PLUMBER

SAQA 91782

Learning Area 3

Read and interpret plans/drawings, specifications, documentations and standards

Learning Project 1

Identify, read and interpret architectural and building (basic construction) plans and drawings (incl. simplified sketches for instruction purposes and quantities)

Time allocation: 16 hours

APPRENTICE
WORKBOOK

Apprentice Name and Surname

Before starting with the actual Learning Project, please familiarise yourself with the information on this page!

How to use this workbook

The DSPP learning support material provides additional teaching aids for the knowledge and practical skills modules based on the NOCC-A21 syllabus that was developed according to the new QCTO curriculum. The workbooks supplement the existing learning material available at the TVET colleges and consist of work assignments, which can be used by the lecturers as part of the assessments. The completed assessments will be filed in the Portfolio of Evidence (PoE) and form one of the admission requirements for the trade test at the end of the apprenticeship.

The workbooks focus on practical, workplace-driven aspects and contribute to personal growth and development of the apprentice. The focus is the apprentice!

The workbooks are arranged under headings (viz. Introduction to the Learning Project, Preparation, Theory, Work Assignments and Assessments, Further Development and Workplace Experience), using colours and icons to help the apprentice navigate easily through the workbook and are designed to suit the level of the apprentice. The mentioned time allocation is applicable to the knowledge and practical modules done at the TVET college only.

Below is a short description of the different sections of the workbook.

Introduction to the Learning Project

On page 4 of the workbook, the apprentice is introduced to the Learning Project. The section begins with a motivational quote, picture or story to inspire the apprentice to 'think out of the box' and to apply this mind-set to work with the workbook. With a short paragraph introducing the upcoming Learning Project, the apprentice will have an idea of how the practicals will be applied in class.

Preparation

The next heading "Preparation" is one of the most important parts of the workbook and can be used at the beginning of the Learning Project. The aim is to arouse the interest of the apprentices in the Learning Project by challenging them with problems and questions varying in difficulty and presented in a fun, creative and mostly scenario-based fashion. There is no pressure on the apprentices to have all the answers - this will encourage them to participate.

Theory

The theoretical section entails the formal process of instruction as set out by the NOCC-A21. The lecturer is aware as to the desired outcomes and range of topics and he/she plans the process in such a way that training is effective and completed within the allocated time frame.

Work Assignments & Assessments

Work assignments are completed by apprentices in order to assess their knowledge and skills and to determine effectiveness of the training against the stated outcomes. The assessments and evaluations are done objectively and present an opportunity to identify and schedule remedial activities. These must be formally agreed upon between the apprentice and the lecturer. Furthermore, the assessments serve as proof for the completed knowledge and practical skills modules in the Portfolio of Evidence (PoE).

Further Development & Workplace Experience

"Further Development" aims to allow apprentices to delve deeper into the featured topics. The format may include references to websites, books, documents, projects or experiments. Lecturers do not formally keep track of apprentices' activities in this section. The employment of the apprentices at the workplace is aimed to provide "real-life" work experience. The "Workplace Experience" section of the workbook ensures that apprentices complete a variety of tasks at the workplace.

ENJOY THE PROCESS!

LEARNING AREAS		LEARNING PROJECTS	
LA 1	Prepare and plan for work	LP 1	Identify, read and interpret architectural and building (basic construction) plans and drawings (incl. simplified sketches for instruction purposes and quantities)
LA 2	Use and care of basic trade- specific hand- & power tools, measuring and testing devices, equipment and materials	LP 2	Identify, read and interpret engineering drawings and specifications
LA 3	Read and interpret plans/drawings, specifications, documentations and standards	LP 3	Use plumbing manufacturer and supplier documentation
LA 4	Install and test below ground (waterborne) drainage system	LP 4	Use plumbing regulations and standards (SANS)
LA 5	Install, maintain and test above ground soil, waste and vent systems		
LA 6	Install and maintain basic sanitary ware fixtures (basin, wc, shower)		
LA 7	Install and test cold and hot water distribution/ reticulation systems		

My progress in becoming a ***Professional Plumber***

Figure 1

Do you agree with the above statement? How will you contribute?

.....

.....

.....

.....

.....

1. Introduction to Learning Project 1

Architectural plans and drawings form the basis of construction work. They illustrate to plumbers and other contractors exactly what is expected of them.

Being able to correctly interpret these plans is a vital skill you will need throughout your career. You will get a better idea of how to read and interpret such plans and drawings in this Learning Project, as well as exercise your skills in drawing to enhance your understanding.

You will encounter one of the many aspects of "art" in the plumbing profession. Have fun with it!

2. Preparation

The purpose of architectural drawings vary, but all are technical drawings of buildings. We all know that an architect plays an important role in the design and development of construction projects.

The drawings and specifications developed by the architect are the foundation of everything that you as a plumber, and all other members of the construction team will do.

It is important, therefore, that you clearly understand architectural drawings. Your distribution and installations must fit the architectural design, and will be drawn into the architectural plan for planning purposes.

An architectural drawing is basically a manual for a building. The architectural drawing is an illustration of what the final product will look like, plus an instructional tool on how to achieve it. Architectural drawings can be devoted to depicting an overview of the building (i.e., an elevation), or they can focus on a particular element (a detail).

Basically, architectural drawings are categorised as:

ARCHITECTURAL DRAWINGS	
Block plan	Exploded drawings
Floor plan	Isometric projections
Site plan	Axonometric projections
Elevation	Survey drawings
Cross section	Record drawings
Detail drawings	Working drawings

Let us view some examples:

Block plans

(common scales 1:500, 1:1250, 1:2500)

Block plans show the siting of a project in relation to Ordnance Survey Maps. Boundaries, roads and other details are shown.

Figure 2: Block plan

Site plans

(common scales 1:200, 1:500)

Site plans focus on the site itself, and not the surrounding area and usually show the following:

- The location of the building
- Topography of the site (existing and finished levels)
- Roads, paths, paved areas and plants
- Objects / buildings to be demolished
- Earthworks required, including cutting and filling, and the provision of bank and retaining walls
- All external services
- Water, gas and drainage layouts
- Electricity layout, telephone layout
- Walls and fencing
- Gates
- Other external components such as litter bins

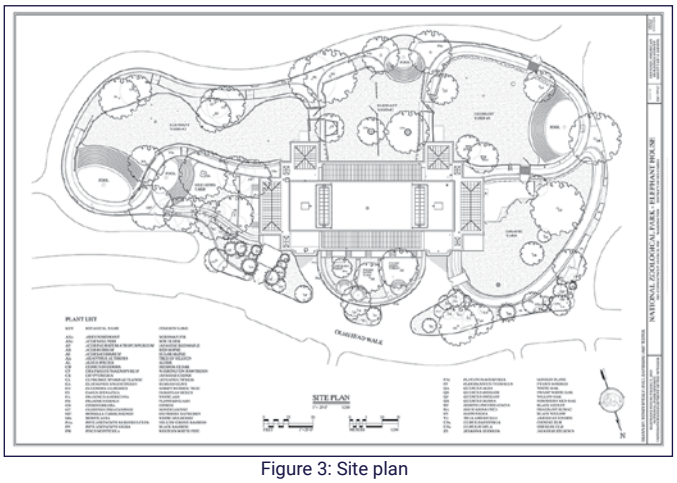


Figure 3: Site plan

Floor plans

(common scales 1:50, 1:100, 1:200)

A floor plan is a drawing to scale, showing a view from above of the relationships between rooms, spaces and other physical features at one level of a structure.

Dimensions are usually drawn between the walls to specify room sizes and wall lengths / thickness. Floor plans may also include details of fixtures like showers, geysers, etc. Floor plans may include notes for construction to specify material, finishes, construction methods, or symbols for electrical items.

To be able to differentiate between all the information, different line types and thickness of lines are used.

Basic floor plan

If a set of working drawings for a project is prepared, the floor plans should include the following elements:

a.	Walls and partitions	b.	Main openings in walls (i.e. doors and windows) and partitions (walls)
c.	Door swing	d.	Room names and if necessary numbers
e.	Stairs (in outline)	f.	Grid references (when applicable)
g.	Services	h.	Furniture (fixed and loose if necessary)
i.	Fittings		

Mark all above-mentioned elements that you can identify in the floor plan on the right with the respective letter (a-i).

Notes:

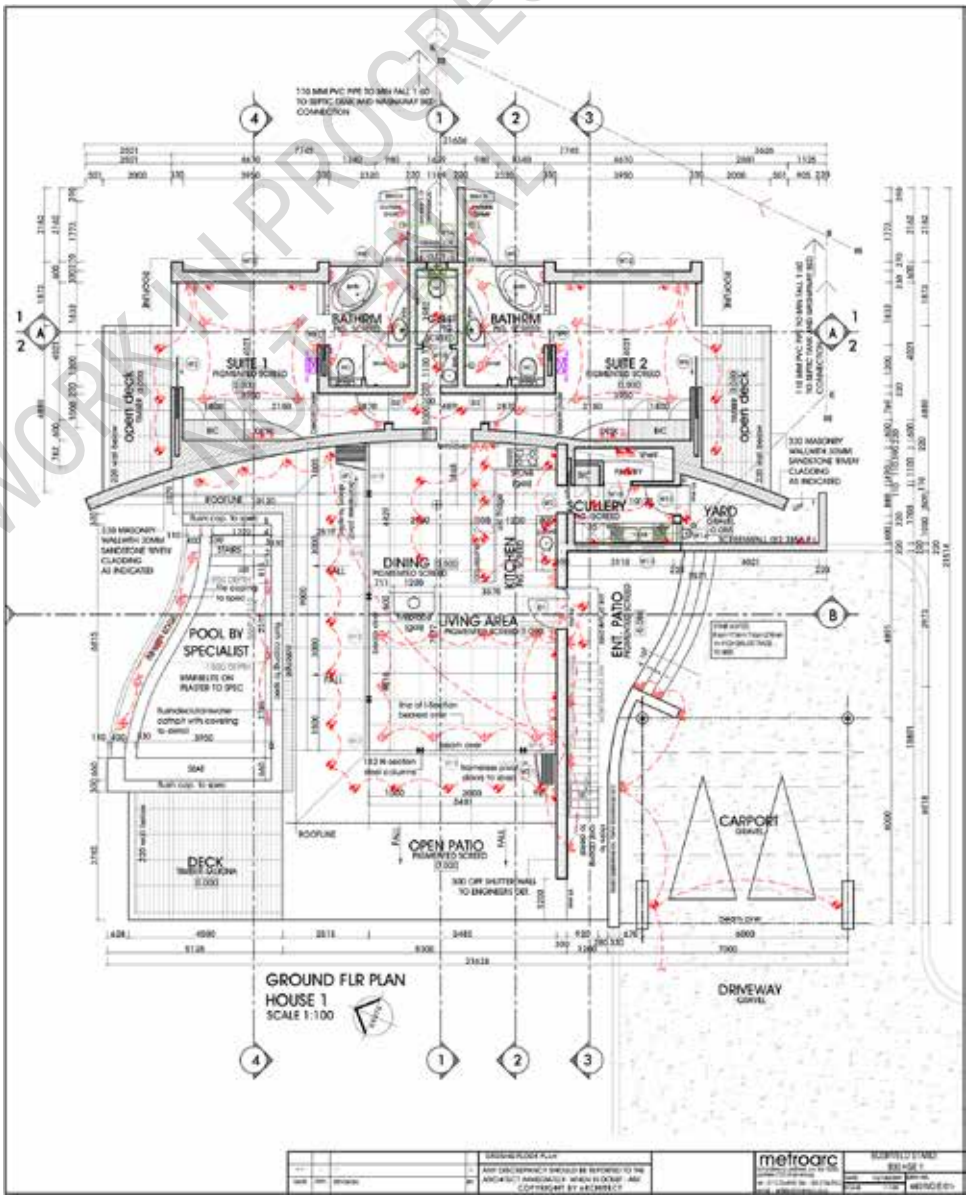


Figure 4: Floor plan

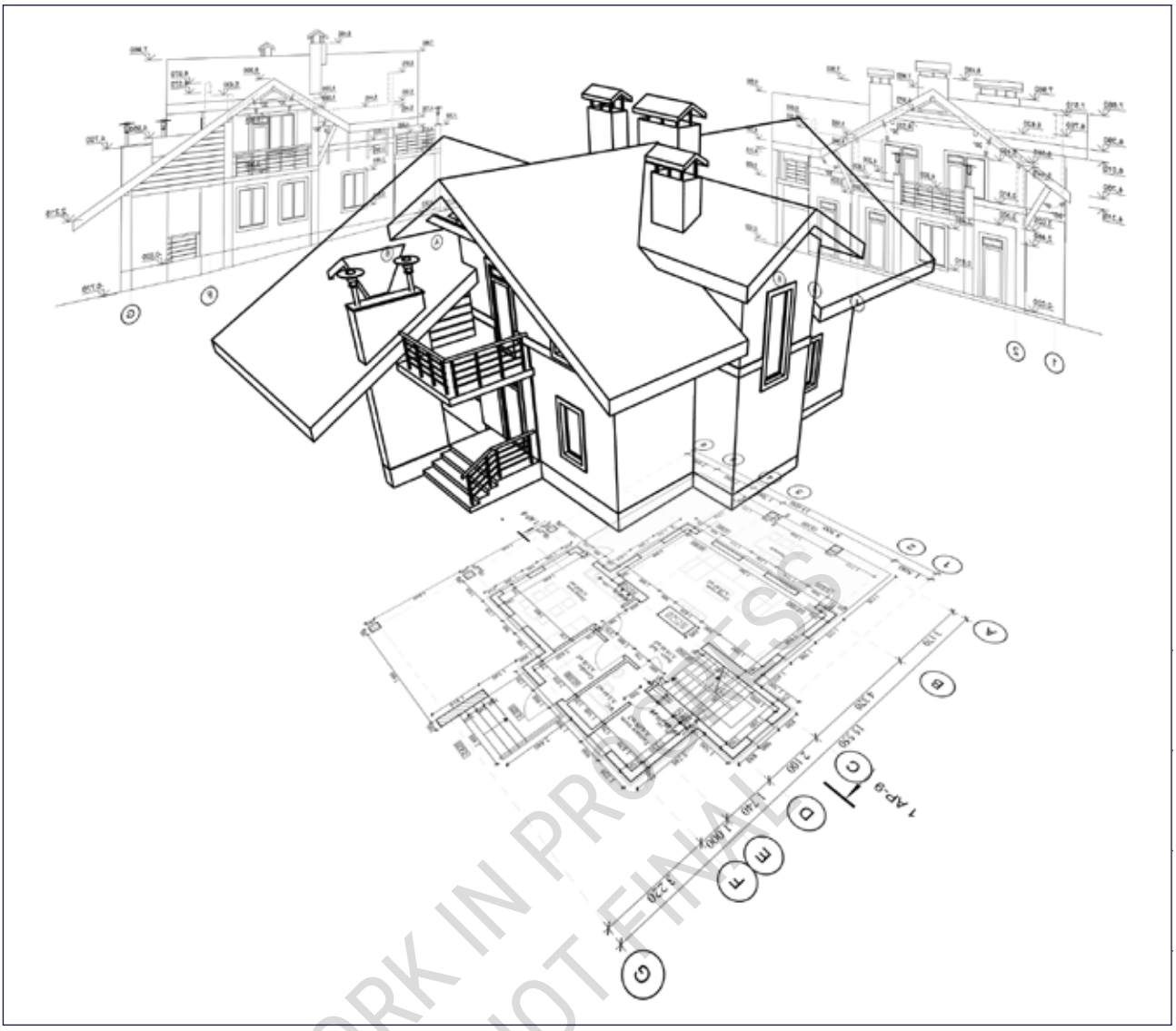


Figure 5: ????

Study Figure 5 above, what drawing is shown in the picture?

Can you identify a floor plan in the drawing? If yes, use a color pen and outline the floor plan on the drawing.

Cross sectional drawing

How do you know that the drawing on the right is a "cross section?

Figure 6: Cross section

Can you think of reasons why cross sectional drawings are used?

Elevation drawing

What is the use of an elevation drawing?

What are the most important facts that you can gather from this kind of drawing?

Figure 7: Elevation

In which way does this detailed architectural drawing differ from the previous two drawings?

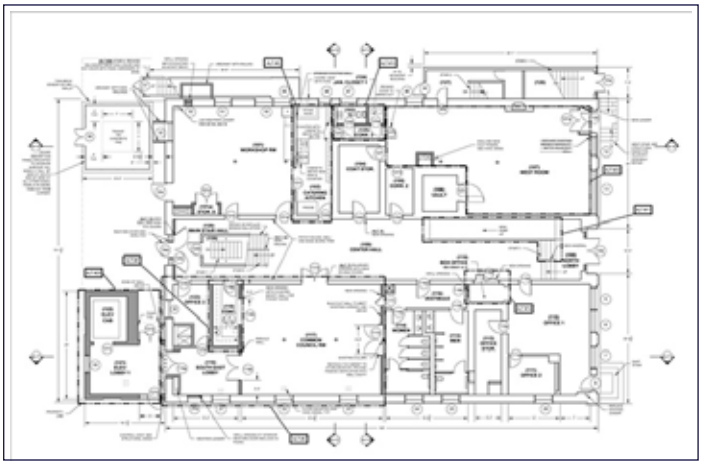


Figure 8: Detailed drawing

Study the list below and determine whether you can find the information on any of the three drawings that we have looked at.

Using the below table, indicate whether the information is illustrated in the specific drawing. If not, note that it is lacking and indicate in which of the three drawings you would expect to find the information.

	Cross Sectional Drawing	Elevation Drawing	Detailed Drawing
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			

1. Read and interpret the title block and find drawing number
2. Establish whether plans are approved and current
3. Interpret plumbing related symbols
4. Understand the application of the scales on the drawing versus actual measurement on the ground
5. Identify the boundary pegs
6. Distinguish the direction of the contours
7. Locate and explain the purpose of the specifications
8. Determine the servitudes and connection points
9. Clarify the orientation of the building on site
10. Position the routing of the drainage system
11. Calculate the gradient from information given
12. Check the drainage system against site plan
13. Determine the height of the finished floor level
14. Identify the position of sanitary fittings
15. Position and layout of hot water reticulation
16. Position and size of water connection
17. Find reticulation and pipe sizing
18. Review plumbing elevations

Questions I want to ask in class...

3. Theory

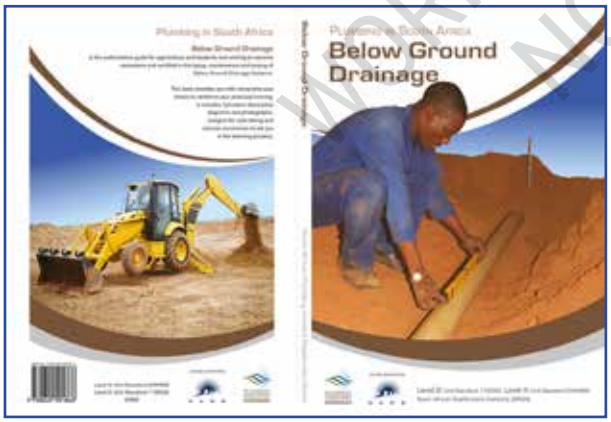
Underpinning Knowledge

The Underpinning Knowledge section is made up of the detailed description of what you should know and be able to do at the end of the Learning Project.

The lecturer will lead you through a process during which you will deal with these topics.

The Work Assignments and assessments are designed to test your understanding of the various topics.

My books for this Learning Project



Practical Skills Modules Content

Apprentices must be able to do/perform the following (hard and soft) skills:

Planning/ Preparation/ Sourcing/ Implementation/ Execution/ Processing

- Read and interpret title block and find drawing number
- Establish whether plans are approved and current
- Interpret plumbing related symbols
- Understand the application of the scales on the drawing versus actual measurement on the ground
- Identify the boundary pegs
- Distinguish direction of the contours
- Locate and explain the purpose of the specifications
- Determine the servitudes and connection points
- Clarify the orientation of the building on site
- Position the routing of the drainage system
- Calculate the gradient from information given
- Check drainage system against site plan
- Determine the height of finished floor level
- Identify the position of sanitary fittings
- Position and layout of hot water reticulation
- Position and size of water connection
- Find reticulation and pipe sizing
- Review plumbing elevations
- Draw a simplified sketch based on architectural drawing

Evaluation/ Documentation/ Housekeeping

- Fold plans as per standards
- Store plans according to standards

Underpinning Knowledge Modules Content

Knowledge of:

- SANS 10400, 10252 Part 1+2, 10254, 10106, 1352
- Sources of architectural drawings
- Architectural drawings, their key elements and purpose thereof
- Single line sketches based on drawings
- Plumbing symbols and abbreviations on architectural drawings and their meaning
- The importance of approved and up-to-date plans
- Transfer of scale to actual measurements
- Appropriate folding, care and storage systems for plans

4. Practical Work Assignments

The aim of the Work Assignments is to determine whether you understand the information that was presented to you during the previous sections and to determine whether you have mastered the necessary skills.

Individual assignments also assess your ability to function on your own, to think creatively and to solve problems - individual assignments are indicated with this icon:

Apart from everything else, **group assignments** measure your ability to work in a team, to communicate effectively, to lead and manage when called upon, etc. Those assignments are marked with this icon:

Auxiliary Calculation / Notes:

Work Assignment 1

Scenario

A good client of the company recently purchased a house in an established suburb in Johannesburg. The house was built in 1965 and has a good basic foundation. However, the bathroom has remained unchanged since the house was built and now requires upgrading.

The client wants your boss to quote him for the complete plumbing installation. He hands him some 3D drawings created using free software downloaded from the internet.

Figure 1: 3D impression of new bathroom

Figure 2: 3D impression of new bathtub

Figure 3: 3D impression of new basin

Task

1.1

It is your task to draw a floor plan with all necessary information for your colleague, who will order the correct length of piping material and execute the installation at a later stage.

The only information in addition to the client's 3D drawings is the following:

- Room size 39,2 m³
- Width of room 35 dm
- Floor size 140 000 cm²
- Floor/ wall tile 600 x 600 x 8 mm
- Waste water pipe (stack) diameter 70 mm

For all further dimensions, you will need to measure in Figures 1-3 and make your calculations in relation to the information given.

Make a sketch of a floor plan including all the information you think is necessary (use the floor plan on page 6 as reference).

Space for drawing:

1.2

Currently your boss only marks his drawings by putting a company stamp on the individual pages. You suggest using a title block instead; he agrees and asks you to design one for his company "Watergirls Pty Ltd."

He suggests the following information to be added to the title block. Go through the list and explain the relevance of each of the details your boss wants to have added to the title block.

- Drawing number

- Scale

- Reference number

- Drawn by, incl. date

- Checked by, incl. date

- Company name

- Company logo

- Block for amendments

- Client name

- Project number

- Project name

Is there any information you think is missing?

1.3

Draw a title block for your company, including all necessary information, and present it to the rest of the class for discussion.

Space for drawing:

1.4

The client's new bathroom is situated on the second floor of a building. The waste water stack is running from the top floor straight down to the ground as indicated in Figure 1.

Make a drawing to illustrate the waste pipes running to the basins and the floor level shower trap keeping in mind a fall of approximately 2%. Show the floor construction, especially the height in a separate drawing.

Space for drawings:

Work Assignment 2

Scenario

Your company was contracted to perform the plumbing installation for a client's new house. For you to get an overview of the size and scope of the project, your boss gives you the site plan of the proposed building. As he made you the project leader for the installation, he wants you to familiarise yourself with the plan and also asks you to determine some information upfront.

Your company secretary copies and prints the plan, as the boss wants to keep the original in his client file for further reference. To fit the plan on an A4 size paper, the secretary reduces the size by half - see site plan Figure 1 below.

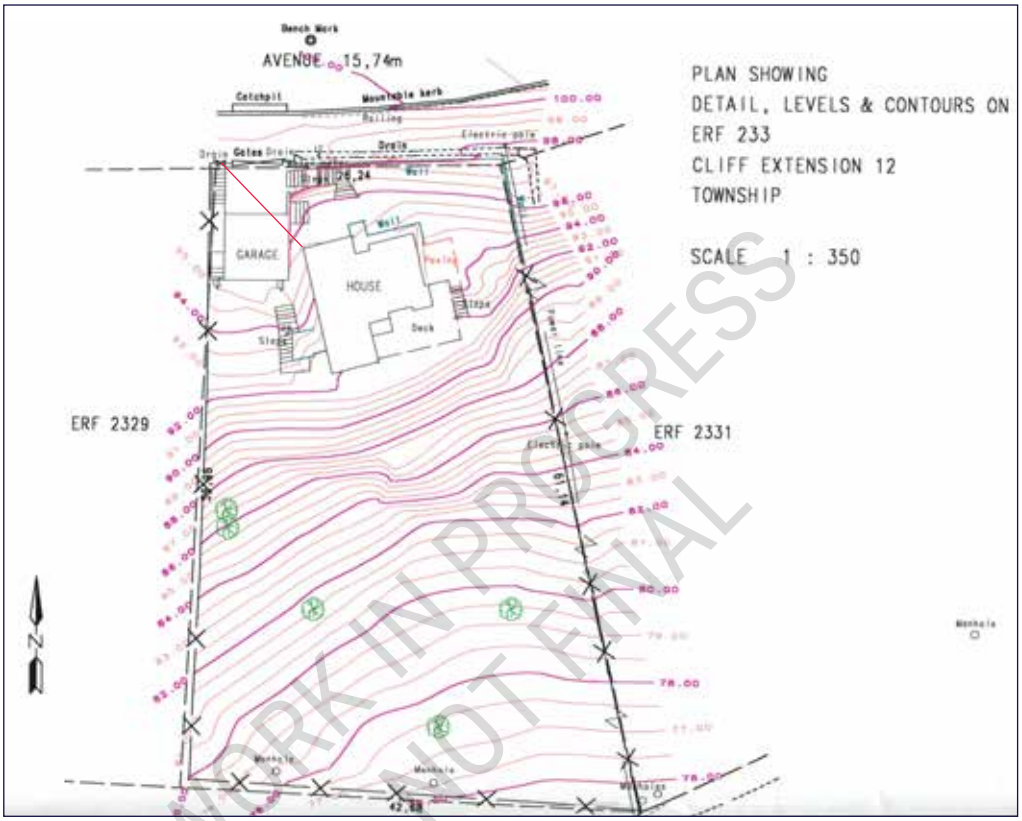


Figure 1: Site plan

Task

2.1

What impact does the reduction in scale by your secretary have? Does the scale still reflect the reality or has the scale changed? If yes, what would the new scale of the plan be?

2.2

The client plans to invest in a solar power system. As the garage will not have a strong enough roof to carry the geyser, the only feasible place to install the panels is on the roof of the house. For maximum generation of solar powered energy, you know that ideally the panel has to be installed facing North.

Your boss wants to calculate the system's efficiency and asks you to determine how much the house is positioned off North (in degrees).

Describe how you will answer his question by using the information given on the site plan. Do you have the necessary information to give him an answer? If not, ask your lecturer for the information you think you might need and calculate the position.

Space for calculations:

2.3

You are busy compiling a list of material and equipment you might need for the job.

Assuming the route for the pipe from the drain outside of the stand to the house is a straight line, as shown with the red line in Figure 1, what is the distance?

Space for calculations:

2.4

Study the site plan, paying special attention to the elevation. What problem might you encounter if you wanted to dig a trench from the house to the manhole in the far South / East corner of the stand?

Discuss your reasoning in class.

PLUMBER
SAQA 91782

Learning Area 3, Learning Project 1

Apprentice name .....

Apprentice number .....

WORKPLACE SAFETY CHECK

Ref	Personal Protective Equipment (PPE)	Y/N
1	Eye and ear protection in use	
2	Personal protective equipment in use	
3	Correct type of gloves used	
4	Safety harness in use	
5	Reflective clothing / hard hats in order	
	Condition of Work Area	
6	Working area safe to use	
7	Platforms, gates, guards, lockout in place/closed	
8	Workers in safe position	
9	No slippery conditions	
	Safety Devices and Protection	
10	All barricades effectively installed	
11	Signal system operational	
12	Work permit in order	
	Portable Electrical Equipment	
13	Cords, plugs, switches inspected	
14	Operators using equipment trained	
15	No faulty or sub-standard equipment / tools used	
16	Welding machine approved, registered, inspected	
17	Safe weld device / soldering device installed and tested	

Ref	Hand Tools / Type and Condition	Y/N
18	Tools clean and in good condition	
19	Guards fitted where required	
20	All hand tools approved / to standard	
21	No defective tools used	
	Lifting Gear / Ladders and Scaffolding	
22	Inspect physical condition prior to use of ladders , complete checklist	
23	Inspect physical condition prior to use of scaffolding, certified by authorised person, safe to use	
24	Lifting equipment safe to use , certified by authorised person	
	Fire Equipment	
25	All fire equipment in working area certified and safe for use	
	Ventilation	
26	All ventilation equipment in workplace operational	
	Permit and Documentation	
27	All permits and documentation in order and approved for specified task	
	Authorisation of Personnel	
28	All personnel qualified and authorised to perform duties as required	

PLUMBER *SAQA 91782* **Learning Area 3, Learning Project 1**	Apprentice name Apprentice number

What safety issues do you consider important when assessing the work area and task? Conduct a risk assessment (HIRA-Hazard Identification Risk Assessment) and complete all documentation.		
WORKPLACE	**WORKPLACE HAZARD IDENTIFICATION MUST BE DONE DAILY BY THE CANDIDATE IN THE WORKPLACE** **Also note and report hazards to and from workplace**	**ASSIGNMENT NUMBER**
LEARNING AREA	**HIRA-HAZARD IDENTIFICATION RISK ASSESSMENT**	**DATE**
HAZARD NUMBER	**HAZARDS (DEVIATIONS) IDENTIFIED**	**REMEDIAL ACTIONS TAKEN**
SIGNATURES		
Apprentice		
Team Member		
Safety Representative		
Artisan		
Supervisor		

5. Assessment

PLUMBER *SAQA 91782* **Learning Area 3, Learning Project 1**	..... Apprentice name ..... Apprentice number

GENERAL PROCESS ASSESSMENT *(0 - 10 points per criteria)*					
EVALUATION CRITERIA	**Excellent** *(9 - 10 points)*	**Very Good** *(7 - 8,5 points)*	**Good** *(5 - 6,5 points)*	**Average** *(3 - 4,5 points)*	**Below Average** *(0 - 2.5 points)*
Participation					
Attitude					
Initiative					
Creativity					
Grasp					
Knowledge					
Precision					
Safety					
Assisting					
Outcomes					
				TOTAL	
				General Process Assessment Result	

WORK ASSIGNMENT 1 *(0 - 10 points per criteria)*		
QUESTION / EVALUATION CRITERIA	**Topic**	**Evaluation** *(0 - 10 points)*
1.1	Detailed floor plan drawn up	
1.2	Correctly identifying relevance of details for title block	
1.3	Detailed title block drawn up	
1.4	Detailed and correct drawing	
	TOTAL	
	Work Assignment 1 Result *(Total / 0,4)*	

WORK ASSIGNMENT 2 *(0 - 10 points per criteria)*		
QUESTION / EVALUATION CRITERIA	**Topic**	**Evaluation** *(0 - 10 points)*
2.1	Correctly determining scale	
2.2	Correctly describing the process for determination of house orientation	
2.3	Correctly calculating distance	
2.4	Correctly identifying possible problems with trenching	
	TOTAL	
	Work Assignment 2 Result *(Total / 0,4)*	

GENERAL EVALUATION *(0 - 10 points per criteria)*		
QUESTION / EVALUATION CRITERIA	**Topic**	**Evaluation** *(0 - 10 points)*
G.1	Good understanding of the nature of architectural drawings and plans	
G.2	Good understanding of the application of drawings and plans by the plumber	
G.3	Good understanding of technical issues and calculations related to using drawings and plans	
G.4	Ability to orient self in terms of both the "big picture"and finer details	
	TOTAL	
	General Evaluation Result *(Total / 0,4)*	

TOTAL LEARNING AREA 3 LEARNING PROJECT 1 (0 - 10 points per criteria)		
EVALUATION CATEGORY	**Topic**	**Result** *(Base 100)*
1	General Process Assessment	
2	Work Assignment 1	
3	Work Assignment 2	
5	General Evaluation	
	TOTAL	
	Result Learning Area 3 Learning Project 1 *(Total / 0,4)*	

ASSESSMENT RESULTS			
Total Score **Learning Area 3** **Learning Project 1**	**SCORE**	**COMPETENT**	**NOT YET COMPETENT**
Strong / Weak Areas			
Suggested Remedial Effort			
General Comments *(Lecturer)*			

Sign *(Lecturer)*	..... Date	..... Name & Surname	..... Lecturer Signature
Sign *(Apprentice)*	..... Date	..... Name & Surname	..... Apprentice Signature

6. Further Development

Using your own computer or that of the college, register at *https://www.smartdraw.com* (Smartdraw) for free.

Use this site to design different plans and sketches, and do plumbing installation planning. Challenge your fellow apprentices to all design their best installation plan on a floor plan that was decided on beforehand.

Ask your lecturer to evaluate the designs.

7. Workplace Experience

Use either your workplace building or one of the projects the company is busy with. Using a tape measure, determine the size and layout of the building. Make a basic sketch and use that to draw a proper floor plan when you are at a suitable venue.

Copy the existing plumbing installation onto the floor plan using colours and symbols as prescribed, and present the sketch and plan to your manager.