SCIRT Rebuilding Infrastructure

LEARNING LEGACY

Lessons learned from one of New Zealand's most challenging civil engineering projects: rebuilding the earthquake damaged pipes, roads, bridges and retaining walls in the city of Christchurch 2011 - 2016.

# Best practice subsurface utility location

**Story:** Utilities Location and Protection

**Theme:** Programme Management

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A document which contains a set of procedures for the "best practice" mark out and recording of subsurface utilities.

This document has been provided as an example of a tool that might be useful for other organisations undertaking complex disaster recovery or infrastructure rebuild programmes.

For more information about this document, visit www.scirtlearninglegacy.org.nz

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# BEST PRACTICE
# SUBSURFACE UTILITY LOCATION

**SCIRT File Name :** 10001-CN-GE-MO-0001

**Team :** Delivery Management Team

**Revision :** 2

**Date :** 22/04/2013

| Issued for | Author | Approved by | Date |
|---|---|---|---|
| Information | Dave Bain | Tony Gallagher/Paula Lock | 22 April 2013 |

## Contents

# 1 Scope and General Information

## 1.1 Scope

This document is an integrated set of procedures for the 'best practice' mark out and recording of subsurface utilities to ensure that such work is performed safely, effectively and to the highest possible standards.

## 1.2 Definitions:

For the purpose of this document the following definitions apply:

1.1.1 **Subsurface Utility Location**: The co-ordinated application on a given site of detail from as many information sources as possible and the marking out (to a range of prescribed tolerances) on the surface of the ground.
The location process also includes identifying the utility types expected at the given site and noting any other items that might also be of a utility nature. The process also provides for a range of confidences (Quality Levels) to be allocated to each item or cluster of subsurface utilities depending upon the nature of the information sources

1.1.2 **Quality Levels:** A series of four formally-prescribed descriptions, derived from Australian Standard AS5488: 2013 but selectively re-interpreted by SCIRT to tighter tolerances of depth and positional accuracy, of the various sources of information for determining the final marked out location of subsurface utilities to a given confidence level. The Quality Levels range from D to A, with the latter having the highest confidence levels in the certainty of the depth, nature, and position of any subsurface infrastructure so identified. – Refer Appendix 8

1.1.3 **Plans:** The paper or electronically-supplied records of subsurface utilities for a given site, generally provided by each asset owner who has utilities at that site. These

- May contain records of depth, route run, cross-sectional details, measurements off identified datums, and depths.
- Are to be regarded as being guides only to the location of the subsurface utilities to which they pertain.
- Must have been sourced from the asset owner within the past 30 days.
- Plans are generally obtained from the Dial Before You Dig service (0800 248 344).

1.1.4 **Ground Penetrating Radar ('GPR'):** A device that is which

- Is mounted on a 4 wheeled cart structure in close proximity to the surface of the ground
- Contains at least a transmit antenna, a receive antenna, associated radar electronics, an odometer to trigger the transmitting function at regular intervals, and a suitable display/controller device
- Uses frequencies between 250MHz (megahertz) to 1000 MHz
- Can be calibrated to take account of ground conditions and proved accurate depth information.
- Is operated by a trained person that understands how to interpret the results from the survey in the context of local conditions they observe and by correlating the output with anticipated target shapes and outlines.

1.1.5 **Pipe and Cable Tracer**: A device to trace and determine the horizontal position of subsurface utilities of a metallic nature. Such a device consists of two separate devices, a transmitter and a receiver. Each will

- Allow the use of at least two frequencies, a low frequency of about 512 Hz or 815Hz to allow for physical coupling to metallic items that are de-energised, and a high frequency of around 82 kHz (kilohertz) that is used to induce signal into a metallic utility when placed above and parallel to it.

- Have transmitter powers in the range of 1-10 watts. The transmitter may also be equipped with a clamp-type antenna as an option, allowing a nominal 82kHz signal to be induced into a specific utility which the clamp is placed around.
- A Sonde operating at 512 or 815 Hz, and connected to a camera or drain rod and pushed up a pipe, may also be used as the transmitting source.

1.1.6 **Mark-out:** The recording on the ground surface at the nominated survey site of Horizontal positions of all centre lines corresponding to the horizontal position of each subsurface utility, along with a brief descriptor of each utility type. Depth to the top of each utility can also be recorded.

Marks on the ground are in laid up in various colours of spray paint according to the SCIRT guideline in Appendix A. Indications of the extent of contiguous targets (e.g.: ducts laid by one asset owner) can also be recorded in the mark-out detail. The final mark out, if being done for planning purposes or significantly ahead of construction work, or if specifically sought by SCIRT, can be recorded by manual use of a GPS unit having horizontal spatial accuracy of +/- 100 mm or better (or +/- 50 mm in depth and position if working on SCIRT Q/L B accuracy mark out).

1.1.7 **Potholing:** Digging one or more small-scale test holes to locate subsurface utilities to Quality Level A. Can be completed using hydro or vacuum excavation, as opposed to careful hand digging.

# 2 Subsurface Utility Location Application & Planning

## 2.1 Application

The co-ordinated and systematic application to SCIRT procedures of the following information and geophysical survey techniques to

- Provide an adequate level of confidence in location of subsurface utility that permits informed engineering design ahead of a civil engineering project.
- Allow the safe excavation
- Mitigate risk to the subsurface utilities,
- Ensure the health and safety of workers,
- Ensure productivity is maintained
- Minimise unplanned disruption and delay

The location of subsurface utilities includes sourcing information from

- Surface observations of marks, covers, trenches, depressions, outlets, building features relevant to termination of utilities, visible utilities (e.g.: drains in sumps), bollards of all types, lamp-posts, and hydrants.
- Anecdotal history of area (e.g.: previous site uses, road widening evidence)
- Dial-Before-You Dig records for the site
- Plans and records provided by the utility owners known to have subsurface utilities on the site
- Detail provided by surface based geophysical technologies including GPR, Cable and Pipe Tracers, Sondes, Pipe Cameras, Water Hammer devices, Ferrous Metal Locators (for buried hatch covers), and hydraulic/vacuum excavation.

The range of techniques used from the list above may vary depending on local site conditions and the Quality Level required .

Where certain of the above tools cannot be applied (e.g.: not being available) the application of fewer of the technologies or options above might be called for, resulting in a reduced outcome quality that will still inform the users of the information accordingly.

The key benefit of a correctly-applied approach to this art is the highest possible confidence in the knowledge of the location and depths of the subsurface utilities prior to exposing or working around them in any subsequent work carried out informed by such information. In addition, one may list:

- Minimised risk of injury or death to workers on the site
- Minimised risk of construction delays or cost escalations due to consequences arising from Utility strikes during subsequent work
- Minimised risk to corporate, professional, or individual reputation
- Optimal planning for cost-effective modifications to utility siting or interaction with other items in proximity
- Opportunity to improve the quality of the 'as-built' records for the site

## 2.2 Planning for a site mark-out

- Ensure the site requiring mark out is clearly identified and that the required Quality Level is defined in advance of commencing work (Refer Appendix C – Utilities Location Briefing Form)
- Organise any traffic management required
- Contact Dial-Before-You-Dig prior to obtain all plans and records prior to arriving on site.
- Study plans for completeness prior to arriving on site and confirm any details not clearly described (e.g.plan scale or clutter at any given point).
- Consider what survey pattern/strategy is appropriate and plan for an optimum outcome by taking into account local site conditions that might influence results (e g; hilly terrain, uneven ground, known site issues )
- Plan for weather conditions, such work is best carried out when there is no rain.
- Upon arriving on site, assess all physical attributes and reconcile these with the details previously obtained to ensure completeness

## 2.3 Marking out a site

1. Use the pipe and cable tracer to confirm the horizontal positions of the metallic assets
2. Horizontal position of non-metallic assets is confirmed by laying tracer wires laid concurrently
3. Correlate these positions with the plans supplied.
4. Depths should not be called with cable and pipe tracer technology unless cross-correlated with first-principles 45 degree nulling-and-symmetry technique.
5. Use a 250 MHz GPR systematically to confirm the horizontal positions of the non-metallic assets or those marked out via tracer wire methods, correlating these with the plans supplied.
6. All depths called must be confirmed with the GPR as practicable
7. Ensure that the GPR survey pattern is such as to cross all targets perpendicularly so as to ensure no errors in depth readings.
8. Use the GPR to confirm that the target size conforms to the expected target size
9. Use GPR in a 'contextual' fashion, observing signs of isolated trenches or disturbances with expected target location
10. Enhance target clarity by ensuring survey depth window is nominally twice the penetration depth.
11. Signal strength of targets should be used to confirm or correlate target material (e.g.: Metal vs. non-metal).
12. Ensure that there is a cross-correlation with surface markers and identifying features for each given utility type.
13. If unknown targets are observed on a given trace, confirm by running parallel sweeps at least 1m to each side to assess correlation of target line.
14. Be aware of the risk of false targets when working with GPR near large trees.
15. Any relevant unusual subsurface features (e.g.: buried man-made targets such as flat-topped surface features, covered tram tracks, slumpage, voids, earthquake damage) observed in the course of the survey should also be recorded or noted and conveyed with the site report.
16. Mark all identified targets on the site to the descriptors and colours as specified in Appendix A, also noting the Quality Level ('Q/L') of any identifications NOT made to Q/L B.

## 2.4 Recording data obtained during a site mark out

All identified targets are to be marked indelibly as per 3.3 (Appendix A) and, unless otherwise instructed, recorded by means of hand-held GPS to a resolution of better than +/- 100 mm in the horizontal plane (or +/- 50mm or better in the vertical and horizontal plane for utilities exposed in the location process). The location contractor has the responsibility of ensuring the GPS survey technique is adequate for the satellite coverage at the site and that the data has been correctly taken. Saved GPS data is to be transferred to the SCIRT database within X working days of the mark-out.

## 2.5 Briefing excavation crews prior to excavation\

If excavation work is to follow the location and mark out process, it is essential that the location contractor formally and fully brief the project engineer and site supervisor as to the nature of the subsurface utilities, the depths and positions (with accuracy statements on all points taken), special features of the site noted in the survey, and any unknown targets observed.

## 2.6 Operator requirements

A single operator is generally all that is required for a mark-out but larger sites may require a second operator for improved efficiency

The operator must have a demonstrated competency in subsurface utility location to SCIRT requirements.

## 2.7 Cable and Pipe Tracer Features and Specifications

With such commonly available technology sold in an extensive variety of packages, the following minimal requirements should be present in such equipment used by the professional location contractor:

- A transmitter with a power of at least 5 watts and preferably 10 watts, capable of maintaining this into a direct connection impedance of 10 kilohms. The transmitter power setting should be adjustable.
- Transmitter frequencies of at least 815Hz and 82 kHz but potentially also including other frequencies such as 8 kHz, and 33 kHz.
- A 100 mm clamp-style antenna accessory and direct-connect leads and earth stake accessory
- An ample supply of transmitter batteries for the day or a rechargeable transmitter
- A receiver with 4 heads and selectable sharp peaking and nulling modes, frequency capability to match the transmitter above, and additional modes of 50Hz and RF. Ideally the receiver should have a spirit level to indicate the 45 degree inclination for conducting the first-principles depth mode effectively.
- Push-button depth modes on receivers are an option but not to be used to determine depths formally

### 2.8 Ground Penetrating Radar ('GPR') Features and Specifications

In order to allow the best combination of penetration depth and identification of weaker reflecting targets (e.g.: air-filled ducts), all surveys carried out must be done at 250 MHz.

Ideally the GPR antenna should be shielded to minimise the effects of surrounding above-ground surface features. Wide-band antennas offering up to +/- 50% of the 250MHz centre frequency offer an advantage in data clarity and ideally antenna used should be as wide band as possible.

GPR units must have practical, quick, and simply-used on-screen means to confirm the propagation speed of the GPR signal in ground at every point at which a depth reading is taken.

Ideally depth ranges and gain on the GPR display should be settable by the operator and adjustable in real time without having to re-trace the surveyed data once a change has been made.

A filter to remove horizontal stratigraphy on the display is a useful feature that should be included.

Whilst trace recording is not required for SCIRT locations, the facility to save and later download a given subsurface feature noted by the operator is encouraged. To this end, associated fudicial marks on the display are an advantage.

## 3 Health & Safety

### 3.1 PPE

In accordance with SCIRT Health and Safety Requirements and Guidelines

## 4 Traffic Management

Suitable traffic management must be arranged in accordance with SCIRT Traffic Management Requirements and Guidelines.

## 5 Environmental Matters

The survey technology has no adverse environmental impact per se. Limited environmental impacts might arise from the placement of markings on the ground so the operator should be mindful at time when marking out to avoid undue or permanent damage to private property or sensitive areas or damage to plantings when using survey or mark-out equipment.

# 6 References

This document has been compiled with the kind support of:

TR Lord and Associates Ltd t/a LORD Civil -

http://www.lordcivil.com/images/stories/news/locatesafe-brochure.pdf

and

http://www.lordcivil.com/products-mainmenu-64/locate-safer-buried-utility-management/268-locate-safer .

**Other References** :

SCIRT DESIGN GUIDELINE - Utilities Coordination and Sub Surface Utilities Information; SCIRT DG 005 Rev 7: 17/04/13

SCIRT, 'Survey Specification – Asset Assessment & Detailed Design, Revision 2.1', 17 Jan 2012.

# 7 Consultation Training Services & Equipment Suppliers

LORD Civil
Christchurch
www.lordcivil.com

GeoSystems Christchurch
Christchurch
www.geosystems.co.nz

Canterbury Locating Services Ltd
Christchurch
canterburylocating@xtra.co.nz

Detect Services Ltd
New Plymouth
www.detectservices.co.nz

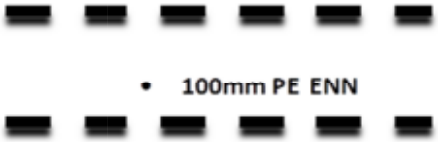
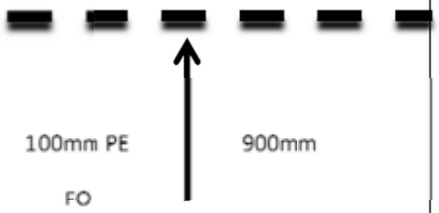
Radar Sub Surface
Lyttleton
www.subsurface.co.nz

Underground Service Locators
Wellington
www.undergroundlocators.co.nz

# 8 Appendix A

## 8.1 Utility Abbreviations & Mark-Out Colour Coding

| Service | COLOUR | Network Operator | Christchurch Marking Convention |
|---|---|---|---|
| Electrical, Lighting, Traffic Signals<br>Lines, Cables and Ducting | ORANGE | Orion | ORN |
| | | CCC (Street lights and Traffic Signals) | CCC |
| Telecommunications<br>Lines, Cables and Ducting | PURPLE | Telecom/Chorus (CHOR) | CHOR |
| | | Telstra (TCL) | TELECOM/CHORUS<br>TCL |
| Ultra Fast Broadband<br>Fibre Optic Cables | PURPLE | Enable | TELSTRA CLEAR<br>ENN |
| Gas | YELLOW | Contact/Rockgas | GAS |
| Potable Water | BLUE | CCC | H2O |

| | | | |
|---|---|---|---|
| **MATERIAL TYPE and SIZE**<br><br>When known, the size, material type and owner of the service shall be indicated at the beginning and end of the locate request area and site specific in between |  | 100mm Polyethylene owned by Enable | • The dot will go where the locator is receiving the centre strongest signal strength |
| **OFFSETS**<br><br>Where possible offset marks should be used in conjunction with colour coding. Offset marks shall include an arrow pointing in the direction of the utility line with the distance in millimetres to the location of the utility line shown on the right hand side of the arrow. Material type and other information on the lefthand side of the arrow |  | 900mm offset to a 100mm PE encased fibre optic cable | |
| **Abbreviations** | | | |
| PE | Poyletheylene | EW | Earthenware |
| PVC | Polyvinyl Chloride | RFC | Reinforced Concrete Pipe |
| HPVC | High density Polyvinyl Chloride | PCCP | Pre Stressed Concrete Pipe |

# 9 Appendix B

## 9.1 Quality Levels

**Quality Level D:**

Utility attribute information from SCIRT GIS shall include:

(a) Utility owner;
(b) An indication of the utility type; and
(c) An indicative location of the visible and subsurface features of the utility.

Tolerance does not apply to an indicative location that is attributed to quality level

**Quality Level C** (as re-interpreted by SCIRT from AS5488):

Quality level C is described as a surface feature correlation or an interpretation of the approximate location and attributes of a subsurface utility asset using a combination of existing records (and/or anecdotal evidence) and a site survey of visible evidence. The minimum requirement for quality level C is relative spatial position.

Attribute information

Quality level C attribute information shall include:

(a) Utility owner;
(b) An indication of the utility type;
(c) An interpolation of the location and direction of the subsurface utility using visible features or GPS coordinates if available, as points of reference;
(d) feature codes of visible features including but not limited to pits, access chambers, poles, valves and hydrants; and
(e) The location of visible features measured in terms of spatial positioning with a maximum horizontal tolerance of +/-200 mm.

**Quality Level B** (as re-interpreted by SCIRT for a greater confidence level):

Quality level B provides relative subsurface feature location in three dimensions. The minimum requirement for quality level B is relative spatial position.

Attribute information

Quality level B attribute information shall include:

(a) Utility owner;
(b) An indication of the utility type;
(c) The location of visible features measured in terms of relative spatial positioning with a maximum horizontal tolerance of +/-100 mm; and
(d) The location of subsurface features measured in terms of relative spatial positioning with a maximum horizontal tolerance of +/-100 mm and maximum vertical tolerance of +/-100 mm.

Where there are contiguous services (e.g. a cluster of Chorus ducts) an indication of the horizontal extent of these shall be recorded to a minimum of Level C

**Quality Level A** (as re- interpreted by SCIRT for a greater confidence level):

Quality level A is the highest quality level and consists of the positive identification of the attribute and location of a subsurface utility at a point to an absolute accuracy in three dimensions. It is the only quality level that defines a subsurface utility as 'validated'.

Where the whole line segment cannot be verified by line of sight, quality level A shall not be attributed to the line segment between validated points.

Attribute information

Quality Level A attribute information shall include:

(a) Utility owner
(b) The utility:
    (i) Type;
    (ii) Status (in service or unknown)
    (iii) Material;
    (iv) Size; and
    (v) configuration
(c) feature codes of visible and subsurface features including but not limited to pits, access chambers, poles, valves, hydrants; and
(d) the location of points surveyed on visible surface and subsurface features measured in terms of absolute spatial positioning with a maximum horizontal and vertical tolerance of +/- 50 mm.

# 10 Appendix C

## 10.1 Utilities Location Briefing Form

| | |
|---|---|
| **Project ID** | *Your project ID here 10XXX* |
| **Project Name** | *Your project name/description here* |
| **From** | *Type your name here* |
| **Contact Details** | *Type your desk and mobile phone numbers here* |
| **Date** | *Type date here* |
| **Requested Due Date** | *Type date information is required by. Be realistic!* |
| **Project Purpose** | *Expand* |
| **Deliverables** | *Clarify format data is returned in; ie 12d file, excel sheet with xyz, CAD file hand drawn sketch, photographs etc* |
| **Known issues?** | *Ie fuel pipe line, level 2 road, NZTA road, private access required, known site contact (provide contact details) etc* |
| **References** | DESIGN GUIDELINE - Utilities Coordination and Sub Surface Utilities Information; SCIRT DG 005 Rev 5: 11/02/13<br>SCIRT, 'Survey Specification – Asset Assessment & Detailed Design, Revision 2.1', 17 Jan 2012. |

| Utility attribute information shall include: | *Quality Level* | | | |
|---|---|---|---|---|
| | ***A*** | ***B*** | ***C*** | ***D*** |
| **1.** utility owner | ✓ | ✓ | ✓ | ✓ |
| **2.** an indication of the utility type; | ✓ | ✓ | ✓ | ✓ |
| 3. an indication of the utility status (in service or unknown) | ✓ | × | × | × |
| 4. an indication of the utility Material | ✓ | × | × | × |
| 5. an indication of the utility Size | ✓ | × | × | × |
| 6. an indication of the utility Configuration | ✓ | × | × | × |
| **7.** an indicative location of the visible and subsurface features of the utility. | ✓ | × | × | ✓ |
| 8. an interpolation of the location and direction of the subsurface utility using visible features or GPS coordinates if available, as points of reference; | × | × | ✓ | × |
| 9. feature codes of visible features including but not limited to pits, access chambers, poles, valves and hydrants; | ✓ | ✓ | ✓ | × |
| 10. the location of visible features measured in terms of spatial positioning with a maximum horizontal tolerance of | 50mm | 100mm | 200mm | NA |
| 11. feature codes of visible and **subsurface** features including but not limited to pits, access chambers, poles, valves, hydrants; and | ✓ | ✓ | × | × |
| 12. Subsurface feature vertical tolerance | 50mm | 100mm | NA | NA |
| 13. Subsurface feature horizontal tolerance | 50mm | 100mm | 200mm | NA |

**Note:** Quality level A is the highest quality level and consists of the positive identification of the attribute and location of a subsurface utility at a point to an absolute accuracy in three dimensions. It is the only quality level that defines a subsurface utility as 'validated'.

Where the whole line segment cannot be verified by line of sight, quality level A shall not be attributed to the line segment between validated points.

(Quality level D is equivalent to the SCIRT GIS system)

Typical pothole ID# format: 10XXX-PH-YYY, where 10XXX is the project number (SCIRT assigned) and YYY is the sequential counter, starting at 001.

| Location ID # | Street | House # | Targeting service of which type<br><br>Pressure main, laterals, all, etc | Original or Make safe pavement<br><br>O/M | Quality Level<br><br>A/B/C | Notify Engineer when digging<br><br>Y/N | Other ie different level of accuracy (state) etc |
|---|---|---|---|---|---|---|---|
| *10999-PH-001* | *Magdala Place* | *1* | *lateral* | *O* | *A* | *N* | |
| 10XXX-PH-001 | | | | | | | |
| 10XXX-PH-002 | | | | | | | |
| 10XXX-PH-003 | | | | | | | |
| 10XXX-PH-004 | | | | | | | |
| 10XXX-PH-005 | | | | | | | |
| 10XXX-PH-006 | | | | | | | |
| 10XXX-PH-007 | | | | | | | |
| 10XXX-PH-008 | | | | | | | |
| 10XXX-PH-009 | | | | | | | |
| 10XXX-PH-010 | | | | | | | |
| 10XXX-PH-011 | | | | | | | |
| 10XXX-PH-012 | | | | | | | |
| 10XXX-PH-013 | | | | | | | |
| 10XXX-PH-014 | | | | | | | |

*In addition, a clearly annotated proposed plan must also be attached and contain the following information:*

- *Project Name and Project Number*
- *Street addresses and house numbers*
- *All known utilities shown*
- *Clearly marked location of the proposed pothole and/or scan areas*
- *The type of the proposed investigation works (laterals, mains etc)*

# 7 Appendix D - DESIGN GUIDELINE - Utilities Coordination and Sub Surface Utilities Information; SCIRT DG 005 Rev 5: 11/02/13

**Stronger Christchurch Infrastructure Rebuild Team**

SCIRT
Rebuilding Infrastructure

**DESIGN GUIDELINE**

| | |
|---|---|
| Number : | 005 |
| Design Group: | GEN |
| Revision : | 19/02/13 |
| Original: | 24/01/13 |

□ Wastewater X Utilities □ Stormwater □ Geotechnical
□ Structures □ Roading □ Water Reticulation

Subject: Utilities Coordination and Sub Surface Utilities Information
.

Original: Design Management

Approved: Paula Lock
Ian Campbell
Tony Gallagher

Updated by : Dave Bain

Keywords:
Utilities, Services, Power, Telecommunication, Gas

The purpose of this guideline is to:

a) Describe the process for ensuring the involvement of utility owners in the design process through all SCIRT gates
b) Provide for the accurate mapping, location and depiction of utilities in three dimensions

## 1. Background

A working group led by SCIRT (Utilities Review Panel) has been established and formal agreement reached to facilitate coordination between utility owners, CCC and SCIRT Design and Delivery teams. Additionally the NZUAG Code of Practice, DOL Guideline and other utility specific regulations include these requirements when working with utilities.
This guideline is consistent with NZ regulations, Australia Standard AS5488 (Draft) for Sub Surface Utility Information and the USA's ASCE 38-02 Standard Guideline for the Collection and Depiction of Subsurface Utility Data.
For the avoidance of doubt, section 2.8. of the NZUAG Code of Practice contains the framework and NZ context for these requirements

Key objectives include

- Ensuring technical issues and costs associated with utilities are incorporated into SCIRT designs.
- Taking a one pass approach to complete utility planned maintenance, upgrades or future proofing at the same time as a SCIRT project where practicable

## 2. Requirements

### Concept Design Stage.

- Include SCIRT UTILITIES Coordinator in Initiation and Risk/Constructability workshops
- Use SCIRT GIS to identify potential conflicts. GIS is an indication only for horizontal position and it must be noted that the accuracy of GIS varies depending on the utility viewed. The Metadata section on the GIS website contains detailed comments from each utility which can be generally summarised as follows:

| Utility Type | Utility Owner | SCIRT Comment on SCIRT GIS/12D Accuracy |
|---|---|---|
| Electricity Overhead and Underground | Orion | Generally accurate to within 1500mm horizontally subject to local ground settlement, lateral spread and alignment of poles, cabinets, distribution boxes and streetlights . No vertical accuracy |
| Fibre Optic Ultra Fast Broadband | Enable | Generally accurate to within 1500mm horizontally and vertically subject to local ground settlement, lateral spread and alignment of cabinets and distribution boxes |
| LPG Gas and Landfill Gas | Contact | Generally accurate to within 1500mm horizontally subject to local ground settlement, lateral spread and alignment of valves and meters. No vertical accuracy |
| Fibre Optic and Copper Telecommunication Overhead and Underground | Chorus | **Underground** Indication only for copper, fibre optic,.A number of redundant cables are buried and most of these redundant cables are unmarked. Further investigation and as builts will be required to confirm location.<br><br>**Overhead** copper and fibre optic is generally accurate to within 1500mm subject to local ground settlement, lateral spread and alignment of poles No vertical accuracy<br><br>**Above ground** cabinets and distribution boxes –indication only Further investigation and asbuilts will be required to confirm location. |
| Fibre Optic and Copper Telecommunication, overhead and underground | Telstra/ Vodafone | Although a few unmarked live services exist, Telstra/Vodafone are generally accurate to within 1500mm horizontally subject to local ground settlement, lateral spread and alignment of poles, cabinets and, distribution boxes. No vertical accuracy |

## Concept Design Stage (continued)

- Any subsurface utilities that are deemed **at risk** by the Designer as a result of SCIRT Design must be identified and their location should be confirmed using one of the survey options below.
- Include discussion with the ECI Coordinator from the allocated Delivery Team on utilities deemed at risk

- When deciding on what utilities are at risk, consideration must also be given to local modified ground conditions, and accuracy of Metadata. Consideration should also be given to the potential for crossovers and deviations from standard alignments.
- Communicate Concept design to utility owners via Project Centre and seek their feedback using the Utilities Design Approval form (UDA) – The UDA form is to be used in conjunction with direct contact/meetings with the Utility Owners to discuss their requirements.

## Detailed Design Stage

- Obtain as builts for **at risk** utilities from each utility owner using the contact details below
- SCIRT 12D files are available for Orion and Enable For Telstra and Chorus please use B4 U Dig. Contact/Rockgas can be contacted directly for plans
- Where risk of a conflict was identified at concept design, then in conjunction with the utility location providers, locations must be confirmed to positively identify the utility and provide locations accurate to a minimum of Level B below. For constructability issues, this process is to include the Delivery Team ECI Coordinator
- Utility location providers to provide information on any potentially relevant features or unidentified services.
- Send Detailed Design and Utilities Approval Form to Utilities companies via Project Centre
- Engage directly with affected utility(s) owners and gain agreement on the design requirements and construction methodology required to protect or relocate the affected utility. The utility owner's agreement to this protection or relocation must be detailed on the UDA form in Project Centre.
- If a utility owner chooses to extend or upgrade their network as part of a SCIRT project then a commercial agreement for this work must be negotiated and agreed by the IST Utility Coordinator. That agreement will include both direct and design costs associated with the extension or upgrade
- Detail for the protection/relocation/upgrade for all affected utilities must be included in the Methodology as part of the ECI documentation. For example: Input from both the designer and ECI coordinator will be required on projects where there is permanent work resulting from SCIRT design and temporary work required as part of Delivery teams construction methodology.

# Survey for Design

This guideline is consistent with NZ regulations, Australia Standard AS5488 (Draft) for Sub Surface Utility Information and the USA's ASCE 38-02 Standard Guideline for the Collection and Depiction of Subsurface Utility Data. For the avoidance of doubt, section 2.8. of the NZUAG Code of Practice contains the framework and NZ context for these requirements

## Quality Level D

Utility attribute information from SCIRT GIS shall include—

(a) utility owner;

(b) an indication of the utility type; and

(c) an indicative location of the visible and subsurface features of the utility.

Tolerance does not apply to an indicative location that is attributed to quality level D.

## Quality Level C

Quality level C is described as a surface feature correlation or an interpretation of the approximate location and attributes of a subsurface utility asset using a combination of existing records (and/or anecdotal evidence) and a site survey of visible evidence. The minimum requirement for quality level C is relative spatial position.

### Attribute information

Quality level C attribute information shall include—

(a) utility owner;

(b) an indication of the utility type;

(c) an interpolation of the location and direction of the subsurface utility using visible features or SURVEY ACCURATE coordinates if available, as points of reference;

(d) feature codes of visible features including but not limited to pits, access chambers, poles, valves and hydrants; and

(e) the location of visible features measured in terms of spatial positioning with a maximum horizontal tolerance of ±200 mm.

## Quality Level B

Quality level B provides relative subsurface feature location in three dimensions. The minimum requirement for quality level B is relative spatial position.

Attribute information

Quality level B attribute information shall include—

(a) utility owner;

(b) an indication of the utility type;

(c) the location of visible features measured in terms of relative spatial positioning with a maximum horizontal tolerance of ±100 mm; and

(d) the location of subsurface features measured in terms of relative spatial positioning with a maximum horizontal tolerance of ±100 mm and maximum vertical tolerance of ±100 mm.
Where there are contiguous services (e.g. a cluster of Chorus ducts) an indication of the horizontal extent of these shall be recorded to a minimum of Level C

### Quality Level A

Quality level A is the highest quality level and consists of the positive identification of the attribute and location of a subsurface utility at a point to an absolute accuracy in three dimensions. It is the only quality level that defines a subsurface utility as 'validated'.

Where the whole line segment cannot be verified by line of sight, quality level A shall not be attributed to the line segment between validated points.

### Attribute information

Quality level A attribute information shall include—

(a) utility owner;

(b) the utility—

  (i) type;

  (ii) status (in service or unknown)

  (iii) material;

  (iv) size; and

  (v) configuration,

(c) feature codes of visible and subsurface features including but not limited to pits, access chambers, poles, valves, hydrants; and

(d) the location of points surveyed on visible surface and subsurface features measured in terms of absolute spatial positioning with a maximum horizontal and vertical tolerance of ±50 mm.

## 1. Approving, invoicing and payment of design costs

**Design Stage**

- Designer liaises directly with utility owner and ECI Coordinator to identify best design for protection or relocation of the utility.
- Designer raises work request for utility location through Asset Assessment Team or Survey Manager.
- Designer requests assessment/design and cost estimate from utility owner using UDA form or general correspondence in Project Centre
- Where the utility owner has chosen to extend or upgrade their network in as part of a SCIRT project then a commercial agreement for this work must be negotiated and agreed by the IST Utility Coordinator.
- Where work is for protection or relocation as a result of SCIRT design, utility owner completes assessment/design and invoices SCIRT for this work
- Designer includes relocation of utility in Detailed Design Drawing
- Design Team codes invoice to Design as follows:

| Design Stage | Project Number | Full Code |
|---|---|---|
| **Concept Design** | **10xxx** | **10xxx 10.8500** |
| **Detailed Design** | **10xxx** | **10xxx 15.8500** |
| **For example:** | **10234** | **10234 10.8500** |
| | | |

1. Invoice is approved by Design Manager

NB: Construction Coding must include Project Number 10XXX, GL code 8500, Full code 10XXX 8500

# Plan Requests

When requesting plans, please ensure you provide:

- A clear description of the area concerned, preferably with a copy of the street layout
- Where 33kv or 66kv electrical cables are present, Orion representatives must be notified directly

| Service Authority | | Phone Number | Fax / E-mail/website |
|---|---|---|---|
| **Orion NZ Ltd** | | All requests to be made via the web page. | Underground requests at: www.oriongroup.co.nz |
| **Chorus/ Telecom NZ Ltd** | | | |
| (including old Gas lines which are on CD) | | BeforeUdig 0800-248 344 | www.beforeudig.co.nz |
| | | 0800 248 747 | planrequest@beforeudig.co.nz |
| **Gas - Rockgas** | | | |
| Plans and notifications: | | All requests via email to | LPGAsBuiltAdminRequest@contactenergy.co.nz |
| Delwyn Harrison | | 373-6464 | delwyn.harrison @contactenergy.co.nz |
| Project Engineer: Wai Yu | | 373-6448 | wai.yu@contactenergy.co.nz |
| **Enable Networks** | | 0800 434 273 | |
| **TelstraClear** | | BeforeUdig 0800-248344 | www.beforeudig.co.nz |
| | | 0800 248 747 | planrequest@beforeudig.co.nz |
| Plan interpretations | | 0508-651-050 option 2 | |
| **Liquigas (Lyttelton to city)** | Les Nelson | 033842481 | les.nelson@liquigas.co.nz |

**CONTACT DETAILS**

| Company | Utility | Full Name | Business Phone | Mobile Phone | E-mail |
|---|---|---|---|---|---|
| Chorus | Telecommunications | Richard Clark(Transfield) | 033750667 | 0274906098 | richard.clark@transfieldservices.co.nz |
| Chorus | Telecommunications | Garry Sandford (Downers) | 033393366 | 0274384719 | garry.sandford@downer.co.nz |
| Connetics | Street Lighting | Tony Walker | 033537246 | 0274380758 | walkera@connetics.co.nz |
| Connetics | Street Lighting | Steve Muir | 033537341 | | muirs@connetics.co.nz |
| Contact Energy | Gas | Wai Yu | 033736413 | | wai.yu@contactenergy.co.nz |
| Contact Energy | Gas | Delwyn Harrison | 033736424 | 0276875069 | delwyn.harrison@contactenergy.co.nz |
| Enable Networks | Ultrafast Broadband | Andy Cullen | 033351795 | 0274373831 | andrew.cullen@enablenetworks.co.nz |
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| KIwirail | Rail Crossings | Wayne Ramsay | 033393978 | | wayne.ramsay@kiwirail.co.nz |
| Orion | Electricity Network | Mike Miles | 033639824 | 0274326830 | mike.miles@oriongroup.co.nz |
| Orion | Electricity Network | Fiona McMahon | 033639826 | | Fiona.mcmahon@oriongroup.co.nz |
| Telstra | Telecommunications | Richard Schoeman | 039826596 | 0299826596 | richard.schoeman@telstraclear.co.nz |
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