



Survey manual for land development

February, 2017

Amendment history

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1. Introduction

This document details Barwon Water's requirements for survey and asset recording of assets required for the provision of services to subdivisions and other land development works.

This manual has been prepared to assist engineering and surveying consultants in their dealings with Barwon Water, when working under agreements for the design and construction of water supply and sewerage works within Barwon Water's water and sewerage districts. Any matter not specifically dealt with in this manual will need to be clarified with Barwon Water prior to commencement of any works.

The manual should be read in conjunction with Barwon Water's documentation for:

- Offer Document,
- Subdivision Servicing,
- Water Supply Design,
- Sewerage Design,
- Construction Specifications.

The survey manual is in four parts.

Section 2

Provides general information on:

- The survey requirements for land owners and consultants entering into agreements with Barwon Water;
- Operating guidelines expected to be followed by licensed and works surveyors engaged by owners and or consultants;
- Survey audits and conformance checking which may be undertaken by Barwon Water.

Section 3

Provides detail information on the cadastral requirements of Barwon Water for agreement works.

Section 4

Provides detail information on the "as constructed" water supply survey information required by Barwon Water for agreement works.

Section 5

Provides detail information on the "as constructed" sewer survey information required by Barwon Water for agreement works.

For further information about the survey manual please direct inquiries to:

Technical and Spatial Services Co-ordinator on 1300 656 007 or mail to Barwon Water, PO Box 659, Geelong, VIC, 3220

2. General information

2.1 Survey requirements for land owners and consultants

Landowners who are entering into an agreement with Barwon Water to provide water supply and sewerage works to service a new development must appoint a licensed surveyor to act on their behalf in relation to the cadastral requirements of the Agreement. The cadastral requirements of Barwon Water are detailed in Part Three of this manual.

Consultants acting for landowners, and who are responsible for the design, construction and survey of new works must:

- Appoint Barwon Water accredited and Barwon Water inducted works surveyor to provide the survey requirements of the Works.
- Ensure that sufficient title pegs are maintained during the construction of the Works to enable audits to be undertaken by Barwon Water.
- Ensure that established benchmarks are maintained during the construction period.
- Ensure that the "as constructed" surveys of the Works are undertaken in accordance with this manual and the results forwarded to Barwon Water within the required time.

The survey requirements for water supply and sewerage are detailed in Part Three and Part Four of this manual respectively.

Please note that Maintenance Holes are referred to as Access Chambers or shafts in this survey manual.

2.2 Survey requirements for Barwon Water

Barwon Water will be responsible for the following:

- The provision of existing map base and Barwon Water asset information relevant to the subdivision, in digital or hard copy format.
- Defining the "as constructed" survey information required by Barwon Water after the completion of the Works. This may include the location of other services as well as buildings or features of interest.
- Establishing the accuracy tolerances required for the "as constructed" surveys of the new Works.
- Undertaking survey audits and conformance check surveys.

2.3 Operating guidelines for licensed surveyors and works surveyors

The following guidelines are to be followed by licensed surveyors and works surveyors when engaged by Consultants on agreement works.

2.3.1 Occupational Health and Safety (OHS)

Licensed surveyors, works surveyors and staff under their direction, must at all times comply with the Victorian OHS Act 2004, Victorian OHS Regulations 2007 and associated compliance codes and industry guidelines.

2.3.2 Vegetation

In the event that a survey requires the clearing or trimming of vegetation, the works surveyor must first obtain the written consent of the relevant landowner or of the controlling municipality or authority and supply a copy to Barwon Water.

Clearing and trimming of vegetation must be to the minimum necessary, and the works surveyor is responsible for the collection and removal of debris and the sealing of limbs and stumps, in accordance with the owner's instructions.

2.3.3 Property

The works surveyor is responsible for any damage to property caused during the course of the survey and is required to restore all services, drains, fences, structures and surfaces to their original condition immediately on completion of the survey.

Prior to entry to any land, the works surveyor is required to obtain the written consent of the landowner or controlling authority and confine the survey to an agreed area of operation. In the event that a landowner refuses consent to enter for the purposes of a survey, the works surveyor is to refer the matter to the Consultant, who will liaise with Barwon Water to determine the appropriate course of action.

2.3.4 Survey Marks

The works surveyor is to ensure that established survey marks are maintained at all times and that minimum disruption is caused to subdivision pegs during the course of construction.

2.3.5 Liaison with Contractors and Consultants

The works surveyor must liaise with the Consultant and contractors constructing new water and sewerage works to ensure that:

- The "as constructed" detail is recorded as the Works proceed;
- The recording of "as constructed" detail is completed before backfilling of trenches commences.

The works surveyor must immediately notify the Consultant, in writing, of non-compliances and immediately forward copies of all non-compliances to Barwon Water's Senior Quality Auditor identified during the course of construction of the Works, and retain copies of all such notices for inspection by Barwon Water.

2.4 Survey audits and conformance checks

Barwon Water may initiate survey audits on new works, which will be undertaken without prior notice to the Consultant. The Consultant will only be notified if the audit establishes non-conformance requiring corrective action.

The audits may take the form of:

- A check of the connections of the survey to MGA and AHD.
- A comparison of the constructed position of the works compared to the design position.
- A check on the accuracy and completeness of the submitted "as constructed" records.

3. Cadastral requirements

3.1 Digital cadastral map base

Barwon Water has created and maintains a digital cadastral map base as a foundation data set in its Geographic Information System (ProFIS). Barwon Water records the spatial location of its water and sewerage assets against this map base, and has replaced completely any use of traditional hard copy detail plans.

The map base has an absolute spatial accuracy in urban areas of +/- 0.3m, is co-ordinated within Zone 55 of the Map Grid of Australia, using the Geocentric Datum of Australia 1994 (GDA94). New subdivisions are key-entered before insertion into the map base.

Amendments to the map base are undertaken on receipt of subdivision plans lodged with municipalities and referred to Barwon Water under the Subdivision Act 1988. These subdivisions are shown as being "unregistered" until Barwon Water receives notification of the plan's registration at the State Land Registry.

The map base in all urban areas is supported by geodetic control networks, established by Barwon Water, which are based on, and densify, the State's second order regional geodetic control. These marks are available for use by surveyors via the State's [SMES - Survey Mark Enquiry Service](#) website. GPSNet or SMARTNetAUS should be used to verify the SMES coordinates.

3.2 Map Grid of Australia connection

Licensed surveyors acting for landowners or consultants are required by the Surveyor General to connect surveys for most new subdivisions to the Map Grid.

Barwon Water requires licensed surveyors, as part of the agreement process, to provide a MGA connection for all subdivisions requiring water or sewerage services, in order that the new water and sewer assets can be correctly placed in the GIS, both with respect to the subdivision, and with respect to the Map Grid.

The following procedure is to be followed:

- Prior to the commencement of the Works, obtain from the State's Survey Mark Enquiry Service (SMES) MGA information relating to at least two permanent marks in the vicinity of the subdivision. All marks quoted must be of third order accuracy or better. Marks with fourth order accuracy will not be accepted. Permanent marks must be validated either by terrestrial or GPS (Global Positioning System) technology for horizontal position.
- Barwon Water's Technical and Spatial Services will assist surveyors requiring network extensions for new land development which is remote (>1 km) from existing control stations
- In the event of any anomalies in the data provided, the co-ordinates to be adopted are to be settled with Technical and Spatial Services.
- Connect the subdivision to the co-ordinated permanent marks and provide Barwon Water with field records indicating the adopted marks' identification, co-ordinates and their source, traverse details and derived co-ordinates for at least four points on the subdivision. Two of these points should be at opposite ends of the subdivision and two evenly distributed between. In calculating MGA co-ordinates, local height and grid scale factors are to be applied to traverse distances. The proforma provided in Section Six is to be used to provide the MGA (and AHD) connection information.
- When undertaking traversing to connect the subdivision to the co-ordinated marks, the accuracy of the traversing must be to the same standard of precision as is required for the classification of the survey being connected.
- In the event that the design of new works requires the use of MGA co-ordinates for the set-out and "as constructed" recording of new works, the licensed surveyor must establish and maintain at least three co-ordinated permanent or reference marks (not being subdivision pegs) in the vicinity of the Works. The location, description and computed co-ordinates of these marks are to be provided to Barwon Water at least five working days before the commencement of construction. The relative accuracy of the co-ordinated marks must be sufficient to enable the Works to be constructed within the required tolerances. At least three distance ties to identifiable features are to be provided for each mark.

On receipt of the MGA connection and certified plan, Barwon Water will amend the digital map base with the subdivision being shown as "unregistered" until notification is received from the State Land Registry that the plan has been registered.

The following types of development are exempt from providing Barwon Water with an MGA connection under this agreement:

- Subdivisions not requiring Barwon Water's water and sewerage services.
- Subdivisions for which a suitable MGA connection already exists and a waiver to this effect has been issued by Barwon Water. An "Application for Waiver for MGA Connection" is included in Section Six. A copy of this waiver, signed by Barwon Water's responsible officer, must be lodged with other "as constructed" field notes.
- Subdivisions of six (6) lots or less, which are not part of a staged development and are situated completely within areas where existing map base data can be used to control the co-ordination of the development. Confirmation with Barwon Water should be sought in these cases, and if supported Barwon Water will authorise a waiver for the MGA connection, a copy of which is then to be lodged with other "as constructed" field notes.

3.3 Australian Height Datum (AHD) connection

The heights of all Works designed for Barwon Water are to be based on the Australian Height Datum (AHD), except where otherwise stipulated by Barwon Water.

Barwon Water has extensive networks of levelling in each urban area under its control. These have been based on, and densify, State control surveys.

Barwon Water requires licensed surveyors to undertake the following:

- Prior to the commencement of the Works, obtain from the State's Survey Mark Enquiry Service (SMES) AHD information relating to at least two permanent marks in the vicinity of the subdivision. All marks quoted must be of third order accuracy or better. Marks of fourth order accuracy will not be accepted. Heights must be validated by third order levelling; GPS derived heights are not acceptable.
- In the event of any anomalies in the data provided, the heights to be adopted are to be settled with Technical and Spatial Services.
- Connect the subdivision to the permanent marks and establish at least three stable benchmarks evenly over each stage of the subdivision. Benchmarks must be of an enduring nature and have an identifying number attached or nearby. They should be placed where they will not be disturbed by machinery during construction.
- The surveyor should complete and sign off the AHD connection panels on the Cadastral proforma and provide it to the design consultant, together with the locations, descriptions and height values for the site benchmarks for addition to the water and sewer design plans. This information is to be tabulated on the plans with the location of the AHD adopted stations (where possible) plotted. All site benchmarks must be plotted in their true locations and clearly annotated with their location tie distances.
- Level traversing to establish new benchmarks must be to third order precision in accordance with the Survey Co-ordination (Surveys) Regulations, and all heights are to be quoted to the nearest 0.01 metres.
- All the survey information needed for the set-out, construction and "as constructed" survey of the works is to be documented on the design plans.

3.4 Subdivision information

When the owner submits an Application for Conditions to Barwon Water, the Application must include a computed plan of the subdivision that has been certified by a licensed surveyor. The plan must include the following:

- All lots and their numbers
- Reserves and crown land labelled

- All easements and their identifications
- Stage lots
- All dimensions and areas of lots and reserves
- Road names

Barwon Water also requires a print of the plan showing contours and/or spot heights to AHD.

A copy of the certified plan is required for all developments.

3.4.1 Easements and Reserves

All plans that are referred to Barwon Water for consent to certification under the Subdivision Act 1988 are checked to ensure existing sewer and water mains within the development are contained within easements or reserves. Plans not showing easements or reserves over existing assets may be suspended. This may also apply for any unprotected assets that are located within balance allotments on staged subdivisions.

On receipt of "as constructed" information, Barwon Water will check to ensure that the constructed assets are appropriately protected by easements. In the event that, for example, a sewer main has been constructed outside the easement shown on the certified plan provided by the licensed surveyor, Barwon Water may request amendments to the plan prior to Barwon Water's issue to the appropriate municipality of consent to the release of the subdivision.

4. Water supply agreements

4.1 Information required

Barwon Water requires "as constructed" information on the depth and location of all new water pipes, fittings and associated structures in a format suitable for creation of the asset records in Barwon Water's GIS. Where new assets join existing assets, the depth and location of the immediate adjoining assets need to be shown.

As constructed survey information for water supply assets may be submitted as a digital AutoCAD .dwg file, if you are utilising the ACDC (As Constructed Design Certification) system* or on the Barwon Water proforma in .pdf files.

* The digital ACDC system submission option is available to approved consultants only. Contact Barwon Water's Geospatial Services on 1300 656 007 to obtain training and become an approved consultant.

The documentation detailing submission requirements and the required template file are downloadable from the 'As constructed package' section of the '[Land development forms](#)' page of the Barwon Water website.

The proforma has been designed to:

- Provide the recipients with the contact particulars for the consultant and the works surveyor.
- Support the creation of GIS graphics and attributed data.
- Simplify the entry of element attributes into Barwon Water's GIS database.
- Ensure all nodes (fittings, junctions, end of lines, etc) and links (pipes) are unambiguously located.
- Provide maximum flexibility for the measurement methods used (chainages, offsets, ties, or coordinates).
- Support electronic transfer of "as constructed" records.
- Enable scanning of records.

Barwon Water normally records the depth below finished surface level to the top of the pipe or fitting, rather than AHD height. Where AHD is required, Barwon Water will identify this requirement on a copy of the approved Works design plans returned to the Consultant.

The works surveyor responsible for the survey aspects of the construction of water supply works must supervise the recording of the following information.

Horizontal position and depth from finished surface level to top of pipe at:

- Horizontal bends
- Vertical bends
- Fittings
- Change in pipe characteristics, e.g. diameter, material junctions
- Ends of conduits
- Pipe junctions
- Where the depth varies by more than 0.3 metres due to changes in surface levels.

These points are defined in more detail in the following definition tables, which provide a list of all items used by Barwon Water for water systems definitions. "Y" indicates the attributes that need to be recorded for each item. The general term "node" is used to describe point features (e.g. fittings) and other geometry points. The general term "link" is used for pipes and other linear features.

Where Barwon Water has indicated a design requires the supply of an AHD height for a pipe or fitting, an amended copy of the Works design plan and/or longitudinal section must be submitted showing the "as constructed" heights and their locations. AHD heights quoted are to be the invert of the pipe or fitting.

4.2 Water nodes definition table

Node Type	Code	Dia. (mm)	Material	Date Laid	Depth (m)	Horizontal Location	Further Information
Geometry Points							
Data point on main	PT	Y		Y	Y	Y	
Conduit terminals	C	Y		Y	Y	Y	
Standard Bends							
90 degree Bend	90 deg (H or V)	Y	Y	Y	Y	Y	
45 degree Bend	45 deg (H or V)	Y	Y	Y	Y	Y	
22.5 degree Bend	22.5 deg (H or V)	Y	Y	Y	Y	Y	
11.25 degree Bend	11.25 deg (H or V)	Y	Y	Y	Y	Y	
Fittings							
Fireplug	FP	Y	Y	Y	Y	Y	
Stop valve	SV	Y	Y	Y	Y	Y	
Butterfly valve	BFLY	Y	Y	Y	Y	Y	
Main tap	MTAP	Y	N	Y	Y	Y	
Wheel valve	W	Y	Y	Y	Y	Y	
Supply meter	MET	Y	N	Y	N	Y	Record diameter of service
Scour	SC	Y	Y	Y	Y	Y	
Altitude valve	ALT	Y	N	Y	Y	Y	Record ht above natural surface
Autoflush valve	AF	Y	N	Y	Y	Y	
Float valve	FL	N	N	Y	N	Y	

Flowmeter	FM	Y	N	Y	Y	Y	
Reverse turn valve	RT	Y	Y	Y	Y	Y	Clockwise closing
Flushing point	FLPT	Y	N	Y	Y	Y	
Automatic valve	AUTO	Y	Y	Y	Y	Y	
Test cock	TC	Y	N	Y	Y	Y	
Hose cock	HC	Y	N	Y	Y	Y	
Pillar hydrant	PH	Y	Y	Y	Y	Y	
Non return valve	NRV	Y	Y	Y	Y	Y	
Air valve	AV	Y	Y	Y	Y	Y	
Dead end cap	DEC	Y	N	Y	Y	Y	
Pumping station	PS	N	N	Y	N	Y	
Material change	MAT	N	N	Y	Y	Y	
Tee junction	T	Y	Y	Y	Y	Y	Record larger diameter
Reducer	RED	Y	Y	Y	Y	Y	Record larger diameter
Swabbing point	SWB	Y	N	Y	Y	Y	
Recorder (Anode)	REC (A)	N	N	Y	N	Y	Cathodic protection
Recorder (Chlorine)	REC (C)	N	N	Y	N	Y	Cathodic protection
Standpipe	STA	Y	N	Y	N	Y	
Tap (Ammonia)	TAP (A)	Y	N	Y	N	Y	Ammonia dosing station
Tap (Chlorine)	TAP (C)	Y	N	Y	N	Y	Chlorine dosing station
Flow Control valve	FCV	Y	Y	Y	Y	Y	

Pressure reducing valve	PRV	Y	Y	Y	Y	Y	
Pressure sustaining valve	PSV	Y	Y	Y	Y	Y	

Where:

Code	Code is the abbreviation to be used on "as constructed" proforma sketches to describe each node
Dia. (mm)	The diameter of the fitting in millimetres
Material	The code for the material with which the fitting is manufactured - see Fittings Materials Table below
Date Laid	The date on which the fitting is installed in the format dd.mm.yy
Depth (m)	The depth to the top of the main at the fitting in metres
Horizontal location	The horizontal position of the node fixed by ties to pegs, chainages offsets or co-ordinates

4.3 Fittings materials table

Material	Code	Material	Code	Material	Code
Ductile Iron	DI	Ductile Iron Cement Lined	DICL	Polyvinyl Chloride	PVC
Cast Iron	CI	Cast Iron Cement Lined	CICL	Polyethylene	PE
Mild Steel Cement Lined	MSCL	Brass	B		

4.4 Water pipes definition

All pipes are recorded as links between nodes. The following table lists the attributes that are to be recorded for each link and the required format of the data.

4.4.1 Water Pipe Definition Table

Pipe Attribute	Information and Format Required
Diameter	The internal diameter of the pipe in millimetres.
Material	The code for the material with which the pipe is manufactured - see Pipe Materials Table below.
Class	The class of the pipe - see Pipe Class Table below.
Length	The horizontal length of the pipe between nodes, including the length of any circular arcs.

Date Laid	The date the pipe is laid, in the format dd.mm.yy
Notations	Relevant notations - see the Pipe Notations Table below.

4.4.2 Pipe Materials Table

The following table lists the material code to be used on "as constructed" records for each section of pipe (link) between nodes and includes references to pipe materials which are not in current usage but may be encountered and require recording.

Pipe Material	Material Code	Usage
Polyvinyl Chloride	PVC	
Polyethelyne (High Density)	HDPE	
Polyethelyne (Medium Density)	PE	
Glass Reinforced Pipe	GRP	
Ductile Iron Cement Lined	DICL	
Mild Steel Cement Lined	MSCL	
Copper Pipe	CO	
Asbestos or Fibro Cement	AC	Not in current use
Reinforced Concrete	RC	Not in current use
Cast Iron Concrete Lined	CICL	Not in current use
Galvanised Iron	GAL	Not in current use
Wooden Pipe	WDN	Not in current use
Wrought Iron	WI	Not in current use

4.4.3 Pipe Class Table

The following table lists the pipe classes to be used on "as constructed" records for each section of pipe between nodes.

PVC	HDPE	MDPE	GRP	DICL	MSCL	CO	PE	
CL 12	CL 9	CL 9	10	K 9	N.A.	N.A.	12.5	
CL 16	CL 12	CL 12	12.5	K 12			16	
CL 18	CL 15	CL 15	16					
CL 20			20					

4.4.4 Pipe Notations Table

The following table lists the circumstances where additional notations are to be recorded against pipe links, and the appropriate notation.

Circumstance	Required Notation
Pipe forms part of a scour system	SCOUR
The pipe is in conduit	PIPE IN CONDUIT
The feature is a conduit	CONDUIT
The pipe forms part of a fire service	FIRE SERVICE

4.5 Measurement methods

A combination of a number of measurement methods is possible for locating the horizontal positions of the water assets. The following guidelines should be followed.

The most accurate and preferred method of horizontal location is to use direct radiation method by Total Station or GPS technology. Barwon Water will supply a feature code table to support submission of data in digital format. This does not obviate the requirement for submission of hard copy plans and proformas, which would need to be suitably annotated indicating the existence of digital support data.

All digital data must be on MGA with appropriate corrections for height and grid scale factors applied.

Alternatively, although not preferred, use at least two direct distance measurements to title pegs such that the measurement ties intersect at close to 90 degrees at the measurement point. This should be used as often as possible and always used for the "starting point", where running chainage is to be used for subsequent measurements from that point. Distance ties to existing fences are not acceptable.

Care should be taken when running chainages are used along water mains in the following circumstances:

- Where steep gradients are involved and no slope correction is being applied.
- Where the pipe follows arcs, e.g. around court bowls.

In these situations running chainages must be supplemented by direct distance ties to title pegs at regular intervals.

4.6 Accuracy specification

The accuracy of all surveys to locate the horizontal position of water supply assets with respect to title boundaries or MGA control is to be +/- 30 mm, unless otherwise specified.

The accuracy of all surveys to locate the depth of water supply assets with respect to finished surface level is to be +/- 50 mm, unless otherwise stipulated.

4.7 Water service pipes (Tappings)

The location of water service pipes is to be recorded on the proforma in Section Six. Ties to both ends (tapping point and end of service) are required in MGA coordinates or by direct measurement to title pegs.

The end of service should be measured to at least two (2) title pegs.

4.8 Supply of Information to Barwon Water

All as constructed records must be provided to Barwon Water within 10 working days of the completion of the Works.

5. Sewerage requirements

5.1 Information required

Barwon Water requires "as constructed" information on the height and location of all new sewerage assets associated with gravity sewers and pressure (rising) mains, in a format suitable for recording of the asset data in Barwon Water's GIS. Locations are to be MGA co-ordinates or be with respect to the title boundaries using direct measurement ties to title pegs, running chainages and offsets. All heights are to the AHD unless otherwise stipulated. Where new assets join existing assets, the location and height of the immediate adjoining assets need to be shown.

As constructed survey information for sewer assets may be submitted as a digital AutoCAD .dwg file, if you are utilising the ACDC (As Constructed Design Certification) system* or on the Barwon Water proformas in .pdf files.

* The digital ACDC system submission option is available to approved consultants only. Contact Barwon Water's Geospatial Services on 1300 656 007 to obtain training and become an approved consultant.

The documentation detailing submission requirements and the required template file are downloadable from the 'As constructed package' section of the '[Land development forms](#)' page of the Barwon Water website. All as constructed surveys are to be submitted on the standard Barwon Water proformas.

One page is to be used for each pipe section between access chambers or from an access chamber to an "end of line". The pipe section sketch is to be aligned vertically on the page with the upstream access chamber to the top of the page. A north point **MUST** be provided on each page, and sufficient cadastral detail provided to identify all adjacent lots and streets. Each page is to be signed and dated by the works surveyor.

The proformas have been designed to:

- Provide the recipients with the contact particulars for the consultant and the works surveyor.
- Support the creation of GIS graphics data.
- Simplify the entry of element attributes into Barwon Water's GIS database.
- Ensure all elements are unambiguously located.
- Provide maximum flexibility for the measurement methods used (chainages, offsets, ties, or coordinates)
- Support electronic transfer of "as constructed" records.
- Enable scanning of records.

The works surveyor must supervise the recording of the following information.

Horizontal position and AHD heights at:

- Access chambers
- Ends of lines
- Inspection shafts
- Horizontal bends (rising mains)
- Vertical bends (rising mains)
- Fittings (rising mains)
- Change in pipe characteristics, e.g. diameter, material junctions
- Property connection points
- Ends of conduits
- Vents

These points are defined in more detail in the following definition tables which provide a list of all elements used by Barwon Water for sewerage system definitions, and the attributes which need to be recorded for each element.

5.2 Access chambers definitions

The following tables describe the way Barwon Water defines access chambers, and the appropriate codes to be used when completing the field "Type" under ACCESS CHAMBERS on the sewerage proforma.

5.2.1 Access Chamber Definition Table

Type	Definition	Code
Standard	Where the maximum height differences between the inverts of all inlets and outlets is less than 100 mm.	S
Drop	Where the access chamber has one inlet and one outlet and the height range between the invert of the inlet and the outlet is greater than 100 mm.	D
Multiple Drop	Where the access chamber has more than one inlet and the height range between the inverts of the inlets and the outlet is greater than 100 mm.	M
Access Shaft	The end point of a sewer pipe with access shaft.	E

5.3 Height definitions

The following table defines the height related information to be shown on the sewerage proforma. All heights are to be to the Australian Height Datum (AHD), unless otherwise stipulated.

5.3.1 Heights Definition Table

Height	Definition
NSL	Height of finished surface level adjacent to the access chamber
CL	Height of the rim of the access chamber cover
IL	U/S Access Chamber - Height of invert of sewer pipe at point of departure from the access chamber D/S Access Chamber - Height of invert of sewer pipe at point of entry to the access chamber

5.4 Access chamber cover lid definitions

The following table defines the information required to be provided about the type of cover lid used.

5.4.1 Cover Lid Definition Table

Type	Code
Concrete (Heavy Duty)	CHD
Concrete (Light Duty)	CLD
Cast Iron (Heavy Duty)	CIHD
Cast Iron (Light Duty)	CILD
Gatic or equivalent (Bolt down)	GAT

5.5 Construction method definitions

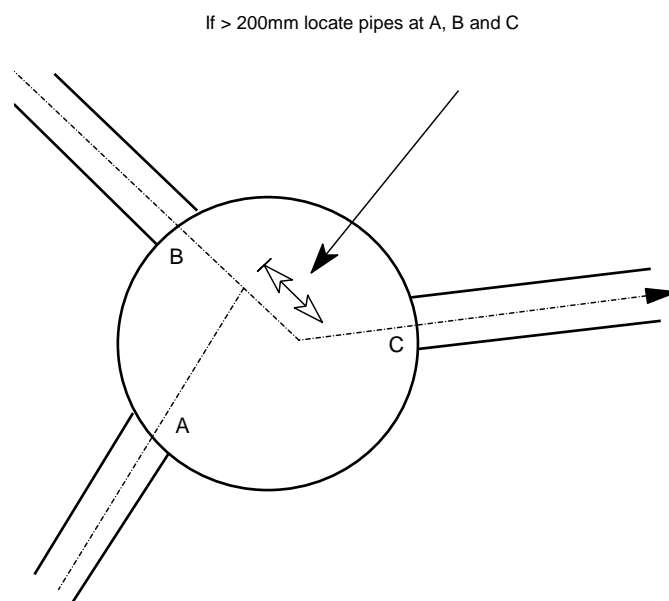
The following table defines the information to be shown about the method of construction used to build access chambers.

5.5.1 Construction Method Definition Table

Method	Code
Method	Code
Concrete Pre-cast	CPC
Concrete Insitu	CIN
Polyethylene	PE

5.6 Use of coordinates

MGA co-ordinates should be used to define the position of access chambers. Barwon Water defines the centre of the access chamber as being at the intersection of the centrelines of the inlet and outlet pipes. Where three or more pipes are involved, and the intersection points are more than 200 mm apart, individual co-ordinates are to be provided at each pipe. See sketch below.



5.7 Pipe sections definitions

For each pipe run between access chambers, Barwon Water requires the following pipe attributes to be recorded on the sewerage proforma in the area provided under PIPE SECTION:

- Diameter (Internal diameter of the pipe in mm)
- Pipe Material
- Pipe Class
- Jointing System used
- Pipe Grade (to be calculated from as constructed information).

Information about the construction method used is to be recorded against a running chainage commencing at the centre of the downstream access chamber. See definition tables below for the appropriate codes for pipe materials, jointing systems, pipe classes and construction method used.

5.7.1 Pipe Materials Table

Material	Code
Polyvinyl Chloride	PVC
Vitrified Clay	VC
Glass Reinforced Pipe (Non pressure)	GRP
Polyethelyne (High density)	PE
Reinforced Concrete Plasti Lined	RCPL

Ductile Iron Concrete Lined	DICL
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5.7.2 Pipe Class Table

PVC Sewer Extra Heavy	VC	GRP	HDPE Profile	HDPE Solid Wall	RCPL	PE	DICL
SN8 (SEH)	CL 4	SN 5000	RSC 400	CL 3	3	HD	PN35
		SN 10000	RSC 800	CL 4.5	4		
			RSC 1400	CL 6	Y		
			RSC 2200				

Where: SN = nominal pipe stiffness RSC = ring stiffness co-efficient

5.7.3 Jointing Systems Table

Jointing System	Code
Solvent welded	SW
Rubber ring	RR
Butt fusion or electrofusion welded	FW

5.7.4 Construction Method Table

Method	Code
Conventional Trenching	CT
Thrust Bored	TB
Pipe Jacked	PJ
Tunnelled	TU

5.8 Property connection branches

For each pipe run between access chambers, Barwon Water requires the following property connection information to be recorded on the sewerage proforma in the area provided under property connection branches:

- Location of each Branch at the sewer main.
- Location and depth to the Entry Point (EP) for each branch.
- Type of Branch
- The length of the Branch

The horizontal location of each Branch and Entry Point is to be shown approximately to scale, as part of the sketch in the area provided on the sewerage proforma. The location is to be fixed by chainage and depth as defined below, supplemented by distance ties and/or offsets to adjacent subdivision pegs.

The following table defines the type of branches used and the code to be used in the field "Type" under property connection branches when completing the sewerage proforma.

5.8.1 Property Connection Branches Definitions Table

Branch Type	Code
Oblique Branch	OB
Type A	A
Type A Special	Sp A
Type B	B
Type C	C
Type TMSP	TMSP
Other	Other
Private rising main	Private RM
Barwon Water rising main	BW RM

5.9 Chainages and depths

Chainage is the horizontal distance to the branch, in metres, measured along the centreline of the sewer pipe, commencing from the centre of the downstream access chamber. Chainage to Entry Points (EP) is measured along the sewer pipe to a point on the sewer pipe perpendicular to the Entry Point.

Depth is the vertical distance, in metres, from the top of the Entry Point, to the finished surface level.

5.10 Rising mains

The works surveyor responsible for the survey aspects of the construction of sewerage rising mains works must supervise the recording of the following information.

Horizontal position and AHD height to the invert of pipe at:

- Horizontal bends
- Vertical bends
- Fittings
- Change in pipe characteristics, e.g. diameter, material junctions
- Ends of conduits
- Pipe junctions
- Receiving access chambers

These points are defined in more detail in the following definition tables, which provides a list of all items used by Barwon Water for Sewer Rising Mains definitions. "Y" indicates the attributes, which need to be recorded for each item. The general term "node" is used to describe point features (e.g. fittings) and other geometry points. The general term "link" is used for pipes and other linear features.

All data is to be provided on the proforma sheets referred to in this manual. The proforma for sewerage is provided in Section Six.

5.10.1 Sewer Rising Mains - Nodes Definition Table

Node Type	Code	Dia. (mm)	Material	Date Laid	Height (AHD)	Horizontal Location	Further Information
Geometry Points							
Data point on main	PT	Y	N	N	Y	Y	
Conduit terminals	C	Y	N	Y	Y	Y	
Standard Bends							
90 degree Bend	90 deg (H or V)	Y	Y	Y	Y	Y	
45 degree Bend	45 deg (H or V)	Y	Y	Y	Y	Y	
22.5 degree Bend	22.5 deg (H or V)	Y	Y	Y	Y	Y	
11.25 degree Bend	11.25 deg (H or V)	Y	Y	Y	Y	Y	
Fittings							
Stop valve	SV	Y	Y	Y	Y	Y	
Non return valve	NRV	Y	Y	Y	Y	Y	
Gas release valve	GR	Y	Y	Y	Y	Y	
Reducer	RED	Y	Y	Y	Y	Y	Record larger diameter
Vent	V	Y	Y	Y	N	Y	Vent diameter
Oxygen Dosing Point	OD	N	N	Y	N	Y	
Material junction	MAT	Y	Y	Y	Y	Y	
Flowmeter	FM	Y	N	Y	Y	Y	
Tee junction	T	Y	Y	Y	Y	Y	Record larger diameter
Scour Tee	SCT						
Scour valve	SC	Y	Y	Y	Y	Y	

Where:

Code	Code is the abbreviation to be used on "as constructed" proforma sketches to describe each node
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Dia. (mm)	The diameter of the fitting in millimetres
Material	The code for the material with which the fitting is manufactured - see Fittings Materials Table below
Date Laid	The date on which the fitting is installed in the format dd.mm.yy
Height (m)	The AHD height at the invert of the main
Horizontal location	The horizontal position of the node fixed by ties to pegs, chainages offsets or co-ordinates

5.10.2 Fittings Materials Table

Material	Code	Material	Code	Material	Code
Mild Steel Cement Lined	MSCL	Ductile Iron Cement Lined	DICL	Polyvinyl Chloride	PVC
Cast Iron Cement Lined	CICL	Polyethylene	PE		

5.10.3 Sewer Rising Main Pipe Definition Table

All pipes are recorded as links between nodes. The following table lists the attributes that are to be recorded for each link and the required format of the data.

Pipe Attribute	Information and Format Required
Diameter	The internal diameter of the pipe in millimetres.
Material	The code for the material with which the pipe is manufactured - see Pipe Materials Table below.
Class	The class of the pipe - see Pipe Class Table below.
Length	The horizontal length of the pipe between nodes, including the length of any circular arcs.
Date Laid	The date the pipe is laid, in the format dd.mm.yy

5.10.4 Pipe Materials Table

The following table lists the material code to be used on "as constructed" records for each section of pipe (link) between nodes and includes references to pipe materials which are not in current usage but may be encountered and require recording.

Pipe Material	Material Code	Usage
Polyvinyl Chloride	PVC	
Polyethelyne (High Density)	PE	

Polyethelyne (Medium Density)	MDPE	
Glass Reinforced Pipe	GRP	
Ductile Iron Concrete Lined	DICL	
Mild Steel Concrete Lined	MSCL	
Asbestos or Fibro Cement	AC	Not in current use
Reinforced Concrete	RC	Not in current use
Cast Iron Cement Lined	CICL	Not in current use

5.10.5 Pipe Class Table

The following table lists the pipe classes to be used on "as constructed" records for each section of pipe between nodes.

PVC	HDPE	MDPE	GRP	DICL	MSCL	RCPL	PE
CL 12	CL 9	CL 9	10	K 9	N.A.	3	HD
CL 16	CL 12	CL 12	12.5	K 12		4	MD
CL 18	CL 15	CL 15	16			Y	
CL 20			20				

5.11 Measurement methods

A combination of a number of measurement methods is possible for locating the horizontal positions of all sewerage assets. The following guidelines should be followed.

The most accurate and preferred method of horizontal location is to use direct radiation method by Total Station or GPS technology. Barwon Water will supply a feature code table to support submission of data in digital format. This does not obviate the requirement for submission of hard copy plans and proformas, which would need to be suitably annotated indicating the existence of digital support data.

All digital data must be on MGA with appropriate corrections for height and grid scale factors applied.

Alternatively, although not preferred, is to use at least two direct distance measurements to title pegs such that the measurement ties intersect at close to 90 degrees at the measurement point. Distance ties to existing fences are not acceptable.

Where sewers run parallel to property boundaries offsets should be provided to title pegs and crossing property boundaries and /or existing fences located by running chainages measured from the centre of the downstream access chamber.

Care should be taken when running chainages are used along sewer pipes in the following circumstances:

- Where steep gradients are involved and no slope correction is being applied.
- Where the pipe follows arcs. Tangent chainages and radius of curve measurements are required.

In these situations running chainages must be supplemented by direct distance ties to title pegs at regular intervals.

5.12 Accuracy specifications

5.12.1 Horizontal accuracy

The accuracy of all surveys to locate the horizontal position of sewerage assets is to be +/- 30 mm, unless otherwise specified.

5.12.2 Vertical accuracy

The accuracy of all surveys to locate the height of sewerage assets with respect to AHD site bench marks is to be +/- 10 mm, unless otherwise stipulated and all heights are to be quoted to the nearest 10 mm.

The accuracy of all surveys to locate the depth of sewerage assets with respect to finished surface level is to be +/- 50 mm, unless otherwise stipulated.

Consideration must be given in low level regions where gravity sewer mains need to achieve hydraulic flows (grades). Accuracies may need to be 10 mm or less in these instances. Barwon Water's Technical and Spatial Services can assist surveyors to achieve these requirements.

5.13 Supply of information to Barwon Water

All as constructed records must be provided to Barwon Water within 10 working days of the completion of the Works.

6. Proformas

- [Completion of works package](#)
- [Cadastral requirements](#)
- [Cadastral plan](#)
- [Application for waiver for MGA connection](#)
- [As constructed survey data – Water](#)
- [As constructed survey data – Recycled Water](#)
- [As constructed survey data - Sewer](#)

All Survey Manual proformas are available at Barwon Water's [Land Development](#) webpage.