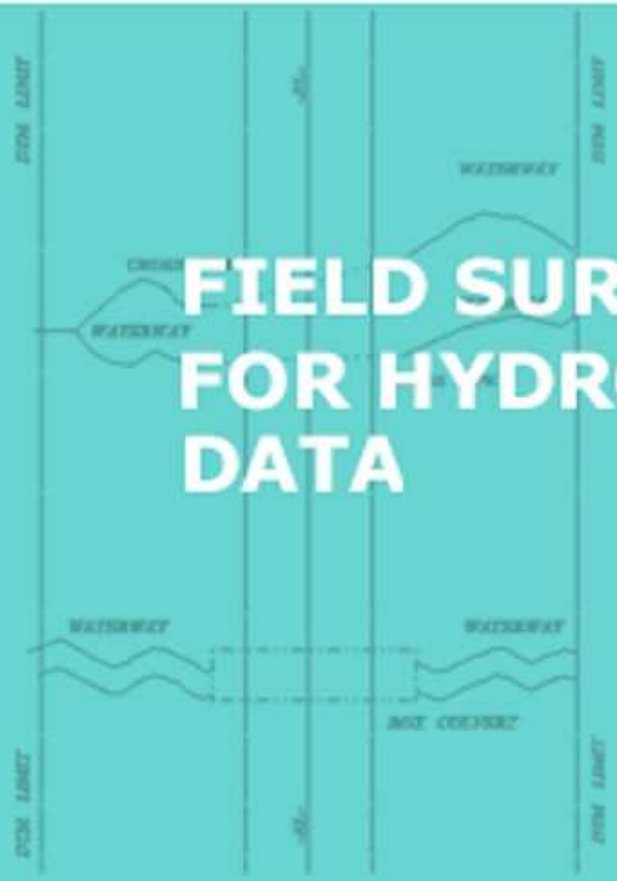
NCDOT

LOCATION & SURVEYS



FIELD SURVEYS FOR HYDROGRAPHIC DATA

Version 2.2 2007
Updated May 2010

LOCATION & SURVEYS UNIT
Field Surveys for Hydrographic Data
Updated: May 2010

It is the intent of Location and Surveys to provide generic survey data to the Hydraulics Unit for their designs. The guidelines are to be used for general project development and should be applicable to all projects. Hydraulic engineers will investigate special situations and the Hydraulics unit will obtain necessary data, with assistance from Location & Surveys as requested.

The Location & Surveys Group Leader, or assistant, should contact the Hydraulic Unit and discuss the Hydraulic needs as a part of scoping the project. When available and determined necessary, a Hydraulics engineer will do a field review with the Group Leader, or designee, to define the Hydraulic needs on the project. Typically, a Hydraulic Engineer has not been assigned to the project at the time of Location's initial surveys; however, they will be able to give guidance in project needs.

Project scoping should include an evaluation of the safety for employees performing the field surveys. If the water depth or strength of current present a safety concern that concern should be documented and conveyed to the Hydraulics Unit.

This documentation should be included in the project survey report and shown in appropriate CADD files. At no time should employees enter water without the necessary safety procedures implemented. In addition to water hazards, the individual scoping the project should be aware of the restriction of employees entering confined spaces.

No one shall be allowed to enter a manhole, catch basin, or culvert without proper safety procedures being followed. If entry is required, assistance must be made coordinated with the Division Safety Engineer.

The guidelines are available on the Location and Surveys web site (http://www.doh.dot.state.nc.us/preconstruct/highway/location/) under the Support area. Updates will be made to these files and attempts will be made to inform all users of the updates.

The guidelines are broken down into the following categories:

Waterways: any definable drainage way including but not limited to ditches, gullies, streams, channels, and rivers.

"T" lines: reference lines to allow hydro surveys to be completed and/or extended.

Cross pipes in drainage networks: existing pipes under roadways and closed drainage systems including catch basins, drop inlets, manholes and interconnecting piping networks. All cross pipes and network data are to be shown in a graphics file along with required elevations. Photogrammetry will merge this data with their files negating the need for classification of these features. Having this data in the graphics file eliminates the need for text files showing alignment relationships.

Box culverts and Bridges: structures bridging existing waterways. All structures data is to be shown in a graphics file eliminating the need for text files.

The private engineering firms that do work for the Hydraulics Unit are given the field survey data compiled by Location. The Hydro estimates are based on Location providing the base data and the PEF supplementing the data as needed.

All drainage structures, except driveway pipes, are to be in a graphics file. Place a note on the classification photo that hydro structures are in a graphics file.

WATERWAYS

Waterways are in any definable drainage way including but not limited to ditches, gullies, streams, channels, and rivers.

Stream type definitions:

Ephemeral: An ephemeral stream is one which flows briefly and only in response to local precipitation,
and whose channel is always above the water table. Groundwater does not contribute to its flow.

Intermittent: An intermittent stream flows only during wet periods (30-90% of the time) and flows in a continuous, well-defined channel. When dry weather reduces groundwater discharge, a stream that flows a good portion of the year may dry up. Runoff from rainfall is a supplemental source of water.

Perennial: a perennial stream has water flowing year round (except for times during extreme droughts). The water table is located above the stream bed. Groundwater is the primary source of flow and runoff from rainfall is a supplemental source of water.

Non-Perennial: can be both Ephemeral and Intermittent. For Location & Surveys purposes, this stream cannot be determined by a visual inspection. An individual that makes this determination is usually a biologist.

Of most importance are the Jurisdictional Streams. A jurisdictional stream is defined as a type of stream that can be Intermittent, Perennial, or Non-Perennial. Representatives from the Army Corp. of Engineers (USACE) and/or PDEA classify a stream or segments of a stream as jurisdictional.

The determination of whether a stream is jurisdictional or not is in the Natural Resource Technical Report (NRTR). This report gives a much more detailed description of jurisdictional streams than the Quad sheets or the county soil mapping we have used previously. The NRTR, in the past, was completed closer to the design phase of a project and has not typically been available to Location & Surveys prior to our field surveys. Now, along with

the NRTR, we will receive a Micro-station CADD file with the Jurisdictional Stream delineation depicting the streams beginning point and ending point.

The Roadway Design will include the name of the PDEA project engineer along with their request for surveys so that inquiries can be made as to the status of the NRTR and the Jurisdictional Stream delineation CADD file (the PDEA Project Engineer can also be located in the Pmii database).

(Please refer to the following 2 memos on Jurisdictional Streams and NEU Wetland Files dated February 2, 2008 and March 30, 2009 from Gregory J. Thorpe, Ph.D.)

All data collected should be transmitted with the appropriate .DTL and the .TNL files. There will be no text files required.

The base width will determine what DTM data the Hydraulics Unit will need. The determining factor will be a bottom width less or greater than 1 meter.

FEB 2 0 2007

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STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

MICHAEL F. EASLEY
GOVERNOR

LYNDO TIPPETT
SECRETARY

February 2, 2007

MEMORANDUM TO: Philip S. Harris, III, P.E., Natural Environment Unit
Charles W. Brown, P.E., PLS - Locations & Surveys Unit
Keith Johnston, P.E., PLS - Photogrammetry Unit
Jay A. Bennett, P.E.- Roadway Design Unit
David R. Henderson, P.E. - Hydraulics Unit

FROM: Gregory J. Thorpe, Ph.D.
Environmental Management Director
Project Development and Environmental Analysis Branch

Art McMillan, P.E.,
State Highway Design Engineer
Highway Design Branch

SUBJECT: Jurisdictional Stream Lines

Phil Harris- Natural Environment Unit
Elizabeth Lusk- Natural Environment Unit
Chris Rivenbark- Natural Environment Unit
Jamie Lancaster- Natural Environment Unit
Randy Griffin- Natural Environment Unit
Charlie Brown- Locations & Surveys Unit
Dale Burton- Locations & Surveys Unit
Marc Clifford- Eng. Application Services
Keith Johnston- Photogrammetry Unit
Art McMillan- Highway Design Branch
Max Price- Hydraulics Unit

A meeting was held on October 19, 2006 with the above listed staff in attendance. The purpose of the meeting was to review the way jurisdictional streams are shown during the preliminary mapping as well as final plans. The following protocol which will be effective February 1, 2007, was established as a result of the meeting:

- NEU will map jurisdictional streams when preparing the NRTR for the planning document. The jurisdictional streams will be imported into the wetland file and displayed as one of two new line styles (see page 2). After validating the wetland file, it will be placed in the appropriate wetland folder on the project store (R: drive) along with an electronic copy of the NRTR Executive Summary. An email will be sent to Hydraulics, Roadway, Project Development, and Location & Surveys as notification of the file being placed in the wetland folder. Hard copies of the NRTR Executive Summary will also be sent to the same parties.

MAILING ADDRESS:
NC DEPARTMENT OF TRANSPORTATION
PROJECT DEVELOPMENT AND ENVIRONMENTAL ANALYSIS
1548 MAIL SERVICE CENTER
RALEIGH NC 27699-1548

TELEPHONE: 919-733-3141
FAX: 919-733-9794
WEBSITE: WWW.DOH.DOT.STATE.NC.US

LOCATION:
TRANSPORTATION BUILDING
1 SOUTH WILMINGTON STREET
RALEIGH NC

- Locations and Surveys will coordinate with Photogrammetry to resolve any differences in final stream locations for final design plans. The agreed upon final stream location will be shown in .pln file.

- Depending on the design stage, Roadway (during preliminary mapping) or Location & Surveys (during final design) will use the stream mapping provided in the wetland file as reference so that the existing jurisdictional stream (JS) line style can be assigned. This will allow the correct jurisdictional status to be provided at a higher precision than would be available in the wetland file. The existing -----JS----- line style will continue to be used in the plan sheet mapping.

- If the wetland file is modified (NRTR addendum, USACE re-verification, etc.), NEU will update the wetland file and contact Hydraulics, Roadway, Project Development, and Location & Surveys.

To best accommodate the workflow that was discussed at the meeting, Engineering Application Services has recommended the following:

- Create two new levels in Nat_Environment_English_Levels.dgn lib
  Exist Hydro Jurisdictional Stream or Body of Water NEU Mitigable
  Exist Hydro Jurisdictional Stream or Body of Water NEU NonMitigable

- Move current levels for wetlands, endangered plants, and endangered animals from NCDOT_Basemapping_Levels.dgnlib to Nat_Environment_English_Levels.dgnlib. This will separate NEU functions from L&S and Photogrammetry functions and help ensure that the appropriate groups are mapping features that are within their responsibility.

- Create two new linestyles. Note that the "NEU JS" was changed to "JS NEU" to be more consistent with the existing JS linestyle name (HYD JS)
  HYD JS NEU MIT ---------- JS NEU ---------- (solid lines)
  HYD JS NEU NONMIT - - - - - JS NEU - - - - - - (dashed lines)

- Add new feature types with new feature codes to NCDOT_Engish.smd, NCDOT_Metric.smd .

- Remove wetlands, endangered plants, and endangered animals tools from NCMAP and create a NEU specific tool palette. Add buttons for JS NEU Mitigable and Non-Mitigable features. Revise Mapping Manual to reflect changes to NCMAP.

If you have any questions, please contact Scott Blevins, P.E. at (919) 250-4016 or Randy Griffin, at (919) 715-1425.

cc:
Deborah M. Barbour, P.E., Preconstruction
Jon Nance, P.E., Field Operations
Elizabeth Lusk- Natural Environment Unit
Chris Rivenbark- Natural Environment Unit
Jamie Lancaster, P.E.- Natural Environment Unit
Randy Griffin- Natural Environment Unit
Dale Burton P.E., PLS- Locations & Surveys Unit
Marc Clifford, P.E.- Engineering Application Services
Max S. Price, P.E.- Hydraulics Unit
Division Engineers

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

BEVERLY EAVES PERDUE
GOVERNOR

cc:

March 30, 2009

MEMORANDUM TO: Philip S. Harris, III, PE, CPM, Natural Environment Unit
Jay A. Bennett, PE, Roadway Design Unit
D. R. Henderson, PE, Hydraulics Unit
Charles W. Brown, PLS, PE, Location and Surveys
Rob Allen, PE, Photogrammetry

FROM: Gregory J. Thorpe, PhD, Manager
Project Development & Environmental Analysis Branch
Art McMillan, PE, Manager
Highway Design Branch

SUBJECT: Incorporation of NEU Wetland File in Final Roadway Plans

On September 9, 2008, a meeting was held between the Roadway Design Unit (RDU) and the Natural Environment Unit (NEU) to discuss procedures for referencing wetland files into Roadway Plans. An additional meeting was held on October 10, 2008 to discuss the topic further.

Per the previous memo dated February 2, 2007, NEU will map jurisdictional streams and wetlands when preparing the Natural Resources Technical Report (NRTR). Upon receipt of the final wetland file and NRTR, the NEU will post these files on the TIP Server under PDEA/Mapping/CADD and PDEA/NEU Project Management/Documents, respectively. For non-bridge projects, the wetland file will be posted 4 months after receipt of the complete Environmental Input Request (EIR) from Project Development. For bridge projects, the wetland file and NRTR will be posted simultaneously, generally 1 year after receipt of the complete EIR.

RDU will use the mapping provided in the wetland file during preliminary design. Location and Surveys (L&S) will use the wetland file as a reference to ensure all jurisdictional streams and wetlands are shown in the planimetric file for the Right of Way plans.

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PRECONSTRUCTION
1541 MAIL SERVICE CENTER
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TELEPHONE: 919-733-9425
FAX: 919-733-9428

WEBSITE: www.NCDOT.ORG

LOCATION:
1 S. WILMINGTON STREET
RALEIGH, NC

The following procedures shall be implemented immediately on all projects:

- NEU will leave on all levels of the wetland file. Once the wetland file has been finalized, the NEU Project Manager will email Jay Bennett, RDU; David Chang, Hydraulics Unit; Dale Burton, L&S; David Harris, Roadside Environmental Unit (REU); and the PDEA Planning Engineer to let them know the wetland file has been placed on the TIP Server. There will be one wetland file for each project including all streams and wetlands.. If a RDU Project Engineer has multiple wetland files for one project, the RDU Project Engineer shall contact the NEU Project Manager and request the files to be merged into one file.

- RDU will modify their design script to only plot the following levels for final plans:
  Exist Hydro Swamp or Marsh
  Exist Environmental Wetland Boundary
  Exist Environmental Endangered Plant Boundary
  Exist Environmental Endangered Animal Boundary

- When RDU sends the "To Locations" (TLOC) letter to L&S requesting surveys, the RDU will cc the NEU, attaching the Scope of Work and map. (Generally, 4 years prior to Let for non-Bridge projects). NEU will review the study area for consistency with the study area covered by the NRTR and existing wetland file. If the TLOC map indicates an area outside of the NRTR project study, the NEU will make a site visit to investigate the new area for jurisdictional features, update the wetland file (if necessary), and alert RDU, Hydraulics, L&S, and PDEA of the updated wetland file on the TIP Server.

- When RDU sends roadway design plans to Hydraulics for 25% plan review (vertical and horizontal) and to NEU for streams/wetlands review, the NEU Project Manager will verify that all jurisdictional streams and/or wetlands are identified on the plan sheets that were shown in the wetland file. If the NEU Project Manager determines the wetland file needs to be revised or that features were not accurately transferred from the wetland file to the plans, they will email the RDU Project Engineer and copy the Hydraulics Project Engineer. The RDU Project Engineer will then request L&S to revise the planimetric file. Once L&S completes the revisions, the RDU Project Engineer will forward them to Hydraulics and notify the NEU Project Manager.

- When RDU sends the "To Hydro" (THYD) letter to Hydraulics requesting hydraulic design, the RDU will cc the NEU, attaching the plans. (Generally, 2 ½ years prior to Let for non-Bridge projects). NEU will review the study area for consistency with the study area covered by the existing wetland file. If the THYD plans indicate an area outside of the NRTR project study, the NEU will make a site visit to investigate the new area for jurisdictional features, update the wetland file (if necessary), and alert RDU, Hydraulics, L&S, REU, and PDEA of the updated wetland file on the TIP Server.

- During the hydraulic design stage, if the Hydraulics design engineer discovers a questionable stream and/or wetland or has questions about the wetland file, the Hydraulics Project Engineer will notify the NEU Project Manager of the area of concern. The NEU Project Manager and RDU Project Engineer will follow the steps mentioned above to revise the planimetric file.

- 24 months prior to Let, the NEU will ensure that the wetland file is up to date and the Jurisdictional Determination (JD) will not expire prior to Let. If the NEU decides that a field visit is warranted and modifies the wetland file, they will alert RDU, Hydraulics, L&S, REU, and PDEA of the updated wetland file on the TIP Server.

Implementing these procedures on all projects should alleviate most of the current confusion associated with the wetland files when producing the Right of Way Plans. Please share this information with your staff and, if there are any questions, please contact Art McMillan, Jay Bennett, Elizabeth Lusk, or Chris Rivenbark.

Cc:

Deborah M. Barbour, PE, Preconstruction
Marc Clifford, PE, Engineering Application Services
Bryan Edwards, PE, CADD Services
Don G. Lee, CPESC, Roadside Environmental Unit

Perennial Waterways Less Than 3 Feet:

Provide underwater breaklines along the deepest part of the waterway and the two (2) top of banks shots, as shown below:

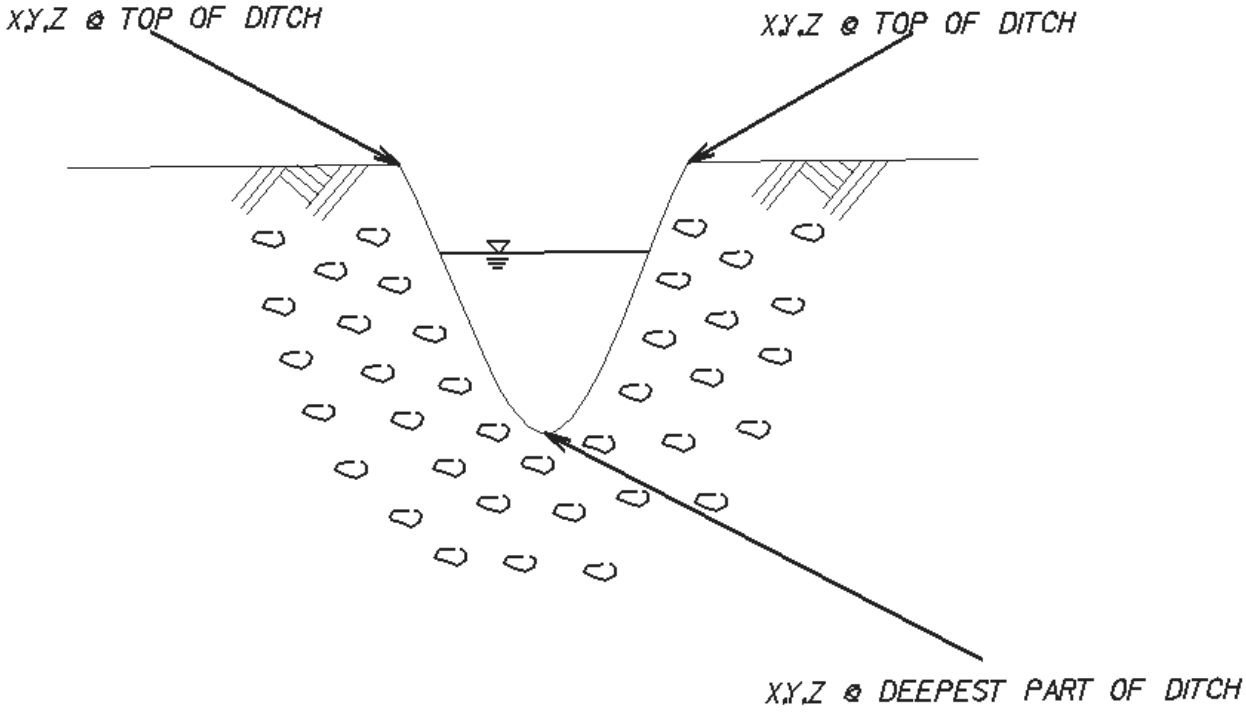


Figure I

Non-perennial Waterways Less Than 3 Feet:

It will be left to the discretion of the field engineer on non-perennial waterways less than 3 feet to utilize field or photogrammetric surveys to collect the DTM drain line. In either case, the plans should be checked to verify that all drainage features are included.

For waterways not visible by photogrammetric methods, provide a drain line along the deepest part of the waterway, as shown below:

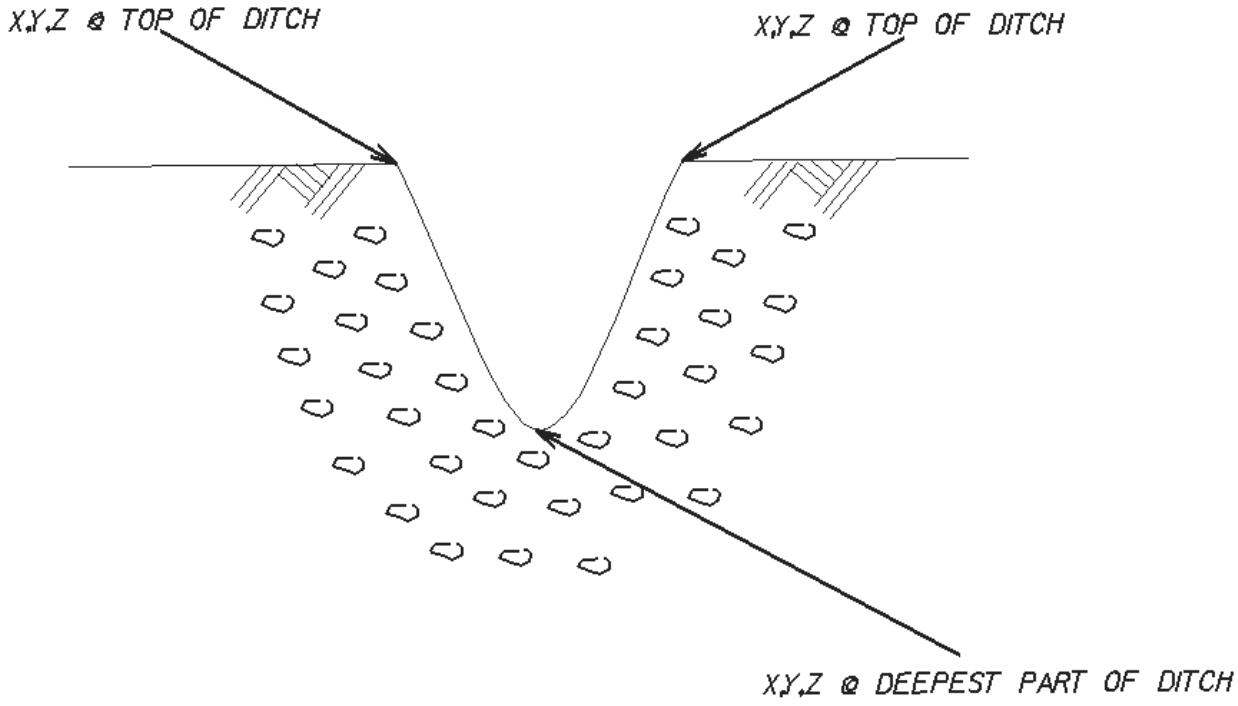
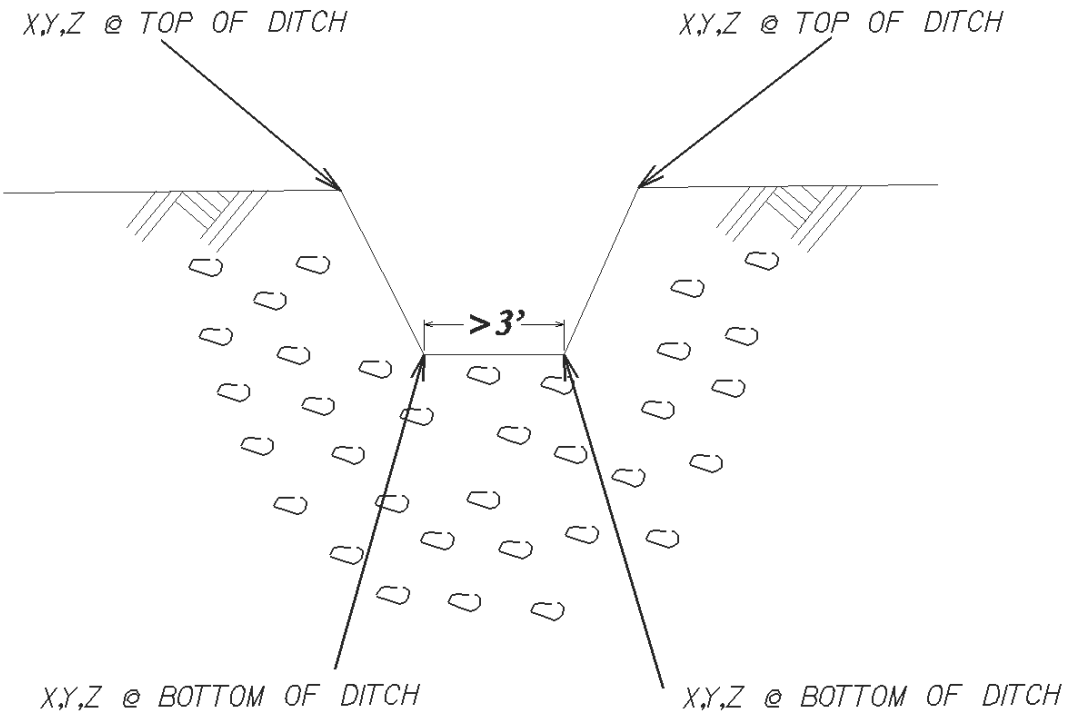


Figure 2

Perennial and Non-perennial Waterways Greater Than 3 Feet:

Provide a minimum of 4 breaklines for waterways greater than 3 Feet (See *Figure 3*) along with a drain line or underwater breakline.



In waterways that are unsafe, a stream should only be collected at water's edge. A note should be made in the DTM file on *Level Exist DTM Breakline Underwater Text* indicating why underwater shots were not collected. (See *Figure 4*)

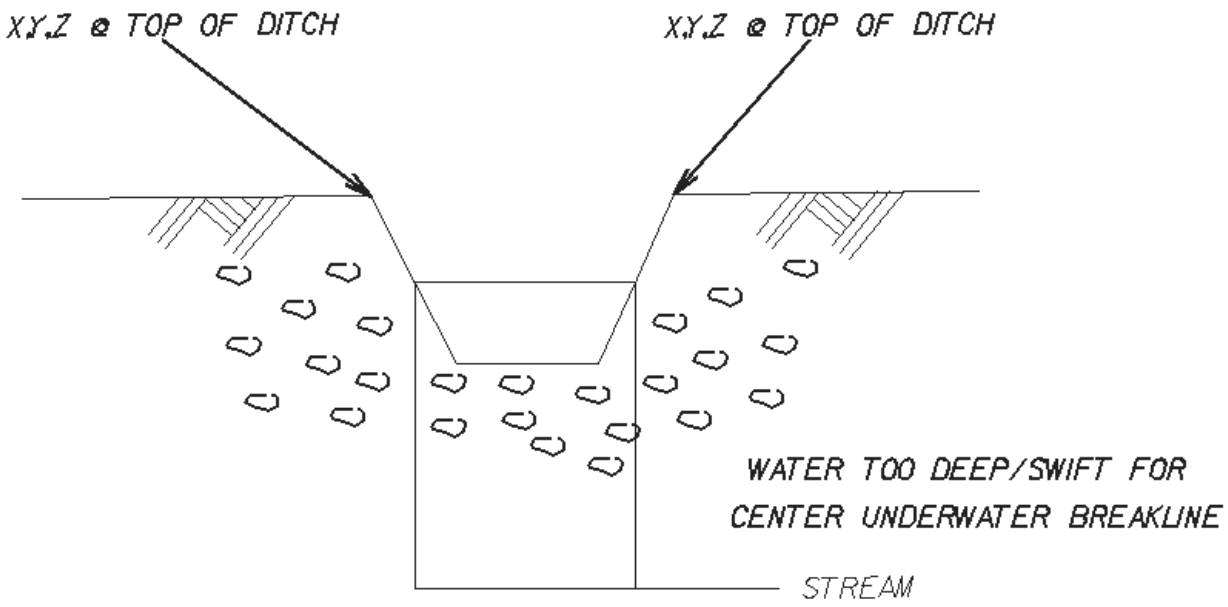


Figure 4

It will be left to the Field Engineer to decide if a waterway is unsafe to collect underwater shots.

WATERWAYS ON NEW LOCATION

Typical sections or shoulder point information should be obtained from the project planning document or public hearing map.

All waterways not visible by photogrammetric methods inside the proposed shoulder points, will need to be surveyed according to the guidelines listed. (See *Figure 5*)

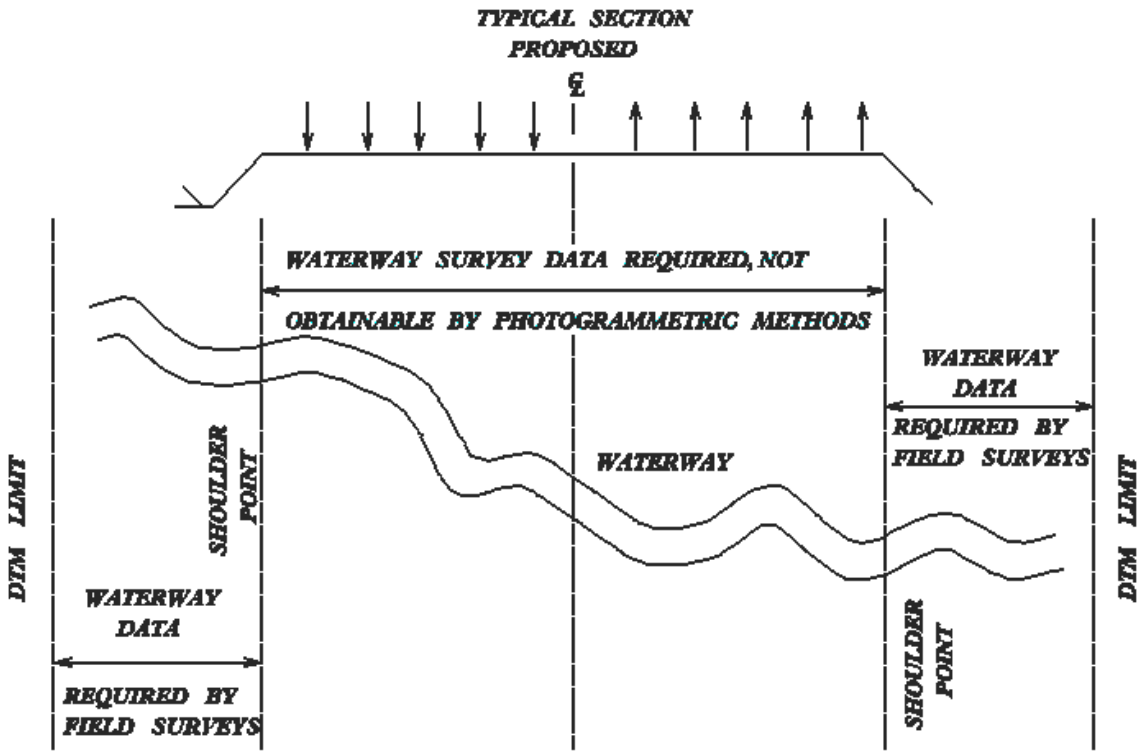


FIGURE 5

Hydraulics survey team will typically obtain additional data required as a result of an alignment shift.

Required DTM Data for Waterways with a Base Width Less Than 3 Feet

(Perennial or Non-perennial)

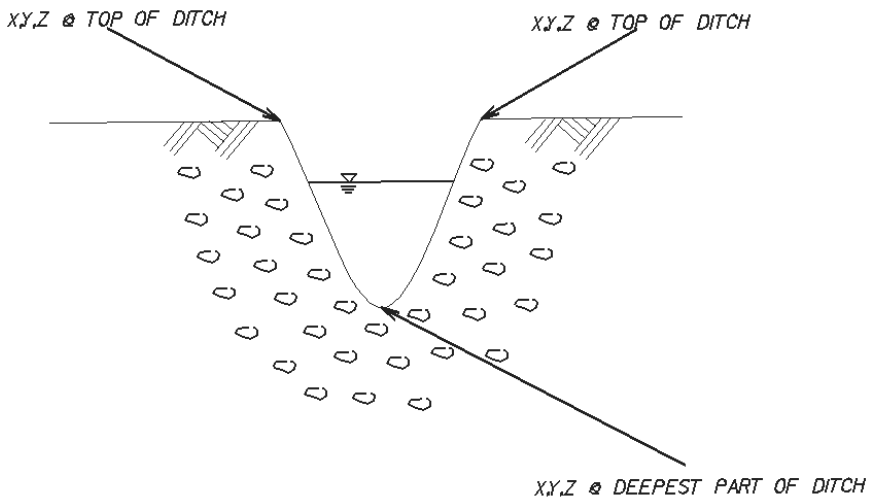
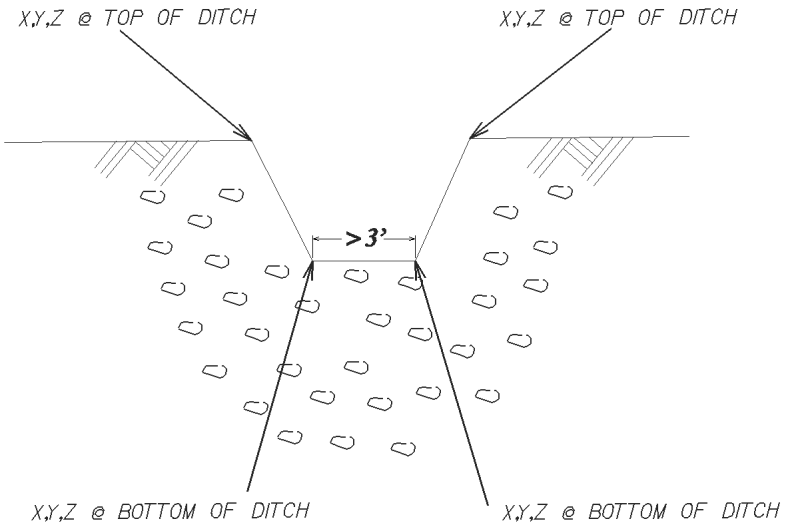


Figure I

Required DTM Data for Waterways with a Base Width Greater Than 3 Feet

(Perennial or Non-perennial)



Waterways That are Unsafe for Collection of Underwater Shots

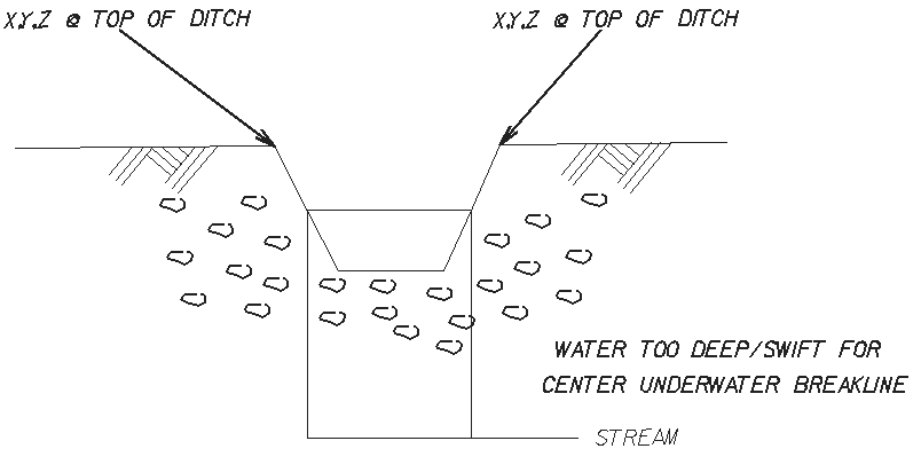


Figure 4

NOTE - we may be able to utilize our hydrographic equipment, pending acquisition, in some situations.

Waterways along Existing Roadways

Provided drain line along the waterway beginning or ending at existing culverts. (See *Figure 6*)

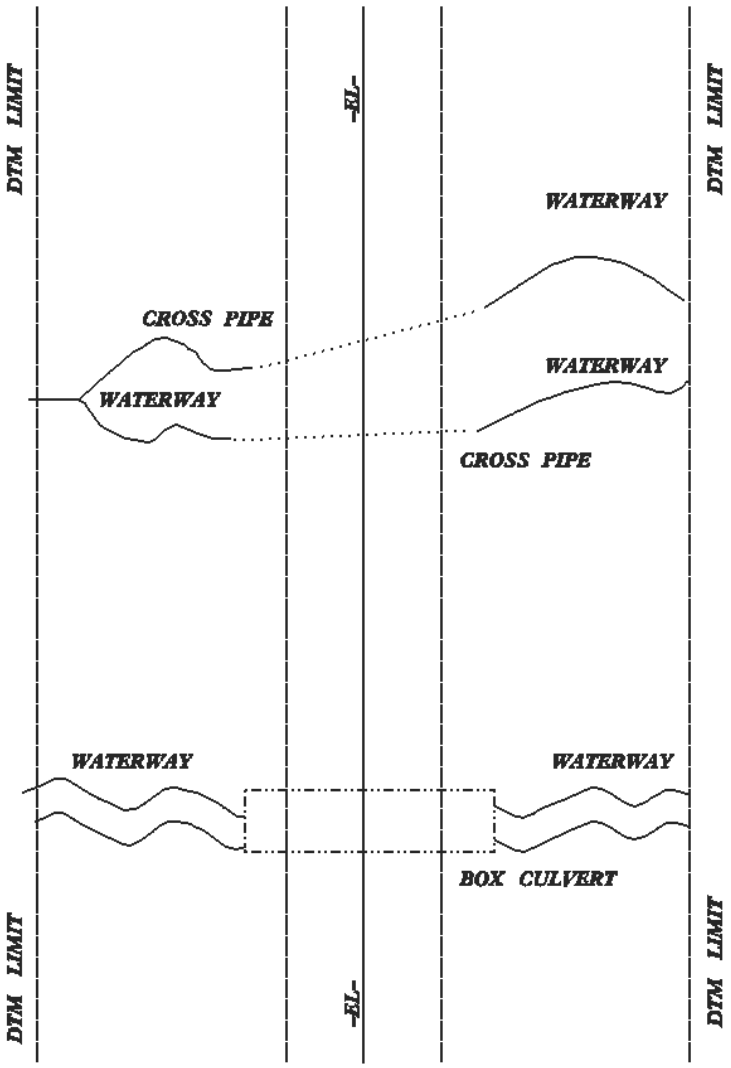


FIGURE 6

HYDRAULIC SURVEY GUIDELINES FOR LOCATION OF "T" LINES

In general, we no longer need to provide -T-lines on our projects for future use by the Hydraulic Unit, however, controls Should always be set in the vicinity of rivers, streams, creeks and other major drainage areas to obtain DTM data. If you decide that you need a –T-lines after discussion with the Hydraulic Engineer, these guidelines would still apply.

Baseline for Hydraulics (-T-Line)

The purpose of the Hydraulic –T- line is only to provide a baseline on the ground from which
The route Location & Survey engineer can collect preliminary hydraulic data and additional information can be obtained as needed by Hydraulics Unit or others.

-T- lines should be established in the field at all waterways (i.e. rivers, creeks, streams, branches, ditches, etc.) that have a consistent 3 feet base width through the project survey limits. If the waterway is generally parallel with the baseline (-BL-) and in close proximity, a separate –T- line is not required. The –BL- will serve as the hydraulic control baseline to obtain hydraulic data in these instances.

-T- line Field Location:

-T- lines should be set generally parallel with the waterway and in the vicinity of the top of bank of the waterway. At the request of the State Hydraulics Engineer, for proposed bridges, the length of the –T- line should extend at a minimum from the proposed –L- line crossing of the waterway the greater of 200 feet or 2 bridge lengths (greater of the existing bridge length or the proposed bridge length) downstream and upstream or to the requested DTM limits, whichever is greater.

Any –T- lines should have at minimum two set points, one of which should be an intersection point with the (-BL-). The intersection point should be an actual –BL- point with an iron pin and cap if there is the potential for major structure construction.

If there is only a minor drainage system planned and no potential for any major structure construction, an intersection point set in line between to –BL- points will suffice.

If the intersection point is set in line between two –BL- points, it will be considered part of the –T- line only and not a control point on the –BL-.

A 12" spike nail, rebar with no cap, or equivalent will suffice as durable construction for later use by the hydraulics engineer. A red topped wooden survey stake or red carsonite marker should be placed next to the set point with the point number and station labeled on the stake.

–T- Line control points should be numbered and labeled by alignment, (i.e. –T1-101, -T-1-102, T2-101, etc, where T# is the –T- line number and -### is the point number).

All baselines for –T- lines should begin at the furthermost left point with T#-###, if looking up stationing of the baseline (BL), and continue with sequential numbering till the end of the project limits. Obviously, sequential numbering of the –T- line points is the goal; however, due to additional requested work, required equalities, etc. these types of acceptable exceptions may inhibit sequential numbering to be achieved in all cases.

All –T- lines should be stationed and begin at the furthermost left point of the –T- line limits with station 5+00.00, if looking up stationing of the baseline (BL), and continue with increasing stationing to the right till the end of the –T- line limits. Stationing of the –T- line control points and inter-visibility between –T- line points is required; however, intermediate staking is not necessary.

Text file and Graphics Format:

-T- lines will be documented in the baseline alignment text file (*.TXT) and the Micro-station graphics file. All –T- line text alignments will include all traverse points with point numbers, North and East Coordinates with Elevations, station of points, and type of point set (i.e., nail set, Rebar, PK nail etc.). Bearing and distance should be provided between adjacent points in the text file. The following statement should be included in the text file:

> *Caution: This –T- Line is a secondary traverse only and should not be used for construction of complex structures. For more information please contact Locating Engineer in charge of surveys.*

In the graphics format, -T- lines should appear in the Microstation CADD file generated for the -BL- and –BY- alignments (i.e. TIP#.BLN) on Level *Exist Horizontal T-Line Alignment*. –T- line traverse points will appear with the default point symbol, -T- line station value, point number, elevation, and bearing labeled on connecting lines.

Minor Structures

Hydrographic data for all minor structures are to be shown in graphic files. Showing this data in graphic format negates the need for text files. See Figure 8 for examples of cross pipes and drainage networks. Sanitary sewer manholes should be in a graphic file as per Figure 8 and placed in .UTL of .BRL files. If inverts are taken from as-built plans, a note should be placed on the associated text level for each structure indicating such. Invert elevations from as-built should be related to project datum.

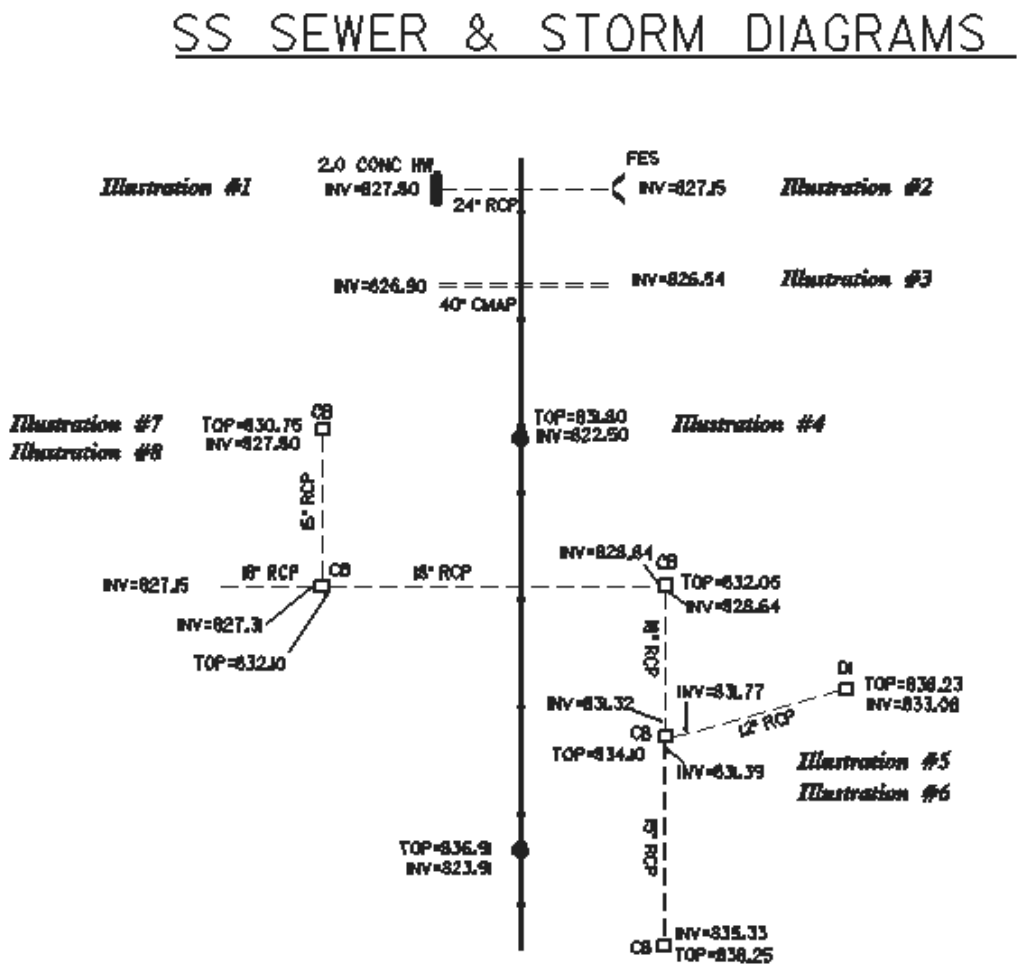


Figure 8

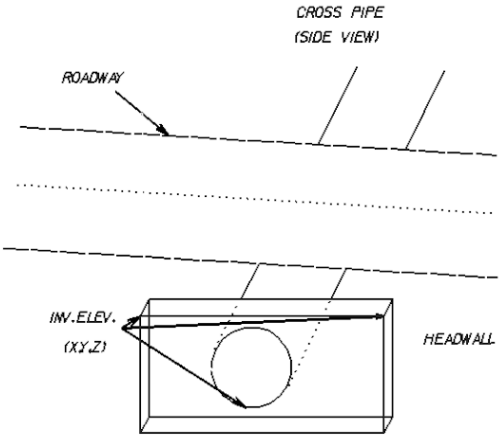


Illustration #1

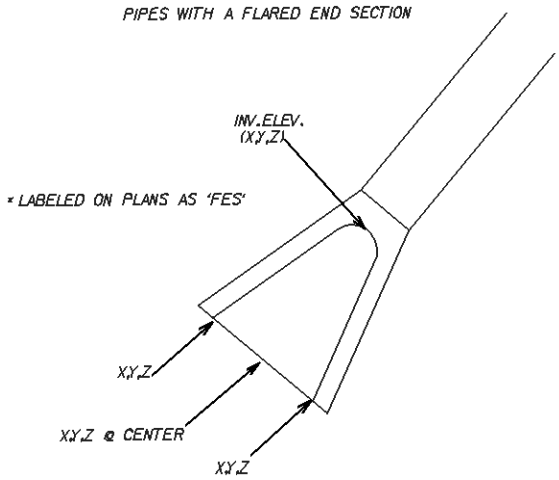
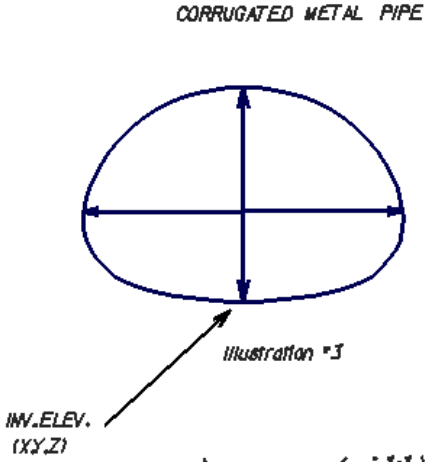


Illustration #2



* ***measure (width) X (height), go to NCMAP and select nominal pipe measurement closest to your field measurement to properly size a CMPA***

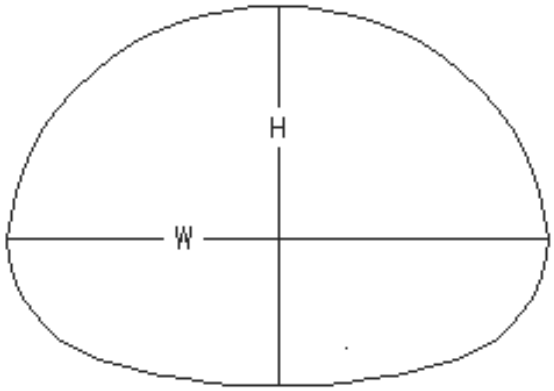
* ***field measurements may vary from nominal pipe sizes due to compression of fill, age of pipe, etc.***

CMPA-CORRUGATED METAL PIPE ARCH

CSPA-CORRUGATED STEEL PIPE ARCH

SIZES ARE ALWAYS MEASURED WIDTH X HEIGHT
(SOMETIMES YOU WILL BE ASKED FOR SPAN X RISE)

SIZES ARE NOMINAL



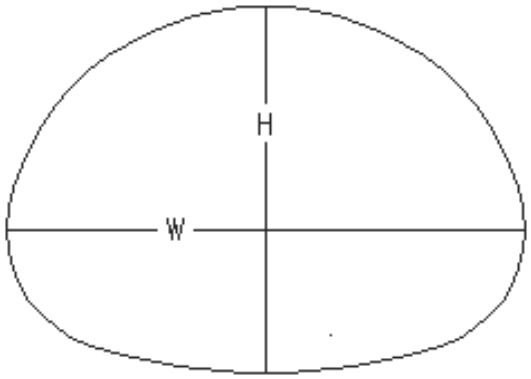
HERE ARE SEVEN OF THE MOST COMMON SIZES:

1) 95" X 67"	(7.9' X 5.6')
2) 103" X 71"	(8.6' X 5.9')
3) 112" X 75"	(9.3' X 6.25')
4) 117" X 79"	(9.75' X 6.6')
5) 128" X 83"	(10.7' X 6.9')
6) 137" X 87"	(11.4' X 7.25')
7) 142" X 91"	(11.8' X 7.6')

NOTE: ROUND PIPES HAVE ONE DIMENSION. AN ODD OR UNUSUAL SIZE IS PROBABLY NOT A ROUND PIPE.

AN ARCH PIPE IS MALIFACTURED AS A ROUND PIPE, SET IN A FORM AT THE FACTORY AND "SQUASHED" TO PRODUCE THE ARCH SHAPE. THE PURPOSE IS TO ALLOW MORE AREA DOWN LOW DURING AVERAGE RAIN EVENTS.

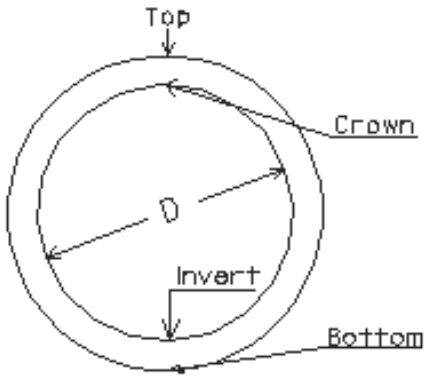
PIPES TEND TO DEFORM WITH AGE AND DEPENDING ON THE AMOUNT OF ROADWAY FILL PLACED ON THEM. (USUALLY WIDER THAN NOMINAL)
IF YOU MEASURE A PIPE IN THE FIELD AND DON'T GET THE EXACT MEASUREMENT OF THE NOMINAL SIZE, USE BEST JUDGMENT TO ARRIVE AT THE CORRECT NOMINAL SIZE.



HERE ARE SOME SMALLER ARCH SIZES:

1) 40" X 31'
2) 46' X 36"
3) 53' X 41'
4) 60' X 46'
5) 66' X 51'
6) 73' X 55"
7) 81" X 59'
8) 87' X 63'

NOTE: PIPE SIZES CAN ALSO BE FOUND UNDER NC MAP (PLACE MINOR STRUCTURE)

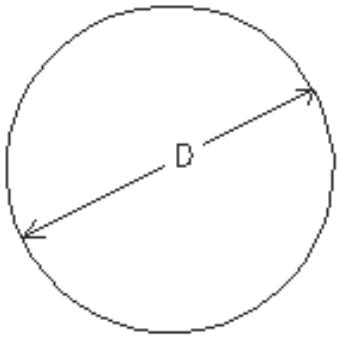


CONRETE PIPE SIZES

12"	54"
15"	60"
18"	66"
24"	72"
30"	84"
36"	96"
42"	108"
48"	120"

NOTE: SIZE IS MEASURED FROM INVERT TO CROWN.

THESE SIZES ALSO EXIST, USUALLY THEY ARE OLDER PIPES AND NOT ENCOUNTERED AS OFTEN AS OTHER SIZES:
(21" 27" 33" 78" 90" 102")



CORRUGATED METAL PIPES

12"	54"
15"	60"
18"	66"
24"	72"
30"	84"
36"	96"
42"	108"
48"	120"

THESE SIZES ALSO EXIST, USUALLY THEY ARE OLDER PIPES AND NOT ENCOUNTERED AS OFTEN AS OTHER SIZES:

(21" 27" 33" 78" 90" 102")

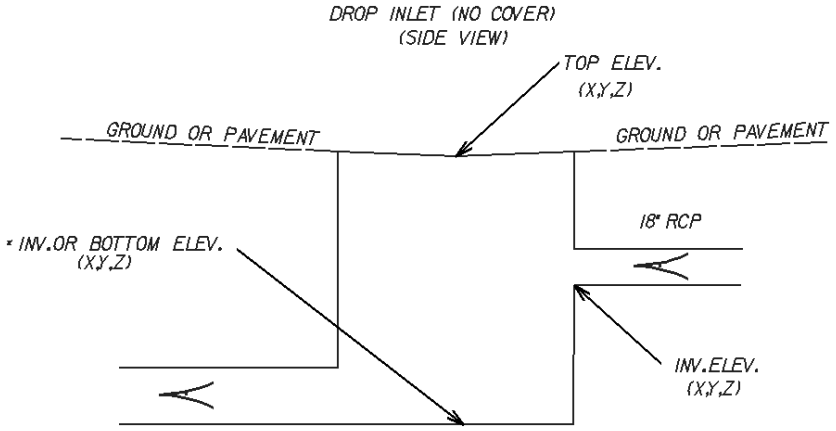


Illustration *5

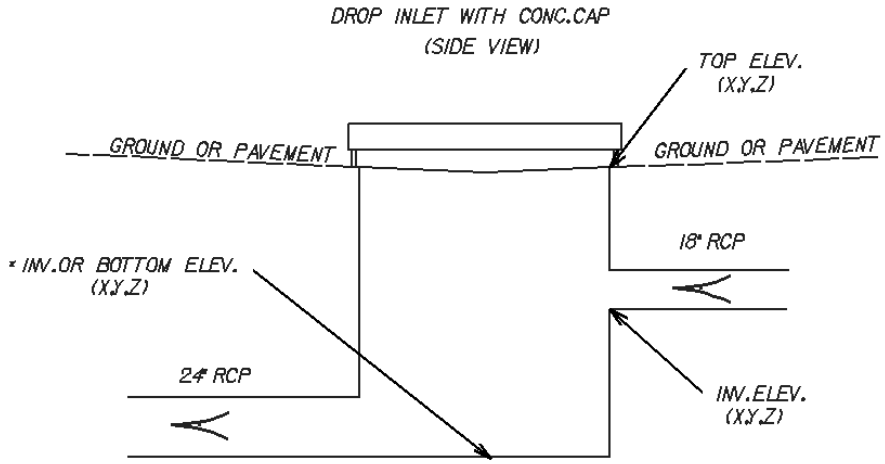


Illustration *6

CATCH BASIN
(TOP VIEW)

USE ONE OF THE Z SHOTS AT FLOW LINE FOR TOP ELEV.

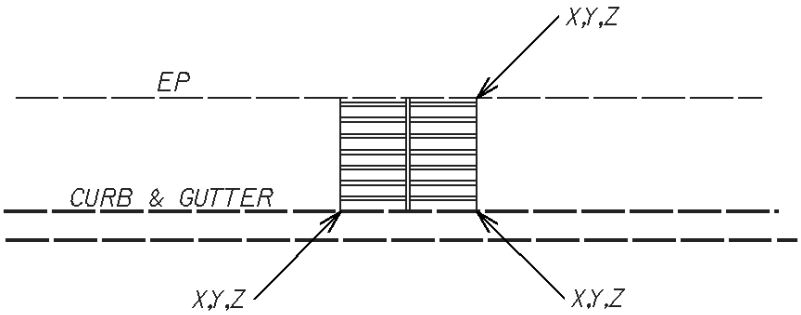


Illustration #7

CATCH BASIN WITH CURB & GUTTER
(SIDE VIEW)

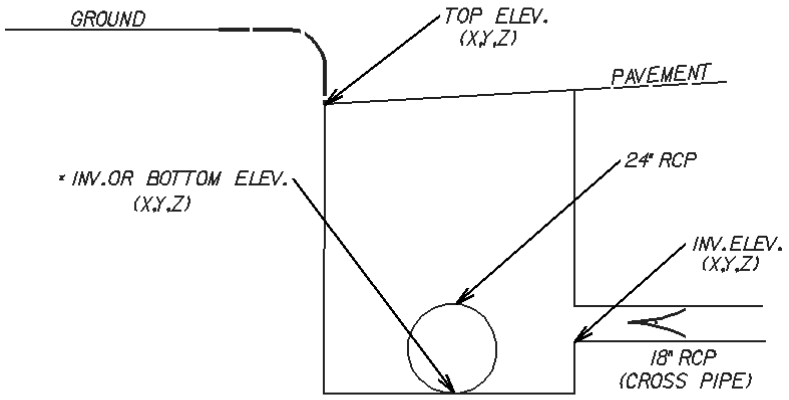


Illustration #8

All shots should be X,Y,Z unless noted by.

MAJOR STRUCTURES

Existing Box Culverts

A minimum of 8 shots are needed for any box culvert. (See *Illustrations 9,10,11,*& *12*) The location of these shots should be labeled in the design file.

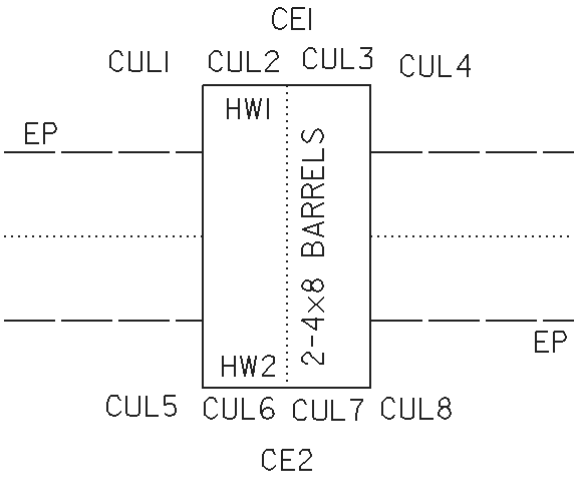
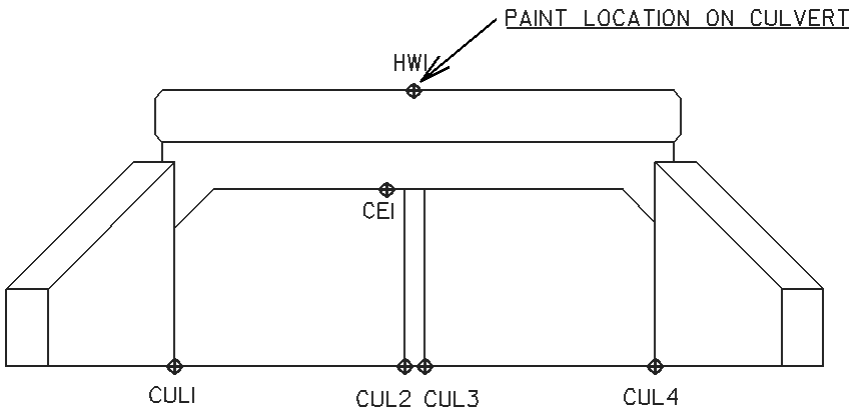
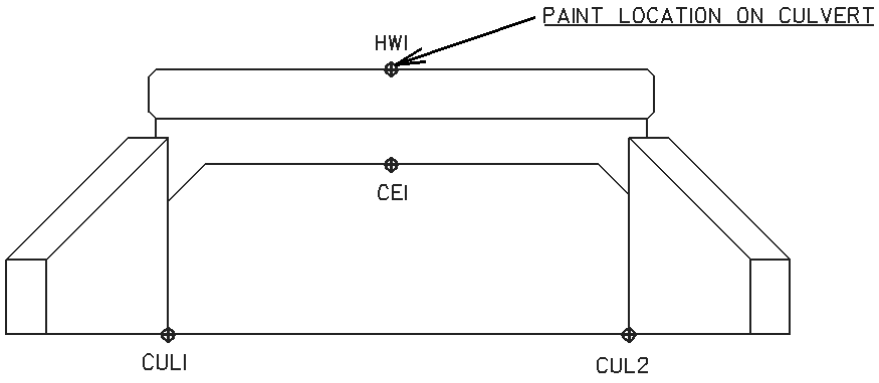


Illustration #9



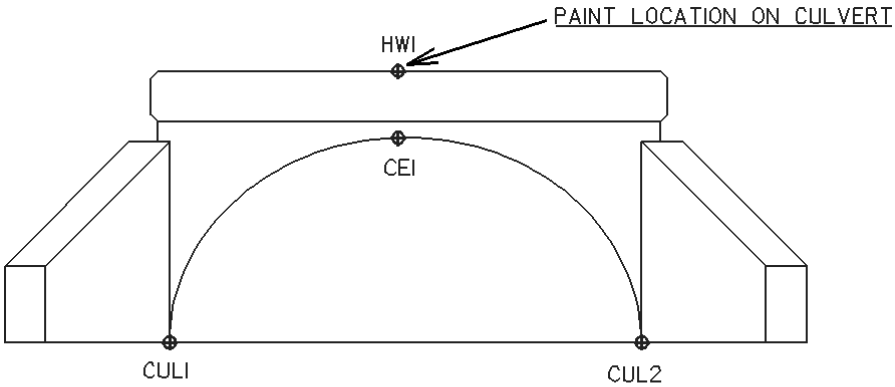
MULTI-BARREL CULVERT
(END VIEW)

Illustration #10



SINGLE BARREL CULVERT
(END VIEW)

Illustration #11



SINGLE BARREL CORRUGATED
METAL ARCH CULVERT

Illustration #12

CUL – designates X, Y, and Z coordinates at the inside corners.
HW – designates centerline top of headwall elevation.
CE – designates centerline bottom of top of slab elevation.

CULVERT #1
TWO BARRELS

	NORTH	EAST	ELEV.
CUL1			
CUL2			
CUL3			
CUL4			
CE1			
HW1			
CUL5			
CUL6			
CUL7			
CUL8			
CE2			
HW2			

ABOVE CHART IS AUOTMATICALLY
CREATED IN NC MAP

Note: The location of the HW shots should be painted on the culvert.

The information collected will be shown in a tabular format adjacent to each culvert. (See *Illustration# 6*)

Hydrographic information should be on the following levels in .BRL or .HYL files, as per the Mapping Manual. This information should include, but is not limited to:

All major structures
Material type, size, etc.
Tables and shot location tags
Label size and number of barrels on

Bridge Crossings

Show bridge seat elevations at lowest beam on Level *Exist Structure Major Bridge Seat Text* in .BRL or .HYL files. (See *Illustration #13*)

Show dashed lines along bridge bents in .BRL or .HYL files. (See *Illustration #14*)

Bridge inventory number will be shown on *Exist Structure Major Bridge Seat Text*.

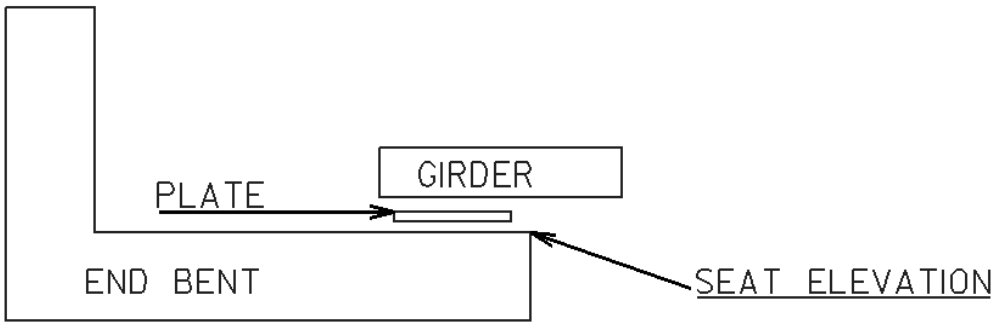


Illustration #13

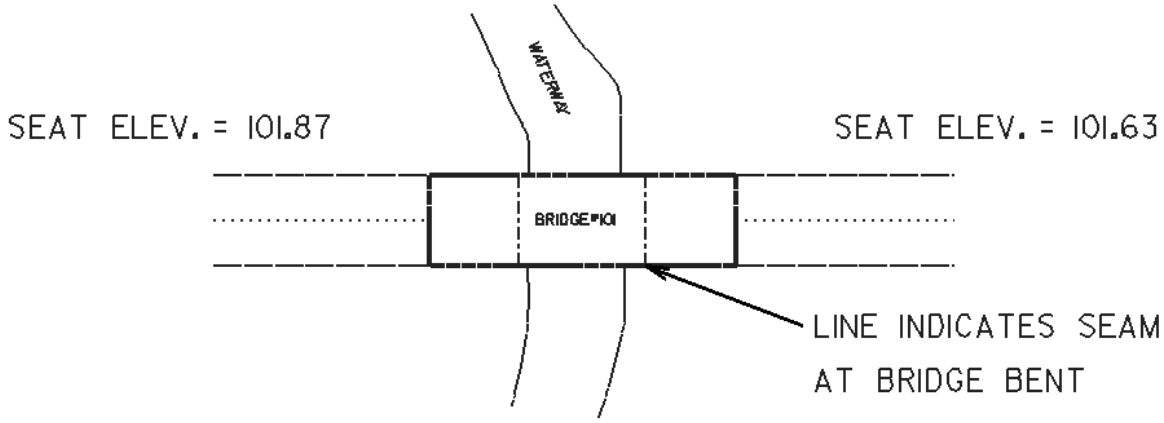


Illustration #14