing expanded on the smooth barked trees as they grew and may be hard to detect though readily apparent to the experienced eye. On thick barked trees the bark was smoothed enough to scribe but no penetration made into the sapwood. This scribing may appear as disjointed lines or even be mistaken for worm or beetle "tracks". Sometimes the bark scribing is all but lost in the roughened and maturing bark.

The surveyor must keep an open mind at all times when searching for the original trees. He must consider not only the species of tree, time of year, size of tree, type of scribing, growth rate, life span and site location but also the characteristics of the original surveyor and the instructions which he had been given to govern his work.

When selecting new trees to mark for bearing trees at a corner several things must be considered. Is the tree young or near maturity, resistant to decay, long lived, well formed, suppressed by other (though inferior) trees, in a good location not subject to undercutting by a stream, large enough to receive all the marks and in good location in reference to the corner? Often there is very little choice, but when there is, all aspects should be considered. It is a well established fact that a large Douglas-fir stump, with the bark removed, is superior to poor trees such as dogwood or cascara, and in most cases young alder.

The blazes should also be kept as small and narrow as possible, consistent with the amount of scribing required. The blaze should be smooth at the edges and carefully done to avoid breaking the bark loose from the cambium layer. This is especially important when blazing trees such as birch, aspen and spruce. The bottom of the blaze should be smooth and well drained to avoid accumulation of sap, water, and dirt. This can frequently be done with an upward stroke of the axe at the bottom of the blaze. On many species of smooth barked young trees bark scribing is preferred. If the only suitable trees available are too small to accept all the marks making a small "BT" blaze at the root crown and marking the tree only "BT" is better than taking no tree at all. Manual requirements should always be fulfilled when possible but should never be used as an excuse to avoid marking bearing trees.

Much of the work performed by the Cadastral Surveyors today is dependent resurvey of intermingled ownership. An original bearing tree marked before the land was patented remains Federal property. But trees now standing on private lands are private property. Permission should always

be acquired before marking privately owned trees, particularly highly prized trees such as walnut or hickory. Never use an ornamental tree in someone's yard!! Painting is recommended. When injured by blazing and scribing the tree is opened to attack by insects, bacteria and fungus. If the wound is painted with a special tree wound paint, manufactured for this purpose and available in aerosol spray cans, the tree is protected until it can heal the injury. Painting is essential on many trees to prevent swift loss to decay.

Many trees, such as lodgepole pine, aspen and alder, grow in dense stands when young. They carry on a continuous battle of "survival of the fittest". When injured by blazing, the tree must attempt to heal the wound and is then less able to survive the battle. When marking such a tree it is recommended that the tree be freed from its close competition. This is done by cutting down, or "ringing" the close neighbors in a thinning process, called releasing. Releasing gives the bearing tree the advantage in the battle for sunlight, water, air and nutrients. Releasing is not always possible or prudent; on private lands the landowner may willingly give permission for cutting of survey lines or marking bearing trees, but would object to releasing. Dense thickets of hawthorn or vine maple make releasing nearly, if not totally, impossible at times. It should be done however, whenever ground conditions dictate or permit.

ARRANGEMENT OF LIST

This list is prepared by the common name of the tree. The common names are listed in capital letters. Many trees are very similar in appearance or durability and are listed together in the interest of simplicity and brevity. This should not be construed that the names are interchangeable. Following the common name is the scientific name, always the genus and in most cases the species. Next is given a list of other common names which may have been used by the original surveyor in his field notes. The original surveyor may have called for a redwood where none exist, the tree was actually an incense-cedar. Or he may have called for a hackmatack, the tamarack in Minnesota, when the tree was really a western larch. These other names are cross-referenced in the index.

Following the other names is a grading ranging from unsuitable or very poor up to excellent. A tree graded very poor should be used only as a last resort and probably be supplemented with a mound of stone or other accessory. These grades are given as an aid in making the decision about which tree(s) should be used to witness a corner. The scale is generally based on young, vigorous trees and not mature or old growth trees.

Following the grading is a written narrative of what is known of the particular species, both as an original bearing tree and recommendation for use as a new bearing tree.

EASTERN WHITE PINE (Pinus Strobus)

Other names: Pine, northern pine, soft pine; may appear as "black pine" or "conk pine"

EXCELLENT

In the Eastern States and Great Lakes Region "Paul Bunyan" logged the white pine. It was one of the more widely used bearing trees by the original surveyors in Minnesota, Michigan and Wisconsin. The blaze is usually completely healed but noticeable, and covered with a heavy pitch layer. Most trees were snow blazed as well. Fire hardened trees will last for many years. If dead the surrounding wood seems to decay readily but the pitch face will retain the scribing indefinitely. Logging and fire are the most probably causes of loss.

When marking the white pine keep the blaze narrow, low, and only deep enough to make a smooth blaze for scribing. Paint immediately.

RED (NORWAY) PINE (*Pinus resinosa*)

Other names: Hard pine, pitch pine, yellow pine, pine

EXCELLENT

The Norway is one of the "hard" pines and has a superficial resemblance to the Ponderosa Pine. The Norway is found only in the Great Lakes and Northeastern States. This tree is at least as durable as the eastern white pine. They are found intermixed, though the Norway will survive under more adverse conditions and is more resistant to fires. The dead and fallen tree, or the sawed stumps, decay slowly. The blaze face pitches over, heals rapidly and may have little or no discernible scar after 75 or more years. Even though the bearing tree may have been logged the pitch face and overgrowth with reverse scribing will remain until destroyed by means other than decay.

Since this tree is heavily logged the blaze should be kept low, with the "BT" close to the ground. Paint the blaze immediately before pitch begins to flow.

JACK PINE (Pinus banksiana)

Other names: Pine, scrub pine, black pine; maybe confused with lodgepole pine

VERY GOOD

The Jack pine looks somewhat like the lodgepole pine of the Western states but is found only in the Great Lakes Region. The wood is hard, resistant to decay when dead and fallen. The blaze is seldom found completely healed but the scribe marks may sometimes still be read after being burned and charred. Burned out stumps may still show the scribe marks, in reverse on the overgrowth of larger trees. When logged for pulp the stumps are usually cut very low to the ground. Slash burning may destroy all traces of scribing or the face. The burned stumps are like a "pine knot" and last indefinitely but are easily removed, like "pulling a plug", from the sandy soil.

The Jack pine grows in dense stands on sandy soils. When marking for a bearing tree keep the blaze low and narrow. Paint thoroughly. Release if necessary and possible.

EASTERN HEMLOCK (*Tsuga canadensis*)

Other names: hemlock, hemlock spruce, spruce pine.

EXCELLENT

A tree found in the Great Lakes and northeastern states, the eastern hemlock is a much more hardy tree than its western relative. The bark is much thicker and the tree is relatively free from loss by decay and fungus. It may reach 600 years of age and worst enemies are logging and fire. If the tree has died and fallen the dried blaze face may still remain. The rolled stump is reddish brown and discolors the soil. A stump hole may be 12" to 18" deep with a row of hard hemlock knots where the log has decayed. The wood decays quite rapidly but wet ground conditions will preserve the stump. The inner bark is a reddish cinnamon color which would aid in identification. The sound wood in a decaying tree is very hard and ill-smelling.

When marking for a bearing tree select the younger trees 6" to 12" diameter and avoid the knots with the blazing for they are very hard, like flint. Keep the blaze small, well drained, and paint thoroughly for there is no resin flow from the hemlocks. The sap is watery.

WESTERN LARCH (*Larix occidentalis*)

EASTERN LARCH or TAMARACK (*Larix laricina*)

Other names: larch, tamarack, hackmatack, juniper

FAIR TO VERY GOOD

The western larch occurs in eastern Washington and Oregon to Idaho and western Montana. The eastern larch or tamarack is native to the Great Lakes region from Minnesota to Maine and in interior Alaska. Both species shed their needles in winter and appear dead during the dormant season. The western larch prefers moist soil but grows on dry slopes. Tamarack is usually found in swampy lands. Both trees are cut for lumber but are used extensively for fence posts and even for shake roofs.

Western larch is usually found with the blaze only partially healed, but may be completely healed under ideal conditions, with no noticeable scar. It is a dependable bearing tree and is nearly always recovered, even if dead, fallen or stumped. The blaze may be decayed to some extent but with some scribing remaining. The wood decays quite slowly. The tamarack is more rot resistant than the western larch. Both trees grow in dense stands and many fallen trees may require examination. Because of the wet conditions that both trees prefer they are not lost to fire to any great extent, but fires will completely consume a dead tree.

Select young trees 8" or larger. Alaska reports problems with carpenter ants. Do not use trees that have a hollow sound when struck, or if there are ants in or near the larch. Keep the blaze narrow, well drained and through the sapwood. The larches are more long lasting if blazed when the sap is flowing, and more resistant to infection and attack by insects. Paint the wound thoroughly. Release if in a dense stand.

ENGELMANN SPRUCE (*Picea engelmanni*)

BLUE SPRUCE (*Picea pungens*)

Other names: spruce, silver spruce, white spruce; may
have been confused with hemlock.

FAIR TO GOOD

Engelmann spruce occurs from eastern Oregon and Washington eastward through Idaho and Montana and Rocky Mountain region. Blue spruce is confined to the Central Rocky Mountain area. Though two distinct species they are very similar in durability as a bearing tree. The wood is soft and decays quite rapidly. They are usually found with the blazes decayed, only partially healed and little trace of scribe marks. These trees favor moist stream bank areas, are long lived (300 or more years) and grow slowly. They are subject to windthrow and the wood rots quickly once on the ground. Though resinous they do not produce a good pitch face to protect against decay of the blaze. Few are ever found with the blaze completely healed and protected.

Though not a "first choice" these spruces are better than aspen and birch with which they are usually found. Select young, healthy trees, 6" or larger. Use a narrow blaze, well drained and paint thoroughly. Release if necessary but these trees do tolerate considerable shade.

BLACK SPRUCE (*Picea mariana*)

WHITE SPRUCE (*Picea glauca*)

Other names: swamp spruce, bog spruce; skunk spruce,
Canadian spruce

POOR TO GOOD

These spruces are found in the Great Lakes region, through Canada, and are most prevalent in the interior regions of Alaska. Black spruce grows profusely in swamps, bogs and muskegs, and may be the only tree available in those locations. It is a slow growing tree and may be only 5" or 6" diameter when 400 years old. The white spruce favors wet conditions but does grow on higher lands and is usually larger than the black spruce and may be cut for lumber. It grows faster but has a shorter normal life span.

The original blazes on these spruces are seldom healed over. Fire may burn the open blazes with little trace of scribing remaining though it may be detected by side lighting. The bark is thin, the wood is soft and decays rapidly when on the usually wet ground. The root system is shallow and leaves no stump hole. Very few of these trees are recovered in the Great Lakes region, indicating they are not desirable bearing trees, if better species are available. Alaska finds them to be better than tamarack, birch or aspen.

Select trees at least 4" to 6" diameter. Keep the blaze small, just large enough to accommodate the required scribe marks. Blaze carefully to avoid separating the bark from the cambium layer, and smoothly drained at the bottom. Paint thoroughly but not excessively. Releasing may be necessary in dense stands. Prune off the lower limbs to a height of about 4 feet on the smaller trees.

NORTHERN WHITE-CEDAR (*Thuja occidentalis*)

EASTERN REDCEDAR (*Juniperus virginiana*)

Other names: arborvitae, swamp cedar, white cedar,
tree-of-life; red cedar, red juniper

VERY GOOD

The white cedar is found in the Great Lakes region and the redcedar from the Great Lakes throughout the eastern states. Both are slow growing, long lived trees, 300 years or more. The white cedar is subject to heart-rot in the older or dead trees. The bark is fibrous giving them a shaggy appearance. White cedar favors a wet or swampy growing condition and is less subject to loss by fire. Though usually hollow the white cedars are one of the most likely of the original bearing trees to be found in the Great Lakes region. If still standing the blaze may be nearly or completely healed. When fallen they decay very slowly and the wood has a distinctive "cedar smell". These trees leave little or no stump hole.

Select young trees, over 8" diameter. Do not use hollow old growth white cedars. Keep the blaze narrow and well drained. Paint thoroughly to retard weathering.

BALSAM FIR (*Abies balsamea*)

Other names: balsam, eastern fir.

POOR

The balsam fir is found from Minnesota to Maine in the Great Lakes region. It is short lived, seldom over 100 years of age. The bark is thin and usually covered with resin blisters. The wood decays rapidly when in contact with the ground. Any injury to the tree causes rapid infection and decay. The possibility of finding an original balsam fir bearing tree marked 100 years ago are very remote. The one tree reported as found had died and was lodged in an elevated position not in contact with the ground. The wood is coarse grained and soon disintegrates.

If no better tree is available select the healthiest looking young tree 5" or so in diameter. Do not use old growth trees. Bark scribing is recommended. The bark scribing rapidly fills with pitch which should afford protection.

WHITE OAK (*Quercus alba*)

BUR OAK (*Quercus macrocarpa*)

Other names: stave oak; blue oak, scrub oak, oak.

VERY GOOD

The white oak is found over most of the country east of the Mississippi. The bur oak is a central states tree, from North Dakota to Ohio and south to Texas. They are very similar in appearance, slow growing and live to ages of 400 to 600 years. The white oak is an upland tree. The bur oak prefers lowlands and stream banks. Both trees are desirable for lumber and fence posts.

The blaze tends to heal well and rapidly. The sapwood decays quickly but once turned to heartwood is much more resistant to decay than the black oak species. On trees marked 100 years ago, if still alive, the blaze will be completely healed over. Stumps will last for 20 years or more after cutting and may have sprouted new trees. Care should be exercised to avoid mistaking beetle "tracks" for scribe marks. The "whorly" grain is quite pronounced for 2 or 3 inches out from the blaze face.

When marking one of these trees blaze through the sapwood but no deeper. Keep the blaze as low as possible and well drained. Paint thoroughly.

NORTHERN RED OAK (Quercus rubra)

BLACK OAK (Quercus velutina)

Other names: oak, red oak, gray oak; yellow oak

GOOD

The red oak is found from Minnesota to Maine and throughout the eastern states. Black oak occurs from southern Wisconsin and Iowa throughout the east and south. They are both in the "black oak" group and are less desirable and durable as bearing trees than are the white oaks. The trees may live to 200 years if not cut for lumber. The red oak is more resistant to decay, is straight grained and very hard when dead and dry. The wood will burn like coal and leave very little ash.

Though slow growing trees the original blaze would be well healed on a live tree. The chance of finding a living tree after 100 years is very remote, because they were usually mature when marked. The stumps rot away leaving a large stump hole which may contain pieces of root and wood. Once begun, the decay rate is rapid. Look for second growth, or young trees to indicate the possible position of the original tree.

Keep the blaze as small as possible, just deep enough to penetrate the thin sapwood, well drained, and near the ground. Paint thoroughly.

SUGAR MAPLE (*Acer saccharum*)

BLACK MAPLE (*Acer nigrum*)

Other names: hard maple, rock maple, maple

VERY GOOD

These hard maples are found from Minnesota and Iowa to the New England states. They reach an age of up to 400 years. These are the "best" of the maple family in terms of bearing trees.

In ideal conditions the blaze will heal quickly, often before decay sets in. There are no reports at this time (1972) of the recovery rate or other information concerning these trees as live original bearing trees. A decaying stump usually has the bark gone and the wood turns black. The stumps do not decay uniformly but do leave a distinct stump hole.

Keep the blaze as short and narrow as possible, smooth at the edges and smoothly drained. Paint thoroughly.

RED MAPLE (*Acer rubrum*)

SILVER MAPLE (*Acer saccharinum*)

Other names: scarlet maple, soft maple, water maple,
white maple, maple.

POOR TO FAIR

These are the soft maple group found throughout the Great Lakes region, central and eastern states. They are rapid growing and short lived, seldom reaching more than 100 years of age.

There is little if any chance of finding a live original bearing tree. The original surveyors marked nearly mature trees which are now gone. The stump decays rapidly but usually leaves a distinct stump hole. New trees frequently sprout from the old stumps. A clump of maples may be a clue to the position of the original bearing tree.

The bark of the young red and silver maples is smooth. If better trees just aren't available it is suggested that young, smooth barked trees be selected and bark scribed. Use larger than normal letters and scribe deep enough to prevent disappearance of the scribing as the tree matures and bark roughens. Paint to prevent fungus infection.

BOX ELDER (*Acer negundo*)

Other names: Ash-leaf maple, maple

VERY POOR

This tree is found from the Rock Mountain Region and throughout the Eastern States. Though in the maple family it is much less desirable as a bearing tree. It grows very fast, does not live more than about 40-50 years and decays rapidly from any injury. The wood is pithy and soft, soon decaying to a mulch when dead.

Though the original surveyors undoubtedly marked this tree for a bearing tree none is known to have been recovered. The normal life span and rapid decay precludes the possibility of finding a box elder.

Not recommended. If nothing else available use a small (BT) blaze only and paint thoroughly.

WHITE ASH (*Fraxinus americana*)

BLACK ASH (*Fraxinus nigra*)

GREEN ASH (*Fraxinus pennsylvanica*)

Other names: Ash, red ash, swamp ash, water ash; may have been confused with basswood.

FAIR TO GOOD

The white and green ash are found throughout the eastern half of the adjacent states. The black ash is a northern tree of the Great Lakes Region and North-eastern states. White ash and green ash are very similar, often being called one for the other. They favor upland areas. Black ash is usually found in low or stream bottom terrains. All are rather fast growing but hardy hardwoods. The white and green ashes are the longer lived of the group and more resistant to decay. None have a life expectancy of more than 100 years.

There are no reports of recovered, life, ash bearing trees marked during the original surveys. The white and green ash stumps have thick and rough bark. The wood is brownish in color. Black ash retains a lighter color, has open pores and the bark turns powdery in fine scales. All ashes decay rapidly when cut. The stumps often sprout new clumps of trees which may be matched to locate a corner.

The ashes are relatively thin barked. Blaze carefully to avoid separating the bark from cambium layers, well drained and small as possible. Release if in dense stands. Paint thoroughly.

EASTERN COTTONWOOD (*Populus deltoides*)

PLAINS COTTONWOOD (*Populus sargentii*)

Other names: cottonwood, eastern poplar; plains poplar.

POOR TO FAIR

These cottonwoods are found throughout the eastern and plains states as the names indicate. They are separate species but very similar in appearance, and are generally just called cottonwood. These trees are rapid growing, reach sizes of up to 6 ft. diameter and have a life expectancy of about 125 years. Like all cottonwoods they thrive only along stream banks and river bottoms. The wood is soft and watery, very heavy when green but usually punky when dead or dying. The wood decays rapidly once on the ground.

These cottonwoods grow so rapidly that they will heal over almost any injury within a few years when young and vigorous. The blaze face will often be rotted out behind the overgrowth but scribing may be found in reverse. If a 10" or 12" tree was originally marked the face may be behind 2 ft. or more of overgrowth with no evidence of the blaze in the rough bark. Once mature, death and decay set in rapidly, the tree soon disappears but if windthrown leaves a large stump hole. The principle objections to these trees is the short life and rapid decay of dead wood or injuries.

Select young trees, up to 10" diameter. Keep the blaze as small as possible and smoothly drained at the bottom. Release if in dense stand. Paint the blaze thoroughly.

QUAKING ASPEN (*Populus tremuloides*)

BIGTOOTH ASPEN (*Populus grandidentata*)

WHITE POPLAR (*Populus alba*)

Other names: aspen, popple, poplar, quaker.

POOR

Quaking aspen is found throughout the western states, Great Lakes region, northeastern states and interior Alaska. It is the most wide-spread of the populus genera. Bigtooth aspen is a tree of the Great Lakes and northeastern states. White poplar is an imported tree that has "gone wild" in many parts of the country and, when young, looks very similar to the aspens. All of these trees are short lived, soft, and decay rapidly when dead. The normal life span does not exceed 100 years. Aspen usually grows in dense stands and often reproduces as "suckers" from the roots of the parent tree. The bark on all but the largest trees is smooth. The aspen are used for pulpwood in the Great Lakes region.

When bark scribed the original bearing trees have been found in good condition. When blazed decay soon destroys the tree. In dry conditions the blaze may harden before disease attacks. Dead trees are often held up by the densely growing neighbors and thus be well preserved for considerable time. Once in contact with the ground the wood rapidly decays and there is little chance of recovery. The aspen often leaves a distinct stump hole. Stool growth may also be a clue to the original tree position.

If aspen must be used for a bearing tree select the healthiest, more dominant tree, 6" to 8" diameter, bark scribe with larger than normal letters, to avoid tearing the bark. Bark scribing may be done with the sharp point of a pocket knife, cut into the bark without removing any of the bark as with the normal scribe. This leaves a thin line and when healed does not flake off. Release from dense stands. Do not use large aspen as they are usually near maturity. Paint the scribing.

WILLOWS, including BLACK, RED, PACIFIC, PEACHLEAF,
CRACK, SCOULER (Salix species)

Other names: None other than willow

POOR

Of the willow family these species sometimes reach tree size, up to 20" or 24" diameter. All willows look pretty much alike to most surveyors. The original surveyors merely called them all willow so they are grouped here. The willows named here are thought to be the most hardy. Some may live up to 150 years of age. The Black Willow of the Eastern States grows to tree size and is logged for lumber. It rarely exceeds 70 years of age. The wood of willows is soft and fibrous, decaying rapidly once dead. The willows require a moist stream bank type environment.

Very few original willow bearing trees have been found. If blazed, the scribing is rotted away and the tree may have a decayed hole completely through the trunk. This writer has seen only one willow that was bark scribed. The letters BT were in the bark near the base and a large decayed hole above. Willow clumps will frequently be found at the record position of a willow bearing tree when the corner has been positively located by other evidence. It can be assumed that the clumps were stools of the bearing tree.

Do not mark willows for bearing trees except as a last resort. A sound Douglas-fir stump with the bark removed would be preferred. If willow must be used try bark scribing if the bark is smooth enough. If not, keep the blaze as small as possible; "BT" only might be best. Paint thoroughly.

HAWTHORN (Crataegus, many species)

Other names: thornapple, haw

POOR

There are too many species of hawthorn (or thornapple) to list here. All are scrubby trees, usually no more than 6" in diameter. They usually grow in dense thickets mixed with vine maple and crabapple on the Pacific slope. In the Great Lakes and eastern portion of the country they occur as single trees in open pastures and borders of woodlands. They are thorny, have hard wood, are short lived and decay quickly when dead.

The original surveyors may have called hawthorn "crabapple", or vice versa. The sapwood is thick under a rough bark. The wood is hard to cut but decays quickly when dead and on the ground. Original hawthorn bearing trees are seldom found and when they are the blaze is badly decayed, with little or no scribing remaining. Identification of the bearing tree is had by reference to another before it can be certain the particular hawthorn is the bearing tree searched for.

Avoid marking hawthorn for a bearing tree. If nothing better is available bark scribe if possible, or keep the blaze small, (a "BT" blaze size is recommended over a full compliment of markings) and paint the wound thoroughly. Release if possible, but this is usually difficult in the dense entanglements.

PIN (FIRE) CHERRY (*Prunus pensylvanica*)

BLACK CHERRY (*Prunus serotina*)

BITTER CHERRY (*Prunus emarginata*)

HOLLYLEAF CHERRY (*Prunus ilicifolia*)

Other names: cherry, wild cherry

VERY POOR TO GOOD

The pin cherry is found in the northern part of the country from Wyoming and Idaho to Maine. Black cherry is a tree of the Great Lakes region and eastern half of the country. It reaches tree size of 24" or more and an age of up to 300 years. The black cherry is logged for commercial lumber and veneer. Bitter cherry is the cherry of the Pacific Northwest. Hollyleaf cherry is a tree of southern California, with holly like leaves but is usually a shrub. The fruits of the black cherry and pin cherry are used to make jelly, wine and brandy. Of this group, only the black cherry is believed to be a good bearing tree.

There is no report of a recovered original cherry bearing tree. Cherry rots quickly once dead and on the ground. Except for the black cherry it is doubtful that any one has ever recovered an original cherry bearing tree. The trees are thin barked, with thick sapwood, easily injured by fire, and injuries decay quickly.

If nothing else is available and cherry must be used bark scribe the tree. Do not snow blaze, and tag carefully. Paint the scribe marks. If blazing must be done use a "BT" blaze only.

PAPER BIRCH (*Betula papyrifera*)

YELLOW BIRCH (*Betula alleghaniensis*)

Other names: canoe birch, white birch, silver birch;
gray birch, swamp birch, birch.

FAIR

Paper birch is found throughout the Great Lakes region, and extreme northern portion of the adjacent states. It is one of the most common trees in interior Alaska. Yellow birch is a tree of the Great Lakes region and northeastern states. Both are considered short lived trees. Paper birch may reach 140 years of age and yellow birch up to 200 years. Both are rapid growing with a thin, "papery", bark, and reach 12" to 24" in diameter. Though the wood is hard it decays very rapidly when dead. The stumps decay to a mulch and leave little or no stump hole, though portions of the bark often remain. Both trees stool into clumps. The yellow birch often takes root in old hemlock stumps, forming a raised root system, similar in type to the western hemlock. Yellow birch is the more durable of the two. If windthrown there is usually a fair sized stump hole remaining.

The original bearing trees of these species are sometimes found. If still standing the blaze is badly decayed with little or no trace of scribe marks. In ideal site conditions the trees have been found alive but mature and in poor condition. Do not discount the possibility of finding an original birch because they have been recovered. Careful examination and search would be a must. Matching rotted stumps and clumps of birches could pay off with a recovered corner.

If using these birches select young trees, blaze very carefully to avoid separating the bark at the edges (they peel easily). Blaze to firm wood, use a sharp scribe and paint thoroughly. If a tree less than 6" is taken use bark scribing but the scribing would have to be deep into the bark and carefully done to avoid tearing. Larger than normal letters would probably be best.

AMERICAN ELM (*Ulmus americana*)

SLIPPERY ELM (*Ulmus rubra*)

ROCK ELM (*Ulmus thomasi*)

Other names: white elm, soft elm, water elm; gray elm
red elm; cork elm, elm.

GOOD TO VERY GOOD

The elms are trees of the Great Lakes region and eastern half of the adjacent states. They are medium to rapid growing trees, favor bottom lands, grow to 3 ft. or more in diameter and have a life expectancy of 150 to 300 years if not logged or killed by Dutch elm disease. Elms usually grow from seed but are known to grow up from root suckers of a dead or logged tree. These trees will completely heal an injury but a noticeable scar usually remains in the rough bark. Once cut or dead and fallen the wood decays quickly, both heart and sapwood. In low land conditions the growth rings are usually wide-spaced, curl and break off. The wood immediately under the bark is dark while the inner core is lighter in color.

There are no reports of recovered original elm bearing trees. They were used extensively by the original surveyors.

If an elm is used for a bearing tree, blaze through the bark just deep enough for a smooth face. Take care not to separate the bark from cambium layer. Smoothly drain with an upward axe stroke to prevent accumulation of the watery sap. Keep the bottom of the blaze high enough to prevent coverage by high water in swampy areas. Paint the blaze thoroughly.

SHAGBARK HICKORY (*Carya orata*)

BITTERNUT HICKORY (*Carya cordiformis*)

Other names: hickory, shagbark; bitternut, pignut,
pecan, swamp hickory

VERY GOOD

There are many species of hickory but the two listed here are found throughout the lower Great Lakes states and eastern half of the country. These hickories are moderate to fast growing trees, reach up to 3 ft. in diameter and an age of 200 years, if not cut or fire damaged. If fungus infection is not severe these trees will completely heal an injury in 25 or 30 years, with little trace of a scar in the rough bark. When dead and fallen the wood decays rapidly, and more so if in wet land conditions. There may be little or no trace of the rotted stump.

Hickories were a favorite bearing tree of the original surveyors. At this time (1972) there is no report of the characteristics of a recovered original hickory though many must have been by sheer weight of numbers. Since the trees are desirable as lumber, veneer, handles, etc., most large trees have undoubtedly been cut.

Select young vigorously growing trees, keep the blaze narrow, smoothly drained, and use a sharp scribe. Paint thoroughly.

AMERICAN BASSWOOD (*Tilia americana*)

Other names: basswood, linden

VERY GOOD

The American basswood or linden tree grows throughout the Great Lakes region, Minnesota to Maine. The tree prefers sandy glacial soil. Basswood is rapid growing, reaches as much as 3 ft. in diameter and up to 140 years of age. The tree is highly prized for lumber and is used as shade trees on city streets. The tree blooms in spring with white blossoms which bees turn into the most delicious honey. The Indians used the tough and stringy inner-bark to make rope. This tree sprouts profusely. Every old stump has a clump of new basswood trees which sprouted from it, forming a natural perpetuation of a trees' location. Young trees have a smooth green bark. Mature trees are protected by a rough and fibrous bark.

The original surveyors often bark scribed the young basswood. As the tree grew the bark scribing disappeared in the rough bark and would be very hard to detect. Dead and fallen trees decay quickly but the sprout clumps of new trees show where the original tree stood in most cases.

Select young and vigorous trees and release from a dense stand. Bark scribe through the bark. Avoid blazing but if necessary keep the blaze small, narrow and smooth at all edges. Paint thoroughly, whether bark or meat scribed.

BLACK WALNUT (*Juglans nigra*)

BUTTERNUT or WHITE WALNUT (*Juglans cinerea*)

Other names: walnut, American walnut; oilnut.

EXCELLENT

These trees are found in the midwest, eastern and lower Great Lakes portion of the country. They are very similar in appearance but the black walnut is the better bearing tree for it grows rapidly, reaches diameters of 3 to 5 ft. and an age of more than 200 years. The heartwood of black walnut is highly decay resistant and will remain for years buried in the ground. Butternut is a fast growing smaller tree, lives only about 75 years and decays quickly when dead and fallen. Both trees bear a very hard nut. The wood is highly valuable for lumber.

There are no reports of recovery of an original walnut bearing tree. Though both trees will heal a wound completely and would likely remain, any tree 100 years old would have been cut for lumber by this time.

Where the walnuts grow they are probably on private land and permission would be required before being used for bearing trees. The same caution would apply before cutting into a walnut suspected of being an original. These are highly prized trees.

SYCAMORE or PLANETREE (*Platanus occidentalis*)

Other names: buttonwood, buttonball

VERY GOOD

This sycamore is a tree of the eastern half of the adjacent states. It grows very rapidly, reaches 8 ft. or more in diameter and lives in excess of 200 years. The bark is a whitish brown, flakes in thin scales, is thin on young trees but thick and rough on old trees. This tree grows in bottomlands and along stream banks like the cottonwood but should not be confused with that species. Some species of sycamore are found in Arizona and California but ~~xa~~ do not reach sizes nearly as large as the planetree discussed here.

There are no reports of recovery of an original sycamore bearing tree. Undoubtedly many exist.

When marking a sycamore select young trees, for large ones are probably near maturity. Blaze to firm wood, well drained and paint thoroughly. Do not bark scribe.

AMERICAN BEECH (*Fagus grandifolia*)

Other names: beech, beechnut, white beech, red beech

FAIR

The beech is an eastern states tree, extending as far west as Wisconsin in the Great Lakes region. This tree is slow growing, reaches 2 or 3 ft. in diameter and up to 300 years of age. The bark is smooth, bluish-gray in color and thin. The beech heals slowly when injured. The tree does reproduce as suckers from the parent root system. The beech nut is formed in a bur which looks very much like the chinquapin bur of the Pacific coast.

There is no report of a recovered beech bearing tree. Many were marked by the original surveyors. The beech is the tree specifically mentioned as the tree type which should be bark scribed in the earlier instructions by surveyor's general. The beech is susceptible to many killing fungi. The wood decays quickly. Though original trees must still exist today the older and larger trees have probably disappeared.

The instruction to bark scribe beech bearing trees still applies. Select young trees however because larger trees are subject to butt-rot, etc. Paint the scribe marks.



United States
Department of
Agriculture

Forest
Service

Huron-Manistee National Forests
Supervisor's Office
1755 South Mitchell St.
Cadillac, MI 49601

231-775-2421 (voice)
231-775-5551 (fax)
231-775-3183 (TTY)

File Code: 7150

Date: December 28, 2016

Subject: Boundary Survey of National Forest System Lands

To: Adjacent Property Owners

Dear Forest Neighbor,

This letter is to inform you that a survey may be performed within the next several months to delineate the boundary between National Forest system and private lands within Sections 10, 13, and 22 of T16N, R12W, Home Township, Newaygo County. During the course of this survey it may be necessary to utilize all existing trail roads within the work area and have access across private lands adjacent to the National Forest. I would be interested in evaluating any information you may have that will aid us in properly determining the location of the common boundary lines. If you have copies of any previous boundary survey drawings or any other historical data that may be pertinent to this project, please forward copies to my attention at the address above.

While performing this survey it will be necessary for us to make measurements around the sections mentioned above. During the course of making these measurements, it may be necessary to clear lines of sight on private land, however, no trees larger than 6 inches in diameter shall be cut. After measurements are made and the location of the property lines determined, corner monuments will be placed and the lines will be cleared of brush and marked with orange fiberglass posts driven into the ground. Trees within 3 feet on the National Forest side of the property line as well as trees on line will also be blazed and painted red. At all property corners we will need to select 3-4 reference objects to preserve the corner location into the future. The reference objects utilized are typically trees, one in each of the different directional quadrants (North, South, East, and West). It may be necessary to utilize trees on private land as reference objects and we are asking your permission to use typically no more than 1 tree on your property. Once the trees are selected it will be necessary for us to drive a nail in the center of the tree at its base to make a measurement from and then place a tag on the tree that will list the direction and distance to the corner location.

If you have any questions or concerns regarding this project, please contact me at 231-942-4958. If you would like more information about the Huron-Manistee National Forests, please visit our website at <https://www.fs.usda.gov/hmnf>.

Sincerely,

Carol A. Waite
Forest Land Surveyor



Caring for the Land and Serving People

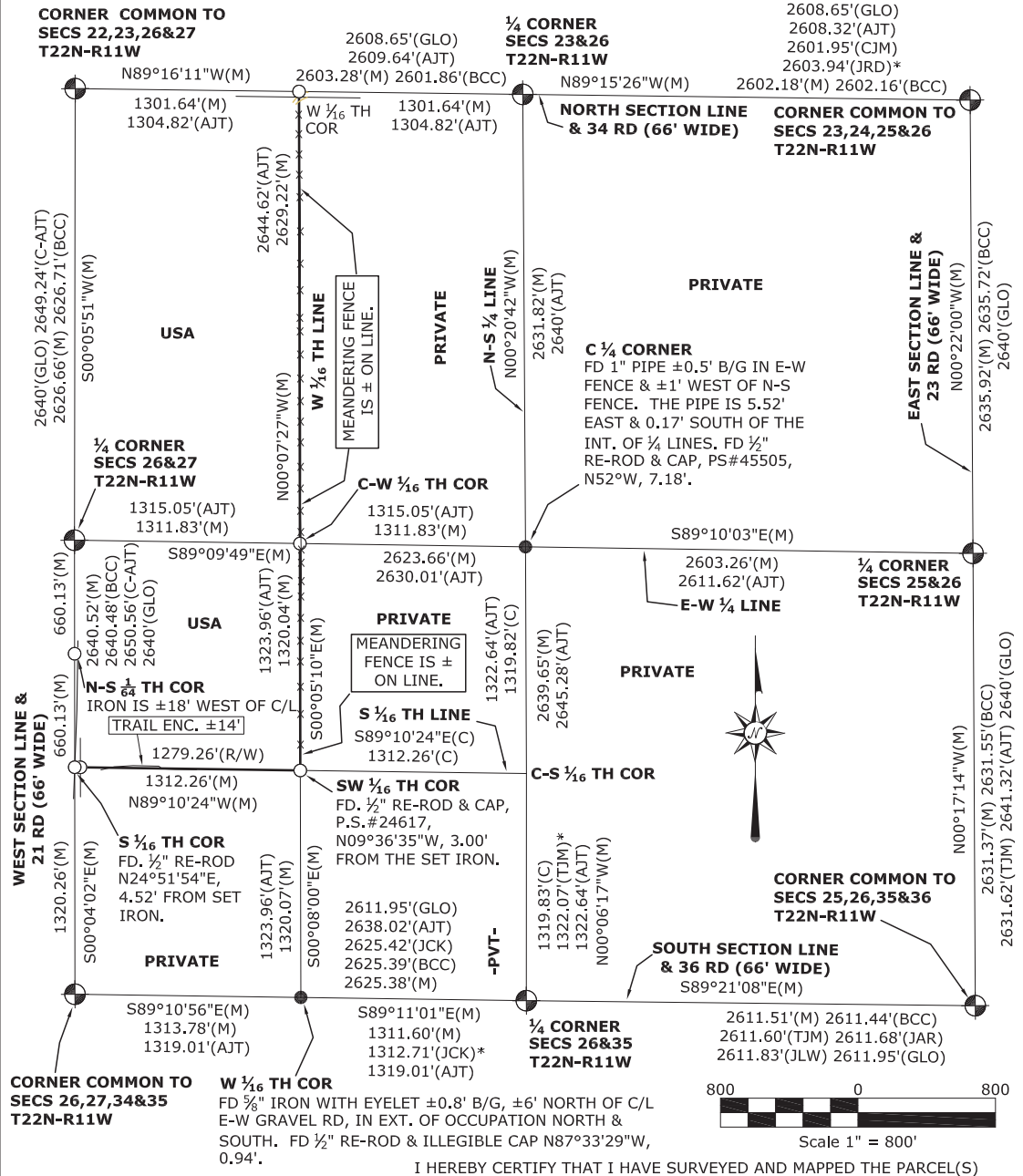
Printed on Recycled Paper



CERTIFICATE OF SURVEY

- LEGEND**
- ⊕ = EXISTING PLS'S CORNER POSITION ACCEPTED
 - = SET 1/2" x 18" LONG RE-BAR & CAP, P.S. #12345
 - = SECTION SUBDIVISION CORNER FOUND AS NOTED
 - (R) = RECORD GROUND DISTANCE
 - (M) = MEASURED GRID DISTANCE
 - (C) = CALCULATED GRID DISTANCE
 - = BOUNDARY LINE POSTED & MARKED
 - x - x - = FENCE LINE
 - (R/W) = DISTANCE TO THE ROAD RIGHT OF WAY
 - (*) = INDICATES MEASUREMENTS TO MONUMENTS NOT UTILIZED OR RECOVERED IN THIS SURVEY

SPACE RESERVED FOR REGISTER OF DEEDS



Joseph J. Surveyor
Professional Surveyor No. 12345

I HEREBY CERTIFY THAT I HAVE SURVEYED AND MAPPED THE PARCEL(S) HEREON DESCRIBED AND THAT THE RELATIVE POSITIONAL PRECISION OF EACH CORNER IS WITHIN THE LIMITS ACCEPTED BY THE PRACTICE OF PROFESSIONAL SURVEYING AND THAT ALL OF THE REQUIREMENTS OF P.A. 132 OF 1970, AS AMENDED, HAVE BEEN COMPLIED WITH.

BASIS OF BEARING: NAD 83 MICHIGAN CENTRAL STATE PLANE GRID

| | | | | |
|---|------------------|---|--|--------------------|
| <h2 style="margin: 0;">Joe Surveying INC</h2> <p style="font-size: small; margin: 0;">1-888-555-4321 PH. 231-555-1000 Fax. 231-555-1001 100 MAIN ST. ANYWHERE, MI 49660</p> | DATE: 03/02/2017 | CLIENT: USDA Forest Service | | FB/PG: FS1/1-18 |
| | DRN BY: AOL | Part of Section 26, T22N, R11W, Boon Twp., Wexford Co., MI. | | JOB NO.: 78910 |
| CHD BY: JJS | SHEET 1 OF 4 | | | |

LEGAL AND COORDINATES

COORDINATE LIST
 NAD83(2011) MICHIGAN CENTRAL ZONE STATE PLANE COORDINATES IN INTERNATIONAL FEET
 ELEVATIONS SHOWN TO TWO DECIMAL PLACES ARE ORTHOMETRIC HEIGHTS DERIVED FROM GPS
 MEASUREMENTS AND THE GEOID12 MODEL. ELEVATIONS SHOWN TO NEAREST FOOT ARE SCALED.
 NAD83 GEOGRAPHIC COORDINATES ARE SHOWN AS NORTH LATITUDE AND WEST LONGITUDE.
 (DEG MIN SEC.ssss)

| POINT | NORTHING | EASTING | ELEVATION | LATITUDE | LONGITUDE | S.F. | C.S.F. | CONVERGENCE |
|-------------|-----------|-------------|-----------|----------------|----------------|-------------|-------------|----------------|
| SE2622N11W | 348551.47 | 19362149.68 | 1348.90 | 44 15 57.56327 | 85 35 57.49151 | 0.999982077 | 0.999922849 | -0 52 14.67687 |
| E142622N11W | 351182.81 | 19362136.49 | 1336.62 | 44 16 23.54311 | 85 35 58.22236 | 0.99998061 | 0.999921971 | -0 52 15.19315 |
| NE2622N11W | 353818.67 | 19362119.63 | 1369.23 | 44 16 49.56707 | 85 35 59.00485 | 0.999979156 | 0.999918959 | -0 52 15.74591 |
| N142622N11W | 353852.41 | 19359517.66 | 1369.96 | 44 16 49.50801 | 85 36 34.77422 | 0.999979159 | 0.999918931 | -0 52 41.01365 |
| SW2622N11W | 348618.42 | 19356913.22 | 1383.36 | 44 15 57.43217 | 85 37 09.45928 | 0.999982085 | 0.999921216 | -0 53 05.51544 |
| W142622N11W | 348580.99 | 19359538.34 | 1356.92 | 44 15 57.46129 | 85 36 33.37991 | 0.999982083 | 0.999922475 | -0 52 40.02871 |
| W142622N11W | 351258.93 | 19356910.12 | 1406.68 | 44 16 23.50399 | 85 37 10.06239 | 0.999980612 | 0.99991863 | -0 53 05.94148 |
| NW2622N11W | 353885.59 | 19356914.58 | 1451.94 | 44 16 49.44013 | 85 37 10.55870 | 0.999979163 | 0.999915018 | -0 53 06.29207 |
| C142622N11W | 351220.63 | 19359533.51 | 1361.13 | 44 16 23.52433 | 85 36 34.00210 | 0.999980611 | 0.999920803 | -0 52 40.46822 |

LEGAL DESCRIPTION OF THE NATIONAL FOREST SYSTEM LANDS:

The Northwest 1/4 of the Southwest 1/4 AND the West 1/2 of the Northwest 1/4,
 Section 26, T22N-R11W, Boon Township, Wexford County, Michigan.

SPACE RESERVED FOR REGISTER OF DEEDS

SURVEYORS LEGEND

- GLO = Orson Lyon (1848)
- AJT = Augustus J. Teed (1895, 1905)
- JLW = Jerry L. Wilcox, RLS 14102 (1986)
- JCK = Joseph C. Kapelczak, PS 24598 (1997)
- TJM = Thomas J. Mueller, PS 25861 (2003)
- CJM = Christopher J. McCrimmon, PS 47962 (2004)
- JRD = Joshua R. Davidson, PS 46659 (2005)
- JAR = James A. Ray, PS 25869 (1989, 2010)
- BCC = Brent C. Clough, PS 52464 (2014)

DISTANCES ARE SHOWN IN NAD 83 MICHIGAN CENTRAL
 STATE PLANE GRID IN INTERNATIONAL FEET.
 1 INTERNATIONAL FOOT = 0.3048 METERS. COMBINED
 GRID FACTOR FOR THE PROJECT = 0.999917793.

GRID DISTANCE _____ = GROUND DISTANCE
 COMBINED GRID FACTOR

I HEREBY CERTIFY THAT I HAVE SURVEYED AND MAPPED THE PARCEL(S)
 HEREON DESCRIBED AND THAT THE RELATIVE POSITIONAL PRECISION
 OF EACH CORNER IS WITHIN THE LIMITS ACCEPTED BY THE PRACTICE OF
 PROFESSIONAL SURVEYING AND THAT ALL OF THE REQUIREMENTS OF
 P.A. 132 OF 1970, AS AMENDED, HAVE BEEN COMPLIED WITH.

Joseph J. Surveyor
 Professional Surveyor No. 12345

Joe Surveying INC

1-888-555-4321
 PH. 231-555-1000 Fax. 231-555-1001
 100 MAIN ST. ANYWHERE, MI 49660

DATE: 03/02/2017
 DRN BY: AOL
 CHD BY: JJS
 SHEET 2 OF 4

CLIENT: USDA Forest Service

Part of Section 26,
 T22N, R11W,
 Boon Twp., Wexford Co., MI.

FB/PG:
 FS1/1-18

JOB NO.:
 78910

CORNER WITNESSES

SPACE RESERVED FOR REGISTER OF DEEDS

Corner Common to
Sections 22, 23, 26 & 27, T22N, R11W
 Found 3 1/2" brass cap monument +/-0.1'
 above grade, +/-6' west of the extension
 of the c/l trail north, +/-6' south of c/l
 e-w trail, on north edge of e-w pine row.
 N55E - spike in SE face of 20" Beech - 80.82'
 S04E - spike in W face of 14" R. Pine - 2.63'
 N83W - spike in N face of 18" R. Pine - 7.74'
 N20W - spike in E face of 18" R. Pine - 36.50'
 N03W - 1/2" re-bar & cap #52464 at position of the
 monument with brass cap #25869 - 29.53'
 North - Fiberglass Post - 1'

1/4 Corner Sections 23 & 26, T22N, R11W
 Found 1 1/2" Wexford County Monument
 +/-8' below grade, +/-3' south of c/l e-w road.
 N01E - nail in 18" Cherry - 55.23'
 S02E - mag nail in P. Pole - 28.17'
 N58W - nail in 14" R. Pine - 89.65'
 N24W - nail in 20" R. Pine - 63.35'
 N07W - monument with brass cap #25869 - 14.15'

Corner Common to
Sections 23, 24, 25 & 26, T22N, R11W
 Found 1 1/2" Wexford County Monument
 in monument box +/-0.2' below grade at
 intersection of roads.
 S88E - nail in Power Pole - 217.07'
 S18W - 1/2" rebar in monument box - 1.37'
 S22W - nail in Power Pole - 147.35'
 S75W - nail in Power Pole - 82.87'
 S86W - spike in 48" Maple - 128.69'
 N40W - p.k. nail in Power Pole - 46.13'

1/4 Corner Sections 26 & 27, T22N, R11W
 Found 1 1/2" Wexford County Monument
 +/-1' below grade, +/-25' west of c/l n-s dirt trail.
 N63E - spike in SE face of 12" R. Pine - 55.65'
 N84E - spike in S face of 14" R. Pine - 39.11'
 S79E - spike in S face of 14" R. Pine - 44.95'
 S53E - spike in N face of 16" R. Pine - 43.44'
 N26E - 1/2" rebar - 8.99'

Center 1/4 Corner, Section 26, T22N, R11W
 Found 1" pipe +/-0.5' below grade in e-w
 fence & +/-1' west of n-s fence.
 N45E - spike in NW face of 11" Maple - 32.87'
 S35E - spike in NE face of 18" Maple - 21.82'
 S28W - spike in NW face of 5" Spruce - 41.15'
 West - east face of 4 3/4"x3.8' high steel fence post - 8.95'
 N52W - 1/2" rebar & cap#45505 - 7.18'

1/4 Corner Sections 25 & 26, T22N, R11W
 Found 1 1/2" Wexford County Monument
 +/-0.2' below grade in monument box,
 +/-3.5' west of c/l n-s road.
 S84E - nail in power pole - 102.80'
 S82E - p.k. nail in cut-off telephone pole - 38.12'
 S05W - Westerly "T" of steel guardrail post - 154.83'
 S14E - S.W. Corner of concrete well pit - 159.73'
 S82W - nail in 12" Maple - 139.90'
 West - broken concrete monument - 43.53'

Corner Comon to
Sections 26, 27, 34 & 35, T22N, R11W
 Found 1 1/2" Wexford County Monument
 +/-1' below grade in c/l e-w road & +/-10'
 east of c/l trail to south.
 N70E - spike in 38" Maple - 52.18'
 S36E - spike in 15" R. Pine - 32.99'
 S12E - spike in 16" R. Pine - 33.24'
 N28W - spike in 14" R. Pine - 43.90'

1/4 Corner Sections 26 & 35, T22N, R11W
 Found 1 1/2" Wexford County Monument
 +/-1' below grade, in c/l e-w gravel road & in
 the extension of fences n-s.
 N55E - spike in 20" R. Pine - 44.14'
 S18E - spike in 28" Maple - 49.90'
 S09W - p.k. nail in corner fence post - 29.87'
 S54W - spike in 42" W. Pine - 41.66'
 N30W - spike in 10" Spruce - 45.09'

Corner common to
Sections 25, 26, 35 & 36, T22N, R11W
 Found 1 1/2" Wexford County Monument
 in monument box +/-0.2' below grade at
 intersection of roads.
 N76E - spike in 16" Spruce - 73.80'
 S54E - spike in 48" Maple - 69.90'
 N53W - spike in 15" R. Pine - 49.68'
 N38W - spike in 18" R. Pine - 51.39'

Joseph J. Surveyor
 Professional Surveyor No. 12345

| | | | | |
|--|------------------|---|--|--------------------|
| Joe Surveying INC <small>1-888-555-4321 PH. 231-555-1000 Fax. 231-555-1001 100 MAIN ST. ANYWHERE, MI 49660</small> | DATE: 03/02/2017 | CLIENT: USDA Forest Service | | FB/PG: FS1/1-18 |
| | DRN BY: AOL | Part of Section 26, T22N, R11W, Boon Twp., Wexford Co., MI. | | JOB NO.: |
| | CHD BY: JJS | | | 78910 |
| | SHEET 3 OF 4 | | | |

REPORT OF SURVEY

SPACE RESERVED FOR REGISTER OF DEEDS

EVALUATION OF CORNERS AND CONFLICTING MONUMENTATION:

A.J. Teed performed a petition survey in Section 26, T22N, R11W in 1895. All controlling corners except the NW section corner and W $\frac{1}{4}$ corner appear to not have any conflicts in the historical record that have not already been resolved and represent either a perpetuation of the original GLO position or a proper subsequent restoration by Teed. I retraced the Teed survey and recovered the following evidence:

N.W. Corner: This corner was set by Brent Clough in 2014 through the remonumentation program by doubling over a Teed witness for a 1/16th corner to the east. There was H.I. Devoe record information calling for crockery at this corner. We excavated around the found monument and also an area covering the intersection of E-W & N trails and didn't recover any evidence of the crockery. I used the position as monumented by Clough in 2014.

C-S 1/16th Corner: Excavated a 2' radius x 1' deep hole around the intersection of N-S and East fences and didn't find any pipe. The fence intersection fits a considerable stump depression N86E, 5' to the center which would be for a possible Teed witness. Found a $\frac{1}{2}$ " re-rod and cap, P.S. #25861, N84°48'58"W, 5.87' from the fence intersection. I utilized a computed location to subdivide the SW $\frac{1}{4}$.

C. $\frac{1}{4}$ Corner: Found a 1" pipe 0.5' below grade in E-W fence and 1' west of the N-S fence. This position would be 1.63' east of the Clough position he used in establishing the W. $\frac{1}{4}$ Corner. It also falls 5.52' East and 0.17' South of the intersection of $\frac{1}{4}$ lines. I used the found pipe for the C. $\frac{1}{4}$ Corner.

C-W 1/16th Corner: We excavated a hole 2' north, 3' east, 3' west and 8' south of the computed location and didn't find any other evidence of the corner. I couldn't recover any evidence of Teed's witnesses. The computed location falls in the old N-S fence and +/-4' north of down fence to the East. I used a computed position based upon the found pipe at the C. $\frac{1}{4}$ Corner and the remonumented W. $\frac{1}{4}$ Corner.

N.W. 1/16th Corner: Excavated a 4' radius hole around a N-S & W fence intersection looking for a post or pipe. The fence intersection fits a ± 18 " diameter stump depression S45°W, 13.3' which would be a possible Teed witness. This position is +/- 3' west of a newer N-S fence. We dug at the stump depression and didn't find any wood fiber to verify the stump remains. Since I was unable to positively identify the corner position I used a computed location for the the W. 1/16th Line.

W. $\frac{1}{4}$ Corner: This corner was established by Brent Clough in 2014 by doubling over evidence that he found at the C. $\frac{1}{4}$ Corner and C-W 1/16th Corner. We searched this area and didn't find any other evidence. This position is +/-25' west of the centerline of a N-S trail road. There appears to have been some considerable earth disturbance in this area. I used the position as established by Clough in 2014.

W. 1/16th Corner - N. Line: Looked for Teed's witness as reference by Clough and didn't find anything definite. The computed position does fit apparent occupation north and south. I used the computed position.

W. 1/16th Corner - S. Line: Fd. 5/8" diameter rod with eyelet on the top, this iron looked like some sort of old buggy part. Teed was at this corner and took 1 witness but didn't identify the monument type. We also found a $\frac{1}{2}$ " re-rod and illegible cap 0.94' west at the computed location. To be consistent with other recovered old monumentation in this area I'm using the 5/8" rod for the position of the corner.

SECTION SUBDIVISION: This Section was computed proportionally holding the found C. $\frac{1}{4}$ Corner. If interior corners were found within acceptable limits I honored those monuments and put a deflection at said position.

ENCROACHMENTS:

Note that County Rd. 34 curves SW away from the section line at the W. 1/16th Corner on the North Section Line. The county road transitions to a seasonal road at this location and becomes part of the NFS Trail System as it heads west. I did not set a r/w iron at this location due to the uncertainty of r/w width at this transition.

There is an ATV trail encroachment along the S. 1/16th Line in the S.W. $\frac{1}{4}$. The trail encroaches +/-14'.

OCCUPATION/FENCES:

There is an old down barbed wire fence meandering along the W. 1/16th Line which travels for the length of our posted line. The fence is within +/-1' of line.

Joseph J. Surveyor
Professional Surveyor No. 12345

| | | | |
|--|------------------|---|-------------------|
| Joe Surveying INC <small>1-888-223-4235 PH. 231-555-1000 Fax. 231-555-1001 100 MAIN ST. ANYWHERE, MI 49660</small> | DATE: 02/27/2017 | CLIENT: USDA Forest Service | |
| | DRN BY: AOL | Part of Section 26, T22N, R11W, Boon Twp., Wexford Co., MI. | |
| | CHD BY: JJS | | |
| | SHEET 4 OF 4 | FB/PG: FS1/1-18 | JOB NO.: 78910 |

Land Corner Recordation Certificate

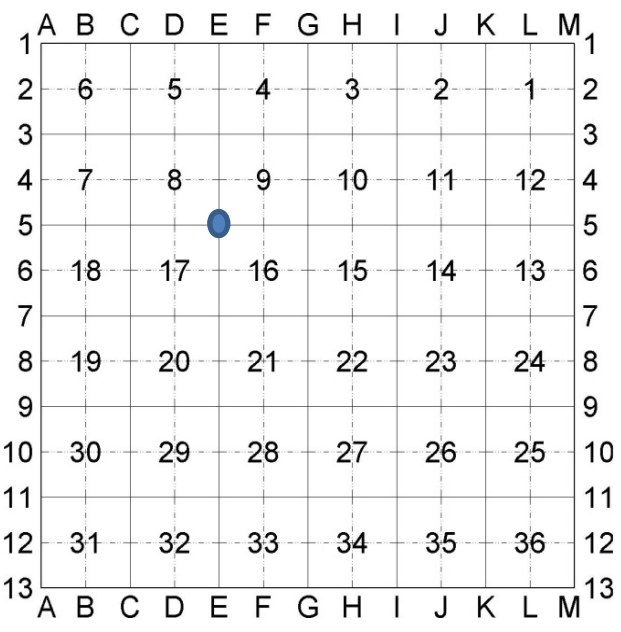
Authority: 1970 PA 74, MCL 54.205

Surveyor's Name: Carol A. Waite Field Survey Date: 3/23/2015
 For corner(s) in: Alcona County

Original Public Land Survey Corner **Corner Code**
 S _____ T 25N R 06E E-05
 S _____ T _____ R _____
 S _____ T _____ R _____
 S _____ T _____ R _____

Property Controlling Corner **Corner Code**
 S 8 T 25N R 06E E-05
 S _____ T _____ R _____
 S _____ T _____ R _____
 S _____ T _____ R _____

Protracted Public Land Survey Corner **Corner Code**
 S _____ T _____ R _____
 S _____ T _____ R _____
 S _____ T _____ R _____
 S _____ T _____ R _____



****This Supersedes LCRC recorded in Liber 3, Page 163 of the Alcona County Land Corner Records**

Part A: Corner History

E-05; Corner Common to Sections 8, 9, 16 & 17, T25N, R6E

1844 – GLO dependent resurvey survey by John & James H. Mullett, set post cor to Sect. 8, 9, 16, 17 witnessed by **1)** Beech 10" N25E 28 lks (18.48') and **2)** Hemlock 16" S71W 15 lks (9.9'). Measured North 2640', East 2645.28', South 2640' and West 2638.35'.

1900 – Andrew J. Freer, County Surveyor, survey for highway states monument as Cedar Post, lists GLO witnesses 1 & 2 and adds **3)** Hemlock stump 25" S16E 12 lks (7.92'), no measurements shown.

1906 – Edw. Chapelle, Sr., County Surveyor, survey of highway, states monument as Cedar Post 4X4, no witnesses or measurements shown.

1942 – R.J. Cooke, RLS #2335, survey for Supervisor's Plat of Evergreen Ridge, indicates concrete monument at the SE corner of Lot 1 to be S12°46'20"W 204.26' from the section corner. No other witnesses or dimensions to adjacent corners shown on plat or in field notes.

1950 – L. Schmalzried, Survey Chief Michigan State Highway Department, government corner tie notes indicate monument as a 2" iron axel housing with flange witnessed by **4)** N52E P.P. 64.10', **5)** S28E 8" Maple 20.73' and **6)** S18E 8" Maple 66.50'. Also indicates corner to be 2.30' East of tangent and 34.54' East of centerline of curve.

1984 – Duane R. MacNeill, RLS #19237, survey in Section 16 recorded in L. 218, Pgs 537-38, does not state monument type or witnesses, measured East 2653.89' and South 2613.20'.

1997 – Frederick J. King, PS #25852, survey in Section 8 recorded in L. 310, Pg. 530-31. fd ½" pipe at base of fence corner post ±68' East of C/L M-65 witnessed by **4)** N20E 47.4' P.Pole and **7)** N75W 105.8' E. face street sign post. Measured 2608.30' North and 2636.28' West. *Editorial Note: the witness 4 is that same power pole mentioned in the 1950 record but the bearing and distance given in the 1997 record is from a different (2nd) monument.

2001 – Larry Steinley, PS #44285, LCRC L. 2 Pg 112, Found ½" iron in centerline of road West, at fence east, approximately 2' East of centerline tangent and accepted as best available evidence witnessed by **8)** N62W Telephone Riser 26.841m (88.06'), **9)** S35W Power Pole 38.301m (125.66'), **10)** S60E 7" Elm 13.210m (43.34') and **4)** N50E Power Pole 21.415m (70.26'). *Editorial Note: the witness 4 is that same power pole mentioned in the 1950 record but the bearing and distance give in the 2001 record is from a different (3rd) monument.

2002 – Jeremy R. Card, PS #47947, survey in Section 8, no corner found, reset from previous Fred King and Bill Woods survey distances and witnesses. Set capped iron falls 67.44' East of C/L M-65 and 0.5' NW of a fence corner post witnessed by **4)** N19E 47.56' U.P., **11)** S54W 154.16' U.P. and **12)** N73W 124.28' P.K. in 4" Post. Measured 2636.28' West.

2005/2006 – John F. Oliver, RLS #19840, LCRC L.3, Pg 163, fd ½" bar and cap #47947 67.5' East of centerline M-65 and recovered three 1997 and five 2002 witnesses, accepted as the correct location for the corner. Replaced rebar and cap with an aluminum cap on a ½" rebar and witnessed by **4)** N22E Power Pole 48.14', **7)** N74W St. Sign 106.42', **11)** S56W Power Pole 155.26' and **12)** N75W PK in 4" Post 125.11'.

Property Controlling Corner E-05 - Position misidentified as a PLSS corner and used to delineate property boundaries in Section 8

See Part "A" above for complete history.

Part B: Surveyor's Report on Perpetuation, Restoration, Reestablishment, or Monumentation of Corner E-05; Corner Common to Sections 8, 9, 16 & 17, T25N, R6E

Found the aluminum cap set by Oliver at the corner of an older page wire pasture fence running South and East. Oliver calls the position 67.5' east of centerline and the 1950 Highway Department records indicate the section corner to be 34.5' East of centerline, the difference being 33' so it is apparent that the fence is actually an old right-of-way fence for the old highway and not on the N-S section line.

I also found the 1/2" rerod recovered by Steinley in 2001 at ±30' East of centerline. The rerod is of unknown origin and was found to be in location inconsistent with both the 1942 plat of Evergreen Ridge and also the 1950 Highway Department record. This appears to have been recorded under MDOT contract for monument preservation but there is not record of it being used to control property boundaries.

At a position calculated from the monuments found at the NW and SE corners of Lot 1 of Evergreen Ridge, I found the 2" axel housing called for in 1950. Since this is in an area of road fill the axel was found 60" below the ground surface. I accept the position of the axel housing as the best available evidence of the original corner dating back to 1942 and raised the axel with a 2 1/2" X 30" stainless steel pipe with 3 1/4" bronze cap stamped with the corner designation, PS number 43074 and year 2015. This position is ±38' East of M-65 centerline, ±3' North of pasture fence East and in ±centerline road to West. It measures East 2657.78' and South 2612.30'. Condition of previous witnesses: **1-3)** not recovered, fall within M-65 construction area, **4)** fair, note that this power pole was used between 1950 and 2006 as a witnesses for each of the 3 monuments found, **5-6)** not recovered, fall within M-65 construction area, **7-12)** not for this position.

Property Controlling Corner E-05 - Position misidentified as a PLSS corner and used to delineate property boundaries in Section 8

This monument is being recorded strictly to comply with the requirements of P.A. 74 of 1970 as amended and P.A. 345 of 1990 as amended and is not an endorsement of the position as representing a corner location or any kind of determination whether it may actually control any property boundaries.

Found aluminum cap on 1/2" rerod at an old right-of-way fence corner ±67.5' East of M-65 centerline per the King, Card and Oliver records. See Part "B" above for explanation of evidence considered for the position of the section corner.

Part C: Field Evidence of Perpetuation or Monumentation of Corner E-05; Corner Common to Sections 8, 9, 16 & 17, T25N, R6E

2 1/2" X 30" stainless steel pipe with 3 1/4" bronze cap ±38' East of M-65 centerline, ±3' North of pasture fence East and in ±centerline road to West, stamped with corner designation and PS #43074

N21E Center Top 5" Sq. R/W Marker 76.67'

***Basis of bearing is true north**

4) N46E Fd 16d Nail in S face Power Pole 63.86' (1950 Schmalzried)

S32E Set 60d nail in SW face 8" R.Pine 137.30'

S10W Concrete Monument at SE Corner Lot 1 204.51' (1942 Cooke)

S26W Set 60d nail in SE face 20" R.Pine 141.18'

N80W Set 60d nail in S face 20" R.Pine 158.02'

West Fiberglass Post 1'

S86E Fd 3" Alcona County Alum Cap @ R/W Fence Corner 30.65'

S82W Fd 1/2" rerod 7.74'

Property Controlling Corner E-05 - Position misidentified as a PLSS Corner and used to delineate property boundaries in Section 8

3" Alcona County aluminum cap on 1/2" rerod at an old right-of-way fence corner ±67.5' East of M-65 centerline

4) N22E Power Pole 48.14'

7) N74W Street Sign 106.42'

11) S56W Power Pole 155.26'

12) N75W PK in 4" Post 125.11'

Geodetic Coordinate Data for E-05; Corner Common to Sections 8, 9, 16 & 17, T25N, R6E

2 1/2" X 30" stainless steel pipe with 3 1/4" bronze cap

| Date of Observation | Latitude | Longitude | Datum and Adjustment Year | Epoch Date |
|---------------------|----------------|----------------|---------------------------|------------|
| 03/23/2015 | N44°34'03.947" | W83°43'35.698" | NAD83(2011) | 2010.0000 |

Geodetic position for this corner was determined utilizing 3 independent RTK GPS observations of at least 30 epochs in length with repeat measurement tolerances of 0.05' horizontal and 0.08' vertical. Position is reference to a local RTK GPS base station which was positioned using Static GPS observations of 6hr 24min. Baselines from 3 Continuously Operating Reference Stations processed through OPUS yielded a position with an overall RMS of 0.011m.

The USDA Forest Service makes no warranty, expressed or implied regarding the accuracy of the geodetic position listed above and reserves the right to correct, update or modify this information without notification.

I, Carol A. Waite, in a field survey on 03/23/2015, certify under the requirements of the Corner Recordation Act, 1970 PA 74, MCL 54.201 to 54.210d, that the corner identified and described hereon has been perpetuated or monumented as described in Parts A, B, and C above, pursuant to the laws and rules of the State of Michigan.

Carol A. Waite, PS
Professional Surveyor's License No.: 43074
USDA Forest Service
1755 S. Mitchell St
Cadillac, MI 49601

Date

Certifying Surveyor's
Seal/Stamp

I, County Representative's Name, state that the corner identified and described hereon and perpetuated or monumented as described in Parts A, B, and C above was presented to and reviewed by the Peer Review Group on Date of Corner Peer Review and is accepted for filing in the County Name County Remonumentation Program.

County Representative's Name
Professional Surveyor's License No.: _____

Date

5253
6

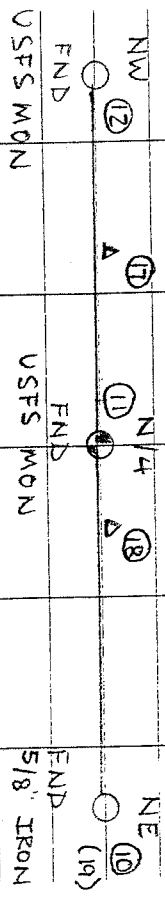
USDA - FOREST SERVICE

SAC
MTP

BOUNDARY SURVEY
SEC 13 T23N R5E
PLAINFIELD TWP, JOSCO CO

CSF: 099992506035

N



TRY 12, 11, 18, 19 (10)
ERROR N - 0.008
E - 0.314
PREC: 1/16864

SCALE
FACTOR 2633.893
11.12 2634.090 802.871

PT H.D. M

18 MAR 10

095151

WEBB RD
66 ROW

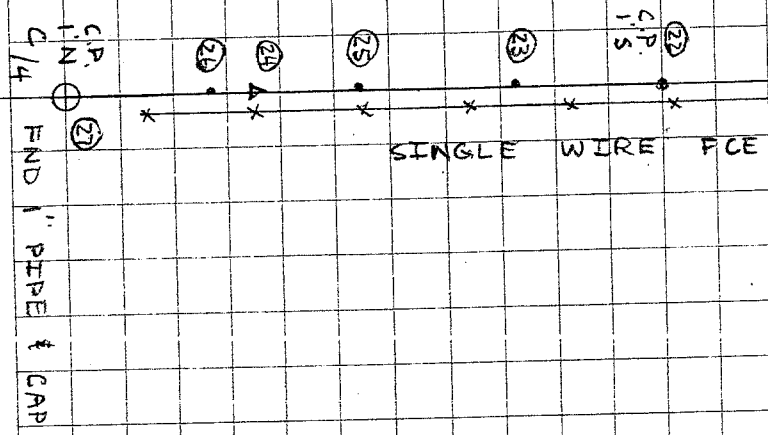
N/4
END USFS MON

C-3000
4000
END BIC
41108

ETR

N

END 3/4" PIPES & CAPS # 19237



SINGLE WIRE FCE

Exhibit 11 - Example Field Notes

505/9

USDA FOREST SERVICE

MTP

BOUNDARY SURVEY
SEC 13 T 23 N R 5 E
PLAINFIELD TWP, JOSCO CO

5151 B

PT 3021-3026 3021-44 A

5036 0.03W 0.02W 0.01E

5037 0.01W 0.01E 0.02E

5038 0.14W 0.11W 0.03E

5039 0.02W 0.01W 0.03E

5040 0.00 0.02E 0.02E

5041 0.01E 0.03E 0.02E

5042 0.09E 0.11E 0.02E

PT 44-3023 44-49 A

5043 0.02E 0.13E 0.11E

5044 0.02E 0.21E 0.19E

5045 0.01W 0.22E 0.23E

5046 0.02E 0.33E 0.31E

5047 0.00 0.36E 0.36E

5048 0.01E 0.43E 0.42E

PT 49-13 49-13 A

5049 0.00 0.00 0.00

5050 0.00 0.02S 0.02S

5051 1.43S 1.46S 0.03S

5052 1.05N 1.00N 0.05E

5053 1.61N 1.55N 0.05E

5054 0.02S 0.10S 0.08E

5055 0.02S 0.11S 0.09E

29 MAR 10 095151

NW

(12)

WEBB RD 66 ROW

C-3021 A

(44) END BIC #41108

N/4

(11)

N

(42) A

C-3026

(43) END BIC #41108

19237

(47)

(48)

END 3/4" PIPES CAP

C.P. 1" N

C-3023

S B/C

(13)

C-3002

4009

A (57)

A (51)

A (53)

(49)

TRV 7, 42, 43, 48-53 (13)
ERROR N 0.102 PREC: 1/20047
E 0.172

5053/10

USDA FOREST SERVICE

MTP

BOUNDARY SURVEY
SEC 7, T 23N R 6E
PLAINFIELD TWP JOSCO CO

PT 10-8 5151C
ABT 10-8 A

| | | |
|------|--------|--------|
| 5056 | 0.05 N | 0.03 N |
| 5057 | 0.00 | 0.02 S |
| 5058 | 0.01 S | 0.04 S |
| 5059 | 0.00 | 0.04 S |
| 5060 | 0.01 S | 0.06 S |
| 5061 | 0.01 N | 0.04 S |
| 5062 | 0.03 N | 0.02 S |

TRV 10, 54, 56, 57 (8)
ERROR N 0.047
PREC: 1/12947
E - 0.172

30 MAR 10

095151

Z

(S1)
5/4
END GLO MON
CR. 1 W

PVT USA

(S1)

END CONC MON
(S1)
(S1) A

SNOWMOBILE TR

PHYS. & WEBB RD.

SW
C P I E
END 5/8 IRON

120

6/5/12

USDA-FOREST SERVICE

SHE MTP

END 3/4" PIPE W/ PLUMBER FITTINGS

N

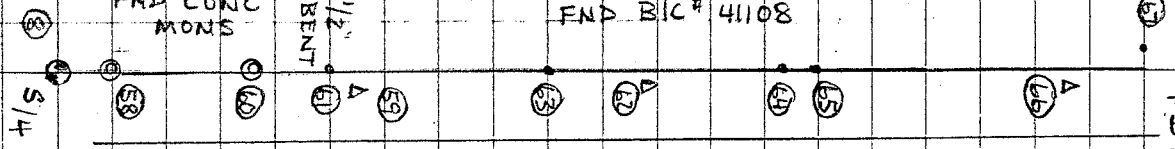
END BIC # 41108

± 12' 2 TK

END 1/2" IRON BENT

END CONC MONS

END 6/8" MON



PVT

USA

01 APR 10

095151

LARGO RD 66 ROW

END 1/4" 5/8" IRON

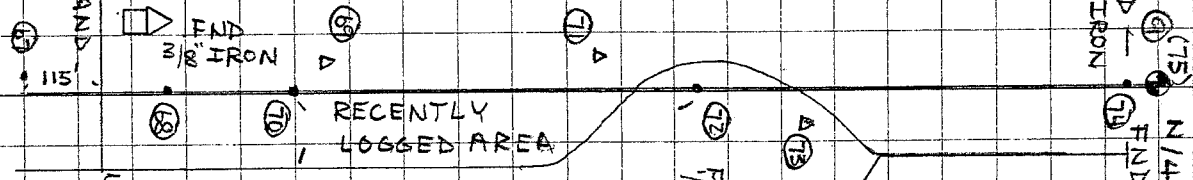
N

RECENTLY LOGGED AREA

± 12' 2 TK

± 12' SAND

END 3/8" IRON



PVT

USA

Standards

For the

Positional Accuracy

of

Cadastral Surveys

When using

Global Navigation Satellite Systems (GNSS)

February 23, 2009 Version
April 5, 2010

Boundary Management
Forest Service
Department of Agriculture

Standards for the Positional Accuracy of Cadastral Surveys
When Using Global Navigation Satellite Systems

Preface

These Standards for the Positional Accuracy of Cadastral Surveys When Using Global Navigation Satellite Systems (the Standards) were developed as an update to the positional standards originally defined, as a product of a joint venture between the United States Forest Service and the Bureau of Land Management, as I.M. 2001-186 (I.M. 186). The positional standards outlined in this updated document are intended to apply to all boundary surveys conducted under authority of State License or other survey-related instructions issued by the Forest Service (Boundary Management) when GNSS technology is used. In addition to the positional standards, this document also defines how survey accuracies should be defined and computed. These positional accuracy standards are harmonious with the current edition of the Manual of Surveying Instructions.

In 2001, when I.M. 186 was originally issued, the use of GPS technology, to include Real-Time Kinematic (RTK) GPS technology, while conducting cadastral or other boundary surveys was still in its infancy. I.M. 186 was intended to provide instructional knowledge on the use of these technologies as well as provide guidance on the accuracy levels necessary to achieve acceptable results comparable to conventional terrestrial surveys. In the last few years as GPS/GNSS technological knowledge and methodology has become more ubiquitous throughout the surveying profession, to the point that portions of I.M. 186 are no longer applicable or required.

The positional accuracy standards, identified in I.M. 186, were defined in terms of the 95% confidence error “circle” as called for in the Federal Geographic Data Committee’s (FGDC) document FGDC-STD-007.1-1998, Geospatial Positioning Accuracy Standards Part 1: Reporting Methodology. However this methodology has not been widely adopted or accepted and, as such, has proven difficult to implement. In this document the positional accuracy standards are defined in terms of the 95% confidence error “ellipse”, which can easily be computed using any contemporary GNSS software suite.

Cadastral Surveys are an important part of the National Spatial Data Infrastructure (NSDI). The accuracy reporting requirements of this document is in accordance with accuracy reporting requirements of the FGDC Geospatial Positioning Accuracy Standards, July 1997. These standards do not require that cadastral surveys be performed to the higher accuracy and methodology required of geodetic control surveys. They are intended to provide sufficient observational, positional and occupational redundancies to detect blunders and quantitatively demonstrate the stated accuracy of a survey has been achieved to ensure a certain level of acceptability and positional confidence.

The positional standards set forth in this document have undergone both internal and external review and scrutiny. All issues, comments and concerns, brought forth, have been considered in the preparation of this document.

Standards for the Positional Accuracy of Cadastral Surveys
When Using Global Navigation Satellite Systems

**Standards for Positional Accuracy
Using GNSS Technology**

The following standards are for Global Navigation Satellite System (GNSS) technology and shall be used to define the minimally acceptable levels of positional accuracy required of any DOA-Forest Service, official land or administrative boundary survey.

Local Accuracy Standards¹

| <u>Semi-major axis 95% error ellipse</u> | <u>Application</u> |
|--|-------------------------------|
| Less than 0.025 (m) | Cadastral Project Control |
| Less than 0.050 (m) | Cadastral Corner Measurements |

Network Accuracy Standards²

| Semi-major axis 95% error ellipse | Application |
|-----------------------------------|-------------------------------|
| Less than 0.050 (m) | Cadastral Project Control |
| Less than 0.100 (m) | Cadastral Corner Measurements |

¹ See Appendix 1, items 3 and 4.

² See Appendix 1, items 5 and 6.

Standards for the Positional Accuracy of Cadastral Surveys
When Using Global Navigation Satellite Systems

Supporting Information

1. The standard is based on the magnitude of the semi-major axis of the 95% confidence level error ellipse.
 2. A least squares adjustment or other multiple baseline data analysis should be used to verify that the required level of positional accuracy has been achieved.
 3. The local accuracy of a control point established as part of a static GNSS project control network can be determined by performing a minimally constrained least squares analysis of the network and ensuring the magnitude of the semi-major axis of the 95% confidence level error ellipse is less than or equal to the values in Table 1.
 4. The local accuracy of a cadastral corner measurement can be determined by performing a minimally constrained least squares analysis of the network and ensuring the magnitude of the semi-major axis of the 95% confidence level error ellipse is less than or equal to the values in Table 1.
 5. The network accuracy of a control point established as part of a static GNSS project control network can be determined by performing a fully constrained least squares analysis of the network and ensuring the magnitude of the semi-major axis of the 95% confidence level error ellipse is less than or equal to the values in Table 2.
 6. The network accuracy of a cadastral corner measurement point established by real time kinematic, fast static or kinematic methods which meet the manufacturer's specifications may be determined by performing a fully constrained least squares analysis of the network and ensuring the magnitude of the semi-major axis of the 95% confidence level error ellipse is less than or equal to the values in Table 2.
 7. The NGS program "OPUS – Static" (<http://www.ngs.noaa.gov/OPUS/>) returns the maximum peak-to-peak separation for each component of the computed position. The maximum peak-to-peak separation of the computed position will be used to estimate the semi-major axis of the 95% confidence error ellipse for network accuracy determination for these standards.
 8. The NGS program "OPUS – RS" (<http://www.ngs.noaa.gov/OPUS/>) returns the standard deviation for each component of the computed position. Two times the largest position component standard deviation will be used to estimate the semi-major axis of the 95% confidence error ellipse for network accuracy determination for these standards.
-

Standards for the Positional Accuracy of Cadastral Surveys
When Using Global Navigation Satellite Systems

Glossary

Cadastral Corner Measurements - The measurements used to define the location of Public Land Survey System (PLSS) corners and boundaries. Cadastral Corner Measurements are based on the Cadastral Project Control coordinates or direct ties to the National Spatial Reference System (NSRS).

Cadastral Project Control – A network or series of the GPS/GNSS of control points that are tied to the NSRS, which is created to control all subsequent GPS cadastral corner measurements. The Cadastral Project Control is adjusted independently of other cadastral measurements

Fully Constrained Least Squares Adjustment - For the purpose of this document, a least squares adjustment performed by holding the horizontal coordinates of all control points and a minimum of one vertical control coordinate fixed and allowing all other points to be adjusted.

Local Accuracy – Is a value that represents the uncertainty at the 95% confidence level in the coordinates of a measured point relative to the coordinates of other directly connected and adjacent points in the survey.

Minimally Constrained Least Squares Adjustment – For the purpose of this document a least squares adjustment performed by holding the coordinates of one control point fixed and allowing all other points to be adjusted..

Network Accuracy – A value that represents the uncertainty in the coordinates of a measured point at the 95% confidence level relative to the NSRS as determined in the survey.

OPUS-RS – An internet located positioning program developed and supported by the National Geodetic Survey (NGS). This program allows the user to submit 15 minutes to 2 hours of GPS data to NGS. NGS will then compute and return, via email, the calculated coordinates of the position.

OPUS-Static - An internet located positioning program developed and supported by the NGS. This program allows the user to submit a minimum of 2 hours of GPS data to NGS. NGS will then compute and return via email the calculated coordinates of the position.

Standards for the Positional Accuracy of Cadastral Surveys
When Using Global Navigation Satellite Systems

CERTIFICATE OF APPROVAL AND ACCEPTANCE

These Standards for the Positional Accuracy of Cadastral Surveys When Using Global Navigation Satellite Systems have been properly vetted and, THEREFORE, are considered approved for use within the United States Forest Service when establishing or reestablishing boundaries, control networks, or other segregation lines necessary to meet boundary management needs.

/s/ Greg Asher

Greg Asher,
Chief Land Surveyor,
Department of Agriculture,
United States Forest Service

Tips on Getting Accurate Compass Readings

A small error when using a compass can result in a significant error in measurement on the ground. To obtain accurate readings when using a compass:

- Hold the compass level and steady so the needle swings freely.
- Hold the compass about waist high in front of the body, except when using a compass with a sighting mirror or a sighting type compass.
- Raise and lower eyes when taking a bearing, do not move your head. Always use the same eye when taking bearings.
- Directly face object that is being measured.
- Magnetic fields will give incorrect compass readings. Avoid taking readings near magnetic fields such as steel, iron (ferrous metals), vehicles, rebar, and clipboards. Even belt buckles, glasses, and rings can interfere with the compass reading.
- Take bearing twice.
- Adjust for magnetic declination as appropriate.
- Follow the direction of travel arrow, not the compass needle, when walking a bearing. Always follow the line indicated by the compass rather than relying on judgment as to the direction.
- Use back bearings to ensure you are on track when navigating.

Adjusting a Compass for Magnetic Declination

The compass needle always points toward magnetic north; however, topographic maps are drawn in reference to true north (North Pole). The difference between magnetic north and true north is called the angle of magnetic declination, or simply, the declination. Therefore, when using a map and compass together, an adjustment has to be made for declination.

Magnetic declination not only changes with geographic location, but also changes slightly over time. In the contiguous U.S., the magnetic declination generally varies between zero and twenty degrees (Figure 4-3). Only along the zero declination line are true north and magnetic north the same, and therefore, no adjustment has to be made for declination (this is the dark, heavy line labeled as 0° in Figure 4-3).

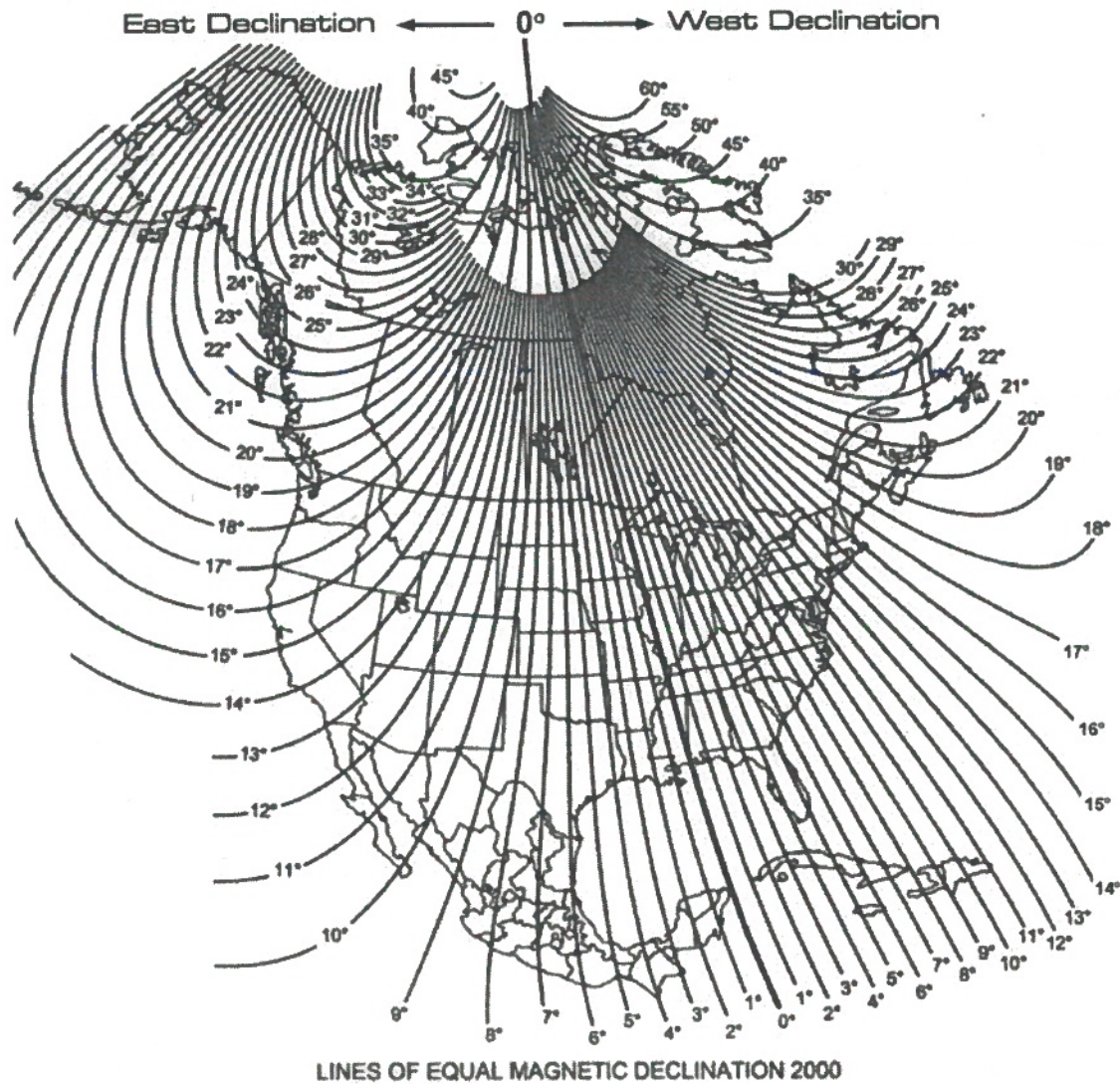


Figure 4-3. Declination chart of United States.

Stricter limits of closure will be specified in the special instructions for classes of surveys where higher precision is indicated by the values involved.

MARKING LINES BETWEEN CORNERS

3-125. The survey is marked upon the ground in the following ways:

(a) The regular corners of the public-land surveys are marked by fixed official monuments as described in chapter IV.

(b) The relation to natural topographic features is recorded in detail in the field notes. (chapter VIII).

(c) The locus of the lines is marked upon forest trees by blazing and by hack marks. Figures 61 and 62. However, in conformity with the National Environmental Policy Act of 1969, the operational need for the marking of lines should be weighed against possible esthetic damage. If special precautions are to be taken in this regard, they should be set out in the special instructions. Also, in the case of resurveys in areas of mixed public and private lands, it may be necessary to restrict the blazing to trees on public land. The surveyor on the ground should apply good judgment in particular cases not covered by his instructions. Where it has been determined that lines will be marked, the methods discussed here are intended to fix the lines permanently with the minimum environmental effect.

A *blaze* is a smoothed surface cut upon a tree trunk at about breast height. The bark



FIGURE 61.—Hack marks on a line tree.



FIGURE 62.—A line blaze.

and a small amount of the live wood tissue are removed with an axe or other cutting tool, leaving a flat surface which forever brands the tree. The size of the blaze depends somewhat upon the size of the tree, but should not be made larger than the surface of an axe blade. A blaze five or six inches in height and from two to four inches in width is usually ample.

A *hack* is a horizontal notch cut well into the wood, also made at about breast height. Two hacks are cut to distinguish them from other, accidental marks. A vertical section of the finished hack marks resembles a double-V extending across a tree from two to six inches depending upon the diameter of the tree.

The blaze and hack mark are equally permanent, but so different in character that one mark should never be mistaken for the other. The difference becomes important when the line is retraced in later years.

Trees intersected by the line have two hacks or notches cut on each of the sides facing the line, without any other marks whatever. These are called *sight trees* or *line trees*. A sufficient number of other trees standing within 50 links of the line, on either side of it, are blazed on two sides quartering toward the line, in order to render the line conspicuous and readily to be traced in either direction. The blazes are made opposite each other coinciding in direction with the line where the trees stand very near it and approaching nearer each other toward the line the farther the line passes from the blazed trees. Figure 63.

The lines should be so well marked as to be readily followed and the blazes plain enough to leave recognizable scars as long as the trees stand. This can be accomplished by blazing just



FIGURE 63.—Marking a line through timber.

through the bark into the live wood tissue. The blazes should be narrow so that they will heal before decay begins, and special care should be taken not to loosen the cambium layer around the blaze, since this will prevent overgrowth. Where trees have branches growing to the ground, the blazes may be omitted unless it is necessary to remove the branches to permit sighting.

Lines are also marked by cutting away enough of the undergrowth to facilitate cor-

rect sighting of instruments. Where lines cross deep wooded valleys, by sighting over the tops, the usual blazing of trees in the low ground when accessible will be performed. The undergrowth will be especially well cut along all lines within distances of 5 chains of corner monuments and within 2 chains of arteries of travel, but the cutting of the undergrowth may be omitted in deep untraveled ravines unless necessary for accurate sighting or measurement.

Line trees and blazing are marked only with

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p
d
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a
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c

t
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h

a
m

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w

The markings on a location monument are described in section 10-33.

Control point monuments established by electronic methods are marked "E C", with a serial number, the year date, and the group number or survey number in the course of which they are established.

CORNER ACCESSORIES

4-83. The purpose of an accessory is to evidence the position of the corner monument. A connection is made from the corner monument to fixed natural or artificial objects in its immediate vicinity, whereby the corner may be relocated from the accessory. Thus, if the monument is destroyed or removed, its position may be identified by any remaining evidence of the accessories. One or more kinds of accessory are employed at each corner established in the public-land surveys (except for corners of minor subdivisions and where specifically not required by the Manual, or omitted by the special instructions).

Accessories consist of (1) bearing trees or other natural objects such as notable cliffs and boulders, permanent improvements, reference monuments; (2) mounds of stone; or (3) pits and memorials. Aside from availability, selection is based on their order of permanence.

4-84. The surveyor cannot perform any more important service than that of establishing permanent and accurate evidence of the location of the corners in his survey. Where the accessories cannot be employed, other means should be adopted that will best serve the purpose.

Bearing Trees and Bearing Objects

4-85. Bearing trees are selected for marking when available, ordinarily within a distance of 3 chains of the corner; a greater distance if important. One tree is marked in each section unless a tree in one or more positions may not be available. A full description of each bearing tree is given in the field notes. This includes the species of each tree, its diameter at breast height, the exact direction from the monument, the horizontal distance counting to the center of

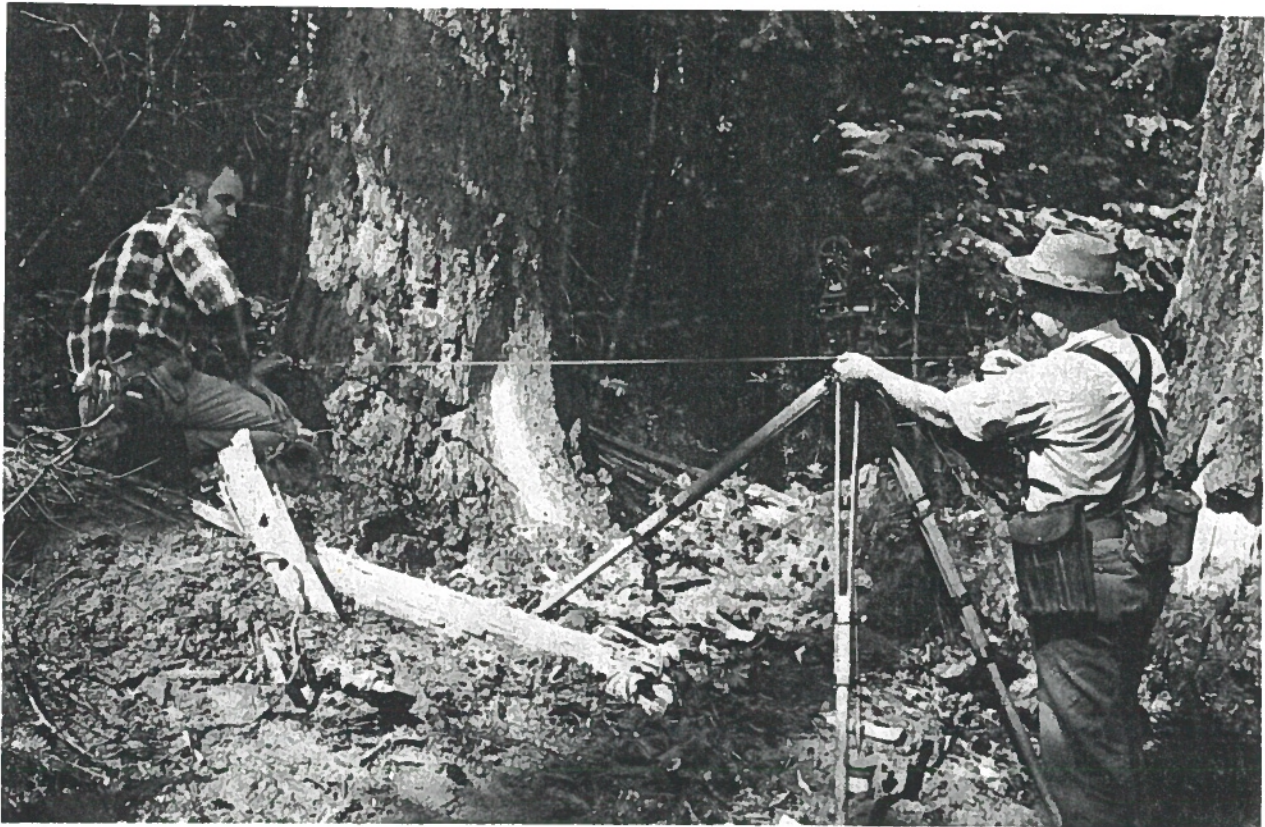
the tree at its root crown; and, the exact marks scribed for the identification of the corner.

Almost any nearby natural object that can be readily identified should be recorded by description, course, and distance. Such objects may not be of a character that can be marked, excepting in the case of a rock cliff or boulder. These are supplemental to the marking of bearing trees, or to fill out a quota where trees are not available in some sections. The description of the cliff or boulder should provide ready identification, including the marking of a cross (X) plainly and deeply chiseled at the exact point to which the direction and distance are recorded.

Another desirable accessory, especially where the usual types are not available, nor suitable on account of the site conditions, such as at a corner that falls in cultivated land, is to record accurate bearings to two or more prominent landmarks.

4-86. The marks upon a bearing tree are made upon the side facing the monument, scribed in the manner already outlined for marking tree corner monuments. The marks embrace the information suggested in the schedule hereinafter given, with such letters and figures as may be appropriate for a particular corner, and will include the letters "BT". A tree will always be marked to agree with the section in which it stands, and will be marked in a vertical line reading downward, ending in the letters "BT" at the lower end of the blaze approximately 6 inches above the root crown.

4-87. There is a great difference in the longevity of trees, and in their rate of decay; trees should therefore be selected, if possible, with a view to the length of their probable life, their soundness, favorable site conditions and size. Sound trees, not matured, of the most hardy species, favorably located, are preferred for marking. Trees 5 inches or less in diameter should not be selected for marking if larger trees are available, and it is generally better to avoid marking fully matured trees, especially those showing signs of decay. Trees 4 inches in diameter, or less, if no better trees are available, are marked with the letter "BT" only at the base, and an "X" at breast height, facing the monument. The species, size and exact position of the bearing trees are of vital importance,



Marking a bearing tree.

as this data will generally serve to identify a bearing tree without uncovering the marks, or even to identify two or more stumps after all evidence of the marks has disappeared.

4-88. Generally only one tree is marked in each section at a particular corner, but in certain instances two trees are required in a section. In such cases it is better to select trees of different species or of widely different size, direction or distance. If the trees are of the same species, in order that confusion may be avoided in the future identification of a remaining tree where the companion tree has disappeared, one is marked with an "X" only (and "BT" at the base).

4-89. A cross (X) and the letters "BO" are chiseled into a bearing object, if it is a rock cliff or boulder; the record should enable another surveyor to determine just where the marks will be found. The rock bearing object is the most permanent of all accessories; it is used wherever practicable, and within a distance of 5 chains.

4-90. A connection to any permanent artificial object or improvement may be included in this general class of corner accessories. The field notes should be explicit in describing such objects, and should indicate the exact point to which a connection is made, as "southwest corner of foundation of Smith's house," "center of Smith's well," "pipe of Smith's windmill," etc. No marks will be made upon private property without the consent of the owner.

Memorials

4-91. Where there is no tree or other bearing object, as above described, and where a mound of stone or pits are impracticable, a suitable memorial is deposited alongside the monument. A memorial may consist of any durable article which will serve to identify the location in case the monument is destroyed. Such articles as glassware, stoneware, a marked (X) stone, a charred stake, a quart of charcoal, or pieces