APPENDIX O

CITY OF SAN BERNARDINO
MUNICIPAL WATER DEPARTMENT

EXAMPLE TIE SHEET
AND GUIDELINES

City of San Bernardino
Municipal Water Department
195 North "D" Street
San Bernardino, CA 92402

City of San Bernardino Municipal Water Department

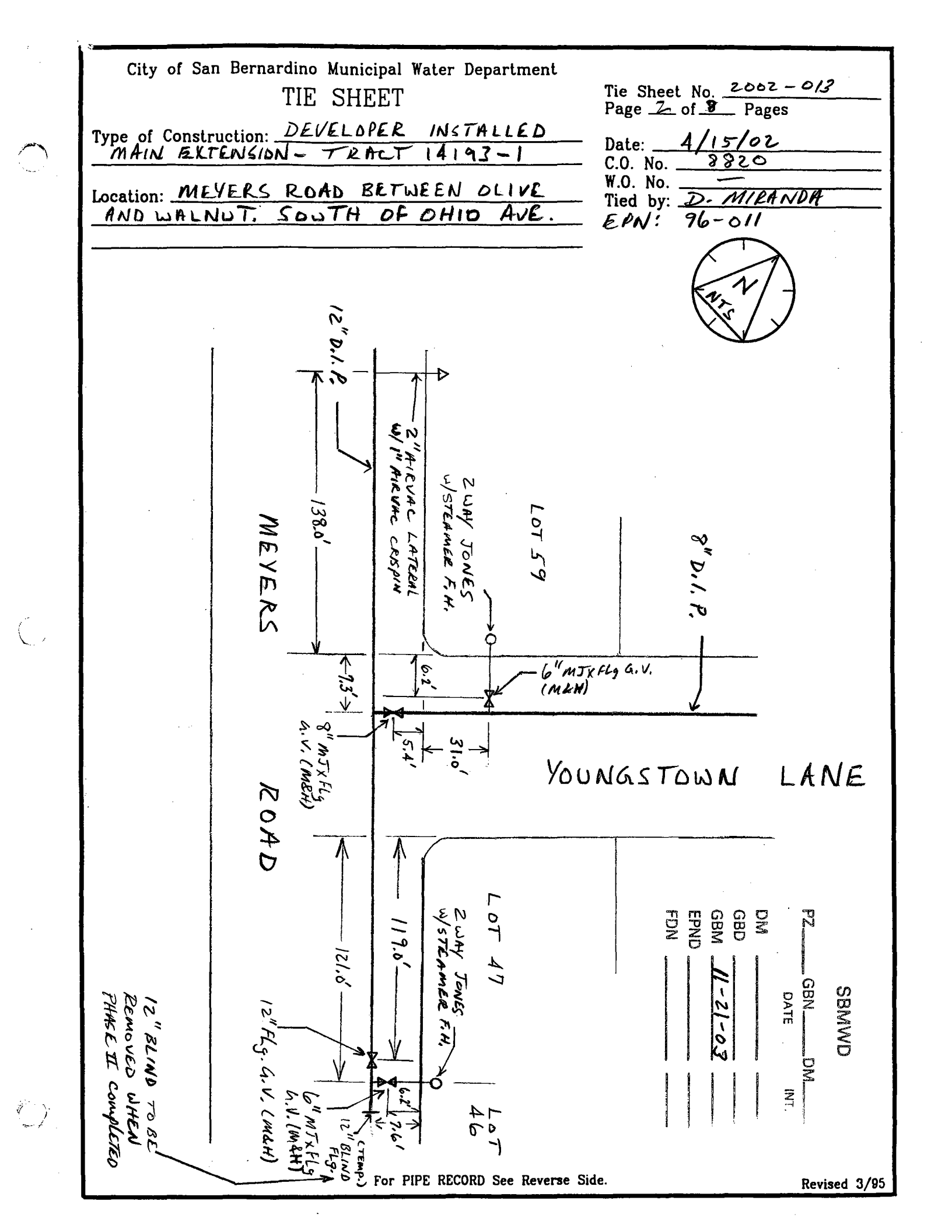
TIE SHEET

Tie Sheet No. 2002-013
Page 2 of 8 Pages

Type of Construction: DEVELOPER INSTALLED MAIN EXTENSION - TRACT 14193-1

Date: 4/15/02
C.O. No. 8820
W.O. No. —
Tied by: D. MIRANDA
EPN: 96-011

Location: MEYERS ROAD BETWEEN OLIVE AND WALNUT. SOUTH OF OHIO AVE.



SBMWD

	PZ	GBN	DM
		DATE	INT.
DM			
GBD			
GBM	11-21-02		
EPND			
FDN			

For PIPE RECORD See Reverse Side.

Revised 3/95

City of San Bernardino Municipal Water Department

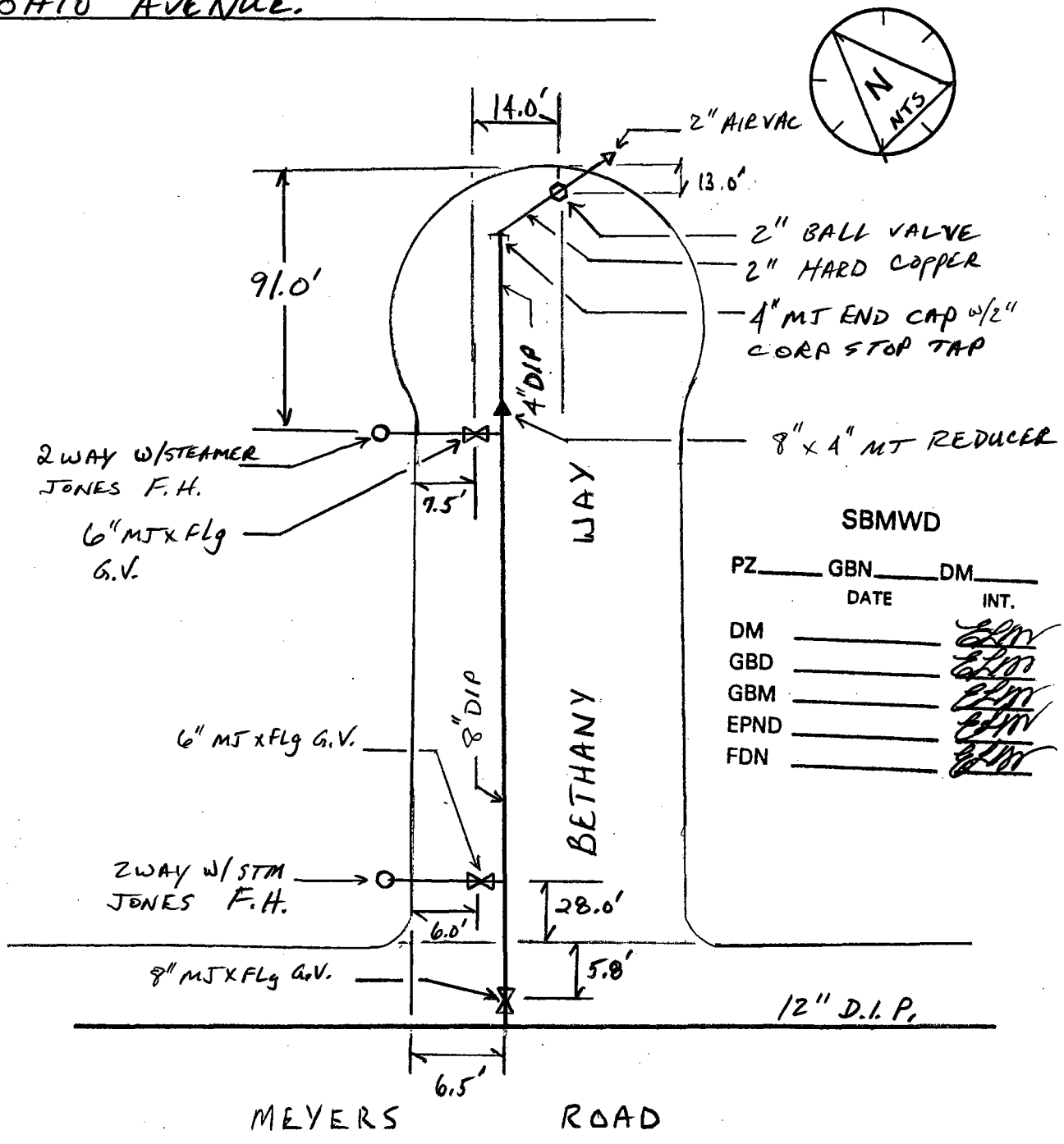
TIE SHEET

Tie Sheet No. 2002-013
Page 4 of 8 Pages

Type of Construction: DEVELOPER INSTALLED MAIN EXTENSION - TRACT 14193-2

Location: MEYERS ROAD BETWEEN OLIVE AND WALNUT SOUTH OF OHIO AVENUE.

Date: 8/27/02
C.O. No. 8885
W.O. No. —
Tied by: D. MIRANDA



For PIPE RECORD See Reverse Side.

Revised 3/95

TIE SHEETS AND FIELD MEASUREMENTS
(WORKING VERSION)

The following field measurement policy provides guidelines for generating an accurate record of field conditions, while providing the Engineering section with valuable information about site conditions during construction.

THE GENERAL DESCRIPTION OF A TIE SHEET:

1. The tie sheet should provide all the information necessary to accurately update the Department's databases.

2. Each tie sheet should cover a geographic location and should remain in progress until all work on a particular location has been complete. When more than one plat is needed on a construction project, match lines should indicate the geographic relationship between each plat on a tie. Each plat should be labeled with a sheet 2 of 3 type labeling so that the collection of plats is indexed as one tie sheet. **Multiple tie sheets on a specific location cause confusion and introduce a variety of potential errors.**

3. A tie sheet should be started on a project prior to construction. This involves researching the appropriate records, visiting the site and taking field measurements, taking pictures of the site before construction, and placing all this information on the tie sheet plat. This plat should be prepared in conjunction with a "meet and mark" when possible. Establish and mark pipelines, centerlines, survey markers, and permanent fixtures.

4. During construction, the tie sheet plat progresses as field measurements are taken.

5. The tie sheet plat should include the following information:

    a. North arrow in circle provided with a "N.T.S." label unless an accurate scale plat is being generated.

    b. All improvements used for taking ties (buildings, bridges, curbs, fire hydrants, etc.)

    c. Property line and/or centerline with a record distance to curb face or property monument locations.

d. All existing Water Department appurtenances in the area. Identify using a color code which ones are to remain and which ones are to be abandoned.

e. Any underground structures, utility lines, or other equipment that would impact construction or affect pipe alignment. Measure exposed utilities, measure located (not exposed) utilities and label as exposed or located utility. Take notes, consolidate note information on tie sheet at the end of the project or as appropriate. Tie any utility of any size that needs to be found at a later date. Keep in mind that not all utility conduits are conductive or have tracer wires.

f. All installed fittings, valves, fixtures, piping, and other appurtenance 1-1/2" in diameter or larger.

g. Information on existing appurtenances and pipe should include size, make, material, and location. You should also include the configuration and relationship to adjacent components.

h. Information on abandoned appurtenances should include size, make, material, location, and original installation date.

i. Information on new appurtenances should include size, make, model, material, location, and depth.

6. All line types and colors should be as follows:

- Property Line/Right-of-Way Line	PL
- Centerline	CL
- Existing To Remain	Blue
- Existing To Be Abandoned	Orange
- Existing Recovered	Yellow
- New Construction	Red
- All Other Linework	Label Specifically

7. See "Field Tie Definitions and Goals" - Attachment "A" for information on what to use as tie points and "Field Measurements" - Attachment "B" for additional information on tie taking.

8. Once a tie sheet has started, it should remain in the tie book unless you are making modifications. Do not take the original tie sheets into the field. When modifying a tie sheet, place a photocopy of the tie with your name and the current date in the tie book.

9. Once the construction is complete, the tie sheet can be closed out. Place the date in the top right corner and your initials. On large or complicated jobs, it is recommended that photographs of the job site after construction be placed in the file and that the construction foreman review your tie sheets for accuracy.

10. The pipe record information will be placed on the back of the tie sheet in the space provided. If more room is needed, add additional pages to the tie sheet.

11. It is recommended that one person be responsible for each tie sheet from start to finish. Never modify someone else's tie sheet. Consult or converse with the person who prepared the tie sheet.

FIELD MEASUREMENTS:

1. Field measurements should be done as promptly as possible to avoid any construction delays. Below ground details should be collected prior to backfilling work. Photos of complex installations are highly recommended.

2. The guidelines outlining what to measure from have been presented in "Field Tie Definitions and Goals" - Attachment "A".

3. The guidelines on making accurate field measurements have been outlined in "Field Measurements" - Attachment "B".

4. Field measurements should be recorded in a field book along with the date, time, and field conditions, tie taker, and brief status of situation.

5. Field measurements may be done by any qualified person.

6. Once the measurements have been taken, a copy of those measurements should be given to the person responsible for the tie sheet recordation.

7. Photographs are highly recommended whenever field measurements are made.

8. Professional care should always be observed whenever measurements are made and recorded and accuracy of nearest 1/2 foot should be maintained.

RECOMMENDED EQUIPMENT:

- Plumb Bob (Small) and String (w/Reel)
- 16 to 25 Foot Measuring Tape (in tenths of an inch)
- Torpedo Level
- Sight Level (1 or 2 Power)
- 2', 4' Carpenters Level w/Case
- 100', 300' Tapes w/Screw Driver
- Measuring Wheel (w/Large Diameter Wheel)

ATTACHMENT "A"

FIELD TIE DEFINITIONS AND GOALS
(WORKING VERSION)

PRIORITY NO. 1 - FIELD TIE:

Definition - a "field tie" provides all necessary information needed to quickly and easily locate water appurtenances in the field.

Goal - the goal of making field ties is to provide a means locating waterlines and related appurtenances in the field. The precision of the tie is relative to the appurtenance being tied. (Valves, pipe, and fittings that are buried or could be paved over should be recorded to 0.1 feet.)

PRIORITY:

1. A tie point within 100 feet of the appurtenance. It is better to tie to a less desirable object within a 100-foot radius than to go outside the 100-foot radius.

2. If no object on the object preference list is within 100 feet of the appurtenance being tied, the nearest tie outside that radius should be used.

3. A description of "non-tie-able objects" such as tree groves and fence lines, can be used to identify visible appurtenances (i.e., blow-offs, fire hydrants, air vacuum release valves). Then a precise tie should be made from those visible appurtenances to those underground appurtenances (i.e., tie hydrant to a fence line with a verbal description and then tie the hydrant gate to the hydrant).

OBJECTIVE PREFERENCE LIST:

1. Curbs

2. Above-Grade Concrete Structures (i.e., Bridge Abutments, Catch Basins).

3. Manhole Covers

4. Rail Lines (Tie to the Track)

5. Fire Hydrants, Air Vacuum Release Valves, Blow-Off Valves

6. Other Utility Appurtenances (i.e., Record Power Pole No., Transformers, Control Boxes).

7. Above-grade structures with poured foundations (i.e., houses, sheds, walkways).

8. Property lines, centerlines

PRIORITY NO. 2 - LEGAL TIE:

Definition - A "legal tie" defines the physical relationship between waterlines and related appurtenances, piping, buildings, etc., and a legal property line or centerline.

Goal - The goal of making legal ties is to locate all Water Department facilities horizontally to measurable permanent legally defined monumentation.

METHOD:

1) Record distance from curb face to appurtenances to two directions.

2) Look up on improvement plans or centerline tie book (3rd floor), the record distance from curb to centerline and record on tie sheet.

3) When recording new waterlines and related appurtenances on distribution sheet, label all dimensions from centerline as well as from curb.

EXCEPTIONS:

A) When centerlines are not available, use property lines and note the following:

1. Record map or legal file of property line.
2. Current right-of-way width.
3. File establishing property line used.

b) When curb is not available or when property information cannot be related to curb information, record the appurtenances dimensions, pipe lengths, and valve locations relative to the water main. Then, at a later date, use survey equipment to tie the entire system to centerline.

c) Where existing facilities have been acquired from other agencies or where current waterlines and related appurtenances locations are suspected, a limited field survey should be used to record key relationships to centerline. Once the survey is complete, the existing field tie information should be used to establish the true location.

ATTACHMENT "B"

FIELD MEASUREMENTS
(WORKING VERSION)

Taking careful, accurate, field measurements is one of the most important responsibilities placed on the Engineering section. All system repairs, future designs, computer systems, as advanced as they may become, are only as good as the field data collected. It takes more time and money to go back out in the field a second time than to make all the measurements the first time.

When taking field measurements, the guidelines presented in "field tie definitions and goals" should define the priority of appurtenances to measure to.

Plumb bobs, right angle prisms, 100' tape and 300' tape, a measuring wheel, an engineers level, and a theodolite are all tools available for making field measurements. It is the responsibility of the person making field measurements to use whatever tools necessary to accurately make field measurements. If the level or theodolite are needed to make measurements contact those familiar with the instruments for assistance.

In most cases, accuracy should be recorded to with 0.1'$\pm$; special conditions may require a higher or lower level of accuracy. Do not record measurements at higher level of accuracy than the measuring tools can provide.

All measurements should be taken in at least two directions. When measuring distances from curb or centerline, make sure you are at right angles to the alignment (right angle prisms are available for this purpose). When taking measurements along a curved street, record the offset from curb or centerline and the length along the arc. A third measurement is recommended to verify the arc length measurement (see exhibit).

Record all field measurements along with the appropriate diagrams in a field book for future transfer onto a tie sheet.