Annex 2.10
Training Material of Basic Training Held in December 2015

Project for Improving the Capacity of WASAs in Punjab Province

Training for development of instructor skill (Basic Course)

16th – 18th Dec. 2015

(3rd day)

Training Instructor : Naoki MATSUO (Japanese Expert Team)

0. Outline (3rd day)

1. Review
2. Closing Session
3. Seven Concepts of Memory
4. Necessary Practice for Training Instructor
5. Let's role-play with video camera
6. Try to the exercise again

1. Review

< 1st day >

1) To see is the most important for making slides
2) Participatory activities are necessary for trainee to retain in their memory

⇩ Use your experience which you learned through this Training Course

Your Training Gets Well *for Trainees*

1. Review

< 2nd day >

1) To use feedback sheet helps your training and presentation skill
2) Strict Opinions make you more good trainer if you can receive the opinions

⇩ Improve your presentation skill

Your Training Gets Well *for Trainees*

2. Closing Session

<Play the Game>

Please read aloud the following numbers clearly in a loud voice.

6, 9, 12
4, 14, 7, 5
8, 11

2. Closing Session

<Play the Game>

Please write the answer of following questions without looking the table

Q1. What is 1st number?

Q2. What is the last number?

Q3. What is the middle number?

3. Seven Concepts of Memory

<Let’s Practice 8>

Think seven concepts of memory

3. Seven Concepts of Memory

<Let’s Practice 8>

Think seven concepts of memory

 Primacy	 Recency	

3. Seven Concepts of Memory

<Let's Practice 8>

Think seven concepts of memory

 Primacy	 Recency	**7±2** Chunking
 Linking	 Record ≠ Recall	**6 x** Review / Revisit
	 Outstanding	

4. Necessary Practice for Training Instructor

1) Don't memorize all scenarios
2) Practice with loud and clear voice
3) Imagine your presentation
4) Roleplay with camera

5. Let's role-play with video camera

< Let's practice 9>

- Check your presentation skill by yourself
- Revise your presentation if necessary (5minutes)
- Let's role-play with video camera

Tea Break

~11:30

6. Try to the exercise again

<Questionnaire>

Fill in two questionnaire sheets
(5 minutes)

<Exercise 5>

Make one presentation slide
(15 minutes)

Save the document and submit to Naoki.
File name: Exercise5_YOUR NAME

7. Closing of Basic Training Course

・Design the Agenda

The agenda organizes your thought

Participants can understand topics easily

・Preparation

Good-Quality Training will be determined about **80%** by his/her Preparation

7. Closing of Basic Training Course

・Visual Aids and Participatory Activities

⇒Improvement of slides and thinking by yourself

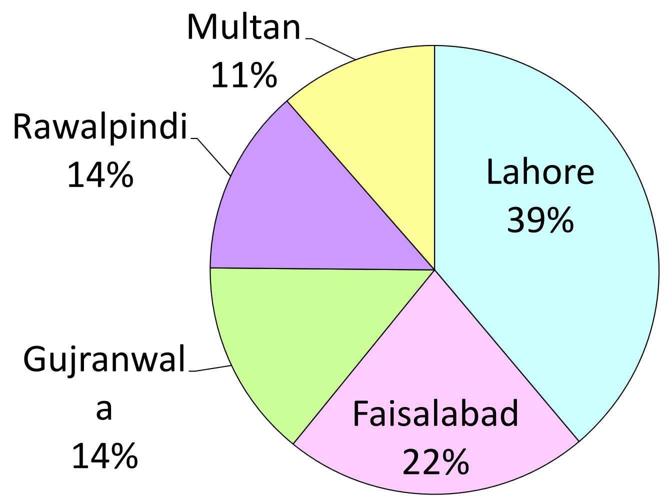
・Feedback Sheet and Recognize your Fault

⇒Improvement of speaking and behavior

・Practice for Instructor

⇒Improvement by self evaluation

Ratio of Number of trainee (average 2016-2018)



Get budget in 2019 following this ratio

Project for Improving the Capacity of WASAs in Punjab Province

Training for development of instructor skill
(Basic Course)

16th – 18th Dec. 2015
(2st day)

Training Instructor : Naoki MATSUO (Japanese Expert Team)

0. Outline (2nd day)

1. Review
2. Try to use a feedback sheet
3. Attention for making presentation slide
   Consider the conclusion in each slide
4. Attention at the presentation
5. Let's give a presentation and use feed back sheet (check list)

1. Review

1) To see is the most important for making slides
2) Participatory activities are necessary for trainee to retain in their memory

<u>Use your experience which you learned through this Training Course</u>

Your Training Gets Well for Trainees

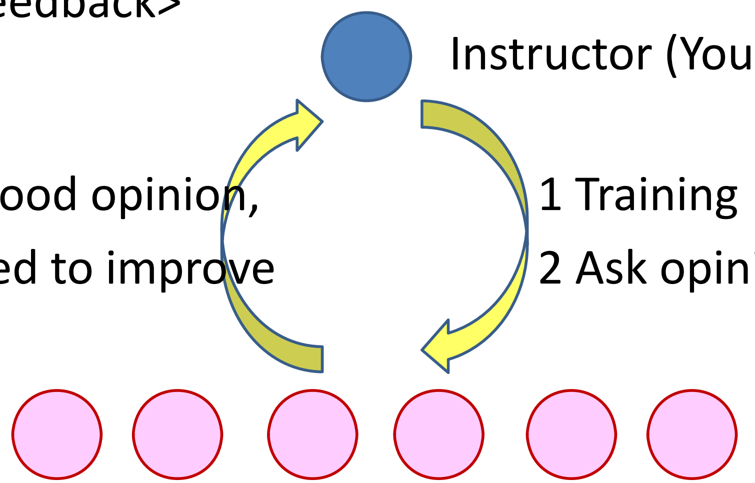
2. Try to use a feedback sheet

<Feedback>

Instructor (You)

3 Good opinion,
Need to improve

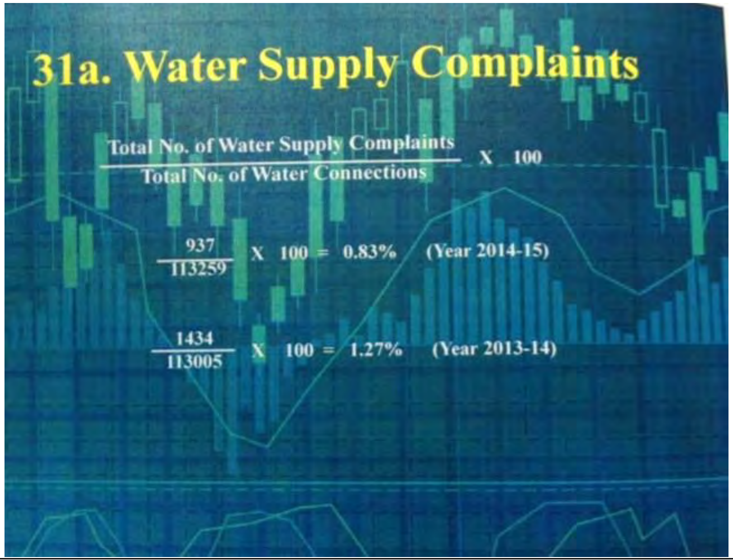
1 Training
2 Ask opinion



Participants (Trainees from WASA)

3. Attention for making presentation slide

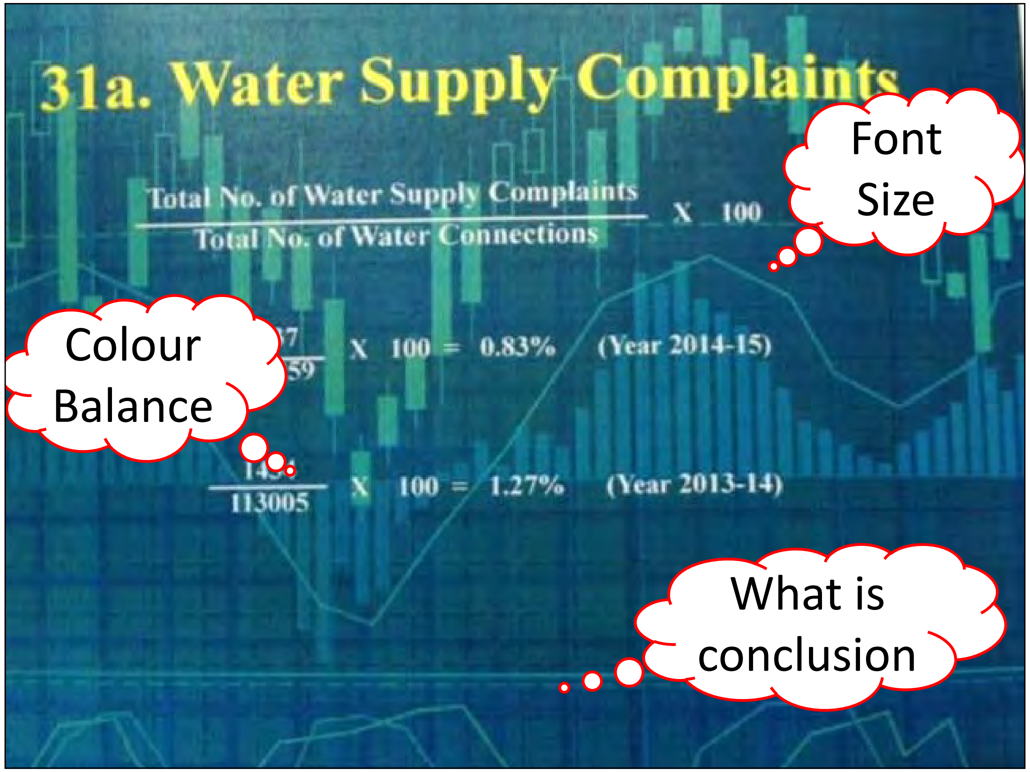
If you were presenter, what do you improve?



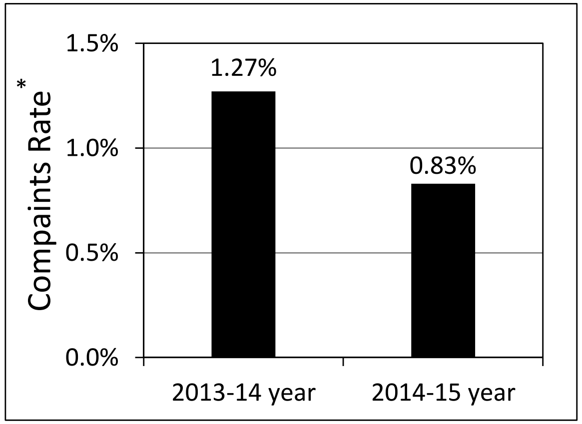
3. Attention for making presentation slide

< Let's practice 4 >

- Discussion and making one slide in each group (20 minutes)
- Leader of group gives a Presentation (15 minutes including evaluation)



31a. Water Supply Complaints



$*: \dfrac{\text{Total No. of Water Supply Complaints}}{\text{Total No. of Water Connections}} \times 100$

Water supply complaints had reduced

3. Attention for making presentation slide

Tea Break

~11:40

3. Attention for making presentation slide

< Let’s practice 5>

<u>Revise your slide again!!</u>

- Add the Conclusion
- Make a Manuscript for one minute presentation
- Reflect the opinions from other members which you got yesterday

File name: Exercise3_YOUR NAME

4. Attention at the presentation

< Let’s practice 6>

- Strength and Accent

“Yesterday, Mr. Hassan made this document until midnight.”

4. Attention at the presentation

< Let’s practice 6>

- Intonation and Speed

Try to read example sentence just one minute!

4. Attention at the presentation

< Let’s practice 6>

▪Voice (Emotion)

“I love you” (with love)

“I love you” (with sadness)

“I love you” (with hatred)

4. Attention at the presentation

< Let’s practice 6>

▪Attitude

- Have Good Posture
- Loud Voice (especially no mike)

4. Attention at the presentation

< Let’s practice 6>

▪To take the middle

Watch the Presentation Movie by “Steve Jobs”

5. Presentation and Feed Back Sheet

< Let’s practice 7>

▪Let’s give a presentation of your slide within one minutes.
(read your manuscript)

▪Other participants check the presenter by Check-List.
Then give comments.

Project for Improving the Capacity of WASAs in Punjab Province

Training for development of instructor skill (Basic Course)

16th – 18th Dec. 2015

(1st day)

Training Instructor : Naoki MATSUO (Japanese Expert Team)

0. Outline (1st day)

1. Agenda
2. Check your capacity
3. Why visual aids? = Purpose
4. Ice Breaker
5. Agreement to the ground rule
6. Facilitation
7. What is good visual aids? = Let's Practice

1. Agenda

<Objective>

The participants of this training course notice and understand what they should do when they carry out the training as an instructor.

<u>What is the most important for training and/or presentation?</u>

Trainee can understand the contents

1. Agenda

<Approach>

1) You can make document in consideration of trainees ⇒ 1st day

2) You can conduct a presentation which the trainees can understand well ⇒ 2nd day

3) You learn the methods of self-development program to perform as a professional instructor ⇒ 3rd day

2. Check your capacity

<Questionnaire>

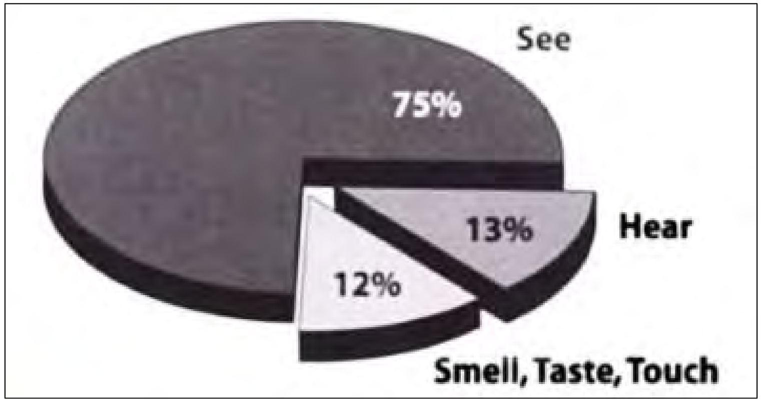
Fill in the questionnaire sheet
(2 minutes)

<Exercise>

Make one presentation slide
(13 minutes)

Save the document and submit to Naoki.
File name: Exercise1_YOUR NAME

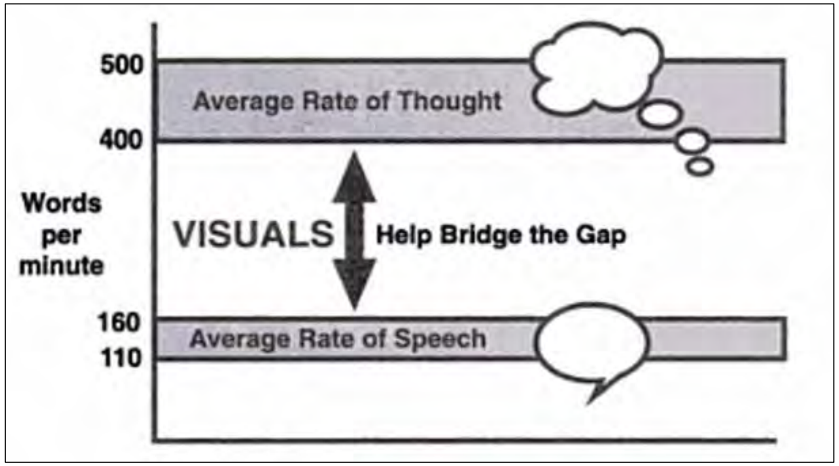
3. Why Visual Aids?



We know 75% information by visually

3. Why Visual Aids?

1) Listen the explanation
2) Listen the explanation with seeing figure



4. Ice Breaker

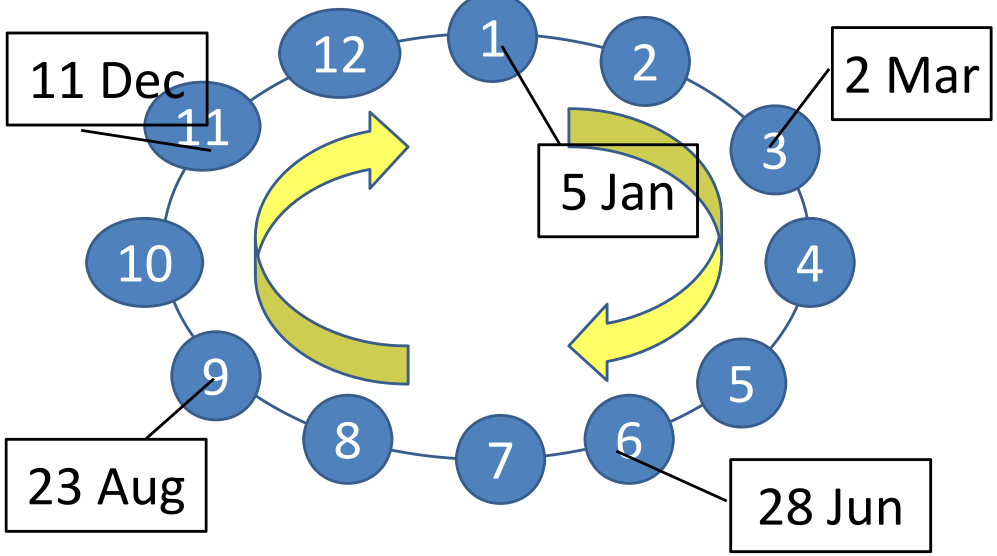
What is Ice Breaker?

- Game and activity to introduce each other and relax together
- There are 3 kinds of Ice Breaker

1) Relax your mind
2) Relax your body
3) Make team

4. Ice Breaker

1) Birthday Chain (Relax your mind)

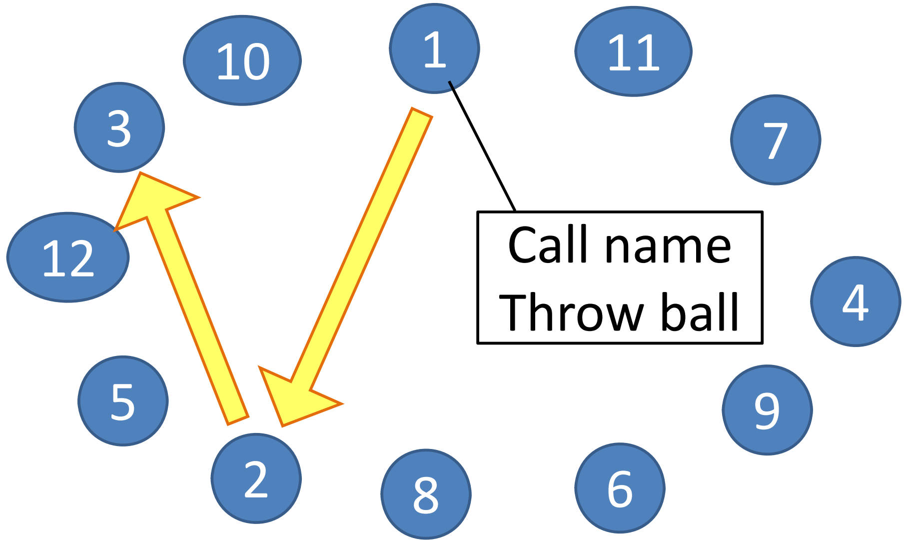


4. Ice Breaker

2) Human Chair (Relax your body)

4. Ice Breaker

3) Name Catch Ball (Make team)



4. Ice Breaker

< Ice Break Questionnaire >

To improve your Ice Breaker for next time

Ice Breaker Questionnaire

Thank you for your participation. Please fill in the questionnaire sheet for Ice Breaker Activity today. Allow me to use your opinion for reference in my seminar from now on.

1) How was the content of Ice Breaker today?

2) Which lesson is the most interesting for you?

3) On the other hand, which lesson is the most boring or unnecessary for you if any?

4) Please write overall impressions and/or the advice to me if any.

Thank you for your cooperation. See you next time.

This is one of feedback sheets

5. Agreeing to the Ground Rule

<Example>

・All the members participate.

The position is equal during training.

・Listen firmly until speaker finishes a comment, Don't break into his/her talk!

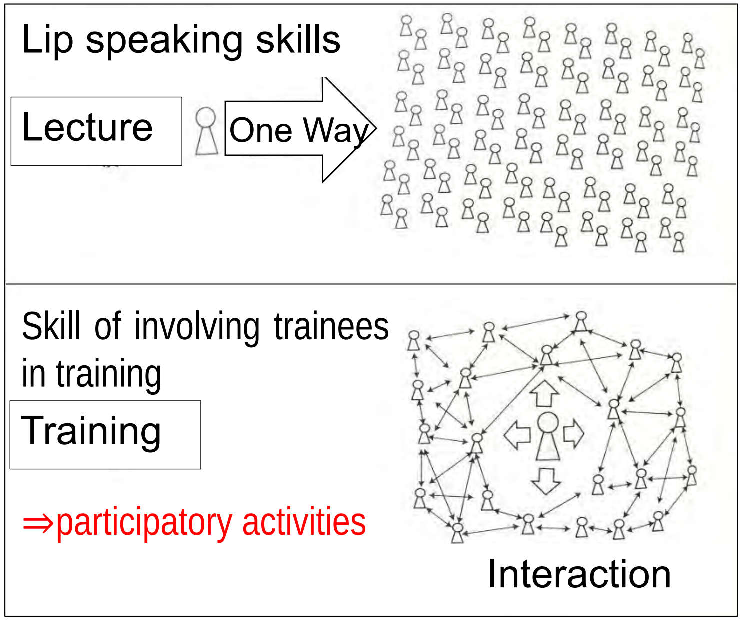
・Return on time after break

・Don’t use mobile phone

・Don’t deny the opinion suddenly

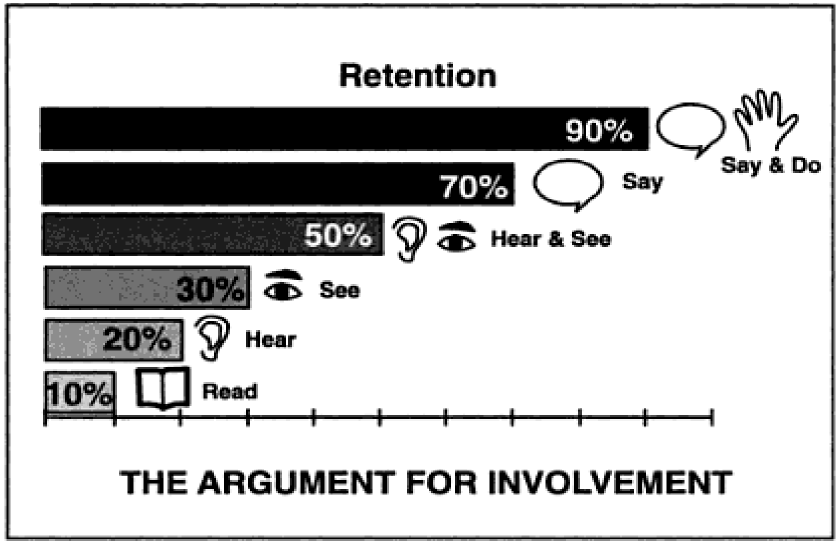
・Speak your true feelings

6. Facilitation



6. Facilitation

The importance of participatory activities



7. What is Good Visual Aids?

< Let’s Practice 1>

What are good visual aids for viewers and participants?

Write your opinion and idea.

(5 minutes)

7. What is Good Visual Aids?

< Let's Practice 2>

Discuss about good visual aids within your group!

After discussion, write the idea on the white board

(10 minutes)

7. What is Good Visual Aids?

Tea Break

~11:35

7. What is Good Visual Aids?

Introduce examples

・Clarity (Colour etc.)

Academy	Academy	Academy
Academy	Academy	Academy
Academy	Academy	Academy

7. What is Good Visual Aids?

・Possible to Read (Font, Size etc.)

Academy	Academy	Academy
Academy	Academy	Academy
ACADEMY	Academy	

7. What is Good Visual Aids?

- Possible to Read (Font, Size etc.)

Academy	Academy	Academy
Academy	Academy	

7. What is Good Visual Aids?

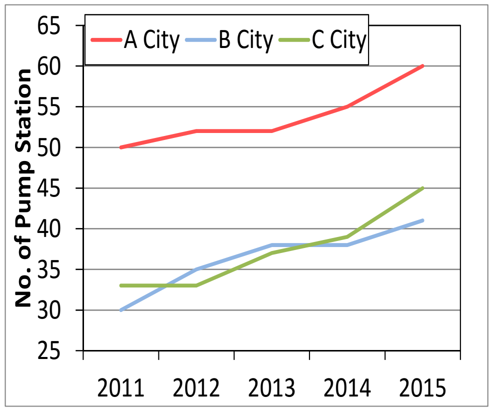
- Concentrate to one point

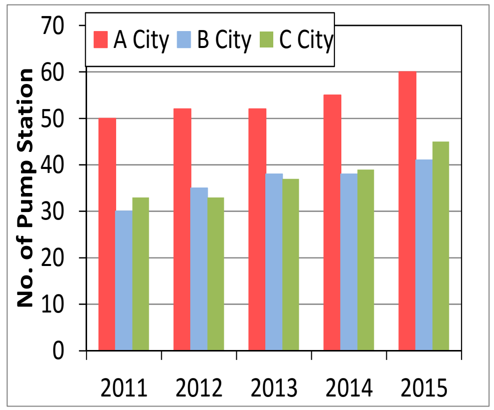
7. What is Good Visual Aids?

- Concentrate to one point

7. What is Good Visual Aids?

- Relationship with what you say





7. What is Good Visual Aids?

- Interesting

7. What is Good Visual Aids?

- Simple (Upper case and Lower case etc.)

TODAY IS WEDNESDAY

Today is Wednesday

today is wednesday

TODAY IS WEDNESDAY

Today is Wednesday

today is wednesday

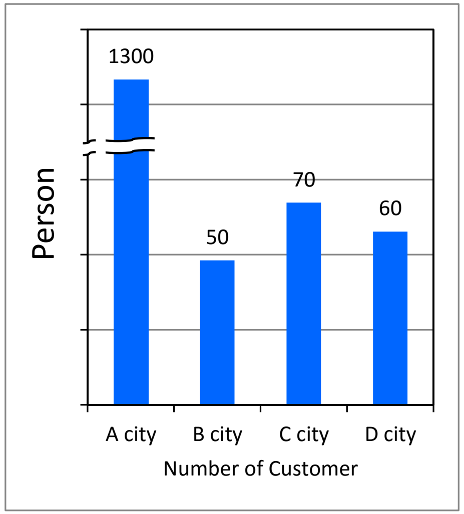
TODAY IS WEDNESDAY

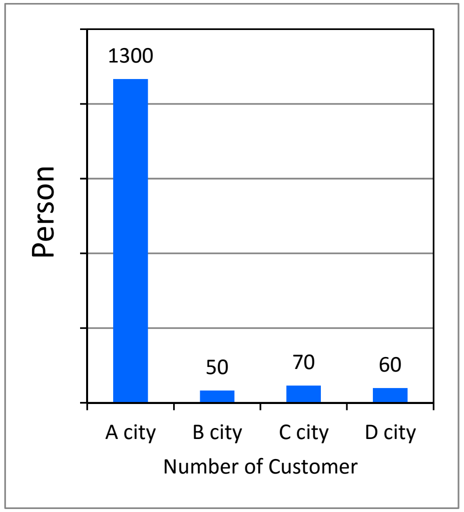
Today is Wednesday

today is wednesday

7. What is Good Visual Aids?

- Correctness (Layout etc.)





7. What is Good Visual Aids?

< Let's Practice 3>

Make table or figure with more attention to visual and consideration to listeners.

(Use same data with "Exercise 1")

(10 minutes)

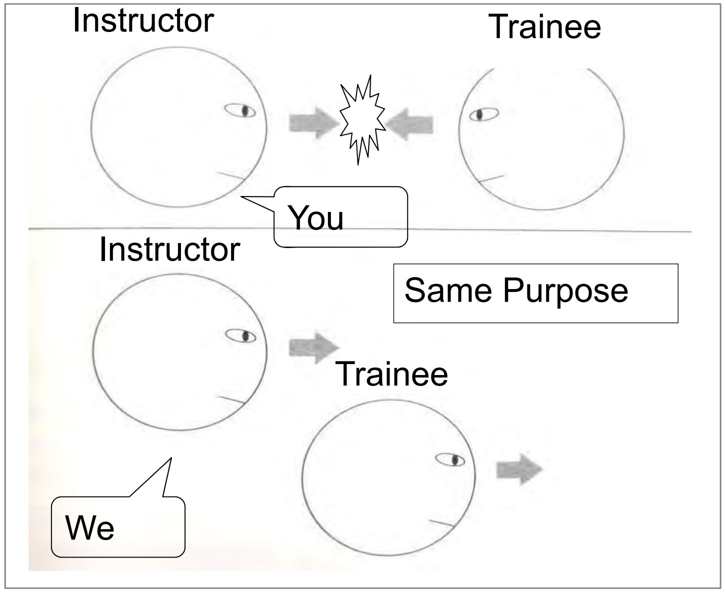
7. What is Good Visual Aids?

< Let's Practice 3>

Then, explain your table or figure within a minute. Furthermore, listen to the advices from other participants.

(30 minutes)

6. Facilitation



31a. Water Supply Complains

$$*: \frac{\text{Total No. of Water Supply Complaints}}{\text{Total No. of Water Connections}} \times 100$$

Water supply complaints had reduced

Annex 2.11

Training Material of Advance Training Held in April 2016

Upgrade of Presentation Skill

1. How to make good presentation

April, 2016

KEN Yokoyama

JICA Expert Team

Contents

1. Structure of Presentation
2. Rules on the Slide
3. Presentation Contents
   Text, Table, Photo & Image, Chart, Figure
4. How see from Participants
5. Closing

Presentation Skill

Aiming for World Standard

To uplift Academy’s lecturers’ lecture skill to World Standard

To make good material, do lecture to trainees, and plan outside fieldwork

To achieve them above, get some hint and skill from this 3 days seminar

Lecture Structure

Type of Lecture

1) Use Textbook

2) Write on the Board
   [Combination 1) and 2)]

3) PowerPoint Presentation
   [Combination 1), 2) and 3)]

Presentation Structure

Presentation A

Ductile Iron Pipe

Ductile Iron Pipe (DIP) is a pipe made of ductile iron commonly used for potable water transmission and distribution. This type of pipe is a direct development of earlier cast iron pipe, which it has superseded. The ductile iron used to manufacture the pipe is characterized by the spheroidal or nodular nature of the graphite within the iron. Typically, the pipe is manufactured using centrifugal casting in metal or resin lined moulds. Protective internal linings and external coatings are often applied to ductile iron pipes to inhibit corrosion: the standard internal lining is cement mortar and standard external coatings include bonded zinc, asphalt or water-based paint. In highly corrosive environments loose polyethylene sleeving (LPS) to encase the pipe may also be used. Life expectancy of unprotected ductile iron pipes depends on the corrosiveness of soil present and tends to be shorter where soil is highly corrosive. However, a lifespan in excess of 100 years has been estimated for ductile iron pipelines installed using "evolved laying practices", including use of properly installed LPS (polyethylene encasement). Studies of ductile iron pipe's environmental impact have differing findings regarding emissions and energy consumed. Ductile iron pipe manufactured in the United States has been certified as a sustainable product by the Institute for Market Transformation to Sustainability.

Presentation Structure

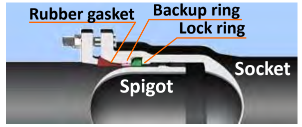
Presentation B

Strong pipe: Ductile Iron Pipe (DIP) ④

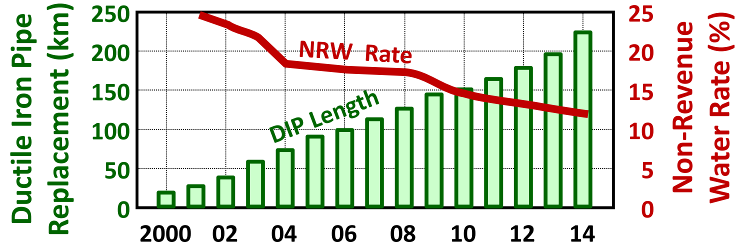
Pipe Life: ____~____ years

Joint type: Spigot & Socket, Flanges

Leak ratio of DIP to PVC: ____ times



Corrosion: Almost none with polyethylene sleeve



Basic of Presentation

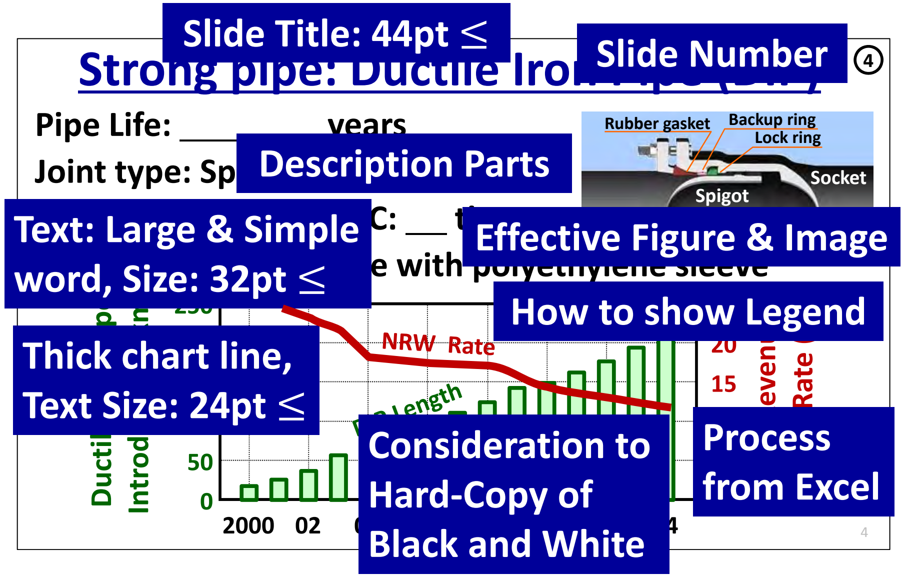
Unification

1) Same Slide Design
2) Same Background
3) Same Font & Size
4) Color Balance
5) Enough Memo Space
6) Few Text (Keywords)
7) Rich Image
8) Align & Centering

Rule

1) Slide Number
2) Regular Font
3) Title on Top
4) Large Text Size
5) Thick Line

Basic of Presentation



Presentation Structure

If need detail information …

Ductile Iron Pipe

Ductile Iron Pipe (DIP) is a pipe made of ductile iron commonly used for potable water transmission and distribution. This type of pipe is a direct development of earlier cast iron pipe, which it has superseded. The ductile iron u to manufacture the pipe is characterized by the spheroidal or nodular nat e graphite within the iron. Typically, the pipe is manufactured using g in metal or resin lined moulds. Protective internal linings a often applied to ductile iron pipes to inhibit corrosi is cement mortar and standard external coati r-based paint. In highly corrosive environme ncase the pipe may also be used. Life expe iron pipes depends on the corrosiveness of soil horter where soil is highly corrosive. However, a lifespan in e as been estimated for ductile iron pipelines installed using "evolved ctices", including use of properly installed LPS (polyethylene encasemen udies of ductile iron pipe's environmental impact have differing findings regarding emissions and energy consumed. Ductile iron pipe manufactured in the United States has been certified as a sustainable product by the Institute for Market Transformation to Sustainability.

Provide material to participants by MS-WORD document!

Grounding of Presentation

Parts of Presentation Slide

Parts	Input Method	Edit
Text	Input text, Copy & Paste	Easy
Table	Input data, Copy from Excel	
Photo	Shot by camera, Data in Web	
Chart	Make chart by Excel or P. Point	
Figure	Make by Shape and Freeform	
Sound	Make by Sound Editor	
Video	Make by Movie Editor	Difficult

Presentation Expression

"Text" and "Table"

"Text" as important keyword is shown by simple words or sentences and large letter size.

In 1 slide, sentence must be 3 or 5 lines.
Letter size must be more than 32pt.
"Arial" and "Calibri" are easy to see.
Only Keywords are better.

Presentation Expression

Font Size: 32pt ≤ (in chart: 24pt ≤)

pt	Arial	Calibri	Times	Century
40	ABCabc	ABCabc	ABCabc	ABCabc
36	ABCabc	ABCabc	ABCabc	ABCabc
32	ABCabc	ABCabc	ABCabc	ABCabc
28	ABCabc	ABCabc	ABCabc	ABCabc
24	ABCabc	ABCabc	ABCabc	ABCabc
20	ABCabc	ABCabc	ABCabc	ABCabc
16	ABCabc	ABCabc	[illegible]	ABCabc
12	ABCabc	ABCabc	[illegible]	ABCabc
10	ABCabc	[illegible]	[illegible]	ABCabc

Eyesight Test?

Presentation Expression

Normal Font (Bold) and Narrow Font

Arial Black	ABCDEabcde12345
Arial	**ABCDEabcde12345**
Arial Narrow	ABCDEabcde12345
Calibri	**ABCDEabcde12345**
Calibri Light	ABCDEabcde12345
Helvetica	**ABCDEabcde12345**

Denote by Mathematic

Insert "Equation" (Mathematical Signs)

1) Less than or Equal: $\leq$ DN50mm
2) Greater than or Equal: $\geq$ DN75mm
3) Not Equal: $a \neq b$
4) Approximately Equal: $L_{a\text{-}b} \cong 90\text{km}$
5) Plus-Minus: 0.6mm $\pm$ 0.1mm
6) Degree (Angle): sin60°
7) Degree (Temperature): 4°C / 109°F
8) Pipe Diameter: ϕ400mm

Bullets and Numbering

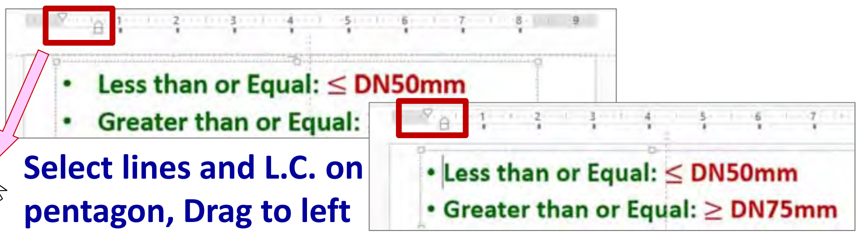
Not use Original Condition

Original

- Less than or Equal: ≤ DN50mm
- Greater than or Equal: ≥ DN75mm

Edit

- Less than or Equal: ≤ DN50mm
- Greater than or Equal: ≥ DN75mm



Select lines and L.C. on pentagon, Drag to left

Not Small Text in Table

Little bit difficult to show Text in Table

Water Distribution Volume Balance of YWWB

(1) Distribution Water Volume [100%]	(2) Revenue Water [92.0%]		92.0%
	Non-Revenue Water (NRW) [8.0%]	(6) Leakage	5.0%
		(7) Illegal connection	0 %
		(8) Water meter error	1.7%
		(9) Uncollectable accou	0.0%
		(10) Used by Bureau	1.0%
		(11) Other	0.3%

"Multiple: 0.85" of "Line Spacing" in "Paragraph"

Small Margin

Distribute Rows

Presentation Expression

“Photo” and “Image”

Optimally processed Photos and Images can paste themselves.

Less than 100KB of Image file size
Cut extra space by “Trimming”
Erase unnecessary words by “Eraser”
Confirm “Copyright” of Photo & Image

Picture Size

Do you find their differences?

2,643KB (2.58MB) ⟷ X 82 ⟷ 32KB (0.03MB)

Image Editor

Image Editing

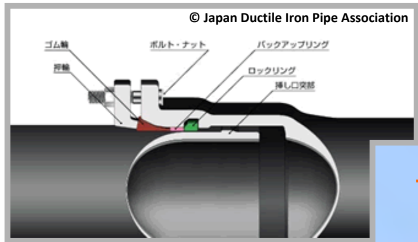
If you do not have a high-end image editing software like Adobe Photoshop®, you have a comparable software in your Windows PC. By taking some effort and time, presentation becomes more gorgeous.

36pt 5lines

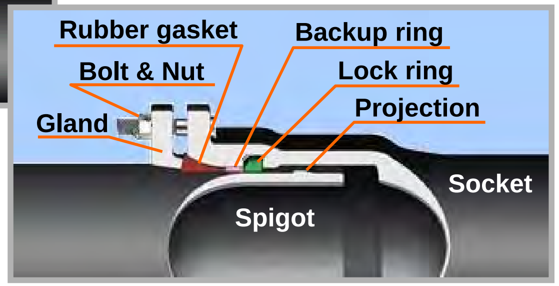
Image Editing Software to be used
Paint (in Windows Accessories)
Microsoft Photos® (in Windows 10)

Paint in Windows Accessories

“Eraser” and “Fill with color” EX.1



HOW?

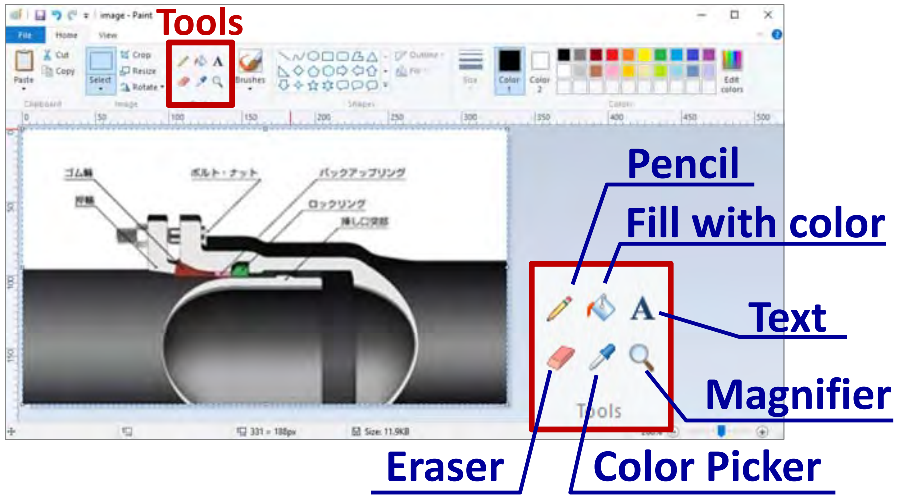


↑ Text is so small, and Japanese language. This needs additional letters.

This DIP NS joint has a large flexible performance. ....

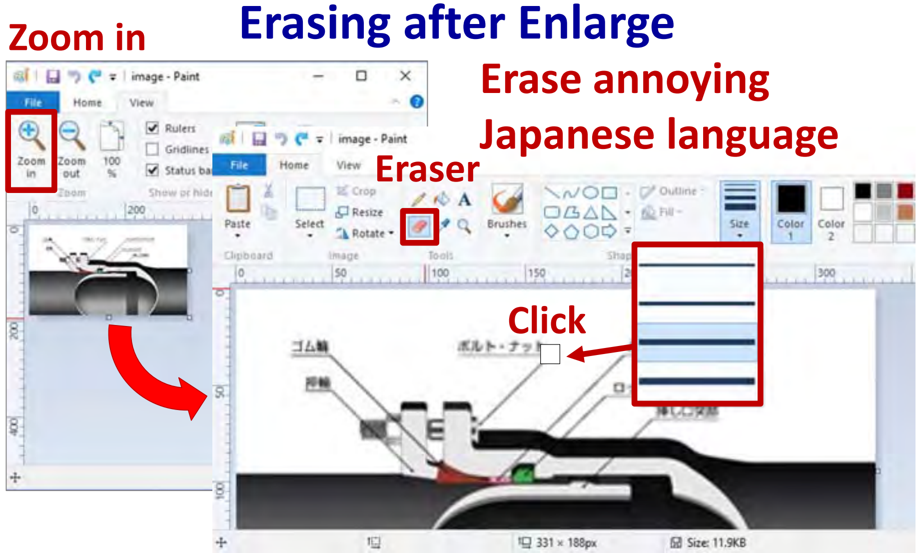
Paint Tools

“Eraser”, “Pencil”, “Fill with color”



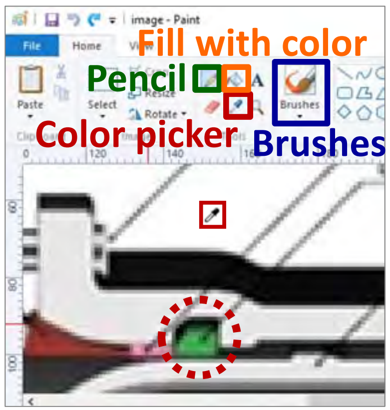
Erase and Patching

Erasing after Enlarge

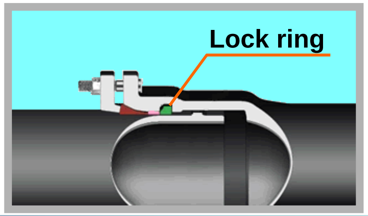


Repainting

“Color picker” and “Pencil/Brushes”



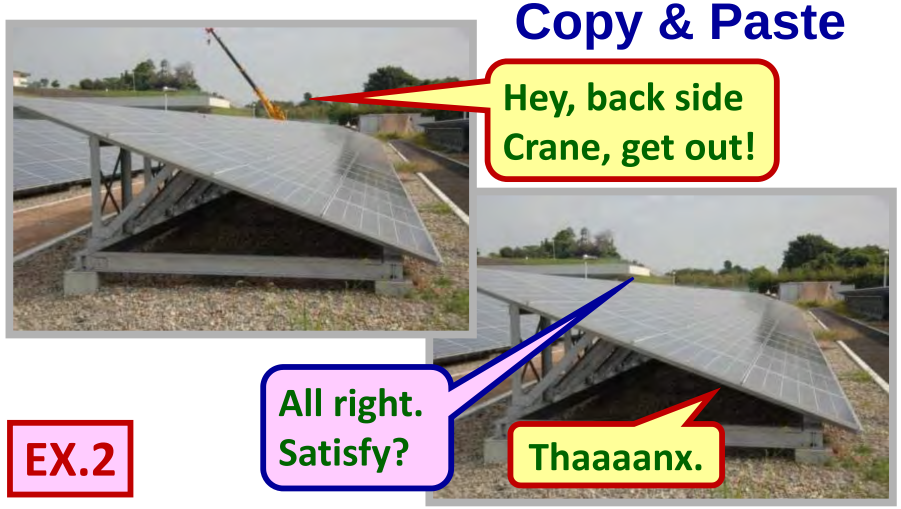
1) Select “Color picker” icon
2) Click on the green part
3) Select “Pencil” icon
4) Trace on black line and change color to green
5) Large area, use “Fill color”



6) Narrow area, use “Brushes”
7) Put text and draw line

Unnecessary Object

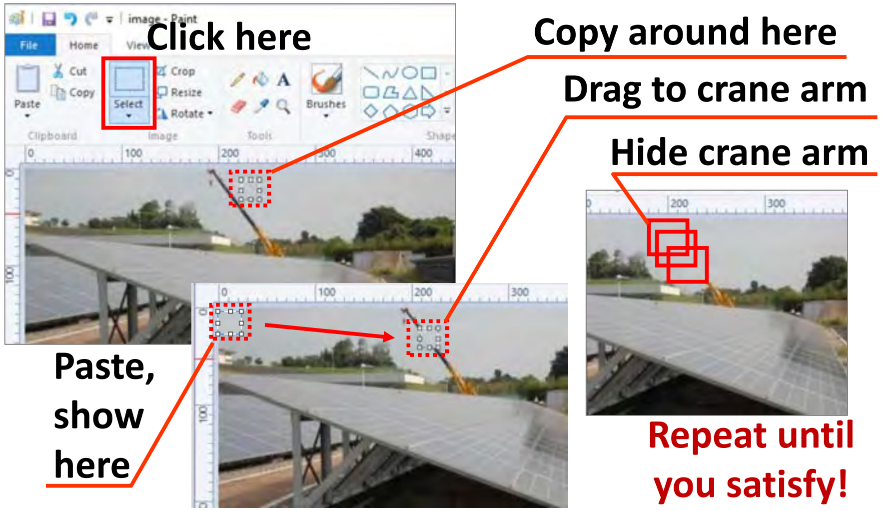
Conceal unnecessary object by Copy & Paste



EX.2

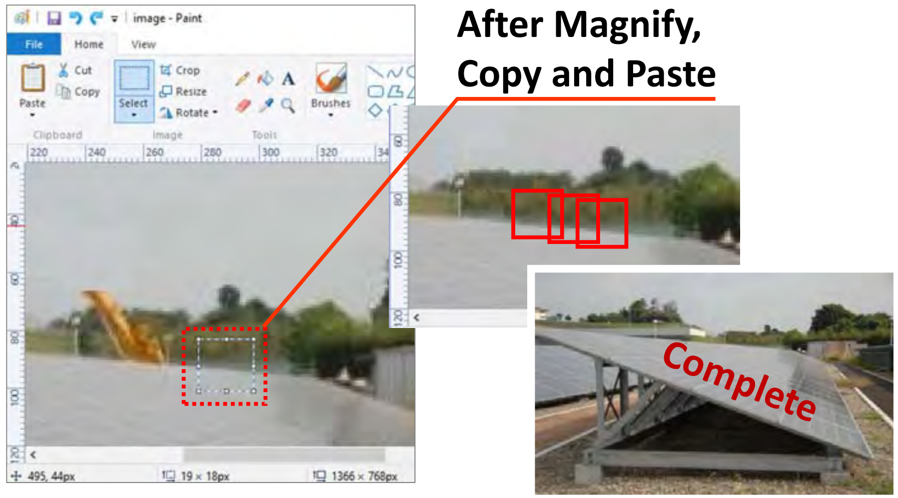
Hide the Object

Conceal unnecessary object



Lap Over Another

Lap Over and Color Painting



Trimming off

Trimming by "Photo"

↑Original photo

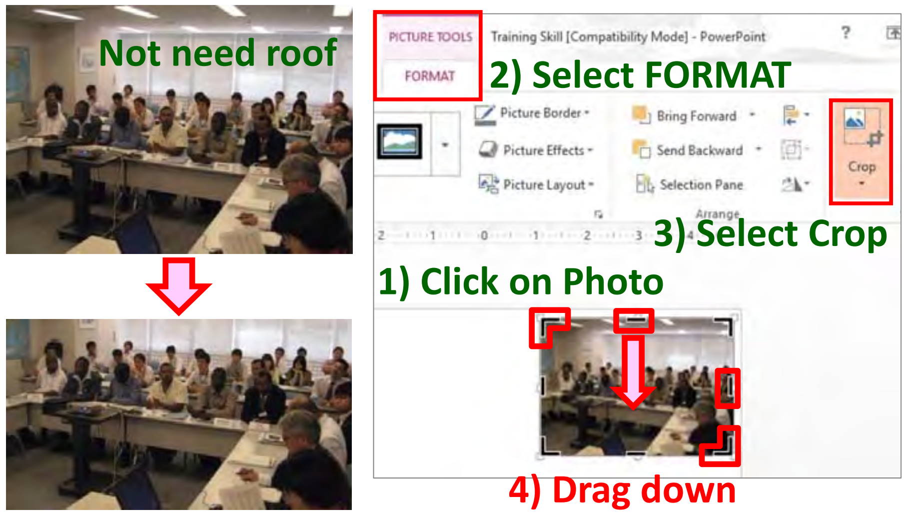
↑Height of photo is same.

←Width of photo is same.

By trimming, it is possible to show photo of the same width and height efficiently.

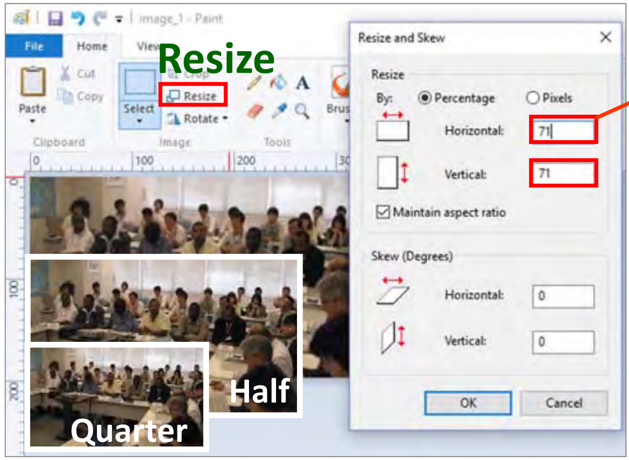
Trimming off

Trimming in "PowerPoint"



Compress Image Size

Picture Size Down by Photo



Input value

Half (71%)
$0.71^2=0.50$

Quarter (50%)
$0.50^2=0.25$

1/10 (31%)
$0.31^2=0.10$

"File" → "Save" → "Insert" in PowerPoint

Presentation Expression

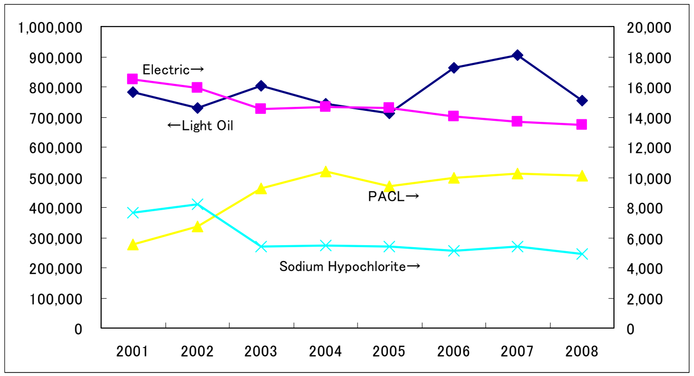
Excel Chart → Process in PowerPoint

Copy of chart object from Excel to Power-Point, and edit gorgeous impression

Excel chart/table is for paper medium.
Excel chart is not easy to see in slide.
Put number in chart is easy to grasp.
Use Secondary Axis, Logarithmic Scale.

Excel Graph for Paper

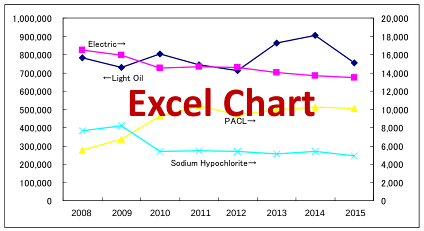
Limit of Edit of Excel Chart



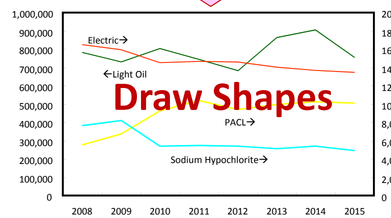
Advantage: Update can when new data inputs.
Disadvantage: Editing cannot be no more.

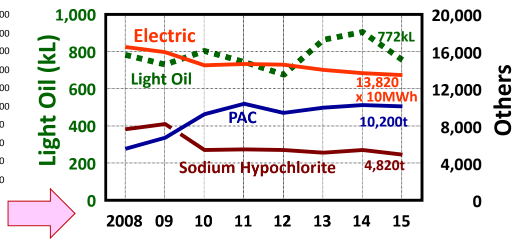
Dressing of Excel Graph

Edit of Excel Chart in PowerPoint



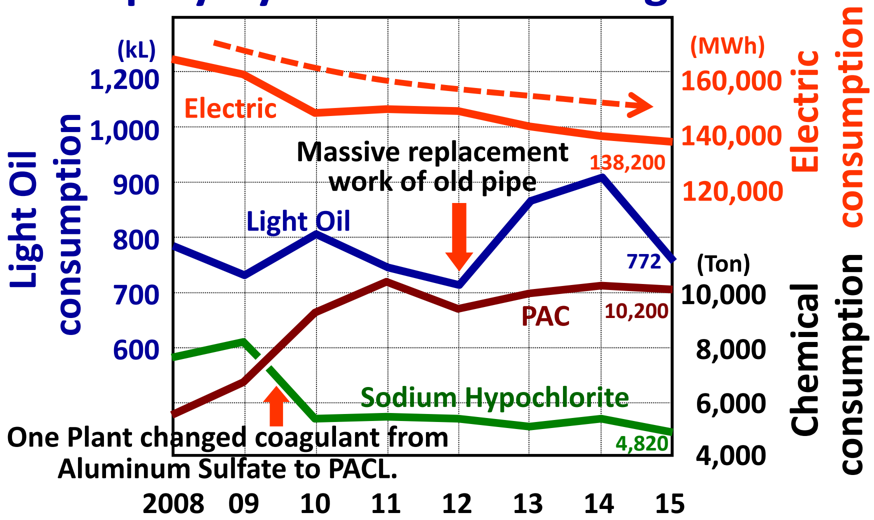
1) Copy from Excel and paste on Powerpoint.
2) Draw Shapes on top of Excel chart as sketch.
3) Not need dots on line.





Display Excel Data

Display by thick line and large letter



Presentation Expression

Creation of Figure (Patience & Sense)

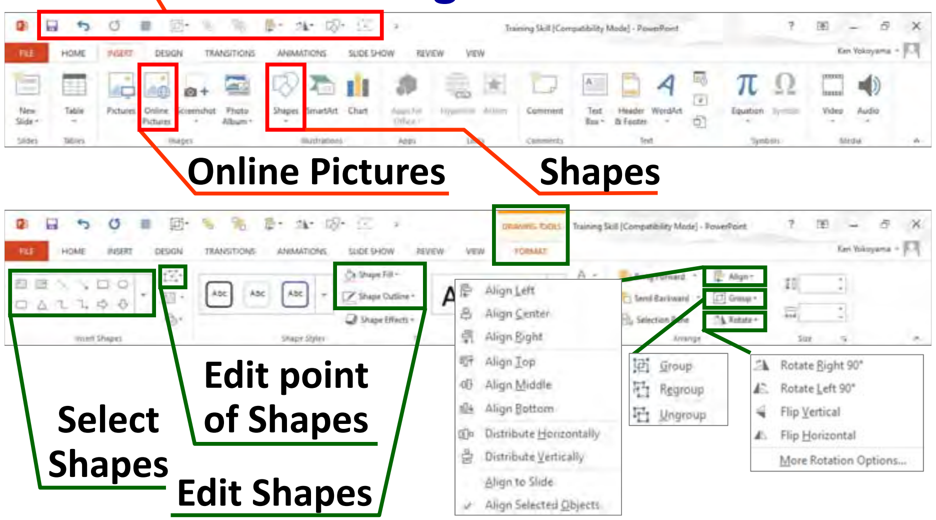
Need to create a drawing along content without resorting to pasting of JPEG and others drawings.

Use “Shapes” & “Online Pictures: Bing”.
Use “Freeform in Shapes” perfectly.
Set useful “Toolbar” icon on the top.
High speed editing by “Ctrl” & “Shift”.

Quick Access Toolbar

Useful Toolbar

Drawing Function

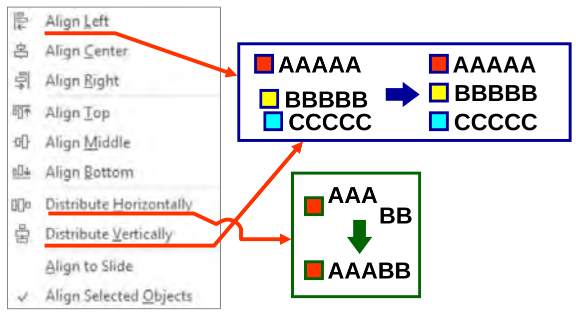


Toolbar Weapon

Editing Function of Drawing

(1) (2) (3) (4) (5) (6) (7) (8) (9) (10) (11) Quick Access Toolbar

(1) Save
(2) Undo
(3) Repeat/Redo
(4) Grid Settings
(5) Group Objects
(6) Bring to Front
(7) Bring to Back
(8) Align Objects
(9) Rotate Objects
(10) Shapes
(11) Edit Points



Left Hand Magic

Object Copy, Cut, Paste, Repeat

Speed up command for Editing

Copy: [Ctrl]+[c]

Cut: [Ctrl]+[x]

Paste: [Ctrl]+[v]

Undo: [Ctrl]+[z]

Duplicate: [Ctrl]+[d]

Redo: [Ctrl]+[y] or [F4]

Select all: [Ctrl]+[a]

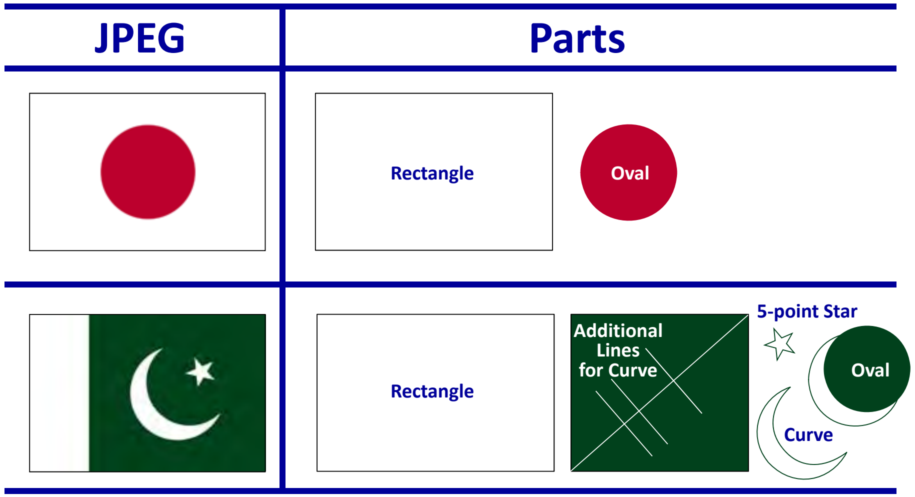
Copy: Mouse Drag as click [Ctrl]

Horizontal/Vertical move: Mouse drag as click [Shift]

Copy after Horizontal/ Vertical move: Mouse drag as click [Ctrl]+[Shift]

Use Shapes Perfectly

Make Flag of Japan and Pakistan

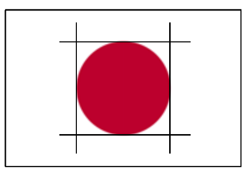


Use Shapes Perfectly

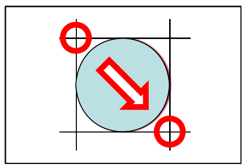
Use Assist by Additional Line

EX.3

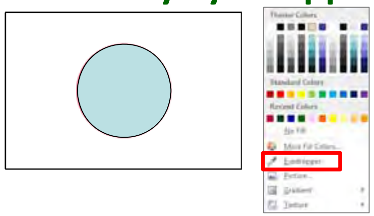
1) Draw “Rectangle” and additional lines for “Oval”.



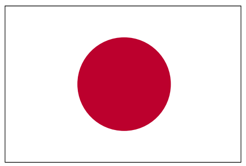
2) Draw “Oval” from corner to opposite angle.



3) Erase additional lines, pick color by Eyedropper.



4) Erase base JPEG

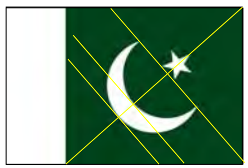


Use Shapes Perfectly

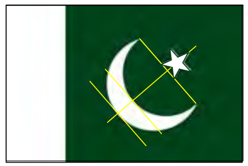
Use Assist by Additional Line

EX.4

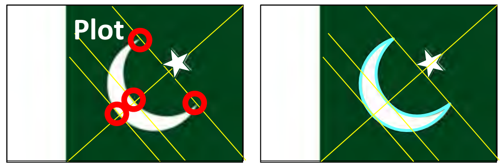
1) Draw 2 “Rectangle” and additional lines.



2) Draw “5-Point Star” and Rotate.

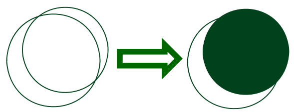


3-1) Draw “Curve” using additional lines.

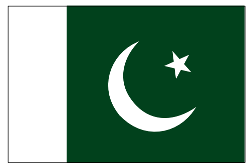


Change to “Corner Point” on Plot

3-2) Or Draw 2 “Oval”.



4) Erase base JPEG

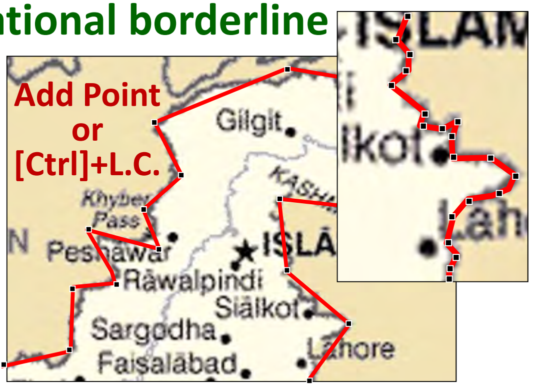


Click & Click & Click

Use Freeform Perfectly

© Wikipedia

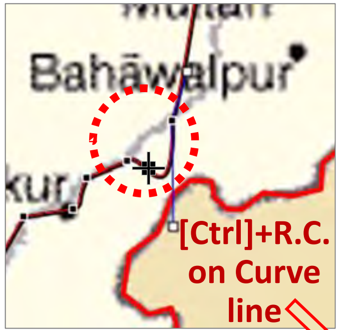
Magnify picture, select of Freeform, and click on the national borderline



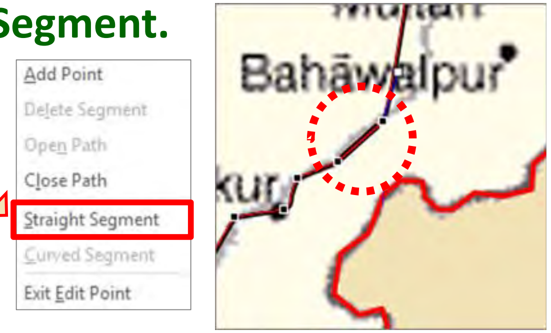
Mouse on line →
Mouse on point →
Drag to collect position

Click & Click & Click

Use Freeform Perfectly



Sometimes, when editing points, line changes from "Straight" to "Curve" Segment.



Not So Difficult

EX.5

Use Freeform Perfectly

© Wikipedia

Presentation Rule

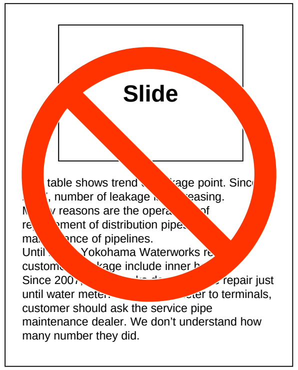
Rule of Presentation

1) Do not use small and many letters
2) Classify slide into Lecture and Handout
3) Consideration of background color
4) Indicate Slide Number
5) Do not use difficult word and expression
6) Sometime do pastime or relaxation
7) Unification of slide style/concept
8) Do not take other's slide on trust
9) Check Copyright and Registration

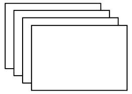
3, 2, 1, Cue

Cue (Instruction, Trigger) Cards

Possible to make reading paper document, but not read? How do we lecture?



Make Cue Cards!

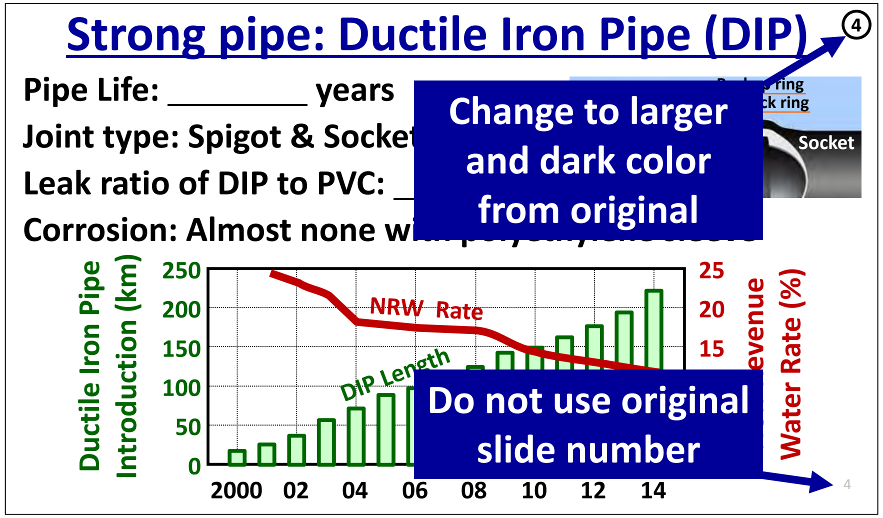


Information Cards (Palm size)

Condition of leakage in YWW
trend of number of leakage
replacement of distribution pipes

Clear Slide Number

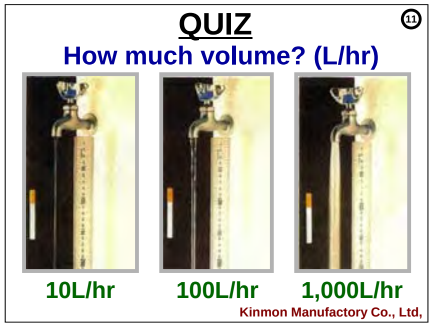
Two slide number are in below slide

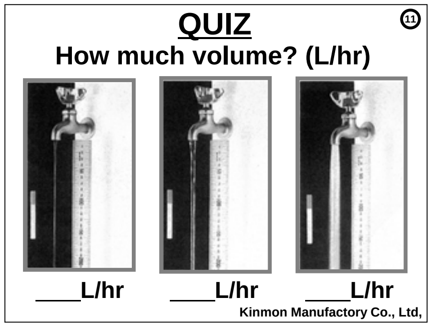


Two Type Material

Make 2 material for Lecture and Handout

Divide 2 lecture material for Lecture (left) and Handout (right)

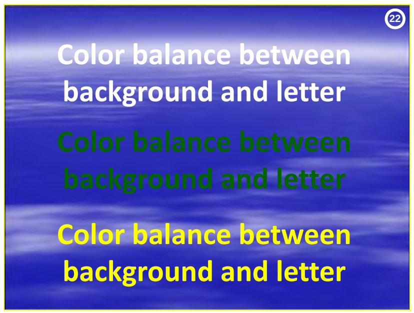


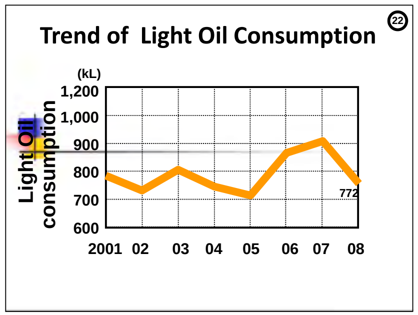


Background Selection

Consideration of Background Design

Monochromatic solid color is preferred, because background using gradient and pattern is difficult to see when the overlap with letters and figures.



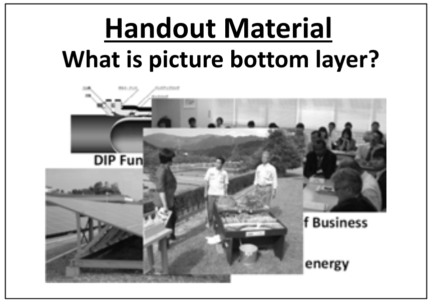


Overlap of Slide Show

49

Do not Overlap Objects in a Slide

Slide Show is nice function to understand its structure and movement.
But Overlap of photo and figure makes hard to see in handout material.



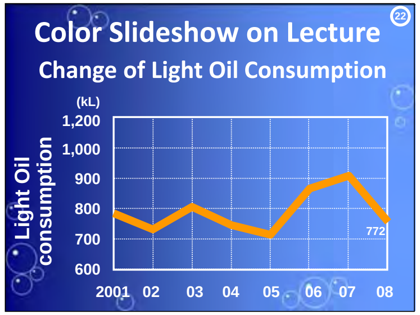
Better to divide slide one by one for hand-out material.

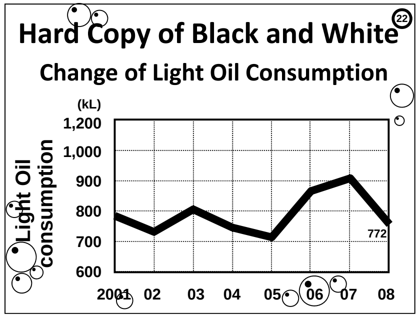
Print by Black and White

50

Handout material of Black and White

In handout material of printing of Black and White, background using the pattern, it is necessary to note that there is a meaningless pattern.



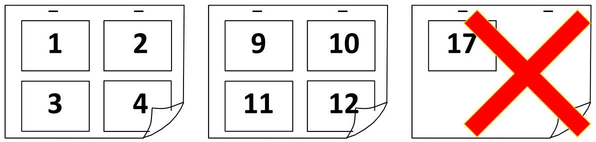


Pay Attention to Final Slide

51

Ask how many Slide in one paper

If number of slide is 17 of handout material, if 4 slides in 1 page, handout is like below. It is better 16 sides, try to decrease 1 slide or add some slides.
If 17th slide is just "Thank You", erase immediately.
Final Slide is not "Thank you" but "Contact".



If letter size is bigger than 32pt, even 4 slide in 1 page is enough to see.

Pay Attention to Final Slide

52

Audience does not need "Thank you"

If participants want to know more, they will ask by e-mail. Cooperate to answer as possible.
Again, Final Slide is not "Thank you" but "Contact".

Pastime / Relaxation

Remove sleepiness

1) Exercise of eyes, neck, hands and legs

2) Physical exercise by pair

3) Exercise for brain

4) Quiz regarding lecture material

Presentation Skill

Closing

1) Not say "I think" unnecessarily

2) Invite laughter

3) Using body language

4) Unabashedly, trying to eye contact

5) No rehearsal is same as No prepare

Upgrade of Presentation Skill

2. How to do good Lecture and Fieldwork

April, 2016

KEN Yokoyama

JICA Expert Team

Contents

1. Confirm Presentation Rule

2. Make Lecture Material

3. Try Lecture

4. How to Plan Fieldwork

Lecture Structure

Type of Lecture

1) Use Textbook

2) Write on the Board
[Combination 1) and 2)]

3) PowerPoint Presentation
[Combination 1), 2) and 3)]

Presentation Rule

Rule of Presentation

1) Do not use small and many letters
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3) Consideration of background color
4) Indicate Slide Number
5) Do not use difficult word and expression
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7) Unification of slide style/concept
8) Do not take other's slide on trust
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Presentation Structure

5

Presentation A

Ductile Iron Pipe

Ductile Iron Pipe (DIP) is a pipe made of ductile iron commonly used for potable water transmission and distribution. This type of pipe is a direct development of earlier cast iron pipe, which it has superseded. The ductile iron used to manufacture the pipe is characterized by the spheroidal or nodular nature of the graphite within the iron. Typically, the pipe is manufactured using centrifugal casting in metal or resin lined moulds. Protective internal linings and external coatings are often applied to ductile iron pipes to inhibit corrosion: the standard internal lining is cement mortar and standard external coatings include bonded zinc, asphalt or water-based paint. In highly corrosive environments loose polyethylene sleeving (LPS) to encase the pipe may also be used. Life expectancy of unprotected ductile iron pipes depends on the corrosiveness of soil present and tends to be shorter where soil is highly corrosive. However, a lifespan in excess of 100 years has been estimated for ductile iron pipelines installed using "evolved laying practices", including use of properly installed LPS (polyethylene encasement). Studies of ductile iron pipe's environmental impact have differing findings regarding emissions and energy consumed. Ductile iron pipe manufactured in the United States has been certified as a sustainable product by the Institute for Market Transformation to Sustainability.

Presentation Structure

6

Presentation B

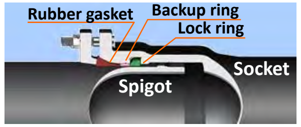
Strong pipe: Ductile Iron Pipe (DIP)

④

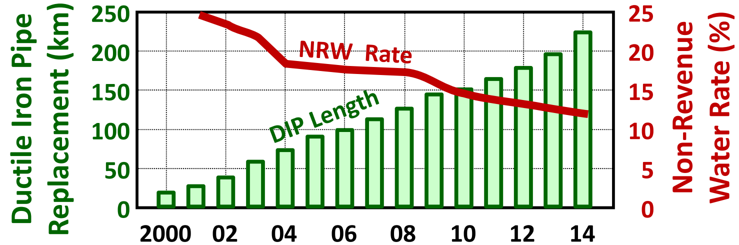
Pipe Life: ____~____ years

Joint type: Spigot & Socket, Flanges

Leak ratio of DIP to PVC: ____ times



Corrosion: Almost none with polyethylene sleeve

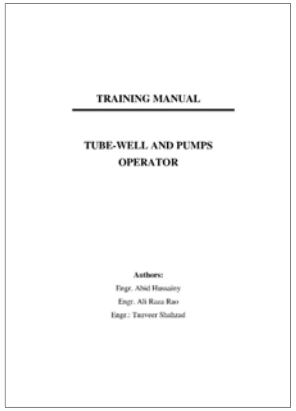


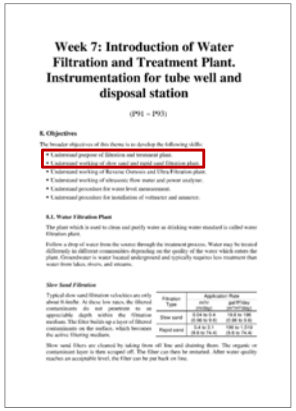
Convert from Textbook

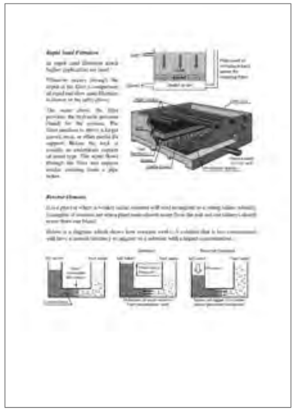
7

What is the important point? EX.6

Make rich 3-4 slides from textbook.







Convert from Textbook

8

You understand well, Trainees well too.

8.1. Water Filtration Plant

The plant which is used to clean and purify water as drinking water standard is called water filtration plant.

Follow a drop of water from the source through the treatment process. Water may be treated differently in different communities depending on the quality of the water which enters the plant. Groundwater is water located underground and typically requires less treatment than water from lakes, rivers, and streams.

← [1] Text and Photo

Slow Sand Filtration

Typical slow sand filtration velocities are only about 0.4m/hr. At these low rates, the filtered contaminants do not penetrate to an appreciable depth within the filtration medium. The filter builds up a layer of filtered contaminants on the surface, which becomes the active filtering medium.

Filtration Type	Application Rate	
	m/hr (m/day)	gal/ft²/day (m³/m²/day)
Slow sand	0.04 to 0.4 (0.96 to 9.6)	19.6 to 196 (0.96 to 9.6)
Rapid sand	0.4 to 3.1 (9.6 to 74.4)	196 to 1,519 (9.6 to 74.4)

Slow sand filters are cleaned by taking from off line and draining them. The organic or contaminant layer is then scraped off. The filter can then be restarted. After water quality reaches an acceptable level, the filter can be put back on line.

← [2] Text and Table

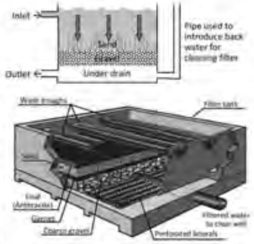
[3,4] Text and Figure →

Rapid Sand Filtration

In rapid sand filtration much higher application are used.

Filtration occurs through the depth of the filter a comparison of rapid and slow sand filtration is shown in the table above.

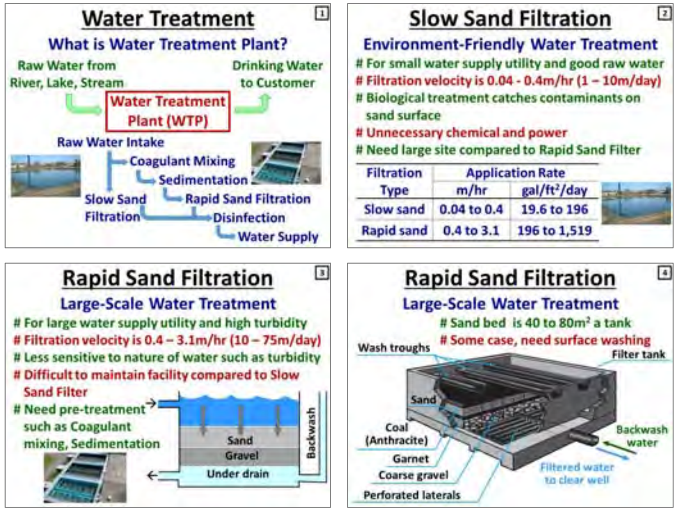
The water above the filter provides the hydraulic pressure (head) for the process. The filter medium is above a larger gravel, rock, or other media for support. Below the rock is usually an underdrain support of some type. The water flows through the filter and support media, existing from a pipe below



Try Lecture

9

5 minutes Lecture of EX.6



Audience checks lecturer's attitude, behavior, speech, and inputs to "Evaluate Sheet".

Preparation before Lecture

10

Check Lecture Room Size

\# Write your name on board, check its size

\# Check color pen, eraser, magnets of board

\# Check PC place and Lecturer position

\# Stand on Lecture position, test eye contact

Eye Contact

11

Don't be shy

Not read paper, right then, where I see?

1) Rear wall

2) Zigzag

Presentation Rule

12

Rule of Lecture

1) It may be made to reading document, but do not read in the lecture.
2) Make "______", trainees fill its answer in the blank.
3) Not One-Way lecture, but Interactive.
4) If need more explanation, make other document paper.
5) Eye Contact to all trainees, don't be shy
6) Anyway, do presentation exercise.

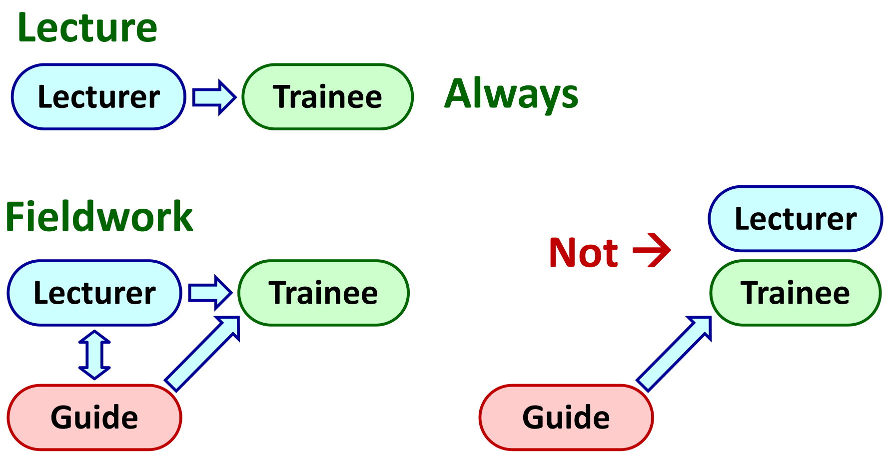
Lecture in Room or Fieldwork

Why need Fieldwork? Support Lecture

Lecture in Room	Fieldwork
Understand facilities' function, spec.	Understand facilities' real operation
See by 2D photo, Black &White, difficult to see	See by 3D 360°, take photo detail part
Not hear operating sound	Hear operating sound and feel vibration
Not understand outside of frame of photo	Understand up, down, right, left side of target
Difficult memorize	Impress in memory

Lecture in Room or Fieldwork

Lecturer must learn before Fieldwork



Fieldwork Structure

First Planning, and go to Fieldwork

1) Select facilities from Textbook
2) Get facility list from WASA
3) Find facility from 1) and 2)
4) Get facility's specification, photo and present condition form WASA
5) Fix visit schedule with WASA staff
6) Ask explanation part with WASA staff
7) Make facility's explanation paper
8) Go to fieldwork site

Fieldwork Structure

Field visit and Site visit

1) Contact to person in charge about visit
2) Get facility/equipment information
3) Make material or ask to make material
4) Show material to trainee before, and collect question and send to lecturer
5) Discuss lecture hours and site hour
6) Make Plan B for rough weather
7) Academy supports lecturer on site
8) Go to fieldwork site

Fieldwork Rule

Notice when visit

1) Always "On Time" or "In Time"
2) Visitor has to act in accordance with the destination's rules
3) Not talk loudly anywhere
4) When move, not spread, move together
5) Listen to lecturer's description, quietly
6) Mobile phone keeps silent mode

There are simple manners, but It is difficult to follow the rule in large number of people.

Sample of Fieldwork

Leakage Survey Work (Preparation)

0) Survey area already decided …
1) Prepare pipeline map and equipment
2) Charge batteries of equipment
3) Check weather report and city event
4) Check traffic condition of survey area
5) Check pipe diameter, material, depth, age, location of valve, hydrant, meter
6) Simulation of staff's activity
7) Go to survey work site

Sample of Fieldwork

Leakage Survey Work (Operation)

1) Find start point on pipeline network
2) Confirm traffic condition and surround safety condition
3) Management of accompaniment of leakage equipment, Not lose stuff
4) Take a rest, not survey long at a time
5) Survey with traffic safety guard
6) In night work, take some light reflection
7) Be careful of robbery

Sample of Fieldwork

Tube Well and Pump Facility

0) Survey area already decided …
1) Prepare station map and facility photo, specification and maintenance record
2) Confirm facility from Textbook
3) Ask to send some photos to WASA Guide
4) Collect questionnaire from Trainees and sent them to WASA Guide
5) Go to Fieldwork site

Sample of Fieldwork

21

Mechanical and Electrical Facility

0) Survey area already decided …
1) Prepare electric control line map and facility photo, specification
2) Confirm facility from Textbook
3) Ask to send some photos to WASA Guide
4) Collect questionnaire from Trainees and sent them to WASA Guide
5) Go to Fieldwork site

Sample of Fieldwork

22

Sewer & Drainage Manhole Survey

0) Survey area already decided …
1) Find location of manhole in pipeline map
2) Charge batteries of toxic gas meter
3) Check weather report and city event
4) Check road surface condition of manhole
5) Set security guard on traffic line for driver and near manhole for pedestrian
6) Prepare safety sign board for passengers
7) Set safety sign hardly against strong wind

Fieldwork Structure

23

Make Fieldwork Program

EX.7

What's you need "Preparation"?

1)
2)
3)
4)
5)
6)
7)
8)

Input here, your Plan, Preparation, Notice.

Fieldwork Structure

24

Make Fieldwork Program

EX.8

What's you need "Preparation"?

Make Check List from Ex.7

How to Evaluate Trainees

Confirm by Interview or Comment

0) Lecturer asks Trainees as follows

1) Purpose of facility, equipment, device, method

2) Keyword or Cue word from Guide's explanation

3) Discussion by Trainees, comment on it

It is difficult to grasp trainees' understanding by quantitative analysis, then ask interview or get comment by qualitative analysis.

Upgrade of Presentation Skill

3. Presentation Flow and Phrase

April, 2016

KEN Yokoyama

JICA Expert Team

Presentation Flow

Preparation of Lecturer's Presentation

1. Verify the lecture contents and time
2. Confirm the trainees' city, job post, job contents
3. Check projector location and projection size
4. Make purposes and results clear
5. Consider whole presentation and each parts
6. Prepare Cue Cards (Not reading document)
7. Display proper Text, Chart, Table, Picture, Figure
8. Do rehearsal in advance and get comment
9. Practice until get self-confidence

Presentation Flow

General Presentation

1) Introduction	Greeting → Self-introduction → Training purposes → Configuration Introduction → Time required
2) Body	→ Explain the issue → Explain the basis of issue → Explain the conclusion of issue → Repetition →
3) Conclusion	Summary → Concludes/Suggest → End
4) Question & Answer	
5) Closing	Show them contact e-mail address

Presentation Phrase

Starting Presentation (1)

1.1 Greeting

- Good morning / afternoon, ladies and gentleman.
- Thank you chairperson for your kind introduction.

* Hello. / Hi, everyone.

1.2 Appreciation for audience

- It's a great honor for me to be here with you today.
- I'm very grateful that you could come today.

* It's nice to see so many of you here today.

*: Informal representation

Presentation Phrase

Starting Presentation (2)

1.3 Introducing myself

- Let me introduce myself.
- (As some of you may already know,) I am ….
- Allow me to introduce myself. I am ….

1.4 Topic

- The title [subject/topic] of my presentation is ….
- Today, I'd like to talk about ….

1.5 Objective

- The objective of this presentation is to present ….

Presentation Phrase

Starting Presentation (3)

1.6 Structure/Composition

- My presentation consists of (three) main points.
- My speech is structured as follows:

* I've divided my talk into three main parts.

1.7 Timeframe

- The presentation will take about (45) minutes.
- I'll speak for about (45) minutes.
- I've been given (45) minutes for my speech.

* I plan to be brief. About (45) minutes.

Presentation Phrase

Starting Presentation (4)

1.8 Questions

- If you have any questions, please feel free to interrupt anytime.
- Please feel free to ask me questions anytime during my presentation.
- I'd be glad to take any questions at the end of my presentation.

1.9 Moving on to the body

- Let me start my presentation. The first point is ….

* OK. Let's start with the first point.

Presentation Phrase

Various Expression (1)

2.1 Sequencing ideas

- First, I would like to discuss …. Secondly, …. Then, …. And finally / Last but not least, ….
- The first point is …. The second point is ….

2.2 Opening new section

- Now, I would like to talk about ….
- This brings me to the second point, which is ….

* Let's now look at …

Presentation Phrase

9

Various Expression (2)

2.3 Ending a section

- I think that covers everything on ….
- I think that deals with ….
- To summarize, ….

* So, this is all I wanted to say about ….

2.4 Taking questions

- Are there any questions or comments on the points I have made?
- Would anyone like to ask a question at this point?

* Questions so far, anyone?

Presentation Phrase

10

Various Expression (3)

2.5 Changing the topic

- Let's now look at …. / Let's now talk about ….
- Now I want to turn to ….

2.6 Referring to relevant

- In relation to ….
- Regarding …. / Concerning ….

2.7 Adding information

- In addition to this …. / Moreover …. / So ….
- Furthermore …. / Despite this …. / Therefore ….

Presentation Phrase

11

Various Expression (4)

2.8 Sidetracking

- If I could just digress for a second ….
- I would like to look at … in passing.
- By the way …. / Incidentally ….

2.9 Backtracking

- Let me come back to ….
- At this point, I would like to go back to ….

Presentation Phrase

12

Emphasis Expression (1)

3.1 Emphasizing particular point

- I'd like to emphasize …. / I should repeat ….
- It is critical to understand ….

3.2 Starting from "What"

- What we can do is to ….
- What I'd like to say is to ….
- What is really important is to ….

3.3 Repeating

- This is a very, very difficult problem.
- We have thought for a long, long time about this.
- We need to do something and we need to do it.

Presentation Phrase

13

Emphasis Expression (2)

3.4 Stressing particular words
- We did achieve this much in just one year.
- It does seem to be a difficult question to answer.
- We have tried repeatedly, but ….
- It was a complete failure.
- It's a great success. / It's a remarkable success.
- It was a brilliant solution.

3.5 Speaking candidly
- Frankly speaking, ….

* To be honest, ….

Presentation Phrase

14

Emphasis Expression (3)

3.6 Paraphrasing
- In other words, …. / To put it simply ….
- Basically, …. Let me put it this way.

3.7 Analyzing points
- Let's look at it more closely.
- We should look into it a little further.

* What does this mean exactly?

3.8 Backtracking important
- I'm sorry I forgot to mention something important when I was talking about …. Allow me to go back to …. I will repeat this part.

Presentation Phrase

15

How do they see your presentation slide?

4.1 Checking with the audience
- Can everybody see this chart clearly?
- I suppose the graph is not big enough for a clear. So please refer to handout later.

4.2 Bullet points
- These are the main points.
- I have itemized (3) main points in the slide.
- Let me explain each of them briefly.
- Let me give you an example for item.
- To illustrate the point, I'd like to give you example.

Presentation Phrase

16

Attract the attention of trainees (1)

5.1 Asking audience's understand
- Is that clear to you?
- Do you see my points?
- Are you following me?

5.2 Interacting by asking question
- How can we explain this?
- Is there anything we can do about this?
- Did you know this?
- How many of you knew this?
- Can I ask for a show of hands? How many ….?

Presentation Phrase

17

Attract the attention of trainees (2)

5.3 Flattering the audience

- I'm sure you don't need me to tell you that ….
- I'm sure this is all familiar to you, but, ….

5.4 Using body language

- Maintain eye contact
- Control your mannerisms
- Use hand gestures
- Move about to create interest

Presentation Phrase

18

Attract the attention of trainees (3)

5.5 Filling the gap

- Now, let me see …. / Well, let me see ….
- The expression I wanted to say slipped my mind.

5.6 Make your English humor

- This is one of words I cannot pronounce correctly. Maybe I should say it the other way round. This is one of few words I am trying to pronounce correctly.
- I'm amazed that you seem to understand my English without much problem. I understand my English only because I've heard it so many times yesterday.

Presentation Phrase

19

Conclusion (1)

6.1 Stating presentation is over

- This brings me to the end of my presentation.
- That covers everything I wanted to say ….

* That's all I have to say.

* Well, that's the end of my presentation.

6.2 Summarizing main points

- Before I finish, let me go over the (3) main points.
- That covers everything I wanted to say …. [again]

Presentation Phrase

20

Conclusion (2)

6.3 Stating conclusion

- To conclude, I'd like to say that … .
- I'd like to finish by saying … .
- In conclusion, … .

6.4 Presenting a proposal

- It seems to me then, that we should … .
- I would therefore recommend (advise) that … .
- Based on the discussion I have just presented to you, I would like to propose … .

Presentation Phrase

Conclusion (3)

6.5 Providing further information

- I have prepared some handouts I will pass round.
- You can get some materials relevant to my talk.
- This is my e-mail address in case you want to follow up on something I said.

6.6 Making closing remark

- Thank you for listening.
- Thank you for your attention.

Presentation Phrase

Question and Answer (1)

7.1 Inviting questions

- I'd be glad to answer any questions.
- If you have any questions, please feel free to ask.
- Are there any questions?

* So, do you have any questions?

7.2 Responding positively

- That's a good (difficult / complex) question.
- Thank you for asking that question.
- I'm glad you asked that question. It allows me to say about … .

Presentation Phrase

Question and Answer (2)

7.3 Asking to repeat question

- I'm sorry, I did not catch the question.
- Would you repeat your question, please?
- Please put it in a simpler way. Would you reframe your question, please?
- I could not understand the part you were talking about …. Would you please repeat that portion?

7.4 Confirm question's contents

- If I understand you correctly, you want ….
- You are asking me about …. Is that right?
- In other words, you are asking …. Is that right?

Presentation Phrase

Question and Answer (3)

7.5 Checking question's answer

- Does that answer your question?
- Is it clear now?

7.6 Answering by referring back

- As I said earlier in the section, ….
- I already made it clear that ….

7.7 Returning the question

- Well, let me ask you the same question.
- Well, I'd rather ask you to answer that question.
- Well, that depends on what you mean by ….

Presentation Phrase

25

Question and Answer (4)

7.8 Accepting criticism

- I accept that. / That's a fair point. / I agree on that.
- You are right on that.

7.9 Avoiding answer

- I'm afraid I'm not the right person to answer this.
- That's not really my field. So, I would rather not answer that question.

7.10 Classified information

- I'm not at liberty to give you that information.

Presentation Phrase

26

Question and Answer (5)

7.11 Cannot answer

- I'm sorry, but I don't have information to answer.
- I really don't know how to answer your question.
- I have to admit that I can't answer that question.

7.12 Answer later

- I'd be glad to discuss the question personally with you after the presentation.
- May I have your e-mail address later to give you my answer? I don't have enough information with me today.

Presentation Phrase

27

Ending

8.1 Closing presentation

- I would like to thank … for providing me with this opportunity to explain (discuss / talk about) ….

* Thank you Mr.AAA, Ms.BBB, for your great help.

1

1. Beautiful Number

Regular Number, it's so Beautiful

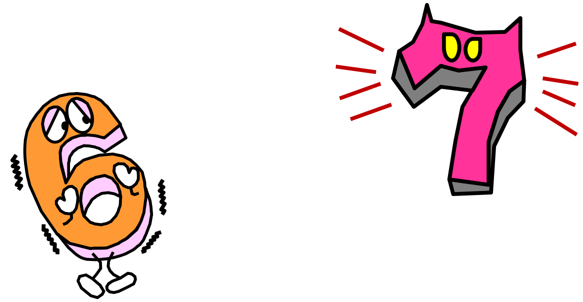
12345679 * 9 = 111111111   8*1+1 = 9
12345679 * 18 = 222222222   8*12+2 = 98
12345679 * 27 = 333333333   8*123+3 = 987
12345679 * 36 = 444444444   8*1234+4 = 9876
12345679 * 45 = 555555555   8*12345+5 = 98765
12345679 * 54 = 666666666   8*123456+6 = 987654
12345679 * 63 = 777777777   8*1234567+7 = 9876543
12345679 * 72 = 888888888   8*12345678+8 = 98765432
12345679 * 81 = 999999999   8*123456789+9 = 987654321

11 * 11 = 121   111111 * 111111 = 12345654321
111 * 111 = 12321   1111111 * 1111111 = 1234567654321
1111 * 1111 = 1234321
11111 * 11111 = 123454321

2

2. Why is 6 afraid of 7?

When number counting,
Six is afraid of Seven.



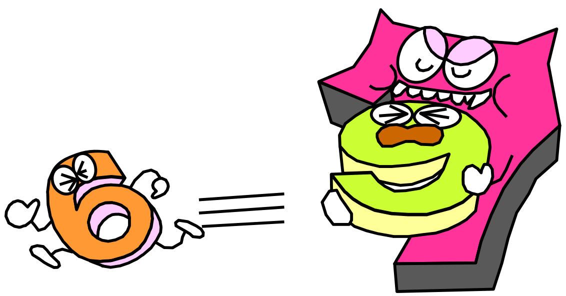
Why is Six afraid of Seven?

3

2. Why is 6 afraid of 7?

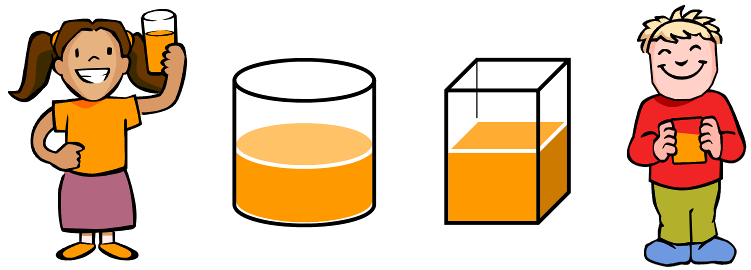
Because

Six heard Seven ate Nine.
6 7 8 9



4

3. Divide Juice into Two



Do not say complain each other.
How can they separate the juice?

3. Divide Juice into Two

Answer

One person divides into half,
and another person chooses.

4. Fantastic Four

Summation of 4 parameters of a, b, c, d is 90.
What's their number under below condition ?

a + b + c + d = 90

Condition: a+2 = b–2 = c*2 = d/2

4. Fantastic Four

Condition: a+2 = b–2 = c*2 = d/2
└[2]┘ └[1]┘ └[3]┘

[1] b–2 = c*2　　b = 2c+2
[2] a+2 = b–2　　a = b-4 = 2c+2-4 = 2c-2
[3] c*2 = d/2　　d = 4c
[4] a + b + c + d = (2c-2) + (2c+2) + c + 4c
= 9c = 90 ∴ c = 10

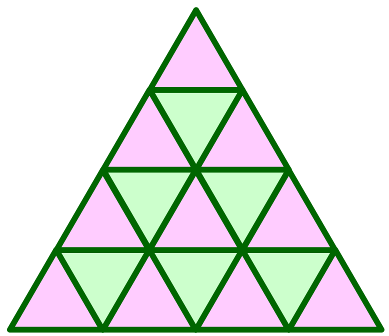
b = 2c+2 = 22
a = b-4 = 18
d = 4c = 40

Answer

a=18, b=22, c=10, d=40

5. Equilateral Triangle

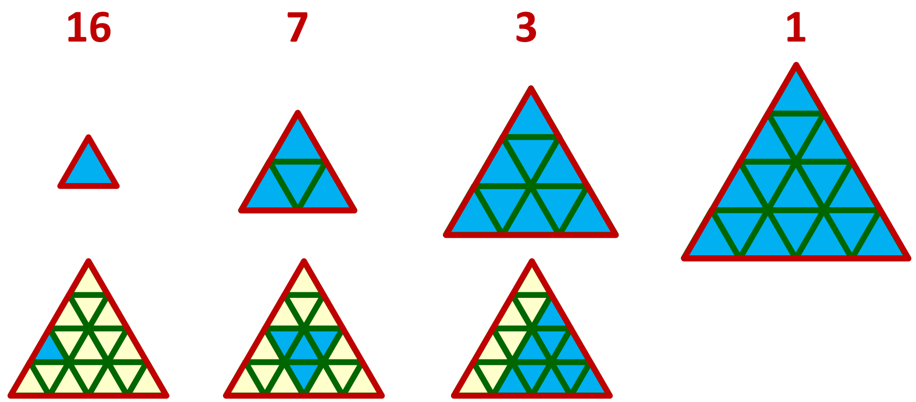
How many Equilateral Triangle?



Not 16 …..

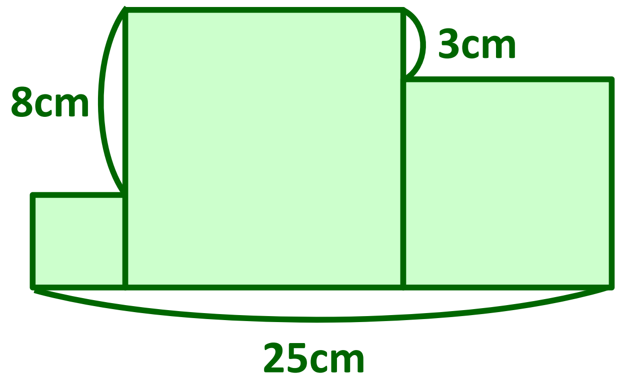
5. Equilateral Triangle

Answer: 27

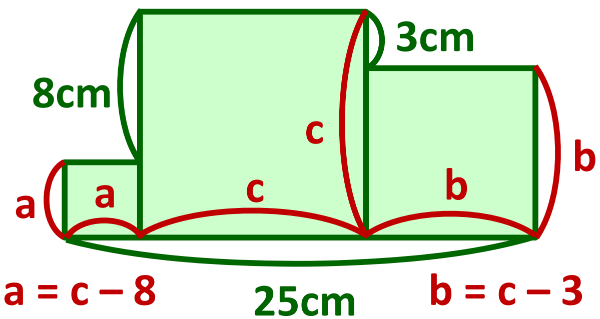


7. Three Squares Area

Calculation of Area of Three Squares



7. Three Squares Area



Answer

$4^2+12^2+9^2$

$= 241cm^2$

a + b + c = 25

(c – 8) + (c – 3) + c = 25

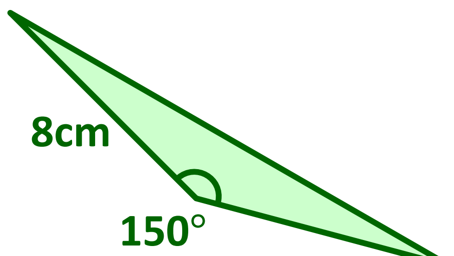
3c = 36 ∴ c = 12cm

a = c – 8 = 4cm

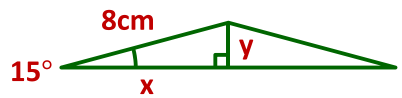
b = c – 3 = 9cm

8. No sine, No cosine

Calculation of Area of Isosceles Triangle without Calculator



Usually …



$\cos(15°) = x / 8$

$x = 8\cos(15°)$

$\sin(15°) = y / 8$

$y = 8\sin(15°)$

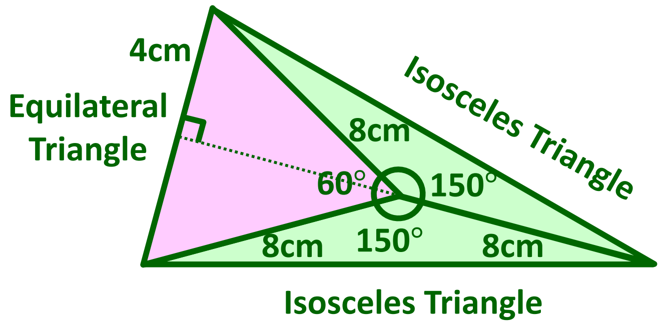
$A = 2x * y / 2 = xy$

$= 64\cos(15°)\sin(15°)$

8. No sine, No cosine

Answer

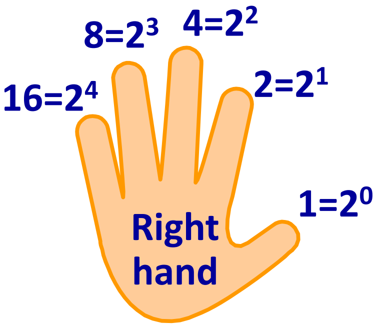
$A = 8 * 4 / 2 = 16cm^2$



9. Number counting

How many can you count number in one hand?

9. Number counting

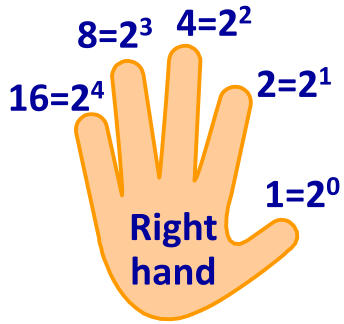


When count number, bend finger.
Thumb is 1, Middle is 4, number is 5.

Binary Notation

1=1	9=8+1
2=2	10=8+2
3=2+1	11=8+2+1
4=4	12=8+4
5=4+1	13=8+4+1
6=4+2	14=8+4+2
7=4+2+1	15=8+4+2+1
8=8	16=16

9. Number Counting



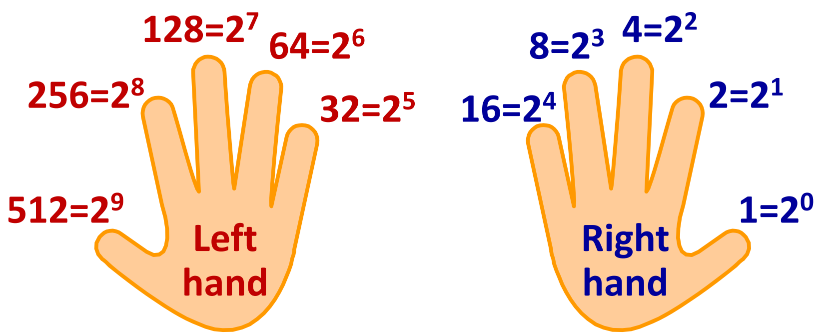
LRMIT Finger
00010= 2
00101= 5
01110=14
11101=29

Binary Notation

17=16+1	25=16+8+1
18=16+2	26=16+8+2
19=16+2+1	27=16+8+2+1
20=16+4	28=16+8+4
21=16+4+1	29=16+8+4+1
22=16+4+2	30=16+8+4+2
23=16+4+2+1	31=16+8+4+2+1
24=16+8	32=To left hand

9. Number Counting

Answer: 31 (32)



Use both hands, count until 1,024 (2^{10})

10. Three after Two

I would like to measure every 1g until 40g by balance.
How many weights should I prepare?

10. Three after Two

Answer: 1g, 3g, 9g, 27g

1=1	11=9+3-1	21=27-9+3	31=27+3+1
2=3-1	12=9+3	22=27-9+3+1	32=27+9-3-1
3=3	13=9+3+1	23=27-3-1	33=27+9-3
4=3+1	14=27-9-3-1	24=27-3	34=27+9-3+1
5=9-3-1	15=27-9-3	25=27-3+1	35=27+9-1
6=9-3	16=27-9-3+1	26=27-1	36=27+9
7=9-3+1	17=27-9-1	27=27	37=27+9+1
8=9-1	18=27-9	28=27+1	38=27+9+3-1
9=9	19=27-9+1	29=27+3-1	39=27+9+3
10=9+1	20=27-9+3-1	30=27+3	40=27+9+3+1

10. Three after Two

Numerical formula = $\Sigma(a_n 3^{n-1})$

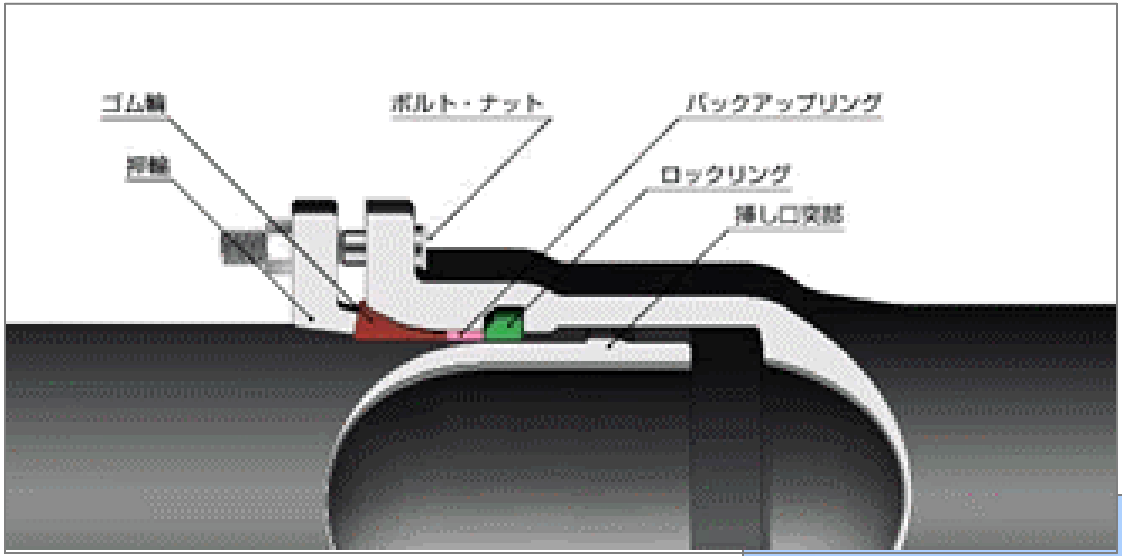
$= a_1 3^0 + a_2 3^1 + a_3 3^2 + a_4 3^3 + a_5 3^4 + \cdots$

$a_n = (1, 0, -1)$

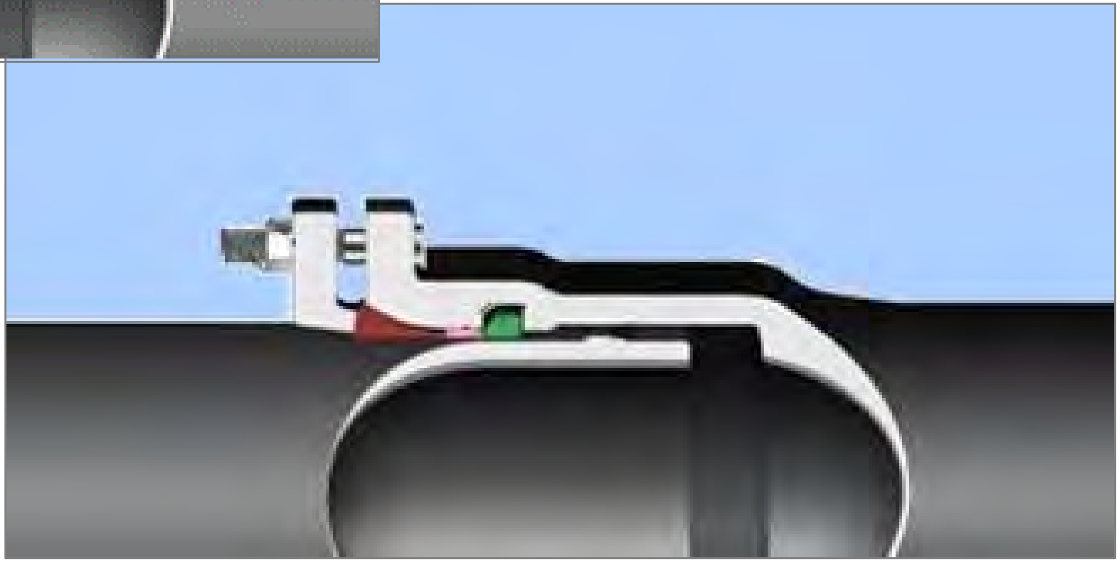
n	
1	1
2	4=3+1
3	13=9+3+1
4	40=27+9+3+1
5	121=81+27+9+3+1
6	364=243+81+27+9+3+1
7	1,093=729+243+81+27+9+3+1
8	3,280=2,187+729+243+81+27+9+3+1
9	9,841=6,561+2,187+729+243+81+27+9+3+1
10	29,524=19,683+6,561+2,187+729+243+81+27+9+3+1

Exercise 1

Erase unnecessary words and arrows



Try



Open “Exercise_1_Paint_DIP.jpg” with “Paint”

Exercise 2

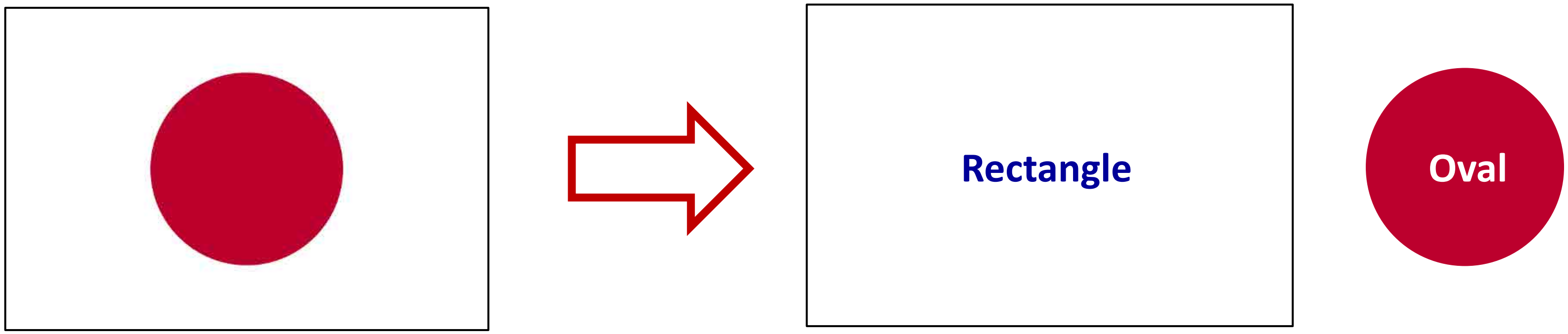
Erase unnecessary Crane over there

Try

Open "Exercise_2_Paint_Crane.jpg" with "Paint"

Exercise 3

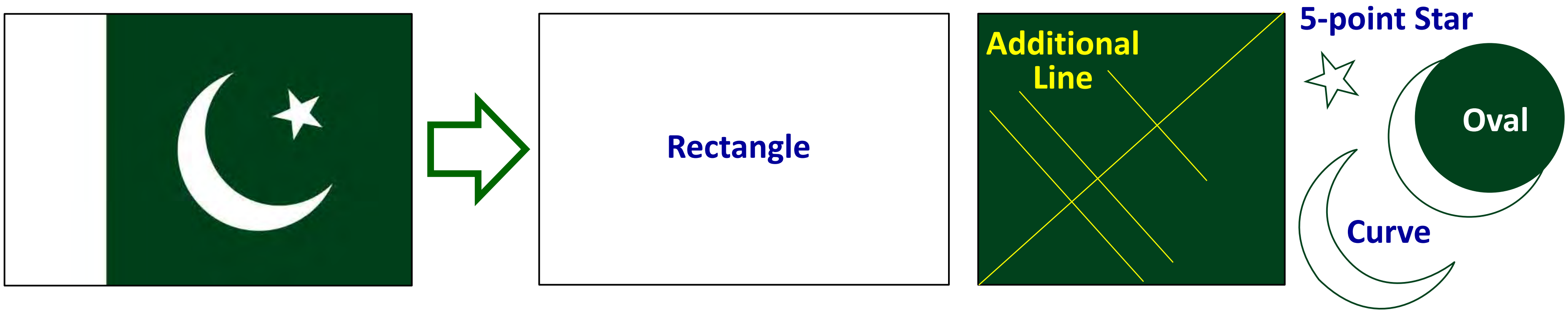
Make National Flag of Japan



1) Draw by Shapes, 2) Composition by Align Center and Align Middle, and 3) Group

Exercise 4

Make National Flag of Pakistan



1) Draw "Rectangle" and "Line", 2) Select "Oval" or "Curve" of Crescent, and 3) Group

1

Exercise 5

Edit of National Border Line of Pakistan

© Wikipedia

1) L.C. on red line, and Select “Edit Points”
2) On line, R.C. and select “Add Point” or [Ctrl]+ L.C.
3) L.C. and Drag to proper point on map
4) Back to 2)
5) If straight line changes curve, R.C. and change to “Straight Segment”

Exercise 6

Week 7: Introduction of Water Filtration and Treatment Plant. Instrumentation for tube well and disposal station

(P91 ~ P93)

8. Objectives

The broader objectives of this theme is to develop the following skills:

- Understand purpose of filtration and treatment plant.
- Understand working of slow sand and rapid sand filtration plant.
- Understand working of Reverse Osmosis and Ultra Filtration plant.
- Understand working of ultrasonic flow meter and power analyzer.
- Understand procedure for water level measurement.
- Understand procedure for installation of voltmeter and ammeter.

8.1. Water Filtration Plant

The plant which is used to clean and purify water as drinking water standard is called water filtration plant.

Follow a drop of water from the source through the treatment process. Water may be treated differently in different communities depending on the quality of the water which enters the plant. Groundwater is water located underground and typically requires less treatment than water from lakes, rivers, and streams.

Slow Sand Filtration

Typical slow sand filtration velocities are only about 0.4m/hr. At these low rates, the filtered contaminants do not penetrate to an appreciable depth within the filtration medium. The filter builds up a layer of filtered contaminants on the surface, which becomes the active filtering medium.

Filtration Type	Application Rate	
	m/hr (m/day)	gal/ft^2/day (m^3/m^2/day)
Slow sand	0.04 to 0.4 (0.96 to 9.6)	19.6 to 196 (0.96 to 9.6)
Rapid sand	0.4 to 3.1 (9.6 to 74.4)	196 to 1,519 (9.6 to 74.4)

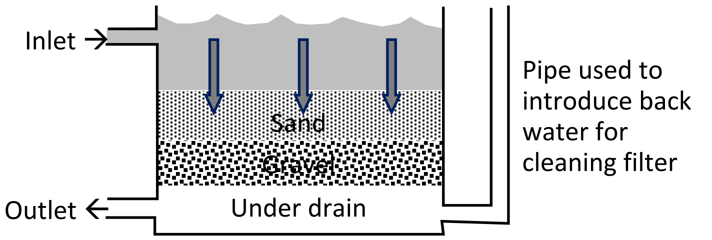
Slow sand filters are cleaned by taking from off line and draining them. The organic or contaminant layer is then scraped off. The filter can then be restarted. After water quality reaches an acceptable level, the filter can be put back on line.

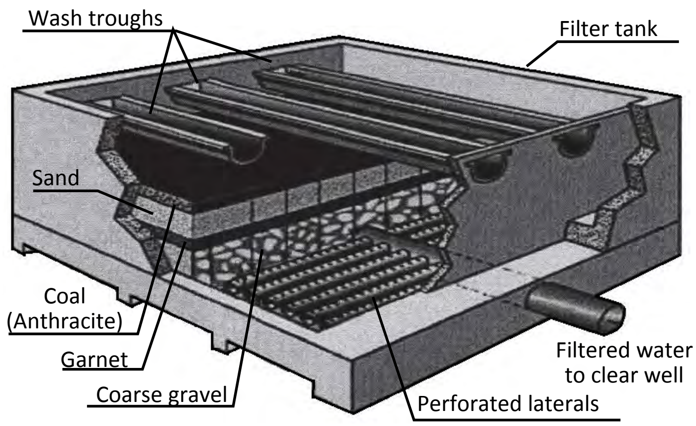
Rapid Sand Filtration

In rapid sand filtration much higher application are used.

Filtration occurs through the depth of the filter a comparison of rapid and slow sand filtration is shown in the table above.

The water above the filter provides the hydraulic pressure (head) for the process. The filter medium is above a larger gravel, rock, or other media for support. Below the rock is usually an underdrain support of some type. The water flows through the filter and support media, existing from a pipe below

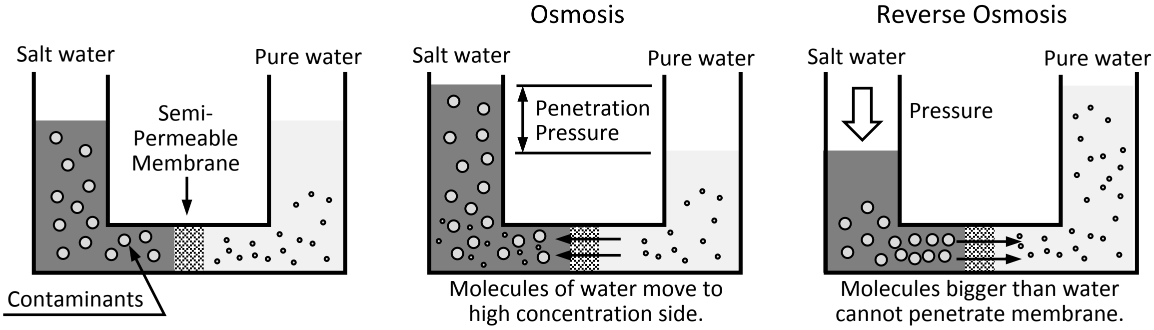




Reverse Osmosis

It is a process where a weaker saline solution will tend to migrate to a strong saline solution. Examples of osmosis are when plant roots absorb water from the soil and our kidneys absorb water from our blood.

Below is a diagram which shows how osmosis works. A solution that is less concentrated will have a natural tendency to migrate to a solution with a higher concentration.



Water Treatment

What is Water Treatment Plant?

Raw Water from River, Lake, Stream

Water Treatment Plant (WTP)

Drinking Water to Customer

Raw Water Intake

Coagulant Mixing

Sedimentation

Slow Sand Filtration

Rapid Sand Filtration

Disinfection

Water Supply

Slow Sand Filtration

Environment-Friendly Water Treatment

For small water supply utility and good raw water
Filtration velocity is 0.04 - 0.4m/hr (1 – 10m/day)
Biological treatment catches contaminants on sand surface
Unnecessary chemical and power
Need large site compared to Rapid Sand Filter

Filtration Type	Application Rate	
	m/hr	gal/ft^2/day
Slow sand	0.04 to 0.4	19.6 to 196
Rapid sand	0.4 to 3.1	196 to 1,519

Rapid Sand Filtration

Large-Scale Water Treatment

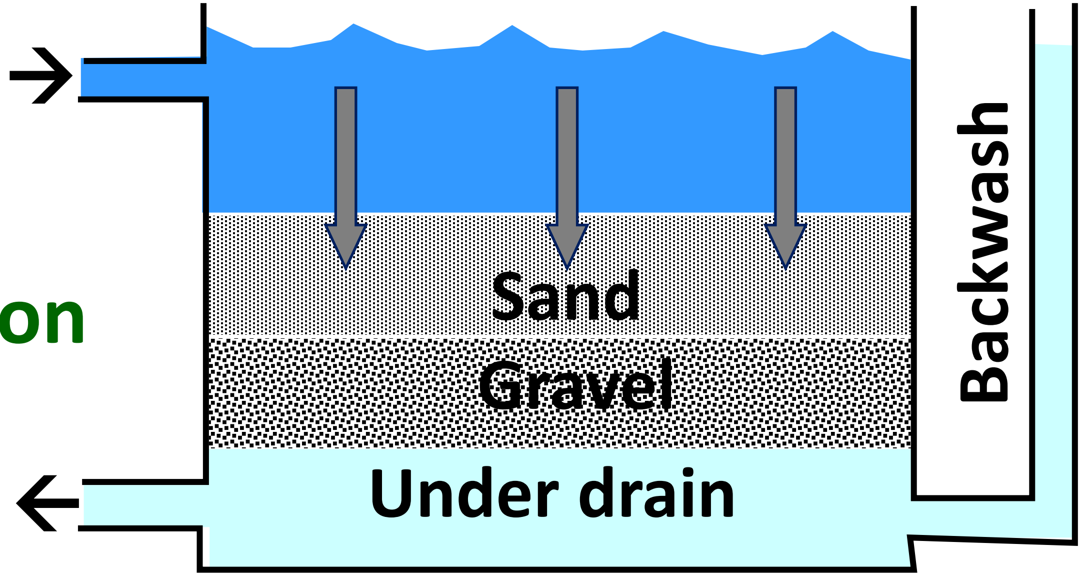
For large water supply utility and high turbidity

Filtration velocity is 0.4 – 3.1m/hr (10 – 75m/day)

Less sensitive to nature of water such as turbidity

Difficult to maintain facility compared to Slow Sand Filter

Need pre-treatment such as Coagulant mixing, Sedimentation

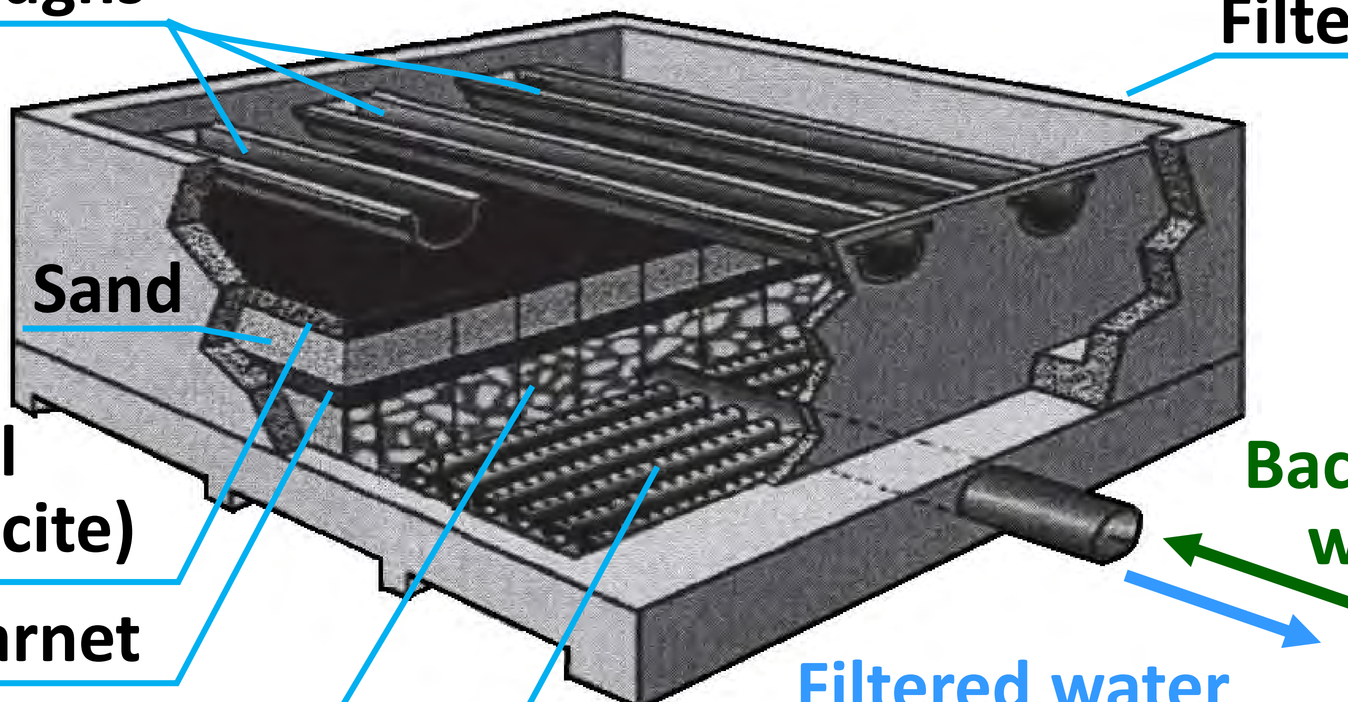


Rapid Sand Filtration

Large-Scale Water Treatment

Sand bed is 40 to 80m^2 a tank

Some case, need surface washing



Exercise 7

Input your Course, here

What’s kind of Fieldwork? Input here

1)
2)
3)
4)
5)
6)
7)
8)

Input here, your Plan, Preparation, Notice.

Fieldwork Check Sheet (Ex.8 / Sample)

Date: , 2016

Lecture Course			
Fieldwork name			
Date and Time		Work Place	
Guide name		Organization	
Lecturer name		No. of trainees	

No	Item	YES	NO	Date/Remarks
	Pickup important facility from textbook			
	Ask facility list from WASA			
	Receive facility list from WASA			
	Select object of facility			
	Ask WASA about visit			
	Receive WASA acceptance of visit			
	Ask paper work of visit			
	Decide implementation date with WASA Guide			
	Ask to send material (photo, specification, map) of facility			
	Receive material above			
	Not prepare material, go to WASA directly, and take photo, copy			
	Contact WASA Guide, who explain which part			
	Contact WASA Guide, detail visit time, place			
	Pre-study of facility			
	Make material for fieldwork			
	Pass material to trainees			
	Collect questionnaire from trainees			
	Send questionnaire to WASA Guide			
	Guidance visitors rule to trainees			
	Pre-explain facility to trainees			
	Confirm meeting time and place			

Training Monitoring Sheet

Name		Organization	

Check Item		Excellent(4)	Good(3)	Fair(2)	Bad(1)
Lecturer	Teaching skill				
	Plain explanation				
	Teaching behavior				
	English level				
Lecture material	Intelligible				
	Difficulty level				
Comprehensive evaluation					

Check Item (Ex. [1:3-10] means [Material number: page-page]	Excellent (4)	Good (3)	Fair (2)	Bad (1)
Presentation Structure [1:3-10]				
Presentation Expression (Text & Table) [1:11-16]				
Presentation Expression (Photo & Image) [1:17-29]				
Presentation Expression (Chart) [1:30-33]				
Presentation Expression (Figure) [1:34-43]				
Presentation Rule [1:44-54]				
Convert from Textbook to Slide [2:7-8]				
Try Lecture [2:9-12]				
Fieldwork Structure [2:13-17]				
Fieldwork Sample [2:18-22]				
Make Fieldwork Plan [2:23]				
Make Check List of Fieldwork Plan [2:24]				
How to Evaluate Trainees [2:25]				
Exercise 1&2				
Exercise 3&4				
Exercise 5				
Exercise 6				
Exercise 7				
Exercise 8				
Comprehensive evaluation				

Comment

Lecturer's Evaluation Sheet

Date: , 2016

Lecturer name		Evaluate from	

No	Item	4 Good	3 Fair	2 Moderate	1 Bad
I	SLIDE				
1	Easy to see font size				
2	Select appropriate font				
3	Easy to see color of table/figure				
4	Balance or Layout of slide (not much space, not biased to one side)				
5	Easy to understand what the Lecturer wants to say when the audience just sees slides				
II	PRESENTATION SKILL				
6	Speed of speech				
7	Strength and accent of speech				
8	Eye contact distribution				
9	Attitude at the presentation				
10	Humor				
11	Easy to understand the contents and explanation				
III	COMMENT				
12					

<Check-List ver.3 (April 6, 2016)>

Annex 2.12
Draft Evaluation Sheet

Training Evaluation Form

Al-Jazari Water & Sanitation Academy

(October 2016)

Please provide your honest evaluation of the training course that you have just undertaken. Your evaluation will help to improve the future delivery of trainings by Al-Jazari Academy. There are two parts of this evaluation sheet a) overall evaluation of course b) Trainer's Evaluation.

Part A) Overall Evaluation of Course

How satisfied are you with:	Not Satisfied 1	Somewhat Satisfied 2	Satisfied 3	Very Satisfied 4	Remarks
The relevance of topics to your needs?					
Was the course content Appropriate?					
Pace of course					
Quality of Training Materials (PPT Slides, Handouts)					
Relevance of field work or OJT					
Overall Presentation quality of Trainer(s)					
Trainer's expertise on topics?					
Training facilities?					

Over all Administration?					
Overall quality of the training workshop?					

1).Were you satisfied with the Logistical arrangements during the training program?

Yes ☐ **No** ☐

If no, why____

2) Were you satisfied with the overall Training Quality you have attended at Al-Jazari Water & Sanitation Academy?

Yes ☐ **No** ☐

If no, then kindly elaborate

3) Were you satisfied with the quality of Training Materials (PPT Slides, Handouts, Textbook etc.?)

Yes ☐ **No** ☐

If no, then kindly elaborate

4) Was the time and length of training appropriate?

Yes ☐ **No** ☐

If no, then kindly elaborate

____

____

6) Would you like to recommend this course/module to your colleagues?

Yes ☐ **No** ☐

____

____

5. Course/module learning outcomes

5 a) to what extent were these course/module learning outcomes accomplished?

	Course/module Learning Outcomes	Accomplished	Not Accomplished
1			
2			
3			
4			
5			
6			
7			
8			

5 b) from your perspective please elaborate why do you think the course/module learning outcomes were not fulfilled

6) Please explain from your experience whether field work or OJT were beneficial or relevant in terms of enhancing knowledge and skills?

6) Please explain from your experience whether field work or OJT were beneficial or relevant in terms of enhancing knowledge and skills?

Part B) Trainer's Evaluation

Name of the Trainer (____________________)

		Below average 1	Average 2	Good 3	Very good 4	Excellent 5	Remarks
A	Qualification & experience						
B	Knowledge of the topics						
C	Explanation of topics						
D	Training Techniques						
E	Communication style						
F	Time management						
G	Presentation Skills						
G	Quality of Learning materials (PPT slides, handouts)						

7) Any other suggestion or comment.

____

____

Name: ___________________________ Signature: __________________________

Note: The information contained in this form will be used for evaluation and analysis. We may also use your comments in certain publications/ reports.

Annex 2.13
OJT Operation Sheet

OJT Implementation Plan

Lecture Topic: ------------- **Date:----------------------**
Academy Trainer(s):- ------------ **OJT Trainer(s):-----------------------**

Day	Place	Target knowledge & skills	Equipment/ Machinery/ Material	Step by step procedure	Time	Evaluation

Annex 3.1

List of Trainees for Training in Japan in Second Project Year

SUB COURSE TITLE: Operation and Maintenance for water and sewerage facilities

No	Name	Sex	Organization	Position
1	Muhammad Zaheer Rana	M	Lahore WASA	Sub Engineer
2	Saeed Ahmad Khan	M	Lahore WASA	Sub Engineer
3	Anum Javed	F	Lahore WASA	Sub Divisional Officer (Mech)
4	Rouf Ahmad	M	Faisalabad WASA	Sub Engineer
5	Muhammad Shoaib Sarwar	M	Multan WASA	Sub Engineer
6	Jehan Zeb Irshad Chattha	M	Gujranwala WASA	Sub Engineer
7	Muhammad Khalique Afzal	M	Rawalpindi WASA	Sub Engineer
8	Jawad Shahid	M	Al-Jazari Academy	Senior Instructor
9	Muhammad Irfan	M	Al-Jazari Academy	Senior Instructor

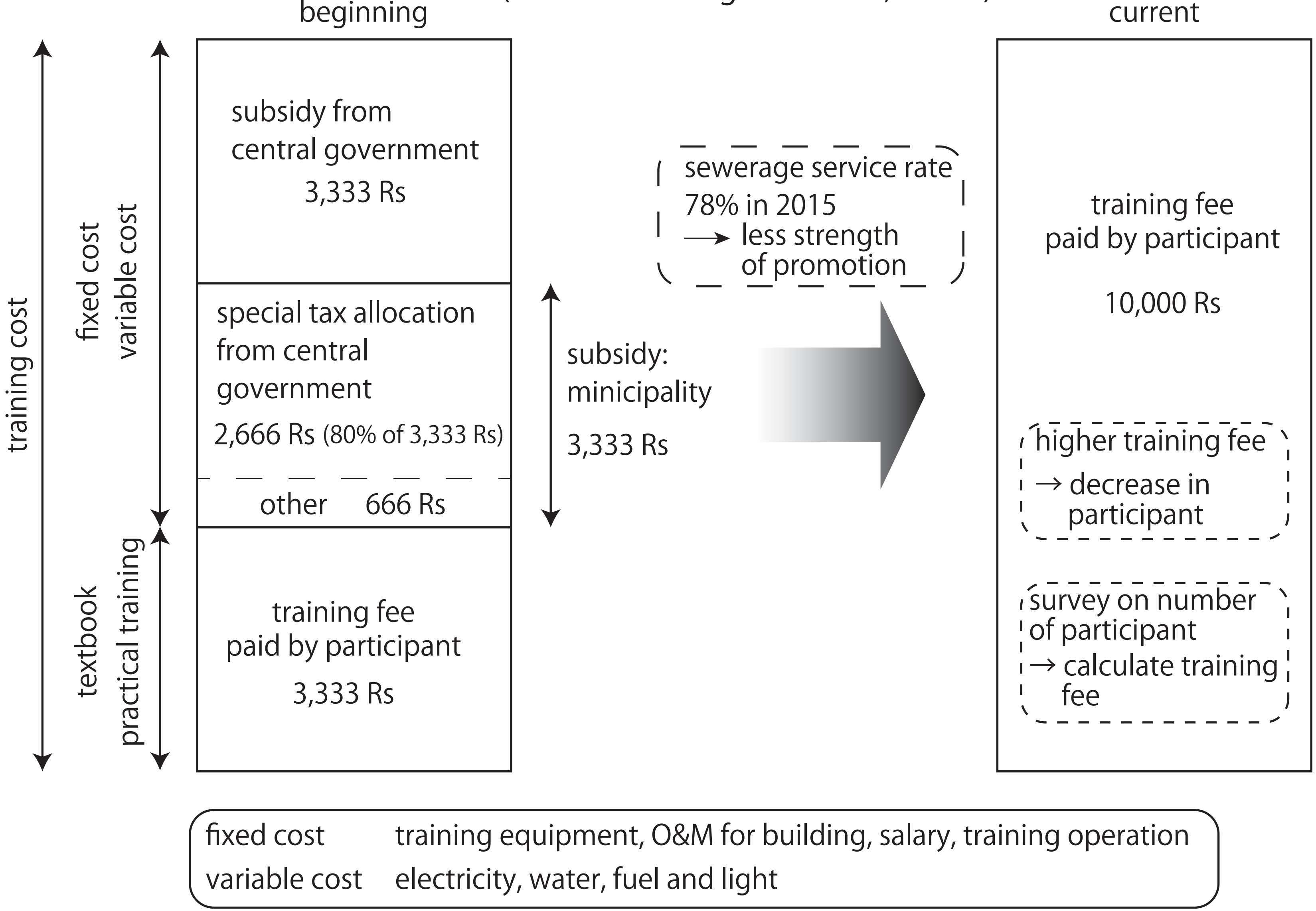
SUB COURSE TITLE: Institutional improvement for water works agencies

No	Name	Sex	Organization	Position
1	Muhammad Fahad Raheel Tariq	M	Lahore WASA	Assistant Director Finance and Revenue
2	Sidra Saleem	F	Lahore WASA	Assistant Director Finance
3	Samina Asif	F	Lahore WASA	Assistant Director Finance
4	Shahid Ibrahim	M	Faisalabad WASA	Assistant Director Finance
5	Muhammad Saeed	M	Multan WASA	Assistant Director Finance
6	Rana Ghulam Murtaza	M	Gujranwala WASA	Assistant Director Finance - Admin
7	Faisal Shahzad	M	Rawalpindi WASA	Sr. Accountant
8	Aneeqa Azeem	F	Urban Unit	Research Analyst
9	Asif Iqbal	M	Urban Unit	Financial Management Specialist
10	Muhammad Kashif	M	Urban Unit	Municipal Finance Specialist

Annex 3.2

Concept of Training Fee at Japan Sewage Works Agency

Financial Sources for Training at Japan Sewage Works Agency
(assume training cost as 10,000 Rs)



Annex 3.3

Invitation Letter for Training

- *Example: O&M of Sewer and Storm Water Drainage* -

ALJAZARI
ACADEMY

No: ALJ-[illegible]

Date: 13 Oc[illegible] 16

The Managing Director,

Water and Sanitation Agency (WASA)

Lahore.

SUBJECT: <u>NOMINATION REQUEST FOR TRAINING COURSE ON "OPERATION AND MAINTENANCE OF SEWER AND STORM WATER DRAINAGE"</u>

AlJazari Water and Sanitation Academy is established under the project titled, "Capacity Building of WASAs in Punjab". This project is technically assisted by the Japanese International Cooperation Agency (JICA) in collaboration with Government of Punjab.

AlJazari Academy is initiating "Operation and Maintenance of Sewer and Storm Water Drainage Including Health and Safety" training course for water professionals of WASAs and other water sector organizations.

This course consists of three modules and intends to enhance the knowledge, skills and professional approach of course participants deployed on the operations and maintenance of sewers system. The participants will realize and value the need to pursue standard technical procedures while performing various operation and maintenance jobs and it will improve their abilities in inspection and testing of sewer defects and implementation of remedial actions. Participants will also be able to get insight of health hazards and risks involved in operation and maintenance works; e.g. risk due to toxic gases, fumes and vapors in sewers. For further information (Course catalog attached).

Operation and Maintenance of Sewer and Storm Water Drainage course will be offered in three session as per following schedule:

Session	Dates	Modules
Session 1	**From Oct 31, 2016 to Nov 02, 2016**	Module 1: Safety Control and Measures for Sewer and Drainage Works.
Session 2	**From Nov 3, 2016 to Nov 4, 2016**	Module 2: Operation and Maintenance of Storm Water Drainage System.
Session 3	**From Nov 14, 2016 to Nov 17, 2016**	Module 3: Operation and Maintenance of Sewer System

We would appreciate if you could nominate eight (8) eligible officials (Sub-Divisional Officers and Sub Engineers) for all three sessions as per schedule mentioned above. It is mandatory that the same participants attend all three sessions.

ALJAZARI
ACADEMY

No: ALJ-10062
Date: 13 Oct, 2016

In this regard, you are kindly requested to send the list of nominated officers including their complete information mentioning name, department, designation, contact number and email address in the given attached form to AlJazari Academy; latest by 25th October, 2016.

The academy will provide free of cost training materials such as handouts, worksheets and stationary and arrange vehicle for site and field visits during training. The academy will also provide hostel facility for those participants who are from outside Lahore.

An early response in this regard will be highly appreciated.

Training Dates:

Session 1: 31st October 2016 – 2nd November 2016
Session 2: 3rd November 2016 – 4th November 2016
Session 3: 14th November 2016 – 17th November 2016

Nominated Personnel should fulfill the following requirements:

- Educational Background: Bachelor Degree with minimum 5 years relevant professional experience in WASA/TMA
- Age Group: 30-50 years
- Good English Language skills
- Females are especially encouraged to apply

For Queries and Correspondence:

Mr. Rehan Khalid

Mobile No: +92-333-7477747

Tel: +92-42-35118574

Fax: 042-35118573

Email: rehankhaled11@gmail.com

Address: AlJazari Academy, Sector A-II, Township, Lahore.

Dr. Kiran Farhan
Principal

CC:

1. Secretary, HUD & PHED, Government of the Punjab
2. Secretary Local Government and Community Development Department
3. Chief Executive Officer, The Urban Unit, Lahore
4. Chief Technical Advisor, JICA

Annex 3.4
List of Participants / Attendance Sheet
- *Example: O&M of Sewer and Storm Water Drainage* -

O&M OF SEWERAGE & STORM WATER DRAINAGE

S 3221

1st NOVEMBER 2016

Attendance Sheet

Sr.No	Name	Organization	Designation	Session I 9:00am-1:00pm	Arrival Time	Session II 2:00pm-4:00pm	Departure Time
1	Mr. Zeeshan Shaukat	WASA Lahore	SDO		9:30		4:00PM
2	Hafiz Raheel	WASA Lahore	SDO		9:30 am	~~ABSENT~~	3:30 pm
3	Mr. Faisal Sarwar	WASA Lahore	SDO		9:30am		4:00pm
4	Mr. M. Armughan Khan	WASA Lahore	SDO		9:30am		4:00 pm
5	Mr. Rana Asif	WASA Lahore	Sub-Engineer		9:30 AM		4:00 PM
6	Mr. Moazzam Shehryar	WASA Lahore	Sub-Engineer	LEAVE	—	LEAVE	—
7	Mr. Ali Haider Naqvi	WASA Lahore	Sub-Engineer		9:30AM		4:00PM
8	Mr. Hassan Tariq	WASA Lahore	Sub-Engineer		9:55 AM		4:00 pm
9	~~Mr. Muhammad Ramzan~~	~~WASA Quetta~~	~~Executive Engineer~~	~~ABSENT~~	—	~~ABSENT~~	—

left at 10:45am without Informing

left without Informing at 10:45am

Replacement (No. 21)

10	Ali Akbar	WASA Quetta	Assistant Engineer	ABSENT	—	ABSENT	—
11	Mr. M. Aslam	WASA Gujranwala	Assistant Director		9.0AM		4:00PM
12	Mr. Jahanzeb Irshad Chatha	WASA Gujranwala	Sub-Engineer	Faisb chattha	9:00AM	Faisb chattha	4:00 PM
13	Mr. Muhammad Tariq Malik	WASA Rawalpindi	Sub Engineer		9, AM		4:00 PM
14	Mr. Hammad Fazal	WASA Rawalpindi	Director		9:00AM		4:00PM
15	Mr. Irfan Ali	WASA Multan	Assistant Director	Irfan Ali	9:00AM	Irfan Ali	4:00pm
16	Mr. Muhammad Adeel	WASA Multan	Sub Engineer		9:00AM		4:00PM.
17	Mr. Hassan Mustafa	WASA Faisalabad	Assistant Director		9:00AM		4:00PM
18	Mr. Ahmad Raza	WASA Faisalabad	Assistant Director		9:00AM		4:00PM
19	Mr. Bilal Azam	TMA Sialkot	Sub Engineer	ABSENT	—	ABSENT	—
20	Iqbal Sabir Shad	PHED (South)	SDO		9.00 AM		4.00 PM

21 Zakir Hussain WASA Quetta. AE 9. Am.

Course Leader:

Curriculum & Instructional Design Specialist:

Annex 3.5
Name Plate and Card

Name card for trainee

Name plate (placed in front of PC)

Annex 3.6
Training Material for Field Activities

Upgrade of Presentation Skill

How to do Fieldwork

August, 2016

KEN Yokoyama

JICA Expert Team

Lecture in Room or Fieldwork

Why need Fieldwork? Support Lecture

Lecture in Room	Fieldwork
Understand facilities' function, spec.	Understand facilities' real operation
See by 2D photo, Black &White, difficult to see	See by 3D 360°, take photo detail part
Not hear operating sound	Hear operating sound and feel vibration
Not understand outside of frame of photo	Understand up, down, right, left side of target
Difficult memorize	Impress in memory

Fieldwork Structure

First Planning, and go to Fieldwork

1) Select facilities from Textbook
2) Get facility list from WASA
3) Find facility from 1) and 2)
4) Get facility's specification, photo and present condition form WASA
5) Fix visit schedule with WASA staff
6) Ask explanation part with WASA staff
7) Make facility's explanation paper
8) Go to fieldwork site

Fieldwork Structure

Field visit and Site visit

1) Contact to person in charge about visit
2) Get facility/equipment information
3) Make material or ask to make material
4) Show material to trainee before, and collect question and send to lecturer
5) Discuss lecture hours and site hour
6) Make Plan B for rough weather
7) Academy supports lecturer on site
8) Go to fieldwork site

Fieldwork Rule

Notice when visit

1) Always "On Time" or "In Time"
2) Visitor has to act in accordance with the destination's rules
3) Not talk loudly anywhere
4) When move, not spread, move together
5) Listen to lecturer's description, quietly
6) Mobile phone keeps silent mode

There are simple manners, but It is difficult to follow the rule in large number of people.

Sample of Fieldwork

Leakage Survey Work (Preparation)

0) Survey area already decided …
1) Prepare pipeline map and equipment
2) Charge batteries of equipment
3) Check weather report and city event
4) Check traffic condition of survey area
5) Check pipe diameter, material, depth, age, location of valve, hydrant, meter
6) Simulation of staff's activity
7) Go to survey work site

Sample of Fieldwork

Leakage Survey Work (Operation)

1) Find start point on pipeline network
2) Confirm traffic condition and surround safety condition
3) Management of accompaniment of leakage equipment, Not lose stuff
4) Take a rest, not survey long at a time
5) Survey with traffic safety guard
6) In night work, take some light reflection
7) Be careful of robbery

Sample of Fieldwork

Tube Well and Pump Facility

0) Survey area already decided …
1) Prepare station map and facility photo, specification and maintenance record
2) Confirm facility from Textbook
3) Ask to send some photos to WASA Guide
4) Collect questionnaire from Trainees and sent them to WASA Guide
5) Go to Fieldwork site

Sample of Fieldwork

9

Mechanical and Electrical Facility

0) Survey area already decided …
1) Prepare electric control line map and facility photo, specification
2) Confirm facility from Textbook
3) Ask to send some photos to WASA Guide
4) Collect questionnaire from Trainees and sent them to WASA Guide
5) Go to Fieldwork site

Sample of Fieldwork

10

Sewer & Drainage Manhole Survey

0) Survey area already decided …
1) Find location of manhole in pipeline map
2) Charge batteries of toxic gas meter
3) Check weather report and city event
4) Check road surface condition of manhole
5) Set security guard on traffic line for driver and near manhole for pedestrian
6) Prepare safety sign board for passengers
7) Set safety sign hardly against strong wind

Fieldwork Evaluation

11

Confirm by Interview or Comment

0) Lecturer asks Trainees as follows
1) Purpose of facility, equipment, device, method
2) Keyword or Cue word from Guide's explanation
3) Discussion by Trainees, comment on it

It is difficult to grasp trainees' understanding by quantitative analysis, then ask interview or get comment by qualitative analysis.

Annex 3.7
Presentation Material for Field Training
on O&M of Sewer and Storm Water Drainage
under a Training on Teaching and Pedagogical Skills

In the name of Allah, the most Gracious and ever Merciful

Module 01

Safety Control and Measures for Sewerage and Drainage Works

Topic No. 04
Standard Safety Practices during Sewer and Manhole Operations

Lecture No. 06
Test for Hazardous Gases

OJT

Lecture Breakdown	Duration
Various Gas Monitors	5.0 Hour
Purpose of Use	
Portable Gas Monitor GX-8000	
Names & Functions for Each Part	
Start the Gas Monitor	
LCD Display, Features & Cautions	
Q&A	

Gas Monitoring at Manhole

Various Gas Monitors

Purpose of Use

Gas monitor enables simultaneous monitoring of the following four types of gases in Manholes:

1- Oxygen O_2
2- Methane CH_4 } COMBUSTIBLE GAS
3- Carbon Monoxide CO } TOXIC GASES
4- Hydrogen Sulfide H_2S

Al-Jazari Apparatus

Portable Gas Monitor
GX-8000

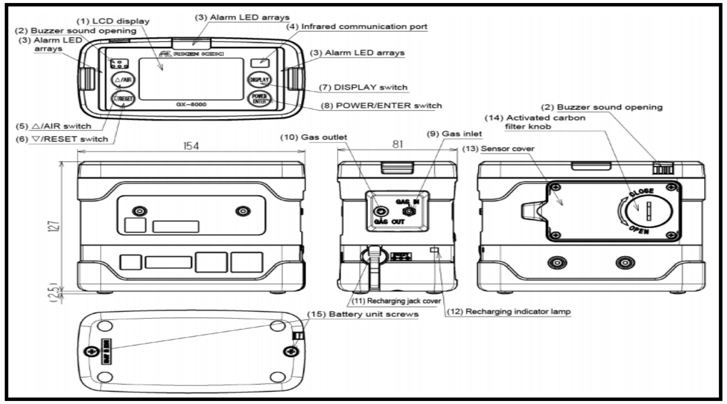
Make:
RIKEN KEIKI Co. Ltd Tokyo Japan

Accessories:

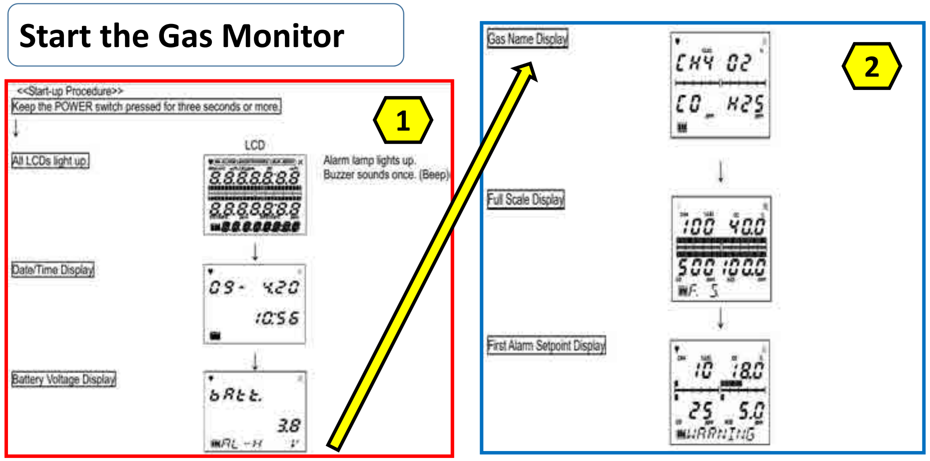
1. Li-ion battery unit
2. AC powered charger
3. Shoulder strap
4. Gas sampling probe

Portable Gas Monitor GX-8000 - Accessories

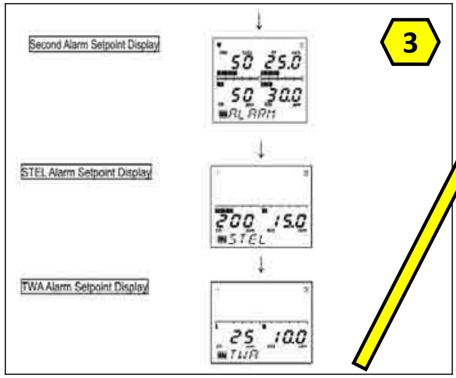
Names & Functions for Each Part

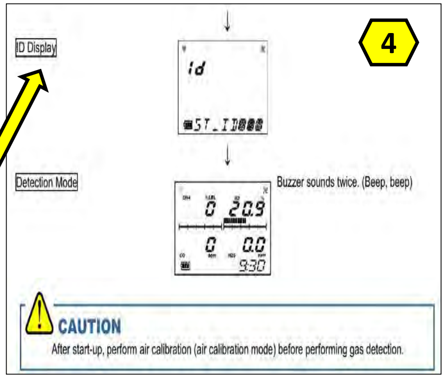


Start the Gas Monitor

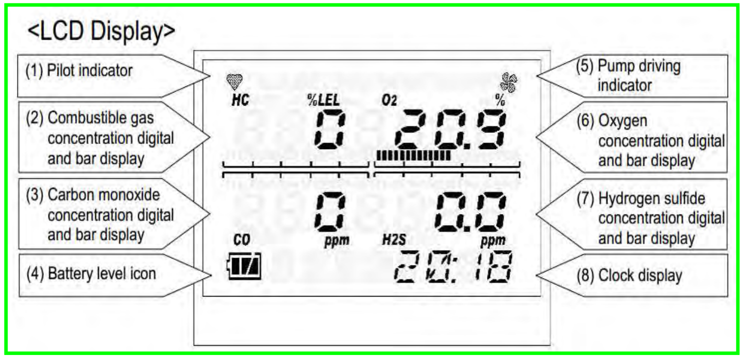


Start the Gas Monitor





LCD Display



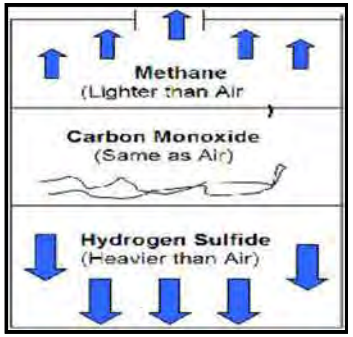
Features of Portable Gas Monitor GX-8000

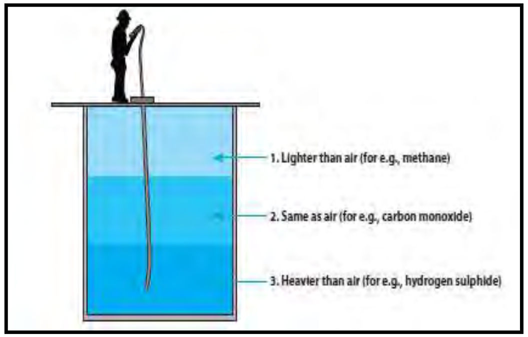
- ❑Portable and battery operated
- ❑Continuously and simultaneously monitor for toxic and flammable gases
- ❑ Audible and visible **ALARMS**
- ❑Small enough and light enough to be worn by an operator
- ❑Over 10 hours of continuous operation on one full battery charge
- ❑Automatic audible and visible low battery alarm
- ❑Remote sample hose

Basic Functions & Operation (5:23)

VIDEO

Physical Appearance of Gases in Manhole





Cautions

- Do not drop or give shock to the gas monitor
- Pressing buttons unnecessarily may change the settings
- Do not use the gas monitor in a place where the temperature drops below -20ºC or rises over 50ºC.
- Do not use the gas monitor where it is exposed to oil, chemicals, etc.
- Verify that the pump driving indicator is rotating before using the gas monitor
- Do not forget to perform a regular maintenance

Questions & Answer Session:

Q. 01:
Describe the most important features of a gas detection device that would be used when entering a manhole.

Q. 02:
What gas do you use for calibration & when to perform calibration of the device?

Q. 03:
What toxic gas is commonly found in wastewater collection systems?

Contacts:

Name	Designation	Contact No.	E-Mail
Mr. Yusuke Ando	JICA expert		
Mr. Muhammad Irfan	Course leader		
Mr. Rizwan Qazi	JICA coordinator		
Miss. Ammara Asif	Young professional		
Miss. Maryam Rabbani	Young professional		

Fieldwork Check Sheet

Date: August 30, 2016

Lecture Course	O & M of Sewerage and Drainage System		
Fieldwork name	Inspection of Manhole & Gas Monitoring		
Time	10:15 am - 12:30 pm	**Work Place**	Meeting Room & Minhaj Univ. Road
Guide name	Mr. Rizwan, Ms. Maryam Ms. Ammara	**Organization**	Al-Jazari Academy
Lecturer name	Mr. Irfan	**No. of trainees**	20-25

No	Item	YES	NO	Date/Remarks
1.	Selection of agenda for field work			
2.	Pickup important facility from course			
3.	Ask about facility from WASA			
4.	Select object of facility (Manhole)			
5.	Decide whether WASA operator is required			
6.	Ask WASA for required technical person			
7.	Decide implementation date and time with WASA Guide			
8.	Pre-study of facility & initial survey			
9.	Preparation of material for fieldwork			
10.	Selection of required equipment and PPE			
12.	Selection of venue for Field work description			
13.	Pass material to trainees			
14.	Field work briefing by the instructor			
15.	Guidance visitors rule to trainees			
16.	Check for weather forecast			
17.	Pre-explain facility to trainees			
18.	Move towards site			
19.	Ensure the traffic management plan at site			
20.	Execution of required field operation			
21.	Return to academy			
22.	Discussion of fieldwork activities after return			
23.	Review of field work			

-

Course … O & M of Sewerage & Drainage System

Field Work on Test for Hazardous Gases

(Module 01…Lecture No. 06)

Date / Day	30 Aug, 2016 (Tuesday)
Time	10:15am to 12:30pm
Site Location	100 Meter around Al-Jazari Academy

Checklist for the equipment & other necessary items:

No.	**Items / Articles**	**Amount**		**Check Box / Status /Comments**
	PPE			
1.	Hard Hats	3	nos.	
2.	Safety Goggles	3	nos.	
3.	Reflector Vests	3	nos.	
4.	Anti-Cut Gloves	3	nos.	
5.	Hard Toed Shoes	2	nos.	
6.	Safety Gums	1	no.	
7.	Helmet Headlights	2	nos.	
	Equipment with Accessories			
1.	Manhole Lid Opener	1	no.	
2.	Gas Monitor with Probe	1	no.	
3.	Air Blower with Flexible Hose	1	no.	
4.	Portable Generator	1	no.	
5.	Extension Cable	1	no.	
6.	Gasoline (Petrol)	1.5	litres	
	Traffic Management Tools / Apparatus			
1.	Traffic Orange Cones	8	Nos.	
2.	Cone Heads	8	nos.	
3.	Cone Holder Clips	10	nos.	
4.	Traffic Warden Light	1	no.	
	Personnel & Documents			
1.	WASA Staff	1	no.	
2.	First Aid Box	1	no.	
3.	Handouts for Participants	25	Sets	

-

Course … O & M of Sewerage & Drainage System

Field Work on Test for Hazardous Gases (Module 01…Lecture No. 06)

Date / Day	30 Aug, 2016 (Tuesday)
Time	10:15am to 12:30pm
Site Location	100 Meter around Al-Jazari Academy

Observation Table for Hazardous Gas Concentration in Manholes

No.	Case / Situation	Location	Hazardous Gases				Remarks
			Flammable Gases		Toxic Gases		
		Kinds of Gases	Oxygen (O_2)	Methane (CH_4)	Hydrogen Sulphide (H_2S)	Carbon Mono Oxide (CO)	
		UoM	%	%LEL	PPM	PPM	
		Max. Values	40%	100%LEL	100PPM	500PPM	
1.	Gas Concentration immediate after Removal of Lid	Manhole No. 01					
2.		Manhole No. 02					
3.		Manhole No. 03					
4.	Gas Concentration after Air Blowing Operation	Manhole No. 01					
5.		Manhole No. 02					
6.		Manhole No. 03					

Annex 3.8
Presentation Material for Field Training
on O&M of Tube Well and Pump Facility
under a Training on Teaching and Pedagogical Skills

OJT Exercise
Checking of Pressure in Supply Area using Pressure Recorder FJN -501

Engr. Zia Mustafa (Lecturer)
Ramisha Taseer
Syed M Usman Ali (Site Support)

Engr. Wajih-Ud-Din (on Site Demonstration)

September 2016

Objective

Water Pressure Measurement using Pressure Recorder

Date	Thursday September 08, 2016
Training Facility	Tube Well Green Town WASA Sub Division
Equipment/Machinery	Pressure Recorder FJN -501
Time	2 Hours (11:15 AM to 01:15 PM)

FJN-501 Pressure Recorder

Water Pressure Recorder is used to measure the pressure of water with the help of graph inside the gauge for twenty Hours

Pressure Recorder FJN-501

Specifications of Equipment

Model and Type	FJN-501 (A-Type)	FJN-501 (C-Type)
Recording Time	4,12,24,72, 168 hours	15,30,60 Minutes
Maximum Pressure Record	1.0 MPa (10bar)	2.0 MPa (20bar)
Power Check	CPU does not work at voltage less than 2.2 V	
Mode Check	LED indicates by blinking	

I.0 MPa = 10 Bar

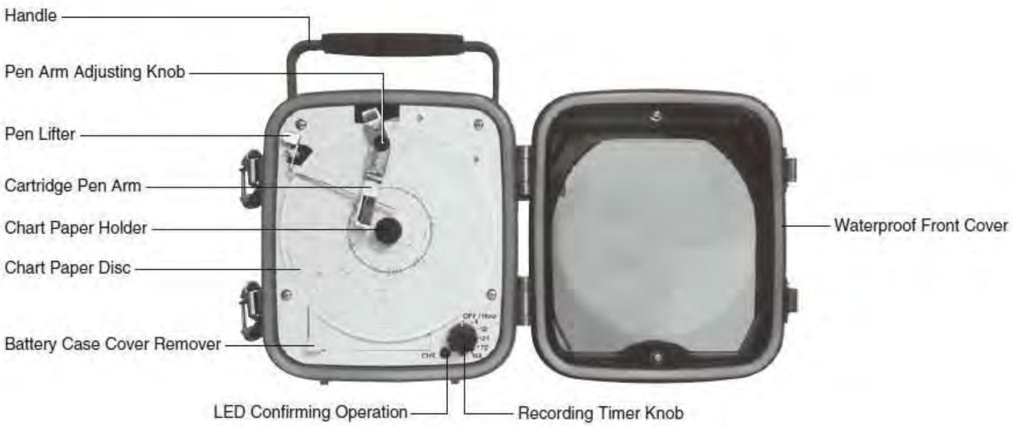
Specifications of Equipment

Model and Type	FJN-501 (A-Type)	FJN-501 (C-Type)
Operation Power	3.0 Volts (Minimum 2.2V)	
Weight & Size	1.35kg (Main Unit)	
Gross Weight	3.7kg (with the carrying case)	
Battery Type & Battery Life	AA - Alkaline Battery	
	4 h .... 80 days 12h .... 220 days 24h .... 380 days 72h .... 720 days 168h .... 970 days	15 min. .... 150 days 30 min. .... 250 days 60 min. .... 400 days

Applications of Water Pressure Recorder

- Verify low water pressure complaints
- locate water pressure spikes
- provide water distribution system modelling data
- Checking for fluctuations in water pressure as an efficient means of controlling water systems.
- Keeping track of water pressure at night when controlling water leakage by decreasing pressure.
- To prevent water leaks by controlling water pressure.
- Making a water pressure distribution chart to find irregularities in water leakage in a system.
- Eliminating districts of poor water service caused by low water pressure.
- Water pressure testing after laying pipe

Parts of Equipment



Components of Equipment

Fuji Coupling 	Coupler of Fuji Coupling 
Cartridge pen 	Leather packing 

Components of Equipment

13 mm Dia. Faucet Adaptor

Alkaline Battery- AA Size

Connecting Hose Type No. 4

Carrying Case

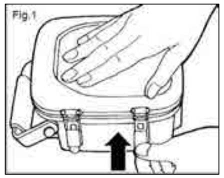
Components of Equipment

Chart Paper Disc
(100 sheets per package)

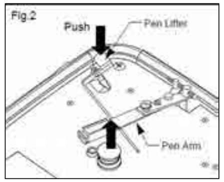
*OPTION
Connecting Hose. Type No.1

Step By Step Procedure

1. Unfasten the clip and open the front cover

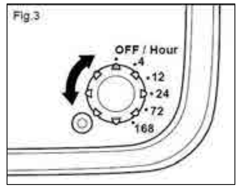


2. Push down the pen lifter to lift up the lift arm, Remove chart paper holder by pulling upward, remove the used one and put new chart

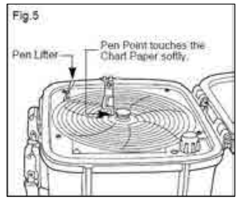


Step By Step Procedure

3. Before mounting the chart paper, check battery status. Turn the knob to 4 hour position and confirm if the LED light becomes ON and OFF for 1 minute than status is good, if LED does not light up, change the batteries

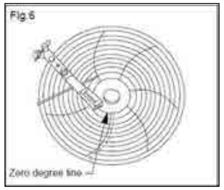


4. Remove the cap of cartridge pen and fit on pen holder, Release the Pen lifter and put down the pen arm so that the pen point will touch the chart paper softly

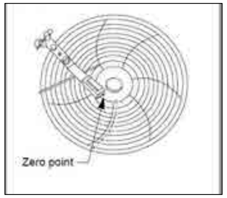


Step By Step Procedure

5. Confirm if the pen point is located on the line of zero, if it is not on zero, adjust it with the help of screw on the arm of pen



6. Route the chart paper Disc so that the pen point will come to the starting point, when the recording work is finished then pen point will come to the starting point



Step By Step Procedure

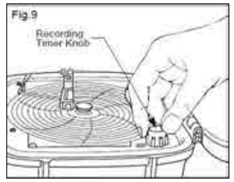
7. Always turn the knob to OFF, before changing chart paper

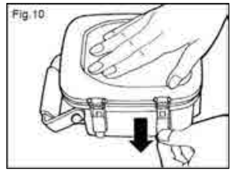
8. Close the front cover after cleaning the water proof packing

9. Connect the hose with meter (valve side)

10. After use, remove the connecting hose after releasing air completely by use of Air bleed knob

11. Pour out some water from valve for removal of dirt as well as air, with whom you want to attach pressure recorder





How to Operate Equipment with the Pipeline

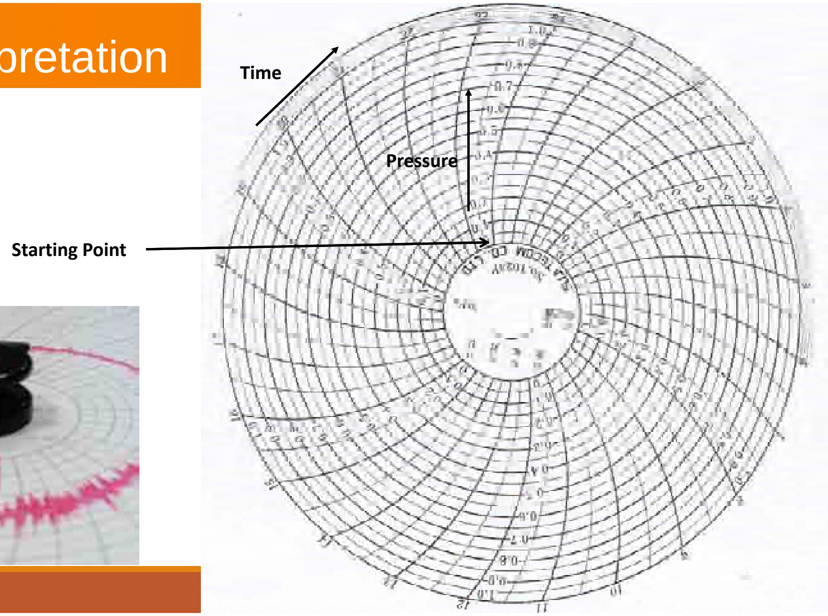
- **PREPARATION FOR FJN-501 MAIN UNIT**

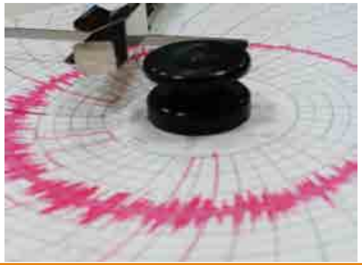
  - Check the residual battery power by turning the Recording Timer Knob to one of the Recording Hours such as 4, 12, 24, 72 and 168 hours
  - Fit up the Chart Paper Disc centered with the Axis after removing the Chart Paper Holder
  - Adjust the position of Pen Point to the line of Zero Degree
  - Turn the Timer Knob to the point of Recording Time required for the operation
  - Close the Front Cover and Lock it with the Catch Clip

How to Attach Equipment with the Pipeline

- Open the Pipeline Valve slowly and drain water to eliminate air remained in the pipe
- Close the Valve and clean the Outlet of it to mount the Fuji coupling
- Attach the Fuji Coupling to the Outlet of Pipeline.
- In this case, the Ball Valve of connecting hose is required to have been closed
- Confirm if the Fuji Coupling has been attached firmly to the Outlet of Pipeline
- Open the valve slowly so as to avoid malfunctions caused by the water pressure given suddenly

Chart Interpretation





Field Work Check Sheet

Date: September 08, 2016

Lecture Course	O&M of Tube Well and Pump Facility		
Fieldwork Name	Checking of Pressure in Supply Area		
Time	10:00 am – 1:00 pm	**Work Place**	Meeting Room & Green Town WASA Sub Division
Guide Name	Ms. Ramisha Taseer	**Organization**	Al-Jazari Academy
Lecturer Name	Mr. Zia Mustafa	**No. of Trainees**	20-25

No	Item	YES	NO	Date/Remarks
1.	Selection of agenda for field work			
2.	Pickup important facility from course			
3.	Ask about facility from WASA			
4.	Select object of facility (WASA Tube well)			
5.	Decide whether WASA operator is required			
6.	Ask WASA for required technical person			
7.	Decide implementation date and time with WASA Guide			
8.	Pre-study of facility & initial survey			
9.	Preparation of material for fieldwork			
10.	Selection of required equipment and PPE			
12.	Selection of venue for Field work description			
13.	Pass material to trainees			
14.	Field work briefing by the instructor			
15.	Guidance visitors rule to trainees			
16.	Check for weather forecast			
17.	Pre-explain facility to trainees			
18.	Move towards site			
20.	Execution of required field operation			
21.	Return to Academy			
22.	Discussion of fieldwork activities after return			
23.	Review of field work			

O&M of Tube Well and Pump Facility

Field Work on Checking of Pressure in Supply Area using Pressure Recorder FJN -501

Date / Day	08 Sep, 2016 (Thursday)
Time	10:00 am to 1:00pm
Site Location	Green Town WASA Sub Division

Checklist for the Equipment & other Necessary Items:

Sr. No.	**Items / Articles**	**Quantity / Amount**	**Check Box / Status /Comments**	
	PPE			
1.	Hard Hats	25	Nos.	
2.	Safety Goggles	25	Nos.	
3.	Reflector Vests	25	Nos.	
4.	Anti-Cut Gloves	25	Nos.	
5.	Hard Toed Shoes	25	Nos.	
	Equipment with Accessories			
1.	Pressure Recorder FJN-501	1	Nos.	
2.	Chart Papers	1	Nos.	
	Personnel & Documents			
1.	WASA Staff	1	Nos.	
2.	First Aid Box	1	Nos.	
3.	Hand-outs for Participants	25	Sets	
	Others …			
1.	Safety Cones	10	Nos.	
2.	Safety Ribbons	12	Nos.	
3.	Traffic Cones Head	10	Nos.	

<u>**O&M of Tube well and Pump Facility**</u>

Field Work on Checking of Pressure in Supply Area using Pressure Recorder FJN -501

Date / Day	08 Sep, 2016 (Thursday)
Time	10:00am to 1:00pm
Site Location	Green Town WASA Sub Division

Observation Table for Checking of Pressure

Equipment	Pressure Recorder FJN-501				
Location	Tube Well Facility WASA Green Town Sub Division				
Measurement hours	Pressure Recorder (A Type)				Remarks
	4 hr.	12 hr.	24 hr.	168 hr.	
Pressure Reading in MPa (After 10 minutes)					
Pressure Reading in MPa (After 20 minutes)					
Pressure Reading in MPa (After 30 Minutes)					
Pressure Reading in MPa (After 40 Minutes)					
Pressure Reading in MPa (After 50 Minutes)					
Pressure Reading in MPa (After 1 hr.)					

Annex 3.9

Comments to Trainers for O&M of Tube Well and Pump Facility, and O&M of Sewer and Storm Water Drainage under a Training on Teaching and Pedagogical Skills

Evaluation for Engr. Zia Mustafa on the training of fieldwork
for O&M of Tube Well and Pump Facility

Point	Improvement Comment
Attitude of lecturer	Speaking speed was fast, but voice was big enough and easy to hear. -> Write the elapsed time of each slide in own material Eye contact was insufficient -> Correspondence in Zigzag scheme
Scale comparison of 5 WASAs	Insert map in case of comparing each area If the magnitude of the various scale WASAs is compared, it needs to dimensionless by using the number of customers, pipe extension, number of WASA staff.
Basis of data	If the related data and photos were obtained on the internet, it needs to display the source.
Lecturer's standing position	Lecturer sat down and operated the PC, but standing and attaching the movement gave more vital feeling -> The lecturer decided to stand and give the lecture for next time. (The improvement was observed for his lecture at next-day's seminar.)

Evaluation for Engr. Muhammad Irfan on the training of fieldwork
for O&M of Sewer and Storm Water Drainage

Point	Improvement Comment
Attitude of lecturer	Speaking speed was good, and voice was big enough and easy to hear. Eye contact and body action were sufficient.
Before lecture	Color pens for white board was checked. It needs an attention to the characters, enough size to see from the last row.
Size of slide characters	The character size for the existing material was small. -> If the margin remains largely, the character size shall be indicated largely.
Description of photos	If there is a margin, insert short description of photo
Important item	For important items, lecturer emphasized that it was important.
Q&A	For the question slide, lecturer gave the time to think to trainees.

Annex 3.10
Comments to Trainers for Courses of O&M of Sewer and Storm Water Drainage, and Asset Management

1) Course: O&M of Drainage and Sewerage
Date: November 1, 2016
Trainer: Engr. Muhammad Irfan
Comments:
- Good ice-Breaking
- Good eye-contact
- In addition to the lecturer, persons that can speak in lecture is the trainees who are only permitted by the lecturer. -> Keep class discipline
- When a cell phone rings, tell to change silent mode.
- Use a larger size of letters in some slides
- Change a color of letters and background. The color balance is not good.
- PPE video is good. But the important points in video are not indicated in the lecture material. -> Copy video contents to the slides, or paste the copy of the screen-shot to the slide.
- Add short explanation to each icon.
- Not insert letters in the triangle. Insert triangle and textbox separately, then overlap them.
- Give more opportunity for holding/touching/operating equipment to trainees.
- A lecturer explains, and an assistant lecturer supports holding bullhorn and gas meter.
- Another assistant pay attention for outsider to enter the training area.

2) Course: Asset Management
Date: November 2, 2016
Trainer: Mr. Nizam-ud-Din
Comments:
- Good eye-contact
- Small letter size on White Board (WB)
- Pen for WB is light, difficult to see from rear side.
- Height of written letter on WB is low, rear side trainee cannot see letter on WB.
- When erase the letter, confirm to trainees.
- If description contents are fixed in advance, make it by Powerpoint. -> Remain as trainees' material
- In the slide, there are not good color balance between letter and background.
- In the slide, letter size is good.
- Slide number is so small. Change from original size to bigger one.
- Do not ask any observer. Ask only trainees.
- When presentation, trainee speaks to audience, lecturer makes audience quiet.
- Make same photo size by trimming
- Ratio of length and width of pictures become same.
- Rewrite the letter of legend on JPEG chart.
- There is no sign and information regarding finish morning lecture and resume time. -> Confirm time schedule always.
- Lecturer needs time management. -> When lecturer feels that trainees' concentration is lost, take a rest or change topic to the relax story.
- Presentation by handwriting on the large paper -> When internet is possible to use, it is better to send trainees' answer by e-mail. -> Remain as trainees' material
- Presentation from trainee is not conversation with lecturer but speech to audience.
- In the lecture, lecturer does not teach only one trainee. Always teach to all participants. If need one on one coaching, do/use in the short recess.
- When one trainee asks question, lecturer must answer to all trainees.
- Keeping order in the class is the duty of lecturer. Lecturer must keep morals and rules.
- Taking a proper short recess.

3) Course: Asset Management

Date: November 3, 2016
Trainer: Engr. Abid Hussainy
Comments:

- Sometimes, 3-4 speakers are mixed at the lecturer position, not clear who is lecturer. If change, completely change.
- Small letter size on WB
- Do not speak trainee without free discussion. Trainee who can speak is admitted by lecturer.
- When description to WB, trainees cannot watch the letter by lecturer's back. -> When description, shift lecturer standing position in order to show clearly.

4) Course: Asset Management
Date: November 4, 2016
Trainer: Engr. Abid Hussainy
Comments:

- When ringing of phone, lecturer points out to change to silent mode.
- Since this training is not the team training, there is no need to apology in late.
  -> Countermeasure of "Latecomer" -> Holding "Attendance Examination" of beginning and closing of class. This exam is so easy, and trainee can see any training material. Number of question is 3-5. Time is only 3-5 minutes. However, trainee does not have exam, "Attendance point" will be zero. -> The change of evaluate system and notice to trainees what is important.
- If the Internet environment can be used, these exercise seem to be good to reply by e-mail.
- Tell closing address and resume time of afternoon to trainees

5) Course: O&M of Drainage and Sewerage
Date: November 14-17, 2016
Trainer: Engr. Muhammad Irfan
Comments:

- Cannot see the content of the scanned JPEG printed in monochrome -> Overwrite with the Shapes of Powerpoint on the base JPEG
- The aspect ratio of the photo is not equalized -> Do not deform the picture or figure by breaking the aspect ratio -> Correspond by the "Crops" or "Resizing"
- Materials to be placed in textbooks are checked beforehand in black and white printing and black-and-white two-tone copying -> Edit from lecture textbook for handouts
- On the first day of the lecture course, post a summary of notes on training
- Trainees with few remarks/comments should have the sentences reading in the slides
- When one person speaks for more than one minute, the lecturer assistant signals and the lecturer aborts his remarks/comments -> If the individual problem of the trainees' water utility is spoken, talk about it during the break time

Annex 3.11
Newsletter, Vol. 1

Aljazari Academy

Newsletter

Vol: 1 Issue 01 | May 2016

Chief Editor: Dr. Nasir Javed | Editor: Dr. Kiran Farhan | Editorial & Design: Communications Team

ALJAZARI ACADEMY

Introduction

Aljazari Water and Sanitation Academy is a strategic initiative of Government of Punjab and Japan International Cooperation Agency (JICA) for capacity building of WASAs, Public Health Engineering Department, City Government and Water Sector service providers. The Academy has been entrusted to the Urban Unit by WASA Lahore. The academy has specifically been established for carrying out capacity building programs in collaboration with JICA and other partners.

Aljazari - Objectives at a Glance

The objective of this purpose-built academy is to improve water supply, sanitation and sewerage services through innovative and effective training programs. One of the target is to assess the impact of all trainings and policies implementation on service delivery of WASAs thus finally developing a roadmap for radical reforms and successful innovations to build existing capacity of WASAs' staff.

Aljazari aims to develop and enrich the curriculum, pedagogy and assessment methods of water sector in a modern and effective way as to meet the demands of current and future training needs. Further, the academy will support water sector organizations to build the capacity of their staff through relevant and quality programs for effective execution of services in their regions, in order to achieve maximum benefits for all stakeholders.

Detail of **Trainings**

1 Training	2 Trainings	1 Training SDOs	2 Trainings	1 Training
O&M	**SWM**	**WASA**	**GIS**	**AD**
Tube wells & Disposal Stations 3 Months	3 Months Each	Induction Training 2 Months	3 Months Each	Assistant Director Finance & revenue 3 Weeks

Building Capacity through Trainings

Induction Training for SDOs, WASA Lahore

The Aljazari Water & Sanitation Academy in collaboration with the Urban Unit and WASA Lahore, organized an eight week Induction Training for newly appointed Sub Division Officers SDOs of WASA Lahore from 11th December 2015 to 8th February 2016. Some 23 SDOs attended the training. The training was arranged on special request of WASA Lahore to build the capacity of their newly officers for planning, design, operation and maintenance of water supply, sewerage and drainage system and introduce them with WASA policies, organizational structure and its legal frame work. While inaugurating the courses, Dr. Nasir Javed CEO the Urban Unit highlighted the efforts of Urban Unit in capacity building of public water and sanitation sector staff through trainings. The ceremony was attended by Urban Unit faculty, Ch. Naseer Ahmed Managing Director WASA Lahore, Engr. Asghar Bhalli DMD WASA Lahore, Dr Kiran Farhan Principal Aljazari, with its faculty and course participants.

Throughout the training, interactive teaching approaches such as group work, case studies, role-plays, field visits and on-job training were utilized to provide ample opportunities to the participants for extensive learning. Professional and technical experts from the Urban Unit, WASA Lahore, Water and Sanitation Program South Asia WSP, KSB Pumps, University of Gujrat and University of Engineering and Technology Lahore delivered lectures.

Training on Skills

for Employability Scheme

A 3 month training program for GIS Surveyors, Tubewell & Pump Operations and Solid Waste Management Field Inspectors was arranged by the academy. The trainings were provided in close collaboration with Punjab Skills Development Fund under the '**Skills for Employability Scheme'.** The aim was to develop skilled workforce for economic prosperity.

Beyond the Classroom

Representatives
of WASA Lahore Visit Aljazari Academy

Chaudhry Shehbaz, Vice Chairman WASA Lahore and Mr. Asghar Bhalli, Deputy Managing Director (O&M) WASA Lahore visited Aljazari Water and Sanitation Academy on 14th January 2016. Dr. Kiran Farhan, Principal Aljazari Academy briefed about the trainings of WASA SDOs. Dr. Nobuyuki Sato, Chief Technical Advisor from JICA discussed briefly the offered trainings.

KOICA Team
at AlJazari Academy

Mr. Sung Chunki, DG Korean Embassy and Dr. Yoon, Head Local Government Korea visited the Academy. The purpose of their visit was to see facilities of academy and study the developed courses for trainings. Dr. Kiran Farhan facilitated them and briefed about whole project and procedure of trainings. KOICA team appreciated efforts of AJWA officials as well as the quality of work being done there.

KSB Team
at Aljazari

Team of KSB pumps; Syed Nadeem Naqvi, DMG Water & Waste Water, Sales & Marketing and Mahmood Ellahi, Senior Manager Water & Waste Water, Sales & Marketing visited Aljazari. In their discussion with AJWA and JICA officials, they focused on manuals of operations and maintenance of electrical and mechanical equipment, capacity of different filtration plants and quality and maintenance. The visiting team and other experts agreed to share expertise and knowledge for improving the capacity of WASAs.

Trainings
in pipeline

Aljazari Academy is currently working on different training programs in diverse fields for WASA that include:

- Leakage Detection & Repair
- Business Planning
- Asset Management
- Operation & Maintenance of Tube Wells & Pump Facilities
- Operation & Maintenance of Sewer and Storm-water Drainage including Safety Precautions
- Operation & Maintenance of Electrical & Mechanical Equipment for Disposal Station, Sewerage & Drainage

Construction
Site Visit

During one of the courses a field visit was conducted to the construction site of WASA Lahore. The RCC Conduit from Shoukhat Khanum Hospital Chowk to Sattu Katla Drain is in construction phase. The main purpose of this construction site is to replace existing open drain to a closed conduit. Existing situation: Sewage from M.A. Johar Town and adjoining settlements is presently being collected at a point close to Shoukat Khanum Hospital and is lifted and transported into Sattu Katla through AN OPEN DRAIN.

Field Visit to KSB Pumps Facility

A visit of KSB pump facility was arranged with the coordination of KSB personnel. The purpose of this visit was to give exposure and on-site orientation of manufacturing of pumps and valves to the newly inducted Sub Divisional Officers in WASA.

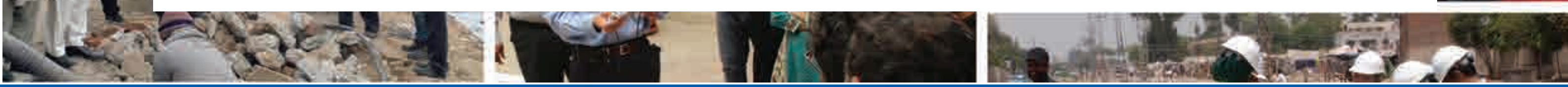
Cities Field Visits

For improving the capacity of WASAs in Punjab province ramps up activities, JICA and Urban Unit specialists visited various facilities in Lahore, Gujranwala, Multan, Faisalabad and Rawalpindi cities. It helped achieve various objectives of the project such as enhancing working relationship with all stakeholders and understanding their training needs and operational issues.

> *We believe that the Urban Unit, Aljazari Academy and WASA together have developed a strong working relationship, which is destined to deliver for the ongoing project and for the development of sector at large", Dr. Nasir Javed, CEO the Urban Unit.*

International
Technical Support

The cooperation and technical assistance from JICA is of extreme significance for the AlJazari Water and Sanitation Academy as JICA is providing support in developing course materials, training systems, organizing trainings for the faculty in areas of pedagogical skills, establishment of on Job Training (OJT) pilot projects in five WASAs as well as providing equipment for Academy and OJT centers.



ALJAZARI
ACADEMY

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Aljazari Academy, Sector A-II, Township, Lahore.

Annex 3.12
Newsletter, Vol. 2

VOL: 2 ISSUE 01 | JUNE, 2016

Aljazari Academy Newsletter

Chief Editor: Dr. Nasir Javed | Editor: Dr. Kiran Farhan | Editorial & Design: Communications Team

ALJAZARI ACADEMY

The Course Design Process

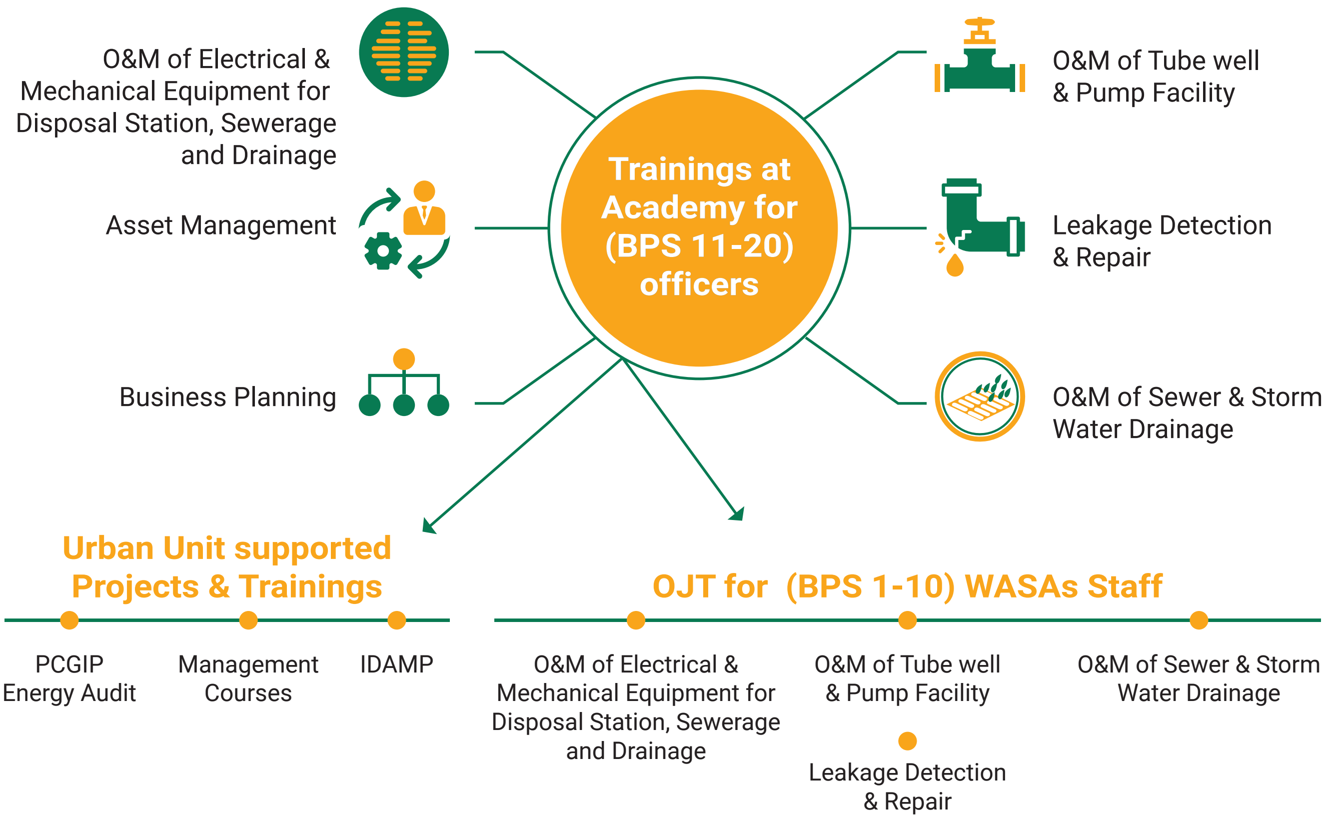
Al-Jazari Academy has introduced a comprehensive course design process; the faculty analyzes and identifies the training needs of WASAs staff in terms of required knowledge and skills on the basis of gaps identification. Course objectives and learning outcomes are formulated, deliberate design of learning experiences along with assessment criteria and its tools are identified and incorporated in all the six courses. During the planning stage, our faculty continuously receives feedback from stakeholders to ensure that courses are focused and customized according to WASAs needs.

In order to optimize learning environment, the overall training delivery focuses on practical approaches and adopts instructional techniques such as demonstrations, discussions, simulations, case studies, site visits, field based projects and on-site training. Throughout the trainings, it is desired to inculcate and impart characteristics such as self-reliance, reliability, responsibility, sense of duty, willingness to accept change and work related ethics among the course participants.

Course Design Steps

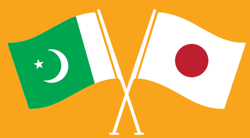
1. Conducted training need assessment to identify gaps in existing knowledge and skills of water sector service providers
2. Developed 6 training courses, competency standards and content
3. Selected most appropriate instructional strategies
4. Selected assessment & evaluation methods and tools
5. Developed instructional materials i.e. courses and module outlines, lecture notes, PPT slides and handouts
6. Received feedback and concurrence from stakeholders for further improvement
7. Identified certification requirements for all six training courses

Training System



International Training

on Water Supply & Sanitation



A delegation consisting of fourteen government officials from Al-Jazari Academy attended a ten day long training in Japan. Among the officials were Dr. Kiran Farhan Principal Al-Jazari Academy, Mr. Abid Hussainy Sr. Capacity Building Specialist Urban Unit, Mr. Moazzam Malik Deputy Secretary Urban Development, Housing and Public Health Engineering Department and the officials from five WASAs of Punjab.

During the visit, the officials got an opportunity to visit headquarters of Yokohama Waterworks Bureau, Ministry of Health, Labor and Welfare in Tokyo Water Works Association, Pakistan Embassy in Minato City Tokyo, JICA Head Quarters in Chiyoda city Tokyo, Nishiya Purification Plant and Nogeyama Distribution Reservoir. The officials attended series of lectures on Human Resource Development, Mapping System for Water Facility Management, Introduction of GIS in Water Supply, Water Supply Operation Synthetic Management System and outline of Nishiya Purification Plant. The training was concluded with a wrap up session, evaluation meeting and closing ceremony.

Consultative Workshop
on Course Outlines

A day long consultative workshop was organized at Al Jazari Academy to finalize the developed course outlines. The rational was to review training content, duration, training delivery methods and assessment. The workshop was attended by representatives of five WASAs, Public Health Engineering Department and Japan International Cooperation Agency experts.

More than 45 participants attended the workshop. Principal Al- Jazari Academy welcomed all participants and briefed about the project and key progress. Later, the faculty along with Japanese experts presented each of the six courses. After the presentations, groups were formed for all courses where the participants gave feedback on course content, its duration, and its bifurcation in classroom teaching and practical sessions, as well as on the training methodologies. The suggestions received from participants were incorporated in existing courses to make these more relevant with the needs of WASAs.

Consultative Workshop
on Module Outlines

A one day workshop on review and finalization of modules, outlines was held at Al-Jazari Academy. Arount 50 participants attended this workshop including officials from five WASAs of Punjab, Coordinator from Pakistan Water Operators Network, technical experts from the Urban Unit, JICA experts and Al-Jazari faculty. Module outlines of six courses were discussed; round table discussions and question & answer sessions were also held.

Ch. Naseer Ahmed, Managing Director WASA Lahore gave concluding remarks; he emphasized that a dedicated training institute was needed for WASAs where officials could get sound professional training and polish their skills and competencies. He appreciated the quality of intellectual input in developing course and module outlines, and efforts in organizing workshops as well as acquiring feedback from participants.

1st National Consultative Workshop
on Courses and Module Outlines

A Consultative Workshop workshop was held at Al-Jazari Academy, Lahore. Some 46 participants from all across Pakistan attended the workshop; mainly from Pakistan Engineering Council, Higher Education Commission, JICA Pakistan, University of Engineering and Technology Lahore, Housing, Urban Development and Public Health Engineering Department, Capital Development Authority, Islamabad, UNCIEF, WWF, WSSC Mardan, all five WASAs of Punjab, WASA Quetta, Punjab Municipal Development Fund Company and the Urban Unit.

Dr. Kiran Farhan briefed the participants about "Project for Improving Capacity course of WASAs" while Ms. Sadaf Hussainy explained the process of designing courses and curriculum. Later, the leaders Engr. Abid Hussainy, Engr. Zia Mustafa, Engr. Mubashir Cheema, Mr. Faisal Qureshi and others presented their course and module outlines.

In the round table discussion, the participants gave feedback and suggestions for further improvement in courses. The chief guest Prof. Dr. Noor Muhammad Khan, representative of Higher Education Commission from UET, Lahore concluded the workshop and gave closing remarks.

Highlights of Certificate Distribution Ceremony

Mr. Sohail Shahzad, Secretary Housing, Urban Development & Public Health Engineering Department, Punjab visited Al-Jazari Academy for the certificate distribution ceremony of Sub-Divisional Officers and Assistant Directors Finance & Revenue WASA Lahore. Dr. Nasir Javed CEO Urban Unit, welcomed the chief guest and gave detailed briefing about academy. 23 Sub-divisional officers and 11 Assistant Directors Finance & Revenue were awarded certificates. The chief guest appreciated the commitment and hardwork of Al-Jazari Academy faculty.

KSB Pumps, Hassan Abdal Visit

Faculty Electrical and Mechinical Equipment course along with JICA team visited KSB Pumps Company Limited at Hassan Abdal. The visit was organised to enhance knowledge the faculity on the KSB pumps frequently in WASA facilities. The visit made it a great opportunity for the faculty to see major departments of the factory and establish networking with the industry experts.

Visit to Kissan Engineering, Lahore

Al-Jazari and JICA operations and maintenance team visited WASA supplier, Kissan Engineering at Lahore for product review and discussion of field issues in order to find best solutions for WASAs.

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Aljazari Academy, Sector A-II, Township, Lahore.

Annex 3.13
Training Schedule for O&M of Tube Well and Pump Facility in Fall 2016

Annexure-I

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Operation and Maintenance (O&M) of Tube Well and Pump Facility Course
Module 1 : Operation and Maintenance (O&M) of Water Distribution System
Training Schedule (October 24 to October 28, 2016)
Course Code: W1221

Sr.No	Day and Date	Themes	Session 1			Tea 11:00-11:15am	Session 2		Lunch 1:15-2:00pm	Session 3		
			1st Lecture 9:00-10:00am		2nd Lecture 10:00-11:00am		3rd Lecture 11:15am-12:15 pm	4th Lecture 12:15-1:15pm		5th Lecture 2:00-3:00pm	6th Lecture 3:00-4:00pm	
			9:00-9:10	9:10-10:00							3:00-3:50	3:50-4:00
1	Monday (October 24, 2016)	• Key Issues in Water Distribution System • Operation & Maintenance of Water Supply Pipelines & Valves	• Introduction of Course Participants • Training Expectations	• Key Issues in Water Distribution System	• Components of Water Supply Facility		• Arrangement of Water Distribution System	• Pipe Material		• Appurtenances	• Critical Report on Major Issues of Five WASA`s (Group Assignment)	• Reflection and Review
2	Tuesday (October 25, 2016)	Operation & Maintenance of Water Supply Pipelines & Valves	• Review of Previous Lecture	• Water Distribution Operational Plan	• Water Distribution Maintenance Plan		• Water Distribution Maintenance Plan	• Water Distribution System Mapping		Individual Assignment on Preparation of Operational and Repair Action Plan		• Reflection and Review
3	Wednesday (October 26, 2016)	EPANET Analysis for Water Distribution System	• Review of Previous Lecture • Brief on Network Analysis Exercise	Network Analysis Exercise of Supply Area of One Tube Well								
4	Thursday (October 27, 2016)	Operation and Maintenance of Water Distribution System	• Review of previous Lecture	OJT at Green Town WASA Sub Division , Lahore Checking of Valves, Hydrants as per Drawings Checking of Pressure and Residual Chlorine						• Comparison of Results of Network Analysis and Field Visit (Practical) • Reflection and Review	• Introduction of Japan Water Works Association (JWWA) and Capacity Development Activities (Mr.Okubo)	
5	Friday (October 28, 2016)	• Water Safety Plan (WSP) • Health, Safety, Environment (HSE)	• Review of Previous Lecture	Water Safety Plan Linked with Distribution Pipelines and Reservoirs			Safety Practices during Repair & Maintenance of Pipelines	Group Assignment (Preparation of WSP and HSE Plan)		Group Assignment (Preparation of WSP and HSE Plan)		• Course Evaluation • Training Closure

Annex 3.14
Training Schedule for Leakage Detection in Fall 2016

Leak Detection and Repair Course

Training Schedule (October 03 to October 06, 2016)

Sr.No.	Day and Date	Themes	Session 1		Tea	Session 2		Lunch	Session 3			
			1st Lecture 9:00-10:00am	2nd Lecture 10:00-11:00am	Tea 11:00-11:15am	3rd Lecture 11:15am-12:15 pm	4th Lecture 12:15-1:15pm	Lunch 1:15-2:00pm	5th Lecture 2:00-3:00pm	6th Lecture 3:00-4:00pm		
										3:00-3:20	3:20-3:50	3:50-4:00
1	Monday (October 03, 2016)	• Basic Knowledge of Leak Detection • Repairing of Leakage and Burst Pipelines	• Introduction of Course Participants • Training Expectations • Current Scenario of Leakage Detection	• Countermeasures for Leakage		• Countermeasures for Leakage	• Leakage Survey Equipment		• Leakage Survey Equipment • Repairing of Leakage and Burst Pipeline	• Repairing of Leakage and Burst Pipeline	**Group Presentation:** Current Practices for Leakage Prvention and Pipe Repairing by the participants of each water utilitiy	• Conclusion and Reflection
2	Tuesday (October 04, 2016)	• On Site Leak Detection	• Review of Previous Lectures • Visit Briefing • Sharing of OJT Plan	**OJT at Green Town Sub Division, Lahore** • Procedure and Use of Acoustic Type Electronic Leak Detector and Listening Stick • Installation and Operation of Metal Pipe Locator, Metal Locator, Non-Metal Pipe Locator • Flow Measurement and Pressure Fluctuations Recording by Ultrasonic Flowmeter and Pressure Recorder						**• Site Visit Report**		• Conclusion and Reflection
4	Wednesday (October 05, 2016)	• On Site Installation and Operation of Leak Detection Equipment	• Review of Previous Site Visit • Visit Briefing	**OJT at Green Town Sub Division, Lahore** • Installation and Operation of Metal Pipe Locator, Metal Locator, Non-Metal Pipe Locator • Flow Measurement and Pressure Fluctuations Recording by Ultrasonic Flowmeter and Pressure Recorder						**• Site Visit Report**		• Conclusion and Reflection
5	Thursday (October 06, 2016)	• Leakage Prevention Plan (Practical)	• Review of Previous Lectures & Site Visit Reports • Briefing on Prevention Plan	• Preparation of Action Plan for Leakage Prevention by the Participants from each Water Utility		• Preparation of Action Plan for Leakage Prevention by the Participants from each Water Utility			**• Group Presentaion & Assessment**		• Course Evaluation • Training Closure	

Annex 3.15
Training Schedule for O&M of Sewer and Storm Water Drainage in Fall 2016

Operation & Maintenance of Sewer and Storm Water Drainage System including Safety Precautions
Module 01 - Safety Control and Measures for Sewer and Drainage Works (03 Days)
Training Schedule (October 31 - November 02 , 2016)

Sr. No.	Day and Date	Themes	Session 1			Tea 11:00 am-11:15am	Session 2			Lunch 1:15 pm-2:00 pm	Session 3		
			1st Lecture 9:00 am-10:00 am		2nd Lecture 10:00 am-11:00 am		3rd Lecture 11:15 am - 12:15 pm		4th Lecture 12:15 am - 1:15 pm		5th Lecture 2:00 pm - 3:00 pm		6th Lecture 3:00 pm -4:00 pm
			09:00 am-9:15 am	9:15 am-10:00 am			11:15 am-11:45 am	11:45 am-12:15 pm			2:00 pm-2:30 pm	2:30 pm-3:00 pm	
1	Monday October 31, 2016	**1**. Risks & Hazards Associated with O & M of Sewerage & Drainage System	• Welcoming Remarks & Participant Introduction • Course & Modules Overview • Training Expectations	• Hazards & Risks	• Group Discussion on Control Measures related to Hazards & Risks • Briefing on Current Safety Practices in WASA		**Visit-01** **(WASA Training Directorate, Gulshan-e-Ravi)** • Observation of Training Facilities and Infrastructure						• Discussion about Visit • Reflection & Conclusion on Day's Activities
2	Tuesday November 01, 2016	**3.** Use of Safety Gears **4.** SOPs for Sewer & Manhole Operations	• Recap & Review of Previous Day Lectures	• Demonstration on PPE	**Visit-02** **(Field Work - WASA Green Town Sub-Division)** • Testing of Hazardous Gases in Manhole with Portable Gas Monitor & Use of Air Blower • Working in Confined Spaces								• Reflection & Conclusion on Day's Activities
3	Wednesday November 02, 2016	**5.** First Aid in Emergency Situations **6.** Traffic Control Practices during Sewer and Manhole Cleaning Operations	• Recall & Review of Previous Day Lectures	• Demonstration on Arrangements for Medical Treatment	**Visit-03** **(Field Work around Academy)** • Use of Metal Locator (M-130) for Detecting Burried Manhole Cover • Traffic Routing (Layout / Execution) during O&M Works								• Assignment • Conclusion & Closing of Module-01

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Operation & Maintenance of Sewer and Storm Water Drainage System including Safety Precautions

Module 02 - Operation and Maintenance of Storm Water Drainage System (02 Days)

Training Schedule (November 03 - November 04 , 2016)

<table>
<tr><th rowspan="2">Sr. No.</th><th rowspan="2">Day and Date</th><th rowspan="2">Themes</th><th colspan="3">Session 1</th><th rowspan="2">Tea
11:00 am-11:15 am</th><th colspan="2">Session 2</th><th rowspan="2">Lunch
1:15 pm-2:00 pm</th><th colspan="2">Session 3</th></tr>
<tr><th colspan="2">1st Lecture
9:00 am-10:00 am</th><th>2nd Lecture
10:00 am-11:00 am</th><th>3rd Lecture
11:15 am-12:15 pm</th><th>4th Lecture
12:15 pm-1:15 pm</th><th>5th Lecture
2:00 pm-3:00 pm</th><th>6th Lecture
3:00 pm-4:00 pm</th></tr>
<tr><td></td><td></td><td></td><td>9:00 am-9:10 am</td><td>9:10 am-10:00 am</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>1</td><td>Thursday November 03, 2016</td><td>1. Objectives of Operation and Maintenance of Storm Water Drains

2. Operation and Maintenance Works for Storm Water Drains</td><td>• Module Introduction & Overview

• Expected Learning Outcomes</td><td>• Need for Operation and Maintenance of Drains

• Measurement of Sludge Quantity deposited in Storm Water Drains</td><td>• Tools and Equipment for Drain Cleaning Operations

• Dredging and De-silting Operations

• Maintenance of Storm Water Drains</td><td colspan="5"><u>Visit-01</u>
<u>(Field Work at Primary & Secondary Drains around Academy)</u>

• Observing the Machinery for Drain Cleaning Operations (WASA Office, Drainage Division-South)
• Estimation of Sludge Quantity in Various Drains (Shaukat Ali Drain)
• De-Silting Operations (Sattu Katlah Drain)</td><td>• Discussion about Visit

• Reflection & Conclusion on Day's Activities</td></tr>
<tr><td>2</td><td>Friday November 04, 2016</td><td>3. Sludge Handling and its Disposal</td><td>• Recap & Review of Previous Day Activities

• Daywork Overview</td><td>• Planning for Sludge Disposal

• Disposal Techniques</td><td colspan="6"><u>Visit-02</u>

• Observation of Open Dumping at Gawalah Colony
• Observation of Landfilling Operation at Lakhodair</td><td>• Assignment

• Conclusion & Closing of Module-02</td></tr>
</table>

ALJAZARI ACADEMY

Operation & Maintenance of Sewer and Storm Water Drainage System including Safety Precautions

Module 03 - Operation and Maintenance of Sewer System (04 Days)

Training Schedule (November 14 - November 17, 2016)

Sr. No.	Day and Date	Themes	Session 1			Tea	Session 2			Lunch	Session 3
			1st Lecture 9:00 am-10:00 am		2nd Lecture 10:00 am-11:00 am	11:00 am-11:15 am	3rd Lecture 11:15 am-12:15 pm	4th Lecture 12:15 pm-1:15 pm	5th Lecture 1:15 pm-2:00 pm	2:00 pm-3:00 pm	6th Lecture 3:00 pm-4:00 pm
			9:00 am - 9:15 am	9:15 am-10:00 am							
1	Monday November 14, 2016	**1.** Inspection & Testing of Sewers & Manholes	• Module Introduction & Overview • Expected Learning Outcomes	• Inspection of Manholes & Sewer lines	• Testing Techniques		**Visit-01 (Field Work around Academy)** • Manhole / Sewer Line Inspection			LUNCH	• Reflection & Conclusion on Day's Activities
2	Tuesday November 15, 2016	**2.** Machinery, Tools & Equipment for Cleaning of Sewer Lines & Manholes	• Recap & Review of Previous Day Activities • Daywork Overview	• Machinery, Tools & Equipment • Cleaning Techniques	**Visit-02 (Field Work at WASA Green Town / Industrial Area Sub Division)** • Introduction & Working of Jetter & Sucker Machine • Hydraulic Method of Sewerline / Manhole Cleaning & Blockage Removal						• Reflection & Conclusion on Day's Activities
3	Wednesday November 16, 2016	**3.** O&M of Disposal Station	• Recap & Review of Previous Day Activities • Daywork Overview	• Disposal Station -Introduction -O&M	**Visit-03 (Field Work at Disposal Stations)** • Observation of O&M works at: **1.** Ameer Chowk Disposal Station **2.** Gulshan-e-Ravi Disposal Station						• Reflection & Conclusion on Day's Activities
4	Thursday November 17, 2016	**4.** Maintenance & Rehabilitation of Sewer Lines & Manholes **5.** Emergency Response Planning (ERP) for Monsoon	• Recap & Review of Previous Day Activities • Daywork Overview	• Repair & Rehabilitation Techniques	• Introduction of ERP • Briefing on Special Measures taken by WASAs During Monsoon Season		• Action Plan for Module 3				• Conclusion & Closing of Module-03

Annex 3.16
Training Schedule for O&M of Electrical Equipment in Fall 2016

Operation and Maintenance (O&M) of Electrical Equipment Course

Training Schedule (November 23rd-November 25th, 2016)

Course Code: WSD 5231

Module-1 Electrical Control Panels

Sr. No.	Day and Date	Themes	Session 1		Break 11:00-11:15am	Session 2		Lunch 1:15-2:00pm	Session 3	
			1st Lecture 9:00-10:00am	**2nd Lecture 10:00-11:00am**		**3rd Lecture 11:15am-12:30 pm**	**4th Lecture 12:30-1:15pm**		**5th Lecture 2:00-3:00pm**	**6th Lecture 3:00-4:00pm**
1	Wednesday (November 23, 2016)	Introduction to main electrical units , Components of electrical control panel, Motor starters, Power factor correction, General design parameters, Preventative maintenance and record keeping	• Introduction of participants • Training Introduction & Expectations • Inquiry about Participants' Background	• Introduction to main electrical units and its components • Understanding of General Design Parameters of the Panel **Activity: Connection diagram of different components of MCU**		• SOPs • Record Keeping • OJT in Class room **Activity:Prepare SOP for Sample Electrical Panel**	• HSE Problem Solving Techniques		• Preventive Maintenance • OJT in Class room **Activity: Prepare Preventative Maintenance Plan**	• Today's Review • Workshop for Participants' Output • Discussion,Queries of Participants • Plan for Tomorrow
3	Thursday (November 24, 2016)	Standard Operating Procedures Problem solving techniques Preventative maintenance	• Today's Aim and Schedule • Review from previous day slides • Equipment Introduction • Confirm Activity w/ Inspection Format	OJT at WASA Tube well at Green Town (10:00-1:15) • SOP, HSE Demonstration • Record Keeping • Preventive Maintenance • Problem Solving and Techniques					• Comparison of Results and filled templates • Assignment of activities to be performend at the respective site	• Today's Review • Workshop for Participants' Output • Discussion,Queries of Participants • Plan for Tomorrow
4	Friday (November 25, 2016)	Action Plan prepration and Presentation, Course evaluation,	**9:00-10:00am** • Today's Aim and Schedule • Review from previous day activities	• Action Plan and Annual Maintenance Plan • Workshop for Preparation of Action Plan		• Participants' Presentation for Lessons Learnt and Action Plan	• Course Evaluation • Review, Discussions, Queries of Participants • Instructors Evaluation		• Follow--up Lecture and OJT in Classroom • Free Discussion	

Operation and Maintenance (O&M) of Electrical Equipment Course

Training Schedule (November 30th-December 2nd, 2016)

Course Code: WSD 5231

Module-2 Generators

Sr.No	**Day and Date**	**Themes**	**Session 1**		**Tea**	**Session 2**		**Lunch**	**Session 3**	
			1st Lecture 9:00-10:00am	**2nd Lecture 10:00-11:00am**	**11:00-11:15am**	**3rd Lecture 11:15am-12:30 pm**	**4th Lecture 12:30-1:15pm**	**1:15-2:00pm**	**5th Lecture 2:00-3:00pm**	**6th Lecture 3:00-4:00pm**
1	Wednesday (November 30, 2016)	Introduction to generators, Basic Design, Electrical Components of Generators Best practices in Generator operations Reliability based preventative maintenance and trouble shooting	• Introduction of participants • Training Introduction & Expectations ・Inquiry about Participants' Background	• Introduction to Generator units and its components • Understanding of General Design of the Generator **Activity: Label Exploded Diagram of Diesel Generator**		• SOPs, Best practices in Generator Operations • Record Keeping	・HSE ・Problem Solving and Techniques		• Reliability based Preventative Maintenance ・Operational Maintenance ・O&M Introduction by Videos and Animations ・Periodic maintenance charts **Activity: Perform preventative maintenance of Generator**	•Today's Review ・Workshop for Participants' Output ・Discussion,Queries of Participants ・Plan for Tomorrow
3	Thursday (December 1, 2016)	Standard Operating Procedures Problem solving techniques Possible causes of engine failure Preventative maintenance and record keeping Electrical components of generator	・Today's Aim and Schedule ・Review from previous day slides ・Activity Inspection Format	OJT with an Actual Generator at Academy ・SOP, HSE ・Record Keeping ・Preventive Maintenance ・Problem Solving and Techniques					• Comparison of Results and filled templates ・Assignment of activities to be performend at the respective site	•Today's Review ・Workshop for Participants' Output ・Discussion,Queries of Participants ・Plan for Tomorrow
4	Friday (December 2 2016)	Prepration and Presentaation of Action Plan, Course Evaluation	・Today's Aim and Schedule ・Review from previous day activities	・Action Plan and Annual Maintenance Plan ・Workshop for Preparation of Action Plan		・Participants' Presentation for Lessons Learnt and Action Plan	• Course Evaluation ・Review, Discussions, Queries of Participants ・Instructors Evaluation		• Follow--up Lecture and OJT in Classroom ・Free Discussion	

Operation and Maintenance (O&M) of Electrical Equipment Course

Training Schedule (December 7th-December 9th, 2016)

Course Code: WSD 5231

Module-3 Introduction to SCADA and HSE

Sr.No	Day and Date	Themes	Session 1			Tea 11:00-11:15am	Session 2		Lunch 1:15-2:00pm	Session 3	
			1st Lecture 9:00-10:00am		2nd Lecture 10:00-11:00am		3rd Lecture 11:15am-12:15 pm	4th Lecture 12:15-1:15pm		5th Lecture 2:00-3:00pm	6th Lecture 3:00-4:00pm
1	Tuesday (December 7, 2016)	Introduction to SCADA, SCADA Functions, System Equipment Operation of SCADA System Usage of SCADA System in Water Utility Case Study : SCADA Installation at Faisalabad WASA, PMU	**9:00-9:10** • Introduction of Course Participants • Training Expectations	**9:10-10:00** Introduction to SCADA System Usage of SCADA in Water Utility	• SCADA Functions		• System Equipment	• Operation of SCADA System		•Case Study: SCADA Installation at WASA Faisalabad, PMU	
3	Wednesday (December 8, 2016)	Case Study on Water Utilities Problem Solving Techniques Preventative Maintenance	Case Study on Water Utilities **Background** **Challenges** **Solution** **Results**			OJT at SCADA Facility Wasa, Lahore Problem Solving Techniques, HSE			OJT at SCADA facility (5-S)		
4	Thursday (December 9, 2016)	HSE and Action Plan	Review of Previous day's Activities		HSE of Electrical Equipment					Action Plan prepration and presentaion regarding HSE	

Annex 3.17
Training Schedule for O&M of Mechanical Equipment
in Fall 2016

ALJAZARI ACADEMY

Operations and Maintenance (O&M) of Mechanical and Electrical Equipment
Training Schedule (December 26th - December 28th, 2016)
Course Code: WSD 5231
Module-1 Pumps, Induction Motors and Valves

Sr. No.	Day and Date	Themes	Session 1		Tea	Session 2		Lunch	Session 3	
			1st Lecture 9:00-10:00am	2nd Lecture 10:00-11:00am	11:00-11:15am	3rd Lecture 11:15am-12:15 pm	4th Lecture 12:15-1:15pm	1:15-2:00pm	5th Lecture 2:00-3:00pm	6th Lecture 3:00-4:00pm
1	Monday (December 26, 2016)	•Pumps •Induction motors •Valves	•Introduction of course participants •Training expectations •Introduction to pumps, motors and valves	•Assembly components of pumps, motors and valves •Selection criteria for pumps and motors		**Exercise1:** •Pump selection criteria •Calculate total head for pumps	•Motor efficiency after the rewinding process **Exercise2:** •Indicate common reasons for motor burnout and solutions to avoid it •Pump motor sizing		• Review of current equipment conditions • Group discussion about current pump, valve and induction motor operational conditions	•Wrap-up for the day
2	Tuesday (December 27, 2016)	•Standard operating procedures (SOPs disposal stations) •Preventive maintenance	•Standard operating procedures (SOPs) •Pumps, motors and valves	•Problem solving technique •Preventive maintenance **Exercise3**: Find and identify appropriate manual section and develop a monthly maintenance plan		**OJT at Gulshan Ravi & Main Outfall disposal station (WASA)** •Practice standard operating procedure of wastewater centrifugal pumps •Pressure checks •Leakage inspection •Valve functions •Gland seal replacement procedure •Lubrication •Mechanical screens				
3	Wednesday (December 28, 2016)	•Standard operating procedures (SOPs Tube-well) •Problem solving techniques •Preventive maintenance	•Standard operating procedures (SOPs) •Pumps, motors and valves	• Introduction to chlorination and filtration system at WASA tube wells		• Introduce OHSAS 18001 • WHO water chlorination guidelines •Chlorination dosage and pump calibration	•Chlorination dosage calculations **Exercise1:** •Adjustment of chlorinator (pump) for required treatment •Identify various parts and features for the chlorinator pump		•Filtration systems components and filter types **Exercise2:** filtration system components and specific function identification	

ALJAZARI ACADEMY

Operations and Maintenance (O&M) of Mechanical and Electrical Equipment

Training Schedule (December 29th - December 30th, 2016)

Course Code: WSD 5231

Module-4 Chlorination and Filtration System

Sr. No.	Day and Date	Themes	Session 1		Tea	Session 2		Lunch	Session 3	
			1st Lecture 9:00-10:00am	2nd Lecture 10:00-11:00am	11:00-11:15am	3rd Lecture 11:15am-12:15 pm	4th Lecture 12:15-1:15pm	1:15-2:00pm	5th Lecture 2:00-3:00pm	6th Lecture 3:00-4:00pm
1	Thursday (December 29, 2016)	OJT for tube well facility	**OJT at Green Town tube-well (4D1-WASA)** •Practice standard operating procedure of tube well •Flow rate check (ultra sonic meter) •Pressure check •Gland seal leakage and replacement procedure •Water filter inspection procedure •Overall process flow for the filtration plant						Preventive maintenance **Exercise3:** Identification of various valve types in respect to their primary function	
2	Friday (December 30, 2016)	•Action plan •Module evaluations •Reflections	•Module 1 and 4 wrap-up •Action plan •Module evaluations •Participant reflections Note: Action plan is for both Module 1 and Module 4 together							

Operations and Maintenance (O&M) of Mechanical and Electrical Equipment
Training Schedule (January 9th - January 10th, 2017)
Course Code: WSD 5231
Module-7 Water Meters and 5S

Sr. No.	Day and Date	Themes	Session 1		Tea	Session 2		Lunch	Session 3	
			1st Lecture 9:00-10:00am	2nd Lecture 10:00-11:00am	11:00-11:15am	3rd Lecture 11:15am-12:15 pm	4th Lecture 12:15-1:15pm	1:15-2:00pm	5th Lecture 2:00-3:00pm	6th Lecture 3:00-4:00pm
1	Monday (January 9, 2017)	•Introduction to water meters	•Training expectations •Importance of water meters	•Major types of water meters		• Assembly components of water meters	**Exercise 1:** List major water meter types and their purpose		**OJT at Al-Jazari Academy** **Exercise 2:** consumer water meter flow rate accuracy check, test is performed with an ultra sonic flow meter	
2	Tuesday (January 10, 2017)	•5S implementation	•Importance of 5S and implementation briefing	**OJT at WASA south equipment yard, Lahore** **Exercise 3:** 5S implementation exercise in the WASA south yard area		•5S Action plan •Module evaluations				

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Operations and Maintenance (O&M) of Mechanical and Electrical Equipment

Training Schedule (January 11th - January 13th, 2017)

Course Code: WSD 5231

Module-5 Heavy Machines

Sr. No.	Day and Date	Themes	Session 1		Tea 11:00-11:15am	Session 2		Lunch 1:15-2:00pm	Session 3	
			1st Lecture 9:00-10:00am	2nd Lecture 10:00-11:00am		3rd Lecture 11:15am-12:15 pm	4th Lecture 12:15-1:15pm		5th Lecture 2:00-3:00pm	6th Lecture 3:00-4:00pm
1	Wednesday (January 11, 2017)	•Introduction to heavy machines •HSE	•Introduction of course participants • Training expectations •Introduction to major heavy machines used at WASAs	•Introduction to major heavy machines used at WASAs continued..		• Assembly components **Exercise 1:** List major assembly components of the jetting machine along with their functions	**Exercise 2:** List major assembly components of the suction machine along with their functions • Today's wrap-up		•HSE applicable to mechanical equipment	
2	Thursday (January 12, 2017)	•Standard operating procedures (SOP) •Root cause and problem solving techniques	•SOP of the jetting unit •SOP of the suction unit •SOP of the backhoe unit		OJT at WASA south equipment yard, Lahore •Demonstration of SOPs and HSE Suction unit Jetting unit •Usage of 5-why technique for root-cause and troubleshooting					
3	Friday (January 13, 2017)	•Preventive maintenance •Action plan •Course evaluation	• Importance of preventive maintenance • Importance of record keeping • Maintenance and operator's manual relationship	OJT at Aljazari Academy, Backhoe unit **Exercise 3:** Develop a monthly maintenance plan for a suction unit		**•Action plan** **•Module evaluations**				

Annex 3.18
Training Schedule for Asset Management in Fall 2016

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Asset Management Course

Training Schedule (October 31, 2016 to November 04, 2016)

Sr.No	Day and Date	Themes	Session 1			Session 2			Session 3	
			9:00-10:00am	10:00-11:00am	Tea 11:00-11:15am	11:15am-12:15 pm	12:15-1:15pm	Lunch 1:15-2:00pm	2:00-3:00pm	3:00-4:00pm
1	**Monday (October 31, 2016)**	Introduction to Asset Management Assets & Asset Condition	Definition of Assets Assets of WASAs	Three different Exercises to identify assets and asset components		Asset Coding structure Asset Condition Assessment & scale to determine Asset conditions.			Assignment 1- Discuss Asset Management System in WASAs/ KWSB/ NSUSC with respect your organzation and prepare a brief report of 300 words.	
2	**Tuesday (November 1, 2016)**	Risk & Application of Asset attributes Asset Management Plan	Ways to determine Risk and application of attributes of assets in effective decision making			Asset Management Plan preparation techniques and discusion on Asset Management Plan of WASA			Assignment 2- Prepare a brief asset risk report of 300 words.	
3	**Wednesday (November 2, 2016)**	Recording and reporting of assets in books of accounts Introduction of Asset Management Information System (AMIS)	Accounting practices for fixed assets in WASAs under Financial Management Manual and developed utilities Depreciation & Fixed Asset Register			Introduction of Asset Management Information System (AMIS) Registration of Users & Addition of Assets into AMIS			Assignment 3- Individual Assignment for formation of Fixed Asset Register	
4	**Thursday (November 3, 2016)**	Asset Management Information System (AMIS) operating skills	Searching and Editing of Assets into AMIS Reporting of AMIS Conslusion and Suggestions			Brief introduction of IDAMP, GIS & AMIS for underground asset			Assignment 4- Individual Assignment to add one to two assets for each category and prepare a brief report for improvement in AMIS.	
5	**Friday (November 04, 2016)**	Preparation of Project & Presentation	Project 1-Preparation of Asset Management Plan of 5-10 tubewells or any area of utility service delivery			Project 1-Preparation of Asset Management Plan of 5-10 tubewells or any area of utility service delivery			Project 1-Presentation on project	

Asset Management Course

Training Schedule (November 21 to 24, 2016)

Sr.No	Day and Date	Themes	Session 1			Session 2			Session 3	
			9:00-10:00am	**10:00-11:00am**	**Tea 11:00-11:15am**	**11:15am-12:15 pm**	**12:15-1:15pm**	**Lunch 1:15-2:00pm**	**2:00-3:00pm**	**3:00-4:00pm**
1	**Monday (November 21, 2016)**	Asset Condition Analysis & Pipe diameter based analysis	Data Description Definition & application of pivot table. Asset Condition Analysis. Demonstration. Practical exercises on analysis and observation.			Pipeline diameter based analysis using pivot table. Demonstration. Practical exercises on analysis and observation.			Assignment 1- Individual: Please prepare the following in steps; 1. Table and graph showing % coditions of pipelines on subdivision level. 2. The D condition lines will then be categoried according to material & diameter (3" to 6"). 3. Write a breif report on findings (WASA Relevent)	
2	**Tuesday (November 22, 2016)**	Asset Age Analysis & Replacement planning	Explanation of age analysis. Demonstration. Asset database analysis exercises in terms of Age.			Explanation of Asset Replacement cost calculation and priortization for replacement planning. Demonstration & practical exercises.			Assignment 2: 1. Categorise the pipeline data age wise and select a subdivision which has oldest pipes. 2. Rank the lines as per their condition. 3.Calculate the Total replacement cost for D & F condition pipes. (Relevent WASA) 4.Write brief paragraph on findings.	
3	**Wednesday (November 23, 2016)**	1) Actual practices of monitoring assets at WASAs 2) Cost comparison of "with" and without" maintenance 3) Review of database analysis	Explanation of actual practices monitoring assets at WASAs: keeping records of the monitoring results, repair/ replacement, procurement, tender, bidding, delivery, inspection, payment, register)			Group discussion and presentation; monitoring, asset database updating (Group Assignment 1, formulation of OJT Implementation Procedure)			Comparison of "with" and without" maintenance (Group Assignment 2): cost & benefit analysis, Internal rate of return (IRR), Net Present Values (NPV)	

Asset Management Course

Training Schedule (November 21 to 24, 2016)

Sr.No	Day and Date	Themes	Session 1			Session 2			Session 3	
			9:00-10:00am	10:00-11:00am	Tea 11:00-11:15am	11:15am-12:15 pm	12:15-1:15pm	Lunch 1:15-2:00pm	2:00-3:00pm	3:00-4:00pm
4	**Thursday (November 24, 2016)**	1) Pipeline replacement plan 2) Replacement with its cost 3) Affordability of the replacement plan	Review of database analysis exercises: e.g. tube well conditions and its replacement year.			1) Pipeline replacement plan: formulating pipeline replacement plan in a WASA, short, medium, and long-term plan, with its cost 2) Replacement with its cost (assignment 3): Exercises of imputing a cost table to calculate the short, medium, and long-term plan.			3) Affordability of the replacement plan: examining affordability of finance with the actual receipts and expenditures of each WASA	

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Asset Management Course

Training Schedule (December 05,2016 to December 10, 2016)

Sr.No	Day and Date	Themes	Session 1 9:00-10:00am	Session 1 10:00-11:00am	Tea 11:00-11:15am	Session 2 11:15am-12:15 pm	Session 2 12:15-1:15pm	Lunch 1:15-2:00pm	Session 3 2:00-3:00pm	Session 3 3:00-4:00pm
1	**Monday (December 05, 2016)**	Introduction and importance of condition rating of assets	1. Introduction to asset condition survey 2. Types of assets & assets attributes 4. Asset condition & performance parameters 5. Asset condition rating 6. Tools used in measuring performance parameters		**TEA**	OJT 1: Participants will conduct the condition survey of the tubewell loacted in Gulberg Subdivision Lahore. OJT 2: Paricipants will conduct the condition survey of OHR		**LUNCH**	**Assignment** - 1. List down all the components within the tubewell station 2. Briefly explain the application of each component 3. Measure the performance parameters of the tubewell station-(Performa given in lecture notes) 4. Prepare asset replacement plan or O/M requirement at the tubewell station 5.Prepare a budget sheet to improve the condition of the tubewell station	
2	**Tuesday (December 06, 2016)**	Introduction and importance of condition rating of assets	Review of Day 1 Group presentation on the result of condition survey of tubewell station Preparation of basic asset management plan based on condition survey			OJT 1: Participants will conduct the condition survey of the disposal station of Gulshan Ravi			**Assignment** - 1. List down all the components within the disposal station 2. Briefly explain the application of each component 3. Measure the performance parameters of the disposal station-(Performa given in lecture notes) 4. Prepare asset replacement plan or O/M requirement at the disposal station 5.Prepare a budget sheet to improve the condition of the disposal station	
3	**Wednesday (December 07, 2016)**	Introuduction ot GIS and its applications in asset mapping, asset data browsing and study	Introduction to GIS	GIS applications in asset mapping, case study		ArcGIS & its components/Asset data browsing			**Practice Exercise**-Browsing and study of asset database in GIS	
4	**Thursday (December 08, 2016)**	Study of assets attributes and classification	Study of assets attribtutes data	Displaying of asset data in terms of attributes (diameter, condition, risk, type etc.)		Asset categorizing in labeling assets attributes	Editing the assets data, making shapefiles		**Practice Exercise:**Study of asset attributes and classification	
5	**Friday (December 09, 2016)**	Pipe Replacement Planning	Applying query functions	Query the pipelines of your interest (e.g., 6" diameter)/Calculating lengths of pipeline		Preparation of water and sewerage network maps on a scale 1:500 & 1:1000			**Assignment 1:** Query the lines of water supply in Gulberg subdivision which should be replaced in year 1, and also calculate length in meters. **Assignment 2:** Preparation of Water Supply Map of Gulberg subdivision on a scale 1:1000 and verify from the field.	
6	**Saturday (December 10, 2016)**	Field Verification Survey	Introduction to GPS	Use of GPS device		Asset data collection with GPS device, tracking pipelines, synchronization of GPS data in ArcGIS			**Assignment 3: (Group)** Demarcation of 10 Manholes in industrial area subdivison by using GPS device and prepare a map.	

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Annex 3.19
Training Material for O&M of Tube Well and Pump Facility
in Fall 2016

O&M of Tube Well and Pump Facility (W1221)

O&M of Water Distribution System (Module1)

Key Issues in Water Distribution System

Zia Mustafa (Water Specialist)
Ramisha Taseer (Research Associate)

October 2016

Outline of the Presentation

3

- Trainee's Expectations
- Learning Outcomes
- Existing Water Distribution System in Five WASA`s
- Key Issues in Water Distribution System

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What are Your Training Expectations??

5

Course Outcomes

O&M of Tube well and Pump Facility

- Improvement in daily operations of WASAs
- Assessment of Water Quality Concerns
- Implement Preventive Maintenance
- Understand HSE Requirements
- Improvement in Professional Responsibilities

6

Existing Water Distribution System in Five WASA`s

WASA Lahore

- Water source Groundwater
- Direct Pumping System
- No. of Tube well 528
  (Supply hours 14-18hr/day)
- Total length of water distribution pipelines 5,444km
- No overhead reservoir in operational state except Lange Mandi OHR (capacity 1MG)

WASA Faisalabad

- 60% of population provided with piped water supply
- Water source Combination of ground water and surface water
- 15MGD of water being augmented in system by French Project
- Present Water Demand 145MGD
- Supplied Water to Consumers 93.5 MGD

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WASA Multan

• 65% of population provided with piped water supply	
• Water source	Ground water
• Depth of WT	70-80ft
• No. of Tube wells	102
• No. of Reservoirs	18 Nos.
• Water supplied to consumers	221MGD
• Water supply pipelines	3” to 24”
- Main lines	231 km
- Distribution lines	1,049km
• No. of Filtration Plants (Cap. 1000 gallons/hr. Each)	32

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WASA Rawalpindi

• 90% of population provided with water supply facility	
• Two Surface water sources with treatment plants	
▪ Rawal Water Treatment Plant	23MGD
▪ Sanjani Water Treatment Plant	6MGD
• No. of Tube wells (0.25 cusecs capacity each) (39 MGD water supplying to consumers)	362
• Transmission and Distribution pipelines length	1,250km (3”to 54”)

WASA Gujranwala

- 40% of population provided with piped water supply
- 10 reservoirs (8 operational & 2 abandoned)
- 67 Tube wells supplying 39MGD of water
- Intermittent supply 10-12 hours in a day
- Distribution length (3” to 24” inches with length of 481km

Salient Features of Water Supply System in Five WASAs (Year 2014-15)

Sr. No.	Water Supply Parameters	WASA Lahore	WASA Faisalabad	WASA Multan	WASA Rawalpindi	WASA Gujranwala
1	Water Source	Ground water	Combination of Ground and Surface Water	Ground water	Combination of Ground and Surface Water	Ground water
2	Total Population (Millions)	9.2	7.19	4.22	4.57	4.66
3	Population Served (Millions)	5.89	1.9	1.43	1.65	0.21
4	WASA served water supply area (km^2)	350	225	365.3	276	25.2

Salient Features of Water Supply System in Five WASAs (Year 2014-15)

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Sr. No.	Water Supply Parameters	WASA Lahore	WASA Faisalabad	WASA Multan	WASA Rawalpindi	WASA Gujranwala
5	Number of Tube wells	528	77	102	362	67
6	Water Coverage (%)	90	60	65	90	40
7	Average amount of water supplied (MGD)	450	93.5	221	68	39
8	Average per capita water supplied GPCD	80	25	50	40	50
9	Supply Hours	14-18	6-7	6	2-4	10-12
10	NRW (% age)	38.4	32.9	22	43	39

Salient Features of Water Supply System in Five WASAs (Year 2014-15)

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Sr. No.	Water Supply Parameters	WASA Lahore	WASA Faisalabad	WASA Multan	WASA Rawalpindi	WASA Gujranwala
11	Metering Ratio (%)	5	1	-	-	-
12	Reservoirs (No. and Capacity) Million Gallons	52, 3.16	44, 2.2	18, 2.35	36, 2.77	10, 1.58
13	Total length of Distribution System (km)	5,544	1,218	1,280	1,200	481
14	Total Annual O&M Cost (Rs. Million)	7,354	1,652	1,075	700	643
15	Total water supply connections	636,338	270,451	66,900	114,655	26,091

Key Issues in Water Distribution System

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- Non Revenue Water
- Metering
- Tarrif
- Intermittent Water supply
- Low Pressure
- Aging Network
- Water Quality
- Cross Connections
- Lack of records
- Inadequate O&M
- Financial constraints

Lecture 1: Key Issues in Water Distribution System

Non Revenue Water (NRW)

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"NRW is the difference in water put into the supply and the amount of water to be billed to consumption"

- NRW Comprises of three components:

1. Unbilled authorized consumption (Water used for Public buildings, parks etc.)
2. Physical losses (leakages from transmission and distribution pipelines)
3. Commercial losses (illegal connections, inaccuracies in meters)

Lecture 1: Key Issues in Water Distribution System

Non Revenue Water (NRW)

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- Major factors contributing towards NRW include:
  - Old aged pipe Infrastructure
  - illegal Connections
  - Inadequate metering System
  - Invisible leaks

Present Status of Revenue and Non-Revenue Water across Five WASAs (Year 2014-15)

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Sr. No.	Name of WASA	Distributed Water (MGD)	Revenue Water (MGD)	NRW Water (MGD)
1	WASA Lahore	238	147	91
2	WASA Faisalabad	112	76	36
3	WASA Rawalpindi	81	46	35
4	WASA Multan	45	36	9
5	WASA Gujranwala	21	13	8

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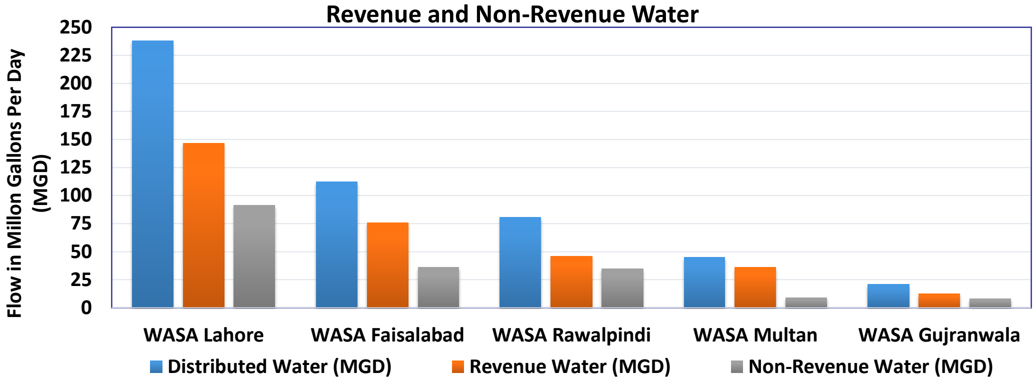
NRW Scenario in Five WASAs



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Metering

Metering Ratio in Five WASA`s

Sr. No.	Name of WASA	Metering Ratio
1	WASA Lahore	5 %
2	WASA Faisalabad	1 %
3	WASA Gujranwala	-
4	WASA Multan	-
5	WASA Rawalpindi	-

Metering

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- Absence of Metering System except LHR & FSD
- Bill collection on flat rat basis
- Installation of meters at domestic & non domestic connections to ensure actual consumption used by consumers

Lecture 1: Key Issues in Water Distribution System

Tariff

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- Present tariff is based on plot sizes (varying from 5 Marla to more than 20 Marla)
- A gradual increase in Tariff is required to improve the financial position of five WASA`s
- The tariff increase needs to address at affordable cost to consumers

Lecture 1: Key Issues in Water Distribution System

Water Supply Tariff (Rs./Month) in 5 WASAs

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Sr. No.	Connections	Plot Size	WASA LHR	WASA FSD	WASA RWP	WASA MUL	WASA GRW
1	Unmetered Connections (Domestic)	5 Marla	52	145	98	60	100
		7 Marla	78	242	160	100	125
		10 Marla	131	242	220	100	150
		1 Kanal	223	322	300	175	250
		Above 1 Kanal	311	644	500	250	325
		Above 2 Kanal	311	966	706	250	600

Domestic Tariff on Un Metered Connections

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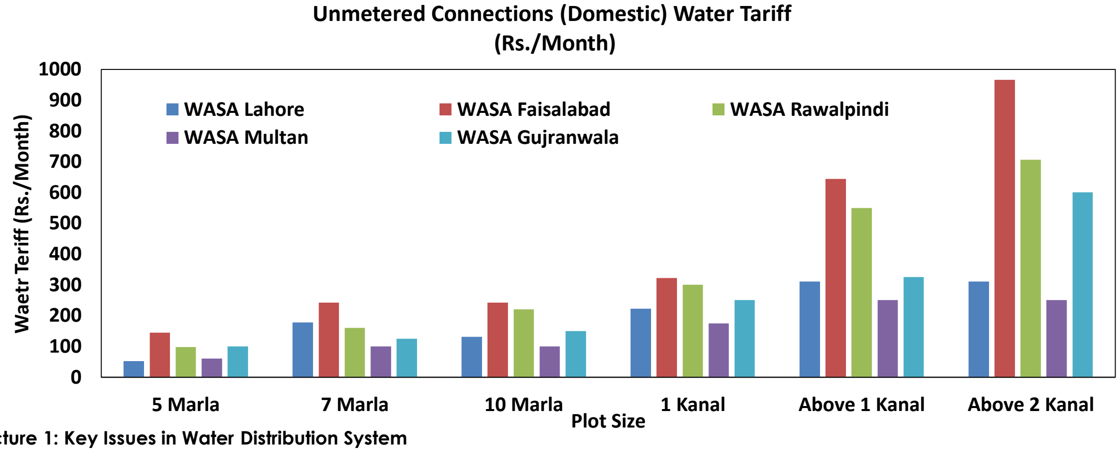

Intermittent Water Supply

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- Intermittent supply system in all WASA`s varying from 2-18 hours
- WASA Lahore 14-18 hours/ day (maximum duration)
- WASA Rawalpindi 2-4 hours / day (minimum duration)
- Supplying water on intermittent basis is major cause of negative pressure which causes contamination of water supply lines

Cross Connections

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- Contamination of water supply pipelines in vicinity of sewer/drain
- Major causes Include
  - Intermittent supply
  - Cracks in pipes
  - leaky joints
  - Improper horizontal & vertical clearance between water supply pipelines and sewers

Low Pressure

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- Low pressure frequently encountered in areas distant from Tube wells

Aging Network

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- Water Supply Pipes used by Five WASAs include:
  - Asbestos Cement (AC)
  - Ductile Iron (DI)
  - Galvanized Iron (GI)
  - Polyvinyl Chloride (PVC)
  - High Density Polyethylene (HDPE)
  - Cast Iron (CI)
  - Mild Steel (MS)

Aging Network...Contd.

- AC pipes are laid more than 90% in all WASA`s
- Corrosion of pipelines and leakages
- Reduction in carrying capacity and inability to sustain high pressures
- Low pressure at user end due to leakages

Aging Network…Contd.

Sr. No.	Pipe Material	Age
1	Asbestos Cement Pipes	40 Years
2	Ductile Iron (DI)	70 Years
3	Poly Vinyl Chloride (PVC)	40 Years
4	Cast Iron (CI)	50 Years
5	Galvanized Iron (GI)	50 Years
6	Mild Steel (MS)	60 Years

Water Quality

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- Water quality is main issue confronting all WASA`s
- Sources of water in Multan Gujranwala and Rawalpindi are low in viruses and bacteria
- High levels of arsenic present in water sources of WASA Lahore and Faisalabad
- Water of Faisalabad not fit for drinking due to presence of salts in water

Water Born Diseases in Children

Lecture 1: Key Issues in Water Distribution System

Water Quality Analysis Results of Five WASAs (Year 2016-17)

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Sr. No.	Water Quality Parameter	WHO Permissible Guideline Value	Water Quality Analysis Results				
			WASA LHR	WASA FSD	WASA GRW	WASA RWP	WASA MUL
1	Appearance	Clear	Clear	Clear	Clear	Clear	Clear
2	Temperature	-	-	-	25 ^{o}C	18	NA
3	Turbidity	5 NTU	0.76	0	0.51	2.5	Unobjectionable

Lecture 1: Key Issues in Water Distribution System

Water Quality Analysis Results of Five WASAs (Year 2016-17)

Sr. No.	Water Quality Parameter	WHO Permissible Guideline Value	Water Quality Analysis Results				
			LHR	FSD	GRW	RWP	MUL
4	pH	6.5-8.5	8.1	7.55	7.1	7.15	6.52
5	Alkalinity (mg/l)	500	160		50	200	110
6	Hardness asCaCO3 (mg/l)	500	136	182	50	175	140

Water Quality Analysis Results of Five WASAs (Year 2016-17)

Sr. No.	Water Quality Parameter	WHO Permissible Guideline Value	Water Quality Analysis Results				
			LHR	FSD	GRW	RWP	MUL
7	Electrical Conductivity (uS/cm)	2000	453	432	204	865	710
8	Calcium (mg/l)	200	37.6	32	32	61	45
9	Total Dissolved Solids (TDS) (mg/l)	1000	285.3	250	143	604	345

Water Quality Analysis Results of Five WASAs (Year 2016-17)

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Sr. No	Water Quality Parameter	WHO Permissible Guideline Value	Water Quality Analysis Results				
			LHR	FSD	GRW	RWP	MUL
10	Chlorides (mg/l)	200	37	10	52	10	130
11	Fluoride (mg/l)	< 1.5	NA	NA	0.06	NA	NA
12	Arsenic (mg/l)	0.05	49.2	6.34	0.01	-	Nil
13	Fecal Coliform	Nil/100 ml	Nil	Nil	Nil	Nil	Nil

Lack of Records

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- Almost all WASA`s field offices lack in record keeping related to operational and maintenance data , Updation of Distribution Maps
- Good record keeping is vital to operate the system efficiently

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Inadequate Operation and Maintenance

- Adequate O&M is necessary to run the system efficiently
- Need of Routine as well as Preventive maintenance are tools for successful O&M
- Training of WASA staff
- Need of best O&M practices

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Financial Constraints

- Financial Constraints being faced by all WASA`s
  - Expenditures are more than the collected revenue per annum
  - More spendings on power cost (about 70% in all WASAs) due to pumping of water through tube wells
  - Increase in tariff is required as per actual consumption, however, on an affordability cost of consumers

Contact

Zia Mustafa
Water Specialist

O&M of Tube Well and Pump Facility (W1221)

O&M of Water Distribution System (Module 1)

Components of Water Supply System

Zia Mustafa (Water Specialist)
Ramisha Taseer (Research Associate)

October 2016

Outline of the Presentation

- Introduction
- Components of Water Distribution System

Introduction

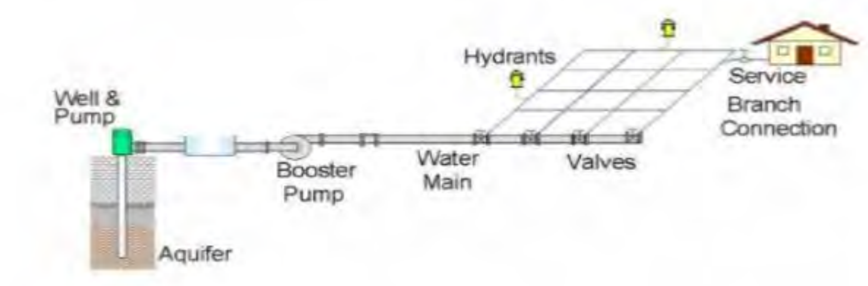
"Water supply system is used to supply water from source to the consumers through different components."

Purpose

- To deliver water to consumer with adequate quantity and quality

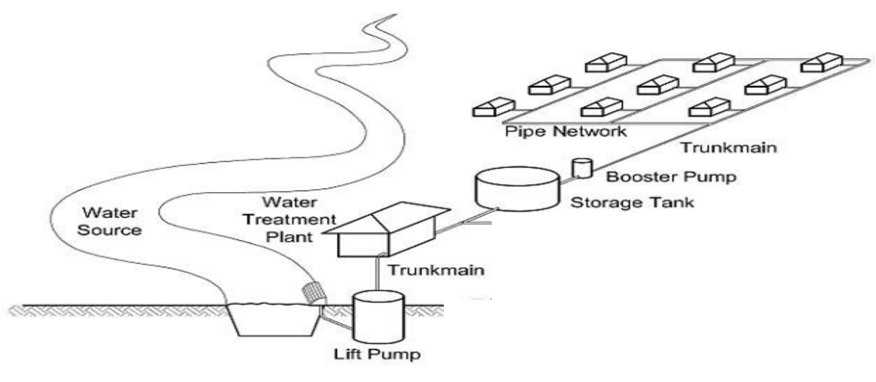
Introduction…contd.

Water Supply System Using a Ground Water Source (Direct Pumping)



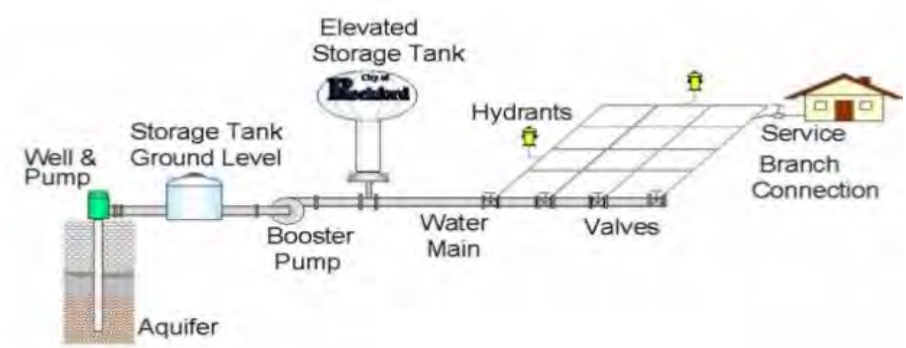
Introduction…contd.

Water Supply System Using a Surface Water Source

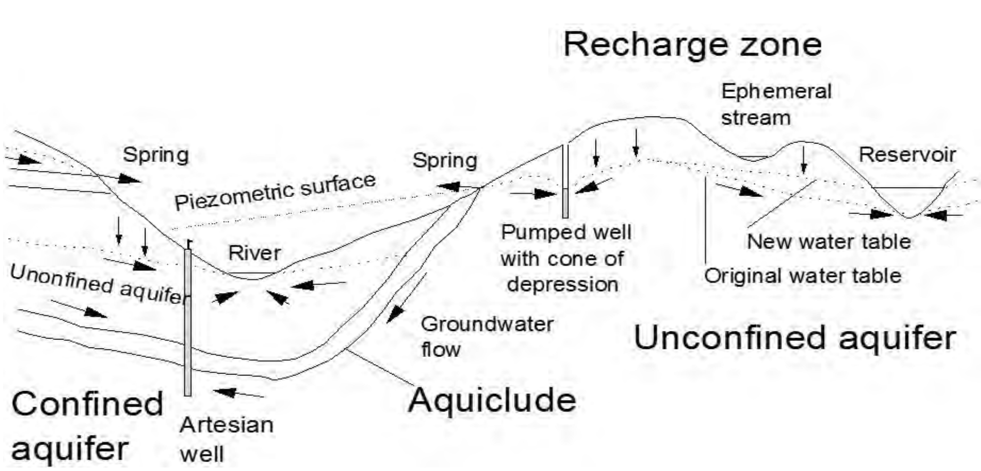


Introduction…contd.

Water Supply System Using a Ground Water Source and Over Head Reservoir



Groundwater Movement



Components of Water Supply System

Major components of Water Supply System are as under:

- Water Source (River/ Tube wells)
- Water Supply Pipelines
- Control Valves (Gate/Sluice valves, Air valves, Drain valves etc)
- Over Head Reservoirs
- Fire Hydrants




Water Sources

Surface Water

- Streams
- Lakes
- Rivers
- Impoundments

Ground Water

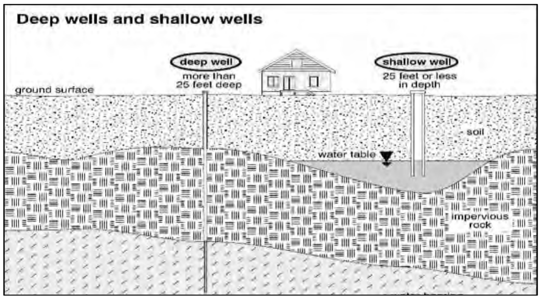
- Tube wells


Tube Well

A water well used to draw groundwater to supply onward to consumers

Types of Well

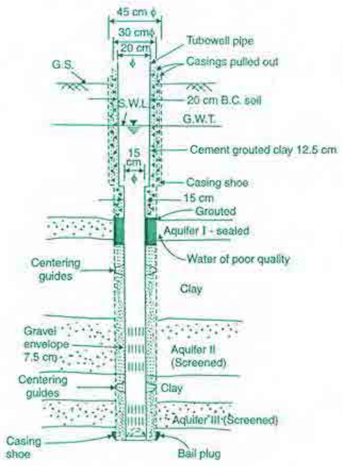
- Shallow Well (Depth <30m)
- Deep Well (Depth >30m)



Tube Well….Contd.

Components of Tube well include:

- Housing Pipe/Casing Pipe
- Strainer/Screen Pipe
- Blind Pipe
- Bail Plug
- Vertical Turbine Pump



Tube Well….Contd.

<u>Housing Pipe</u>

Housing Pipe is used to maintain an open access in the earth and to prevent any entrance of surrounding formations

<u>Strainer/Screen Pipe</u>

Strainer is used to keep sand and gravel out of well while allowing groundwater and water from formations to enter into the well

Strainer / Screen Pipe

Tube Well….Contd.

Blind Pipe

Blind pipe is a Plain pipe with no slots which is fixed against an impervious strata

Bail Plug

Bail Plug is provided at the bottom of pipe and strainer assembly

Tube Well….Contd.

Gravel Pack

Gravel is placed around the outside of the screen to prevent sand from entering into the well and to stabilize the well assembly

Vertical Turbine Pump

Vertical turbine pump comprises a shaft rotated by a motor on the surface. The shaft turns the impellers within the pump housing while the water moves up the column

Water Supply Pipelines

Transmission mains

- convey water from the source after treatment to the storage reservoir for onward transmission to distribution system
- larger in diameters

Distribution mains

- deliver water to individual consumer service lines and provide water for fire protection through fire hydrants, if applicable

Water Supply Pipelines

- Pipes used in Water Supply
  - Asbestos Cement (AC)
  - Ductile Iron (DI)
  - Cast Iron (CI)
  - Galvanized Iron (GI)
  - Polyvinyl Chloride (PVC)
  - Unplasticized Poly Vinyl Chloride (UPVC)
  - High Density Poly Ethylene (HDPE)

Water Supply Pipelines

- Selection Criteria
  Soil type , Roughness coefficient, Ability to resist corrosion, Installation & maintenance cost, Ability to withstand desired pressure etc.)

- Pipe Maintenance (repairing leaks and breaks, flushing, disinfecting and relining)

Valves

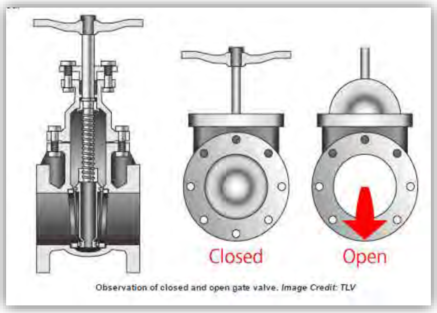
Valves are used to:

- ✓ To shut off or turn on water supply
- ✓ To regulate the flow & pressure
- ✓ To prevent backflow
- ✓ To provide air relief
- ✓ To drain out the sediments accumulated from mains

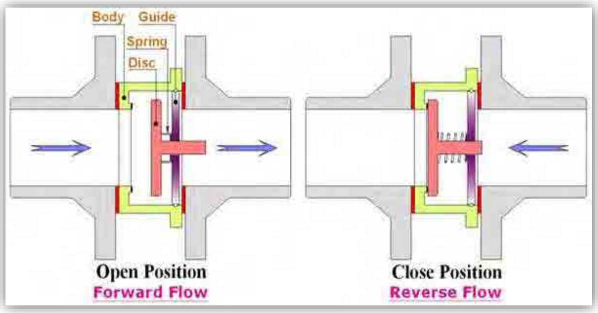
Valves

- Type of Valves (Gate/sluice Valves, Air relief valves, butterfly Valves, shut off valves , altitude valves, Non Return Valve etc.)
- Valve Maintenance (Inspecting valves stem and nut, checking valve condition)

Valves

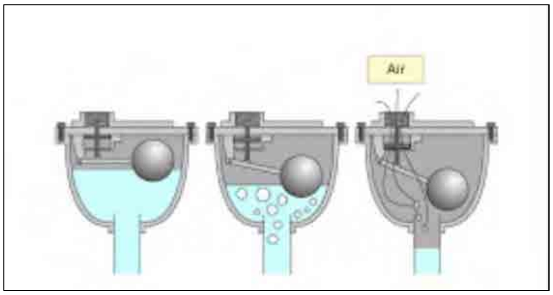


Gate Valve

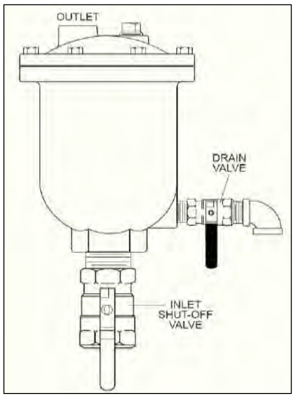


Non Return Valve

Valves



Air Release Valve



Drain/ Scour Valve

Fire Hydrants

Fire Hydrants are used for fire fighting purpose and are provided on distribution main or sub main to tap water for its use during fire

Types Of Fire Hydrants

- Post Type Fire Hydrants
- Flush Fire Hydrants

Overhead Reservoirs

Overhead reservoirs are used for the following purposes:

- To balance supply and demand
- To supply water during emergencies (such as during fires)
- to help in absorbing the hourly fluctuations in the normal water demand

Overhead Reservoirs

Components of Overhead Reservoirs include:

- Inlet pipe (for entry of water in the reservoir)
- Outlet pipe (connected to the distribution mains)
- Overflow Pipes (discharging extra water into drain gutters)
- Air Vents (for fresh air circulation)
- Manholes (for providing entry into the overhead tank for inspection purposes)
- Ladder (to reach bottom of the reservoir)

Contact

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O&M of Water Distribution System (Module 1)

Arrangement of Water Distribution System

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Ramisha Taseer (Research Associate)

October 2016

Outline of the Presentation

- Types of Water Supply Facilities Arrangement
- Surface Water Treatment Alternative
- Types of Distribution Networks
- Valves and Fire hydrants
- Water Pressure Requirement

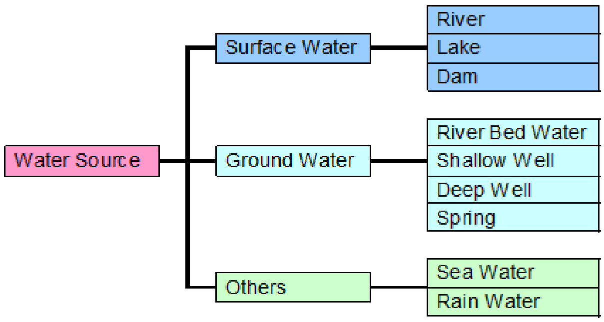
Types of Water Supply Facilities Arrangement

Planning and Design of a water supply system depends on the following:

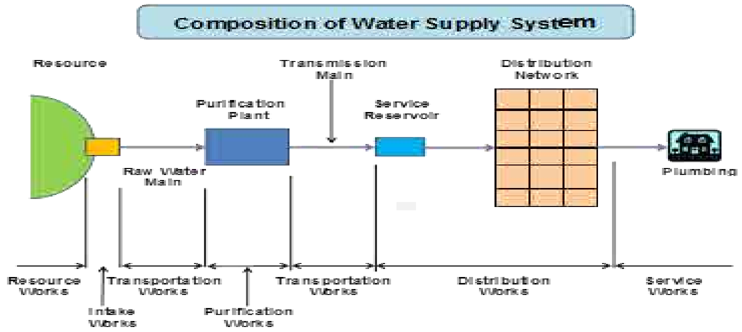
- Source of water
- Transmission of water to overhead Reservoir
- Distribution through distribution pipelines

Types of Water Supply Facilities Arrangement ….Contd.

- Detail of sources of water are as under:

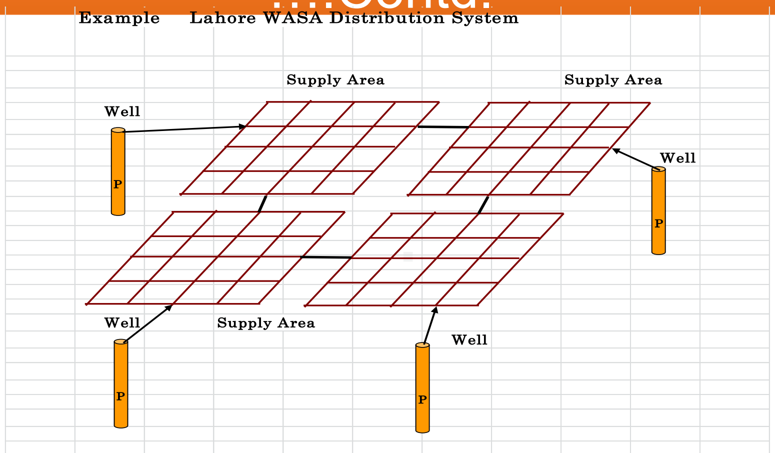


Types of Water Supply Facilities Arrangement ….Contd.



(Layout of Water Distribution System based on Surface Water Source)

Types of Water Supply Facilities Arrangement ....Contd.



(Layout of Water Distribution System based on Groundwater)

Surface Water Treatment Alternative

- Decline of Ground Water on increased levels across all Five WASAs to meet future demand of population
- More water quality concerns in Five WASAs leading to surface water treatment alternative
- Improvement in service delivery by utility service providers

Types of Distribution Network

"Networks are a system of pipes and valves providing the appropriate quality and quantity of water to a community."

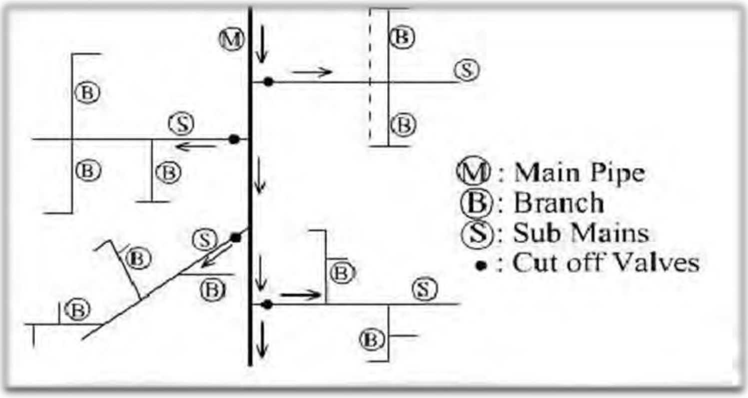
Three ways in which distribution systems are laid include:

- Dead End or Tree System
- Grid System
- Radial System

Selection Criteria for a Distribution Network

- Water quality should be maintained throughout the network
- System capability to supply water to all intended places with sufficient pressure head
- No consumer should be without water supply, during the repair of any section of the system
- Watertight to keep losses to a minimum (e.g. due to leakages)

Dead End or Tree System



one main pipeline runs through the center of the populated area and sub-mains branch off from both sides

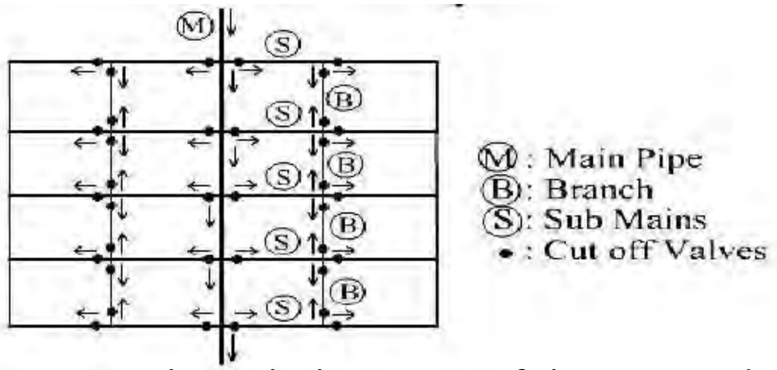
Dead End or Tree System

Advantages:

- ✓ Simple pipe laying
- ✓ Less cut off valves are required
- ✓ Low O&M cost

Disadvantages:

- ✓ Low pressure in remote points
- ✓ Interruption of supply in case of main failure
- ✓ Sedimentation and bacterial growth at dead ends
- ✓ Scour valves required at dead ends

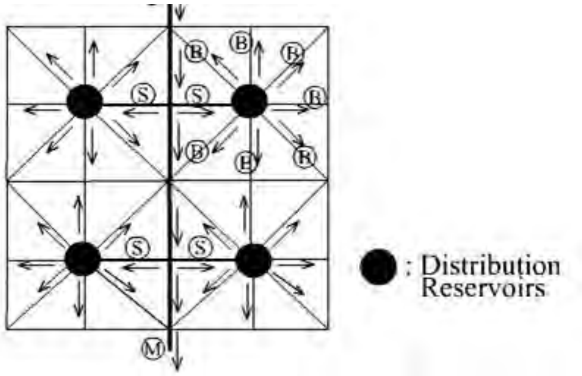


Main supply line runs through the center of the area and sub mains branch off in perpendicular directions
All of the pipes are interconnected and there are no dead ends

Advantages:
- ✓ Minimal chance of stagnation
- ✓ No sedimentation
- ✓ Repairs require small area to be interrupted

Disadvantages:
- ✓ Greater cost of pipe laying
- ✓ Large number of cutoff valves required
- ✓ Longer pipe lengths with larger diameter

Radial System



Area is divided into distribution districts
Each district has a centrally located distribution *reservoir* (elevated)

Valves and Hydrants

- Provision of shut off valves at frequent intervals in water distribution system
- Provision of Fire Hydrant at frequent intervals to meet emergencies due to fire

Water Pressure Requirement

- Minimum Residual Pressure required in Water Distribution System — 14m
- Development of pressure zones in areas with varying elevations

Contact

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Pipe Materials

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2

Outline of the Presentation

- Selection Criteria for Pipes
- Types of Pipes used in Water Supply System
- Factors affecting installation cost

Selection Criteria for Pipes

1. Corrosion Resistance
   - External & internal Corrosion
2. Roughness Coefficient
   - Smoothness of internal pipe surface
3. Soil Condition
   - Loss of support (bedding)
4. Overall Cost
   - Capital Cost
   - O&M cost

Types of Pipes Used in Water Supply

- Cast Iron (CI) Pipes
- Ductile Iron (DI)Pipes
- Asbestos Cement (AC) Pipes
- Steel Pipes
- Galvanized Iron (GI) Pipes
- Reinforced Cement Concrete (RCC) Pipes
- PVC (Polyvinyl Chloride) Pipes
- UPVC (Unplasticized Polyvinyl Chloride) Pipes
- HDPE (High Density Polyethylene) Pipes

Cast Iron Pipes

Advantages

- Withstand high pressures
- Inexpensive
- Durable
- Leak detection straightforward
- Easy to install

Disadvantages

- Heavy & brittle
- Difficult to transport
- Corrodes in soft water
- Metallic taste due to iron leaching

Ductile Iron Pipes

Advantages

- High strength for supporting earth loads
- Lighter than Cast iron
- Less Brittle than CI
- Easy jointing

Disadvantages

- May require wrapping or cathodic protection in corrosive soils or water
- Thrust blocks needed

Asbestos Cement Pipes

Advantages

- Rigid
- High tensile strength
- Easily tapped, cut
- Low friction to water flow
- Corrosion resistant to most soils and water

Disadvantages

- Can release asbestos fibers under corrosive conditions
- Easy breakage when bent
- Difficult to locate

Steel Pipes

Advantages

- High strength for supporting earth loads
- High in cost
- Easy handling & transport

Disadvantages

- Poor corrosion resistance

Galvanized Iron Pipes

Advantages

- Low initial cost
- Toughness
- Long life
- Easy inspection
- Fast assembly

Disadvantages

- Contain lead and Corrode easily
- Deposits buildup causing blockages

Reinforced Concrete Pipes

Advantages

- Durable
- Easy installation

Disadvantages

- Used in very large size (>36”)
- Gravity flow pipe

Polyvinyl Chloride (PVC) Pipes

Advantages

- Inert and Resists corrosion
- Doesn’t support combustion
- Cheap
- Easy to install
- Smooth interior surface
- Very low frictional losses

Disadvantages

- Very brittle (break or crack easily)
- Less flame resistant
- At higher temperature their strength reduces

Unplasticized Polyvinyl Chloride (UPVC) Pipes

Advantages
- Good corrosion resistance
- Light weight
- Ease of jointing
- Low cost
- Smooth internal surface

Disadvantages
- Susceptible to impact damage
- Degradation by certain organic compounds
- Susceptible to poor installation practice

HDPE Pipes

Advantages
- Flexible
- Easily transported because can be rolled
- Used in trenchless installations
- Lightweight
- Resistant to cracking

Disadvantages
- Difficult to locate
- Fusion jointing require skilled installer & special equipment
- Not suitable for large diameters

Factors Affecting Installation Costs

- ✓ Weight of the pipe:
  A pipe that is lightweight can be handled easier and faster
- ✓ Ease of assembling:
  Push-on joints can be assembled much faster than bolted joints
- ✓ Pipe strength:
  If one type of pipe requires special bedding to withstand external pressures while another pipe does not, the choice can impact installation costs significantly

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O&M of Water Distribution System (Module 1)

Valves in Water Supply System

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October 2016

Outline of the Presentation

- Valves in Water Supply System
- Types of Valves
- Maintenance of Valves

Valves in Water Supply System

Valves are used to:

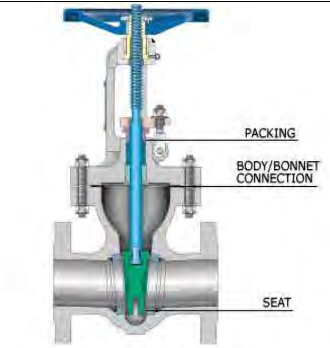
✓ To isolate flow
✓ To regulate the flow & pressure
✓ To prevent backflow
✓ To drain out the sediments accumulated from mains

Types of Valves

- Gate Valve/Butterfly Valve
- Air Release Valves
- Drain Valve/ Wash Outs
- Altitude Valves
- Pressure Relief Valves
- Check Valves/ Non return valve

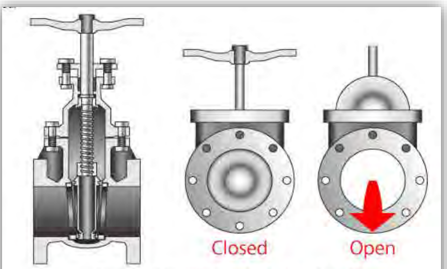
Gate Valve /Butterfly Valve

- Gate valves are used to isolate sections of the distribution system to permit emergency repairs without interrupting service to large numbers of customers
- Components of gate valves include:
  - Body
  - Bonnet
  - Trim



Gate valve Components.
Image Credit: profmaster.blogspot.com

Gate Valve/Butterfly Valve



Observation of closed and open gate valve. *Image Credit: TLV*

- A sliding flat metal disc is moved at right angles to the direction of flow by a screw operated stem
- Provides very little resistance to flow when it is opened

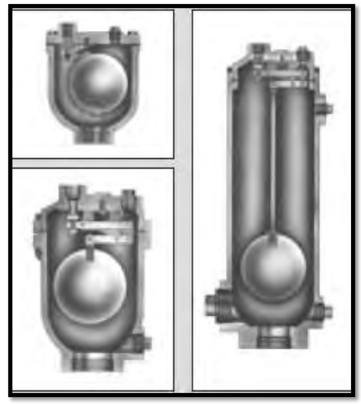
Butterfly Valves

- Mainly installed in lines 300mm and above in diameter

Used for on/off services and for throttling
Pressure drop must be lowest in open position

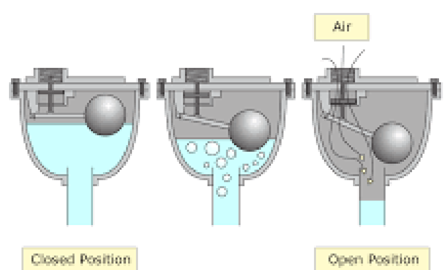
Air Release Valves

- Air valves are used to remove air accumulated in pipe
- Provided at summit points
- Float drops off and air is released
- Erratic operation of pumps & meters



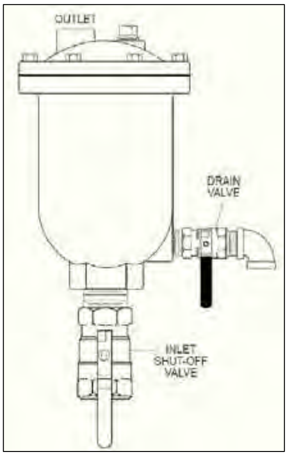
Air Release Valves

- To automatically exhaust small amounts of air which collect at system high points
- Float drops off and air is released



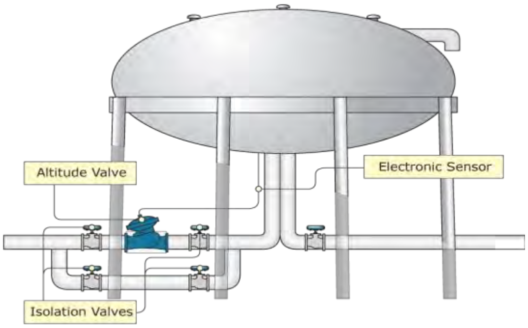
Drain Valves/ Washouts

- Allow sediment to be flushed out and to enable the pipeline to be drained for maintenance and repair work



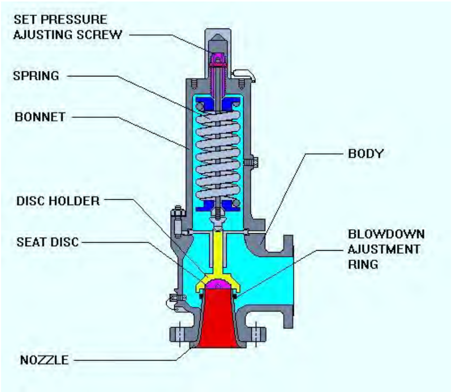
Altitude Valves

- Normally installed at rising mains
- To prevent overflow of overhead reservoirs
- closes at a preset maximum water level to prevent overflow of reservoir and opens to refill when the water level in the tank or reservoir lowers



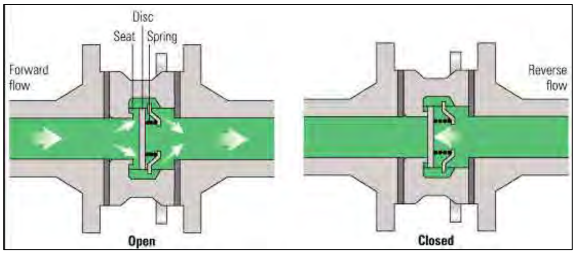
Pressure Relief Valve

- Also known as safety valves
- Used to release high pressures in system to prevent damage



Check Valve/ Non-return valve

- Used for unidirectional flow
- Equipped with a weight and spring



Maintenance of Valves

Components of a Valve Maintenance Program:

- ✓ An updated system map
- ✓ Documentation for each valve
- ✓ Record of maintenance work
- ✓ Sample Valve Operation Worksheet
- ✓ A schedule for routine maintenance

Maintenance of Valves

Components of a Routine Valve Inspection:

- Verify accuracy of location of valve boxes on map
- Updation of map when necessary
- Remove valve box cover
- Inspect stem and nut for damage or obvious leakage
- Close the valve fully

Maintenance of Valves

- Record condition of valve (any maintenance required)
- Replace a valve if it does not completely open or close
- Clean the valve box cover seat
- Place the valve in its operating position (open or closed) when inspection is complete.

Valve Exercising

Valve exercising must be done for flushing dead end lines at least quarterly

Following information must be collected:

1	Unique Valve identification number
2	Visibility and proper elevation
3	Accessibility
4	Location and GPS coordinates
5	Manufacturer
6.	Size and Style of Valve
7.	Number or turns and direction for opening
8.	Check for leakage with detection equipment
9.	Condition of valve
10	Age of valve in system

Valve Operation Worksheet

Date	Valve No.	Location	Size	# of Turns	Direction of Closing	Remarks/ Maintenance/ Deficiencies

Contact

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O&M of Water Distribution System (Module 1)

Operational Action Plan for Water Supply System

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October 2016

Outline of the Presentation

- Operation of Water Supply System
- Why Operational Action Plan Needed?
- Features of Water Supply Operational Action Plan
- Operational Action Plan for Water Supply System

Operation of Water Supply System

Operation of Water Supply System refers to daily operations of various components of Water Supply System such as Pipelines, Valves, Overhead Reservoirs, Fire Hydrants, Equipment etc. to deliver reliable and safe Supply of Water to Consumers with adequate Pressure

Why Operational Action Plan Needed?

- To deliver adequate Supply of Water to Consumers without interruption
- To ensure Safe Water requirement without any contamination to Consumers
- To know about System Component Failure (Pumps, Chlorinators, Valves, Meters etc.)
- To find causes of main breaks in Water Distribution System

Features of a Water Supply Operational Plan

Generally, Water Supply Operational Action Plan Comprises of the following:

- Prevailing operational issues in the system
- Possible causes
- Control measures in the form of Checklists
- Key Responsibilities

Operational Action Plan for Water Supply System

Sr. No	Problem	Possible Cause	Mitigation Measure	Key Responsibility
1	Non availability of updated Water Supply Maps	• Lack of GIS Mapping	• Update water supply Maps with - Clear description of pipe diameter - Location of valves • Ensure availability of updated Maps at respective WASA sub division offices	Sub Divisional Officer (SDO), Supervisor
2	Taste and Odor in water	• High Chlorine Residual • Presence of salts in water	• Lower Chlorine Dose • Apply routine flushing of supply lines or appropriate treatment method	Sub Divisional Officer (SDO), Supervisor and Operator

Operational Action Plan for Water Supply System …Contd.

Sr. No	Problem	Possible Cause	Mitigation Measure	Key Responsibility
3	Turbidity	• Due to presence of Silt or Clay in water (suspended solids)	• Apply flushing of pipelines and appropriate treatment Method	Sub Divisional Officer (SDO), Supervisor
4	Presence of Coliforms or Bacteria	• Water contaminated due to inadequate chlorine • Ingress of contamination transmitted from sewer line in vicinity of water supply line due to cross connections	• Increase chlorine dose as per requirement of WHO Guidelines	Sub Divisional Officer (SDO), Supervisor and Operator

Operational Action Plan for Water Supply System …Contd.

Sr. No	Problem	Possible Cause	Mitigation Measure	Key Responsibility
5	Loss of Residual Chlorine	• Inadequate quantity of Chlorine Solution (Sodium Hypochlorite) injected • Some operational problems linked with chlorine feed pump to supply chlorine in main line at tube well	• Inspect Chlorine solution tanks on regular basis at tube well • Check condition of chlorine feed pump to deliver required amount of chlorine solution tank	Supervisor and Operator
6	Cross Connection	• Ingress of contamination from sewer line to water supply lines due to cracks in pipelines during periods of no supply	• Proper horizontal and Vertical Clearance between water supply and sewer/drain pipe need to be provided	Sub Divisional Officer (SDO), Supervisor and Operator

Operational Action Plan for Water Supply System …Contd.

Sr. No	Problem	Possible Cause	Mitigation Measure	Key Responsibility
7	Pipeline Leakages	• Corrosion, old aged pipes • Absence of leak detection equipment for buried pipe line leakages	• Repair Pipelines leakages • Ensure Gradual replacement of old aged pipes in the network • Conduct Water Audit on regular basis	Supervisor and Operator
8	Leakages from Valves	• Corrosion of Valves • Worn packing material • Improper closure of valves	• Ensure Periodic Inspection of valve chambers • Lubricate gland bolts • Replace cover/bonnet gasket after certain duration • Ensure periodic cleaning of Valve Chambers	Supervisor and Operator

Operational Action Plan for Water Supply System …Contd.

Sr. No	Problem	Possible Cause	Mitigation Measure	Key Responsibility
9	Leakages through Reservoirs	• Leakage from cracks in reservoirs • Internal corrosion of connected piping (inlet, outlet, overflow, bypass pipe) • Improper closure of valves	• Inspect the reservoir on regular intervals from inside and outside • Inspection of connecting pipes and valves on regular basis • Monitor water levels in Reservoirs on regular basis	Supervisor and Operator
10	House Connection Leakages	• Corroded and sub standard material used for plumbing • Poor plumbing practices	• Ensure Polyethylene Pipe for House Connection • Ensure provision of meters at consumer end • Ensure standard pipe material for House connection	Supervisor and Operator

Operational Action Plan for Water Supply System …Contd.

Sr. No	Problem	Possible Cause	Mitigation Measure	Key Responsibility
			• Replace Mild Steel Clamps in the Consumer Connections by Polyethylene or PPR saddles and use S/S bolts instead of ordinary MS bolts	
11	Water loss	• Old and deteriorating pipe network • Illegal connections	• All connections (domestic and commercial) need to be metered	SDO, Supervisor and Operator
12	Defective Meters	• Repair Problems • Rotation of meters due to pressurized air and starting of supply on intermittent basis	• Replace defective meters with new meters	SDO, Supervisor and Operator

Operational Action Plan for Water Supply System …Contd.

Sr. No	Problem	Possible Cause	Mitigation Measure	Key Responsibility
13	Improper Metering	• Majority connections are unmetered • Faulty Meters	• Ensure metering system at consumers end • Ensure routine repair of meters	Executive Engineer, SDO, Supervisor and Operator
14	Low Pressure	• Under Capacity pipes present in the system, distant from tube well • Corrosion of pipelines	• Control buried pipeline leakages • Replace under capacity pipes with increased sizes as per water demand of the area	SDO, Supervisor and Operator

Operational Action Plan for Water Supply System …Contd.

Sr. No	Problem	Possible Cause	Mitigation Measure	Key Responsibility
		• leakages in supply lines • Valve in system partially closed	• Replace gradually old aged pipes in the network • Inspect the valve chamber condition in service areas to identify leakages	
15	Lack of recording Water abstraction at source and consumption by community	• Absence or presence of faulty bulk flow meters at source (tube well) • Absence of consumer meters	• Provide Bulk Flow meters at sources for recording the flow • Ensure hundred percent consumers metering in the system	SDO, Supervisor and Operator

Operational Action Plan for Water Supply System …Contd.

Sr. No	Problem	Possible Cause	Mitigation Measure	Key Responsibility
16	Lack of Monitoring of Pressure at source and in distribution system	• Absence of pressure gauges at various tube wells • Faulty Pressure gauges	• Ensure presence of pressure gauges at all WASA tube wells • Make repair of faulty pressure gauges on priority basis	SDO, Supervisor and Operator

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O&M of Water Distribution System (Module 1)

Maintenance Action Plan for Water Supply System

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October 2016

Outline of the Presentation

- Introduction
- Types of Maintenance
- Requirements for Preventive Maintenance
- Required Preventive Maintenance Activities in Five WASA`s
- Repair Action Plan For Water Supply System
- Availability of tools

Introduction

"Maintenance refers to contain all the system components (supply pipes, valves, equipment etc.) in a good optimum working order by repair and maintenance"

Types of Maintenance

- Routine Maintenance
- Preventive Maintenance

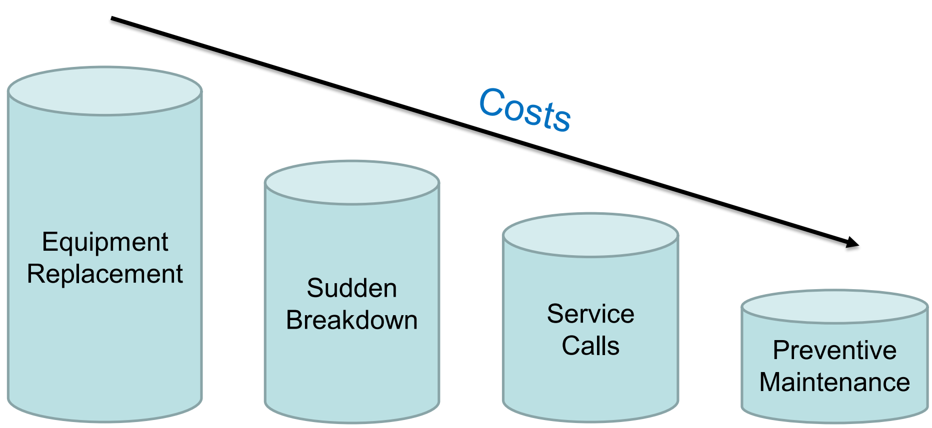
Routine Maintenance

- Routine Maintenance refers to accomplish repair and replacement of parts of the system (Pipes, Valves, Fittings etc.) when damaged or leakages becomes evident from them
- Required to run the system efficiently

Preventive Maintenance

Preventive Maintenance Includes planned activities for maintenance of the system (Pumps, Valves, Flushing of Pipelines etc.) to Prevent their failure at much earlier stage of their design life

Preventive Maintenance



The best way to deal with a Problem is to Prevent it !!

Requirements of Preventive Maintenance Plan

- Regular Planned Maintenance Activities
- Defining Clear Roles and Responsibilities
- Training of Staff
- Availability of Tools

Required Preventive Maintenance Activities in Five WASAs

Sr. No.	Activity	Frequency of Duration	Key Responsibility
1	Flushing of Pipe Lines	Fortnightly	Supervisor and Operator
2	Patrolling of Water Supply Network (To over view Leakages)	Every Month	Supervisor and Operator
3	Water Quality Analysis	Fortnightly	Laboratory Incharge and WASA Sub Division Staff
4	Checking of Pressure in Supply Lines	Daily	Supervisor and Operator
5	Inspection of Bulk Flow Meters	Every Month	Supervisor and Operator
6	Inspection of Consumer Meters	Every Month	Supervisor and Operator
7	Reservoir Cleaning	After every 6 Months	Operators
8	Inspection of Valve Chamber	Every Month	Supervisor and Operator

Repair Action Plan

Sr. No.	Problem	Possible Causes	Mitigation Measures	Key Personnel Responsibility
1	Corrosion of Pipe Line	• Due to completion of service life of pipe • Excess dosage of chlorine in pipeline adversely affecting material of pipe	• Ensure replacement of corroded pipe portion with new pipe • Painting of pipelines if present on ground (especially walled city) • Ensure chlorine dosage as per requirement	Supervisor and Operator

Repair Action Plan

Sr. No.	Problem	Possible Causes	Mitigation Measures	Key Personnel Responsibility
2	Leakages through Pipelines	• External or Internal Pipe Metal Loss due to developed cracks • Faulty and corroded Joints • Aging Pipe Network	• Ensure Replacement of damaged pipe portion with new one • Undertake Regular maintenance audit in service areas	Supervisor and Operator

Repair Action Plan

Sr. No.	Problem	Possible Causes	Mitigation Measures	Key Personnel Responsibility
3	Leakages of Valves (at seat, at cover/ bonnet, at gland packing)	• Corrosion of seat • Settling of Gasket as a result of temperature variations • Worn packing material • Poor maintenance	• Ensure reseating of valve disc • Retighten the bolts at bonnet • Retight the gland packing at nuts • Check opening and closing of valve • Ensure periodic inspection of valve chambers	Supervisor and Operator

Repair Action Plan

Sr. No.	Problem	Possible Causes	Mitigation Measures	Key Personnel Responsibility
4	Valves hard to operate	• Damaged Seat • Valve not fully lubricated	• Provide valves with proper lubrication	Supervisor and Operator
5	Ineffective inventory control system for spare parts and supplies	• Poor Inventory System, based on recording listing of spare parts in registers	• Ensure computerized system at stock yards • Provide adequate inventory of maintenance items	Supervisor and Operator

Availability of Tools

A list of spares required for maintenance shall be prepared and the spares shall be procured and kept for use.

- ✓ Spare check nuts and spindle rods and assorted bolt
- ✓ Nuts and washers for the flanged joints
- ✓ Gaskets for flanged joints for all sizes of sluice valves installed in the transmission system
- ✓ Spare manhole covers
- ✓ Consumables like the gland rope, grease, cotton waste

Contact

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O&M of Water Distribution System (Module 1)

Overhead Reservoirs

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October 2016

Outline of the Presentation

- Introduction
- Present Situation of Five WASA`s in Context of Overhead Reservoir
- Shapes of Overhead Reservoirs
- Components of Overhead Reservoir
- Maintenance of Overhead Reservoir
- O&M Plan of Overhead Reservoir

Introduction

Purpose of Overhead Reservoir:

- To equalize the demand during peak hours
- To equalize operating pressure
- To provide storage for emergencies
  (In case of source failure)
- Maintain desired pressure

Introduction

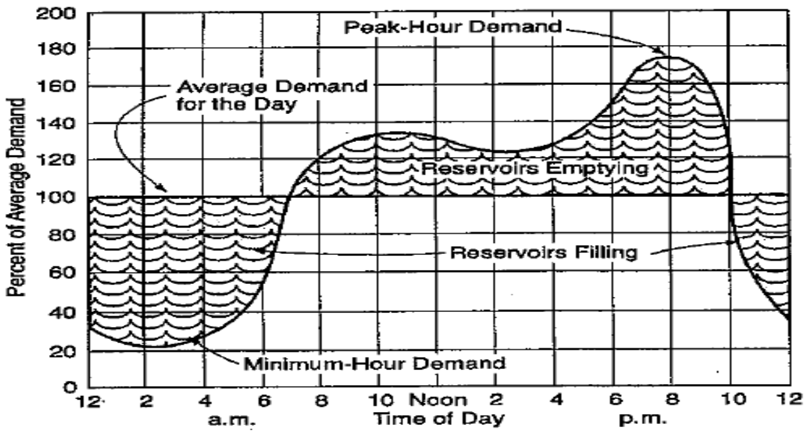
Equalizing Supply and Demand

- Designed for 4-6 hour supply at average demand
- During periods of low demand, OHR are refilled

Advantages of Overhead Reservoirs

- Absorb the hourly variations in demand
- Maintain constant pressure in the distribution mains
- Water stored can be supplied during emergencies
- To facilitate carrying out repairs without interruption to the supply of water

Demand Fluctuation in a Day

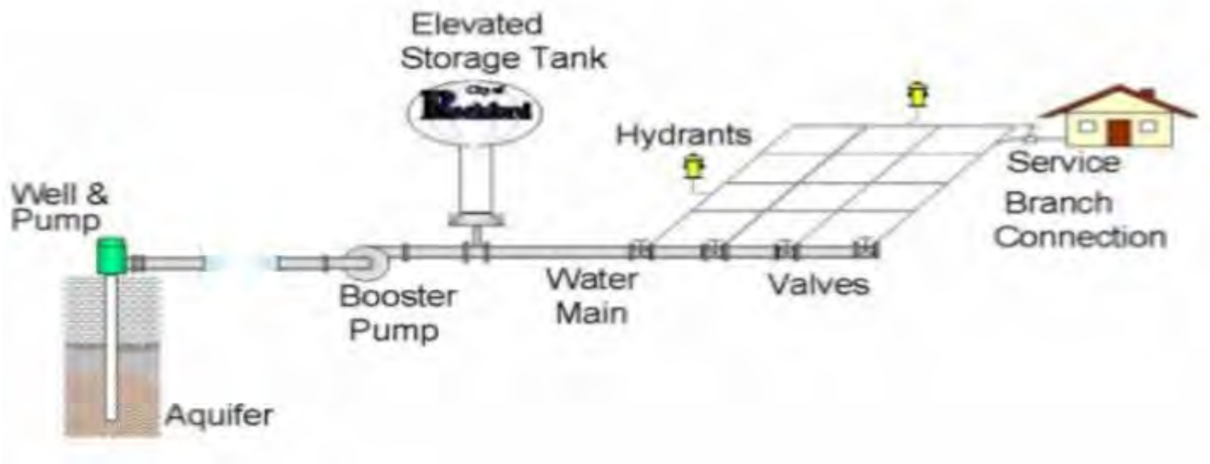


(Function of distribution reservoirs with respect to demand fluctuations)

Present Situation of Five WASA`s in Context of Overhead Reservoir

Sr. No	Water Supply Parameter	WASA LHR	WASA FSD	WASA MUL	WASA RWP	WASA GRW
1	Total Reservoirs	52	37	18	27	10
2	Total Capacity MG	3.16	2.2	2.35	2.77	1.58
3	In Use	1	17	-	25	8
4	Abandoned	51	20	-	2	2

Overhead Reservoir and Gravity Storage System



Shapes of Overhead Reservoirs

Intze Type

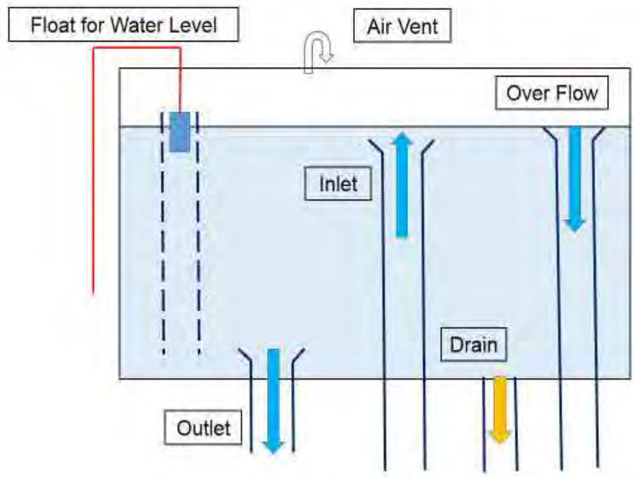
Circular Type

Rectangular Type

Spherical Type

Components of Overhead Reservoir

- Inlet pipe
- Outlet pipe
- Overflow Pipes
- Float for Water Level
- Air Vents
- Manhole for entry
- Ladder
- Valves



Components of Overhead Reservoir

Ladder or Stairs

Bottom of Reservoir

Inlet Pipe

Float Gauge for water level

Maintenance of Overhead Reservoirs

Following are the main maintenance activities:

- Repairing of cracks & leaks
- Proper Screening of air vents & overflow pipes
- Inspection of manhole covers
- Cleaning & inspection of internal structure
- Preventing littoral growth
- Painting of internal surface
- Replacing corroded pipes
- Inspection of valves

Cleaning of Overhead Reservoirs

- Empty the Tank
- Clean the tank with Detergent using steel wire brush
- Fill the Reservoir with water and drain the water
- Fill again the Reservoir for supplying water to consumers
- Add chlorine doze as per requirement in the Reservoir
- Reservoir Cleaning After every 6 Month

Maintenance of Reservoirs

Safety Precautions while cleaning of OHR

- Use of PPE (Gum boots, Hand Gloves, Respirators)
- Proper ventilation by opening air vents
- Guard rails provided at the top roof and around ladder
- Trained personnel

O&M Plan of Overhead Reservoir

Sr. No.	Problem	Cause	Control Measure
1	Structural failure	• Poor engineering design • Poor maintenance • Use of poor quality material	• Improved engineering design • Apply preventive maintenance measures
2	Leakages	• Structural Cracks in reservoir	• Monitoring of Water Level and pressure of water in storage reservoir • Relining • Inspection of Pressure gauges, flow meters and flow level indicator

O&M Plan of Overhead Reservoir…Contd.

Sr. No	Problem	Cause	Control Measure
		• Poor lining material used for water proofing	• Storage tank internal cleaning and lining
		• Aging of piping material	• Replacing older pipe materials
		• Internal corrosion of connected piping (inlet, outlet, overflow, bypass pipe)	• Replacing older pipe materials
		• Improper closure of valves	• Lubrication of valves

O&M Plan of Overhead Reservoir…Contd.

Sr. No	Problem	Cause	Control Measure
		• Corroded entry cover in the reservoir	• Inspection of vents and hatches • Replacing corroded covers
3	Taste and odor complaints	• Long detention time	• Proper opening/closing of outlet valve
		• Contaminant entry	• Check seals on hatches and screens on vents • Install bird wires and fences if necessary
		• Leaching from Internal coatings or new concrete tank	• Check chlorine level • Improve influent water quality • Flush distribution system • Clean and disinfect storage tank

O&M Plan of Overhead Reservoir…Contd.

Sr. No	Problem	Cause	Control Measure
		• Long detention time	• Proper opening/closing of outlet valve
		• Contaminant entry	• Check seals on hatches and screens on vents • Install bird wires and fences if necessary
		• Leaching from Internal coatings or new concrete tank	• Check chlorine level • Improve influent water quality • Flush distribution system • Clean and disinfect storage tank

Contact

Zia Mustafa
Water Specialist

O&M of Tube Well and Pump Facility (W1221)

O&M of Water Distribution System (Module 1)

Updation of Water Supply Maps

Zia Mustafa (Water Specialist)
Ramisha Taseer (Research Associate)

October 2016

Outline of the Presentation

- Introduction
- Importance of Mapping
- Features of updated Water Supply Map
- Example of updated Map
- Procedure for Preparation and Updating of Maps

Introduction

- Updated Distribution Maps is pivotal factor for improved operations of utility service providers
- Required to contain updated water distribution system information

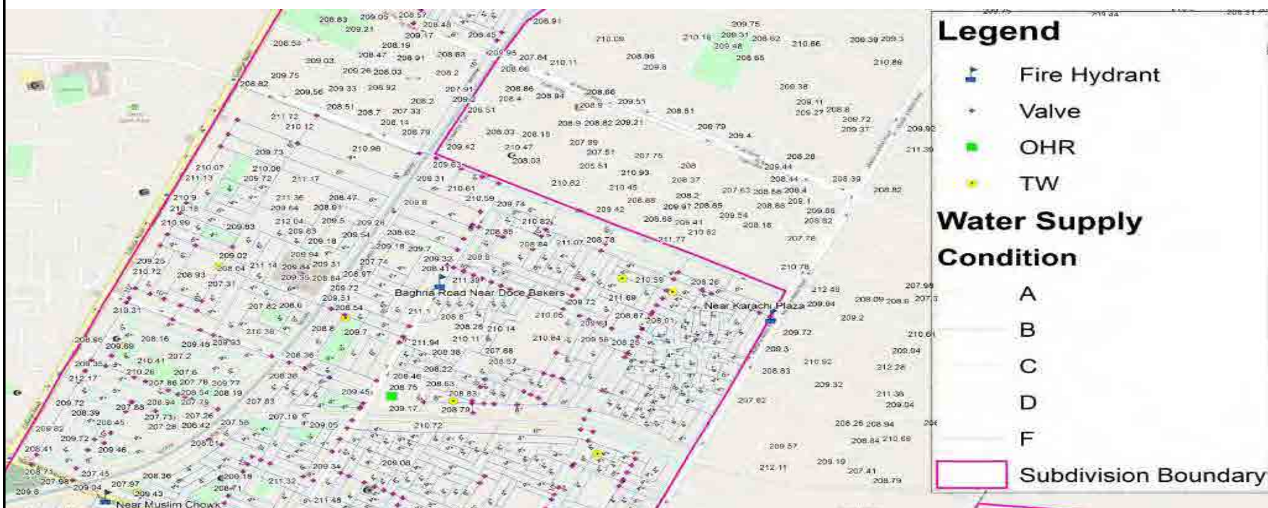
Importance of Mapping

- ✓ Provides a comprehensive knowledge about water distribution network
- ✓ To identify location of buried mains for repair purposes (pipe leakages, bursts)
- ✓ To locate position of valves and hydrants
- ✓ Existing maps can be used to identify areas where future installation can be made

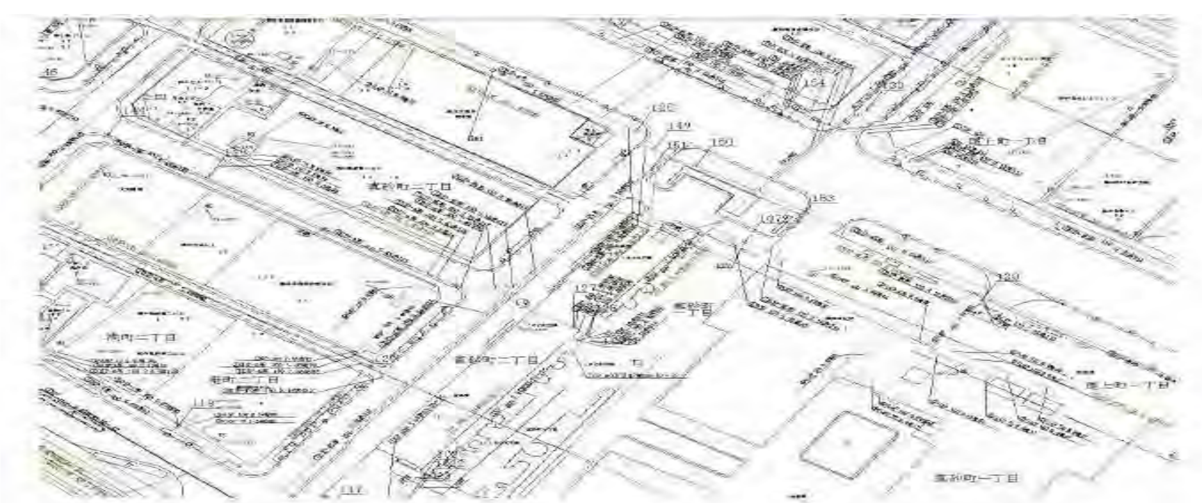
Features of Updated Water Supply Map

- Features of Water Supply Map
  - Contours
  - Tube well & Reservoirs Location
  - Valves, hydrants and Pipe Sizes
  - Taping points

Example of Updated Map



Example of Updated Map



Procedure for Preparation and Updation of Maps

GIS Maps

Geographic Information System (GIS) is a computer program that combines mapping with detailed information on physical structures with geographic area

Procedure for Preparation and Updation of Maps

GIS Mapping

- Compatible with AutoCAD Design Systems
- Layers of information on a single map such as water Lines, Sewers, power Cables etc.
- Number of valve chambers/manholes, pipe lengths , diameters, reservoir locations, pumping stations are indicated in the form of attributes
- Helps the maintenance crew to locate place of work

Contact

Zia Mustafa

Water Specialist

Assignment 1

Critical Report on Major Issues of Five WASA`s

Guidelines for Preparing Assignment

- List down main issues faced by the water utility (Respective WASA).
- Prioritize the issues
- What are the factors that are contributing towards these issues
- How to rectify or improve the current WASA`s Situation in your opinion

Assignment 2

Preparation of Operational and Repair Action Plan

Guidelines for Preparing Assignment

- What are the prevailing operational issues in the system
- Possible Causes
- Control Measures

Assignment 3

Preparation of Water Safety Plan (WSP)

Guidelines for Preparing Assignment

- What are major hazard in water distribution system
- Identify problems associated to these hazard
- Control measures
- Responsible persons to apply the control measures

Assignment 4

Preparation of HSE Plan For O&M of Water Supply System

Guidelines for Preparing Assignment

- What are the major health hazards during the operation and maintenance of water distribution system
- Possible Causes
- Control Measures
- Use of Personal protective equipment

Assignment 2

Preparation of Operational and Repair Action Plan

Guidelines for Preparing Assignment

- What are the prevailing operational issues in the system
- Possible Causes
- Control Measures

ALJAZARI
ACADEMY

O&M of Tube Well and Pump Facility (W1221)

O&M of Water Distribution System (Module 1)

EPA Net Analysis Exercise

Zia Mustafa (Water Specialist)
Ramisha Taseer (Research Associate)

October 2016

Outline of the Presentation

- Introduction
- Purpose of Exercise
- Target Area for Exercise
- Steps in Using EPANET
- Example Network
- Exercise at Supply Area in Green Town

3

Introduction

- A network analysis computer program developed by the U.S. Environmental Protection Agency that analyzes Water Distribution Network
- A tool to determine pressure, velocity in different pipes in a Network

4

Purpose of Exercise

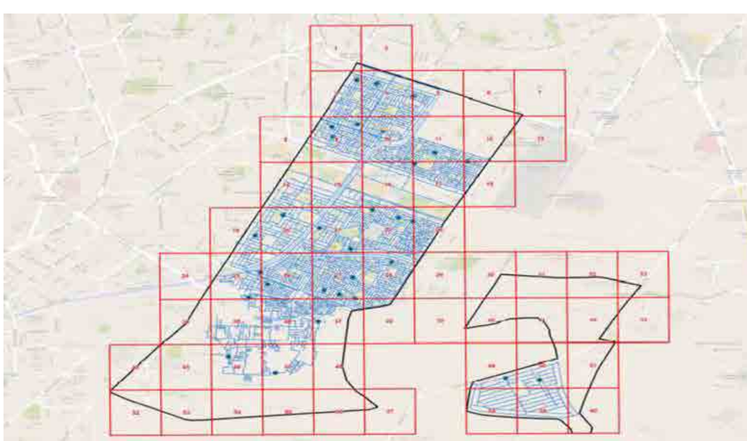
For checking and confirming that sufficient water is supplied to customers within supply area with appropriate pressure or not

- How water pressure within the supply area is changing
- Diameter of pipe is appropriate or not
- Capacity of pump is appropriate or not
- Possibilities of improving

5

Target Area for the Exercise

Grid Map of Green Town



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Target Area for the Exercise

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Steps in Using EPANET

Steps to model a Water Distribution System using EPANET:

1. Draw a network representation of your distribution system or import a basic description of the network placed in a text file
2. Edit the properties of the objects that make up the system
3. Describe how the system is operated
4. Select a set of analysis options
5. Run a hydraulic analysis
6. View the results of the analysis

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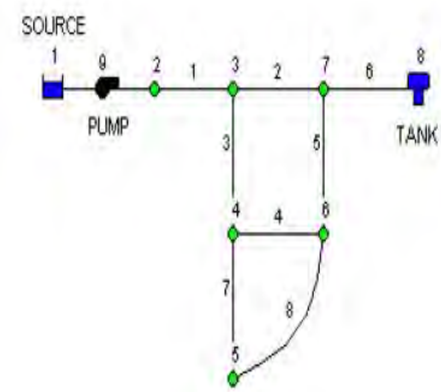
Example Network

- Two Loop Pipe Network
- Source Reservoir (Node 1)
- Storage Tank (60 ft Diameter)
  - Water Level 3.5 ft
  - Maximum Level 20 ft
- Pump capacity (Link 9) = 600 GPM



Example Network

Network Node Properties

Node	Elevation (ft)	Demand (gpm)
1	700	0
2	700	0
3	710	150
4	700	150
5	650	200
6	700	150
7	700	0
8	830	0

Example Network

Network Pipe Properties

Pipe	Length(ft)	Diameter(inches)	C-Factor
1	3000	14	100
2	5000	12	100
3	5000	8	100
4	5000	8	100
5	5000	8	100
6	7000	10	100
7	5000	6	100
8	7000	6	100

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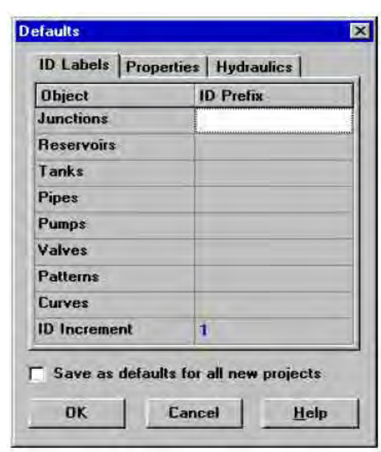
Example Network

Project Setup

- Launch EPANET
- Create a new project
- Select Project >> Defaults to open the dialog form shown in Figure



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Example Network

- On the ID Labels page of the dialog, clear all of the ID Prefix fields and set the ID Increment to 1
- Select the Hydraulics page of the dialog and set the choice of Flow Units to GPM (gallons per minute)

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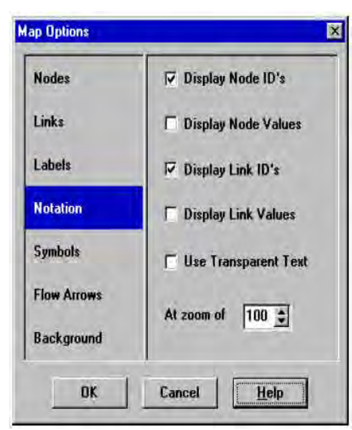
Example Network

- Select **View >> Options** to bring up the Map Options dialog form
- Select the Notation page on this form and check the settings
- Then switch to the Symbols page and check all of the boxes
- Click the **OK** button to accept these choices and close the dialog



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Example Network

- Select **View >> Dimensions** to bring up the Map Dimensions dialog
- Note the default dimensions assigned for a new project. click the **OK** button

Example Network

Drawing the Network

- Select View >> Toolbars >> Map

- Click the Reservoir button 
- Then click the mouse on the map at the location of the reservoir

Example Network

- Click the Junction button and click on the map at the locations of nodes 2 through 7
- Add the tank by clicking the Tank button and click on the map at tank location
- Click the Pipe button . (Note how an outline of the pipe is drawn as you move the mouse from node 2 to 3). Repeat this procedure for pipes 2 through 8.

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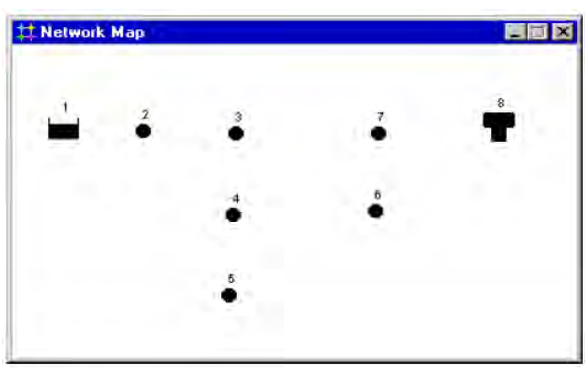
Example Network



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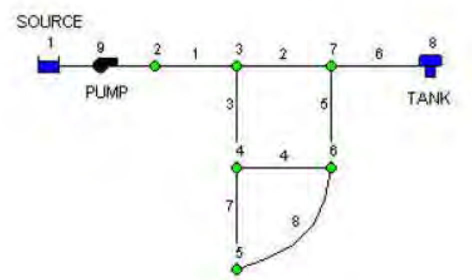
Example Network

- Label the reservoir by selecting T on the Map Toolbar. Edit Box will appear. Type here SOURCE and then hit the ENTER key
- Click the selection button to put the map on the Objection Selection Mode



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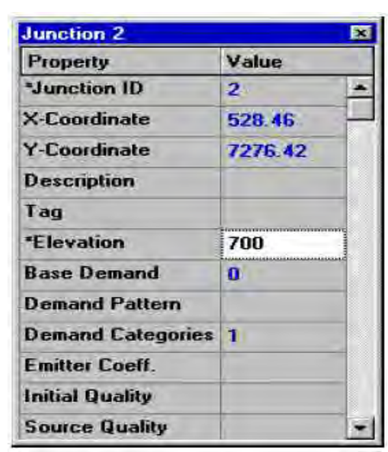
Example Network

Setting Object Properties

- Double-click the object on the map
- Right-click on the object and select Properties from the pop-up menu that appears
- Select the object from the Data page of the Browser window and then click the Browser's Edit button
- Add Elevation and Base Demand (Node 2)
- Click on link to add length, diameter and roughness (c factor) for links



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Example Network

Saving and Opening Projects

- From the File menu select the Save As option.
- In the Save As dialog that appears, select a folder and file name under which to save this project.
- Click OK to save the project to file.

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Example Network

Saving and Opening Projects

- The project data is saved to the file in a special binary format. If you wanted to save the network data to file as readable text, use the **File >> Export >> Network** command instead.
- To open project at some later time, select the **Open** command from the **File** menu.

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Example Network

Running A Single Period Analysis

- Select Project >> Run Analysis or click the Run button. (If the toolbar is not visible select View >> Toolbars >> Standard from the menu bar).
- Select Node Pressure from the Browser's Map page and observe how pressure values at the nodes become color-coded.
- To view the legend for the color-coding, select **View >> Legends >> Node** (or right click on an empty portion of the map and select Node Legend from the popup menu).

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Example Network

Running A Single Period Analysis

- To change the legend intervals and colors, right click on the legend to make the Legend Editor appear
- Bring up the Property Editor (double-click on any node or link) and note how the computed results are displayed at the end of the property list
- Create a tabular listing of results by selecting **Report >> Table** (or by clicking the Table button)

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Example Network

Running A Single Period Analysis

Network Table - Links

Link ID	Flow GPM	Velocity fps	Headloss ft/Kft	Status
Pipe 1	617.42	1.29	0.80	Open
Pipe 2	382.51	1.09	0.69	Open
Pipe 3	159.91	1.02	1.00	Open
Pipe 4	29.34	0.19	0.04	Open
Pipe 5	-90.09	0.57	0.34	Open
Pipe 6	292.42	1.19	1.03	Open
Pipe 7	55.58	0.63	0.57	Open
Pipe 8	-44.42	0.50	0.38	Open

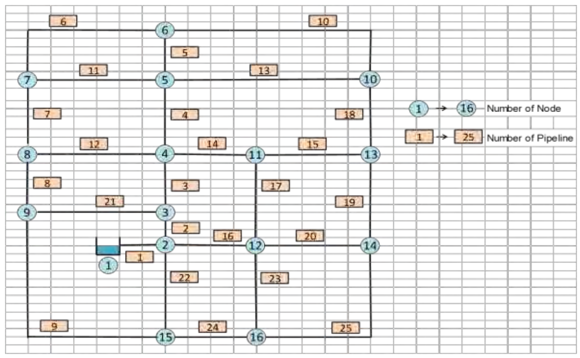
Flows with negative signs means that the flow is in the opposite direction to the direction in which the pipe was drawn initially.

Exercise at Supply Area in Green Town

1. Select and make your main distribution network on your map

Exercise at Supply Area in Green Town

2. Numbering of Nodes and Pipelines



If number of Nodes is small, you will not be able to get good result from network analysis. Or if number of Nodes is too big, analysis will be complicated and it will take long hours.

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Exercise at Supply Area in Green Town

3. Data Sheet of Nodes and Pipeline

No.	Elevation	Water Demand or Supply Amount from Node

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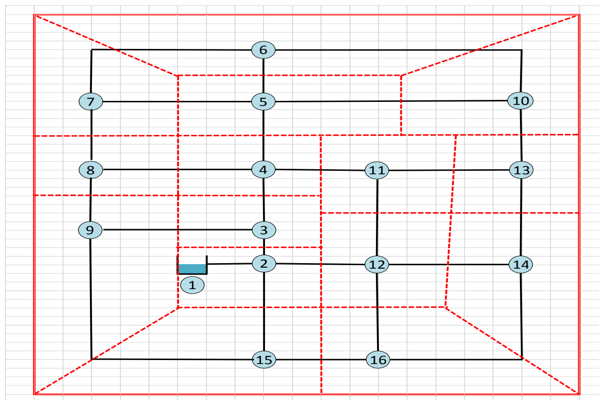
Exercise at Supply Area in Green Town

Supply amount from each node will be calculated according to area, number of customer, population density and types of customers.



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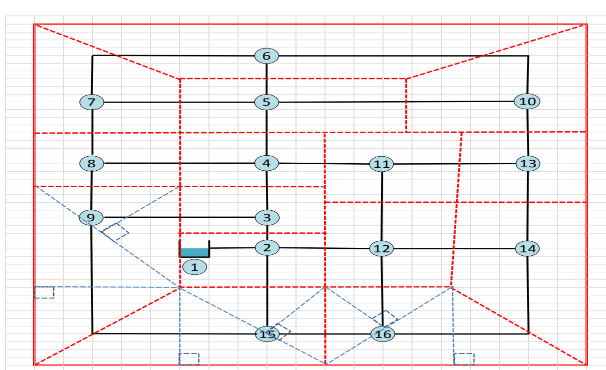
Exercise at Supply Area in Green Town

- Divide each supply area with two right triangle and calculate base times height
- Equal supply amount at each Node (For Exercise Purpose)



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Exercise at Supply Area in Green Town

Supply amount from each Node = Q/(N-1)

Where
Q is Capacity of Tube Well Pump
N is number of Nodes

- Node No.1 is reservoir and we assume water level of the reservoir as lift of Tube Well pump
- Flow amount from reservoir is calculated by Software

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Exercise at Supply Area in Green Town

4. Data Sheet for Pipelines

No.	Start Node	End Node	Length in Feet	Diameter in Inches	Roughness

32

Exercise at Supply Area in Green Town

5. Putting data into EPANET

- Drawing network by making use of mouse and buttons on the Map Toolbar
- First add the reservoir (lift of tubewell)
- Add the junction nodes
- Then add the pipes (Begin with pipe 1 connecting node 1 to node 2)
- Put all data of Nodes and Pipelines into EPA Net

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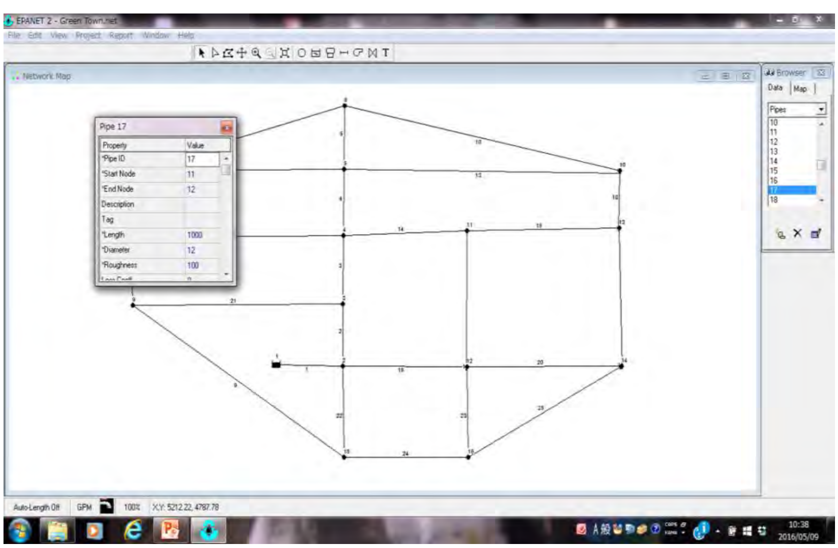
Exercise at Supply Area in Green Town



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Exercise at Supply Area in Green Town

5. Analysis

Run the analysis

6. Evaluation of analysis result

- Water pressure at each node
- Velocity of each pipe

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Contact

Zia Mustafa
Water Specialist

OJT Exercise

Checking of Pressure in Supply Area using Pressure Recorder FJN -501

Zia Mustafa (Water Specialist)
Ramisha Taseer (Research Associate)

October 2016

Detail of OJT Plan

Date	Thursday October 27, 2016
Training Facility	Tube Well located at Green Town WASA Sub Division
Equipment/Machinery	Pressure Recorder FJN -501
Time	2 Hours (2:00PM to 4:00 PM)

FJN-501 Pressure Recorder

Water Pressure Recorder is used to measure the pressure of water with the help of graph inside the gauge for specific hours.

Pressure Recorder FJN-501

3

Applications of Water Pressure Recorder

Pressure Recorders are used to:

- Verify low water pressure complaints
- Provide water distribution system modelling data
- Checking for fluctuations in water pressure
- Keeping track of water pressure at night when controlling water leakages by decreasing pressure
- Making a water pressure distribution chart to identify low, high pressure in Supply Area

4

Specifications of Equipment

Model and Type	FJN-501 (A-Type)	FJN-501 (C-Type)
Recording Time	4,12,24,72, 168 hours	15,30,60 Minutes
Maximum Pressure Record	1.0 MPa (10bar)	2.0 MPa (20bar)
Power Check	CPU does not work at voltage less than 2.2 V	
Mode Check	LED indicates by blinking	

Scale: I.0 MPa = 10 Bar

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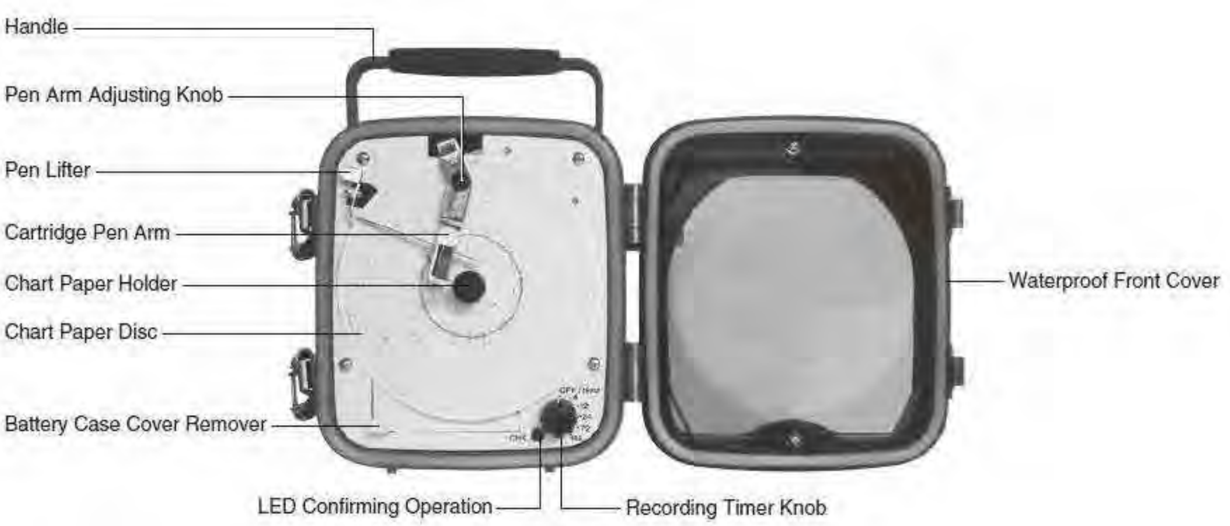
Specifications of Equipment

Model and Type	FJN-501 (A-Type)	FJN-501 (C-Type)
Operation Power	3.0 Volts (Minimum 2.2V)	
Weight & Size	1.35kg (Main Unit)	
Gross Weight	3.7kg (with the carrying case)	
Battery Type & Battery Life	AA - Alkaline Battery	
	4 h ·············· 80 days 12h ·············· 220 days 24h ·············· 380 days 72h ·············· 720 days 168h ·············· 970 days	15 min. ·············· 150 days 30 min. ·············· 250 days 60 min. ·············· 400 days

6

Components of Equipment



Components of Equipment

Fuji Coupling

13 mm Dia. Faucet Adaptor

Coupler of Fuji Coupling

Cartridge Pen

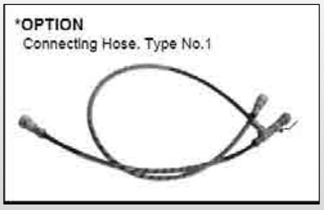
Leather Packing

Components of Equipment

Alkaline Battery- AA Size

Chart Paper Disc
(100 Sheets per package)

Connecting Hose Type No. 4



Connecting Hose

Carrying Case

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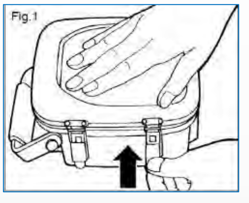
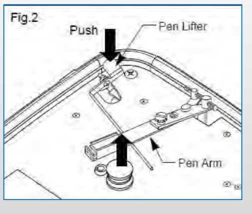
Procedure for Measuring Pressure in Water Distribution

1. Unlock the clip and open the front cover



2. Push down the pen lifter to raise the lift arm. Remove chart paper holder by pulling upward and put new chart paper



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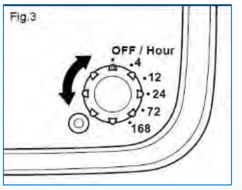
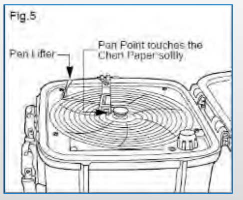
Procedure for Measuring Pressure in Water Distribution

3. Before mounting the chart paper, check battery status (Turn the knob to 4 hour Selector position and confirm blinking of LED for 1 minute, if LED does not light up, change the batteries)



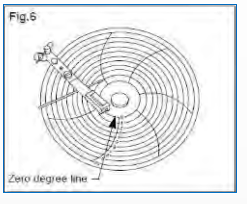
4. Open the cartridge pen and fit it on the pen holder. Release the Pen lifter so that the pen point will touch the chart paper softly



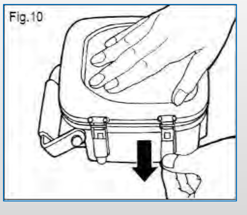
11

Procedure for Measuring Pressure in Water Distribution

5. Rotate the chart paper Disc so that the pen point will come to the starting point



6. Close the front cover and lock it with catch clips



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Procedure for Measuring Pressure in Water Distribution

7. Open the Pipeline Valve slowly and drain water to eliminate air trapped in the water supply pipeline

8. Connect the hose pipe with supply line (through FUJI Adapter)

9. Attach the other side of Hose Pipe to the Pressure Recorder

10.Open the valve of Supply Line gradually to its full supply level

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Procedure for Measuring Pressure in Water Distribution

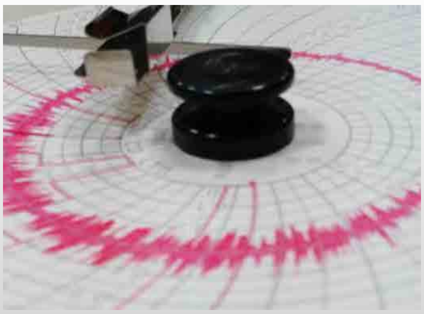
11. Now open the Valve of Pressure Recorder

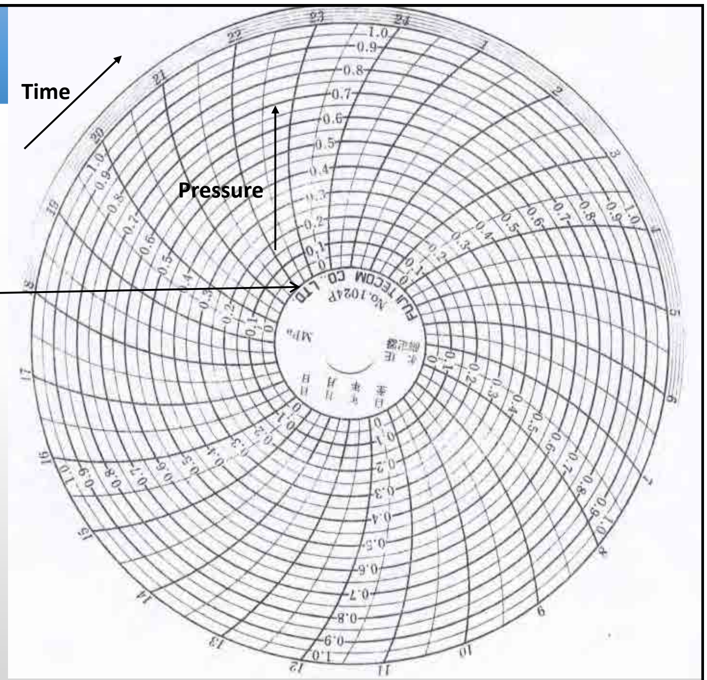
12. Open the Air Bleed knob to confirm that air is removed (continuous drop of water) and then close it

13. Place the Pressure Recorder on Firm Space for recording pressure in supply line

14

Chart Interpretation





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Precautions

- The Pen Point should touch the Zero Line (If it is not on Zero Line adjust it with the help of screw on the pen arm)
- Always turn the knob to OFF, before changing chart paper
- After use, remove the connecting hose after releasing air completely by use of Air bleed knob
- Open the valve of supply line slowly to avoid malfunctions caused by the water pressure changes

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Checking of Residual Chlorine in Supply Area using DPD Reagent

OJT Exercise

Zia Mustafa (Water Specialist)
Ramisha Taseer (Research Associate)

October 2016

2

Outline of the Presentation

- Objective
- Detail of OJT Schedule
- Specifications of Equipment
- Components of Apparatus
- Applications of Residual Chlorine Measuring Kits
- Procedure

3

Detail of OJT Schedule

Day	October 27, 2016
Place	Green Town WASA Sub Division
Equipment/Machinery	DPD (N,N Diethyl-P-Phenylene diamine Reagent Kit
Time	2 hours

4

Specifications of Apparatus

Range	0 to 2.5 mg/l (ppm) Chlorine
Smallest Increment	0.5 mg/l (ppm) Chlorine
Analysis Method	Colorimetric
Sample Size	5 ml
Number of tests	50 (average)
Shipping Weight	176g (6.6oz.)
Case Dimensions	220*145*55mm

Components of Apparatus

Residual Measuring Kit comprises:

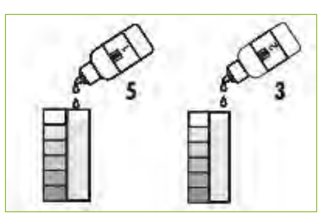
- 1 Color Comparator Cube
- Reagent 1 (20mL)
- Reagent 2 (15mL)

Applications

- To measure Residual Chlorine Levels in Water Supply Pipelines , reservoirs

Procedure

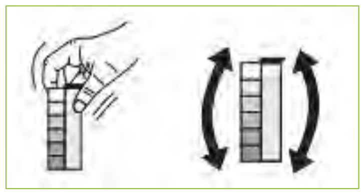
- Add 5 drops of Reagent 1 and 3 drops of Reagent 2 to the color comparator cube



- Fill the color comparator tube with water sample to the 5 mL mark

Procedure

- Replace the Cap and mix by carefully swirling the cube in tight circles and inverting it several times



- Determine which color band best matches the solution in the vessel and record the results in mg/L (ppm) free chlorine

9

10

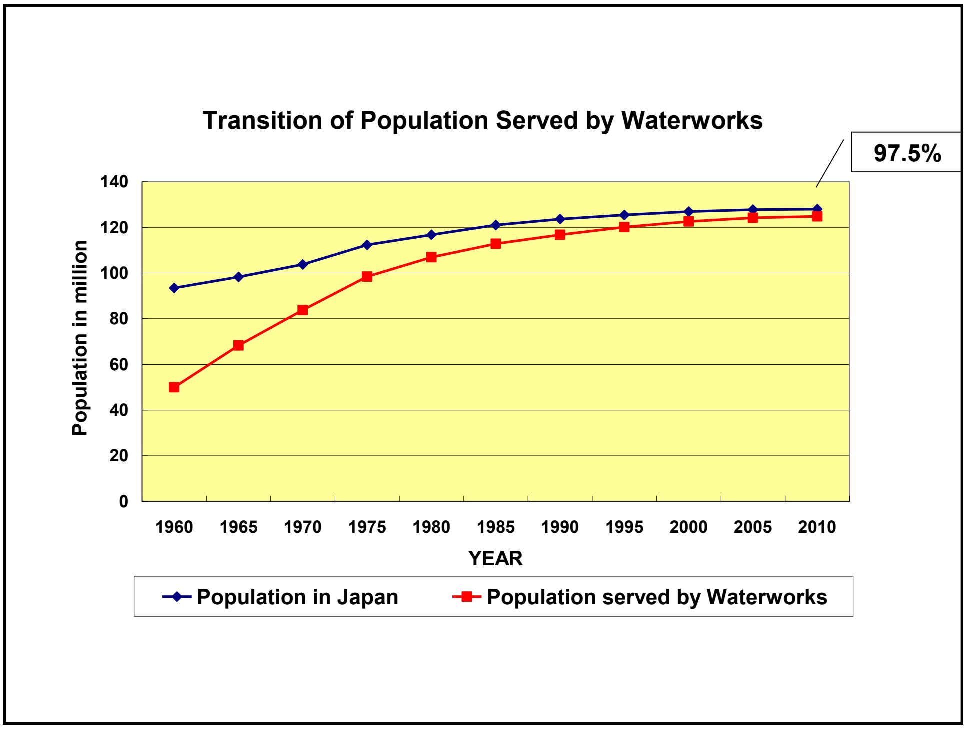
Capacity Building and JWWA's Activities

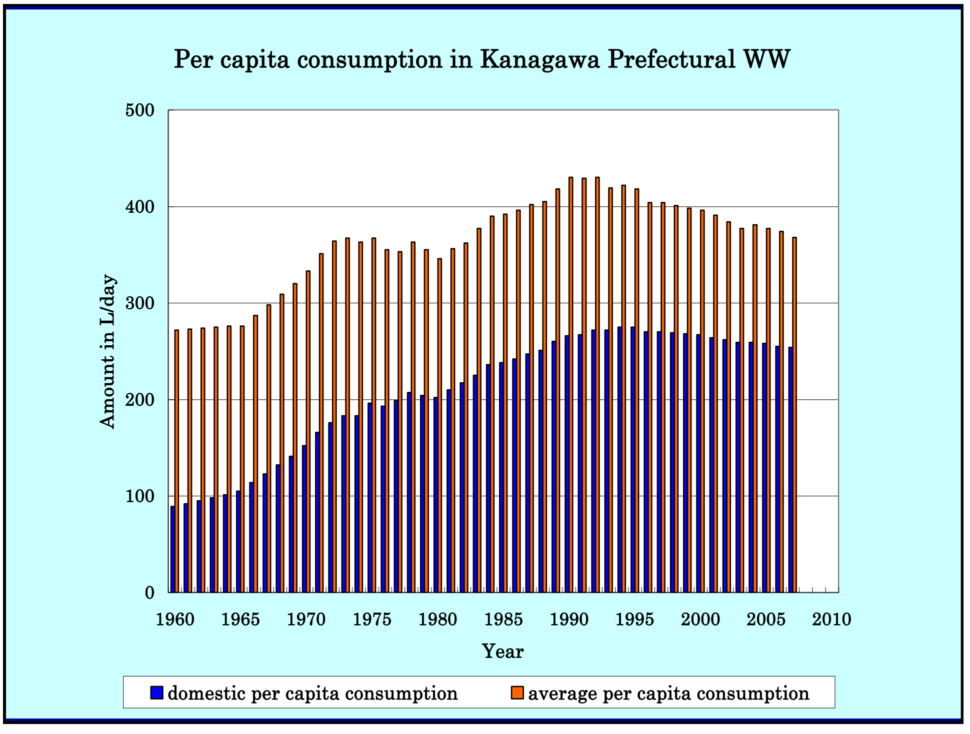
Japan
Water Works
Association

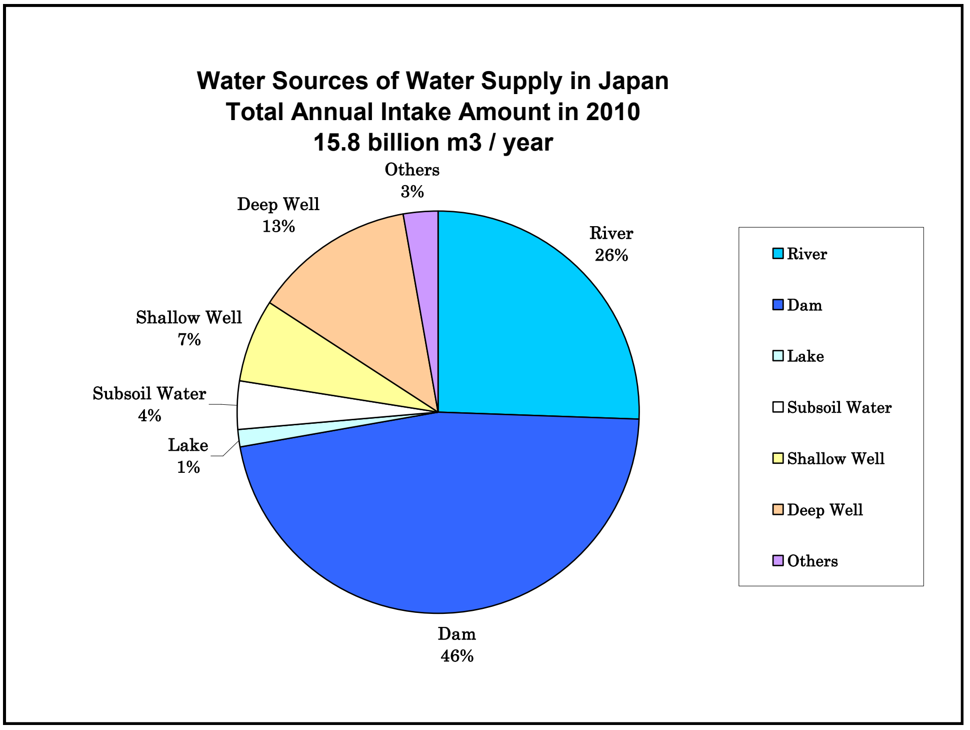
Takuji Okubo
Senior Civil Engineer
Japan Water Works Association

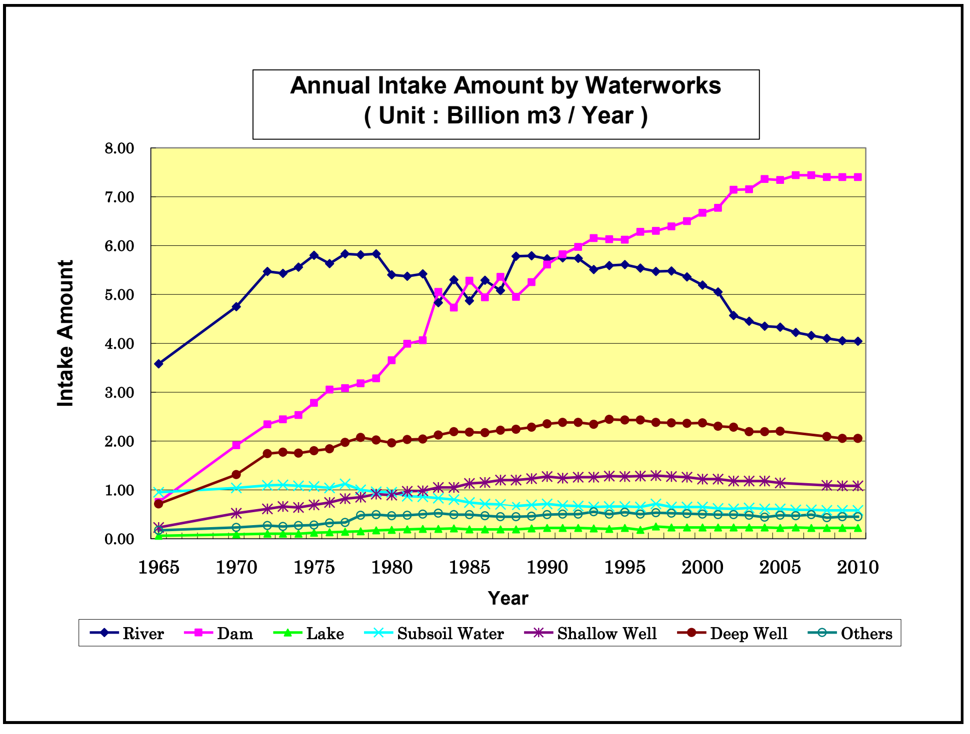
Introduction of JWWA

- **1887** First modern water supply system in Japan established in Yokohama City
- **By 1900** Water Supply System of Hakodate(1889),Nagasaki(1891),Osaka(1895),Tokyo(1898),Hiroshima(1899) and Kobe city(1900) were established.
- **1904** Federation of Water Authority (JWWA's predecessor) established with Seven Cities' WW to create a uniform water quality examination method
- **1932** Japan Water Works Association established

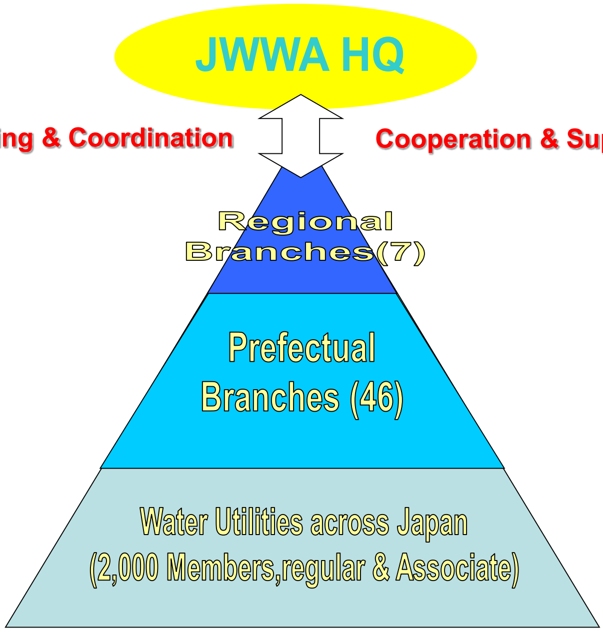

Transition of Population Served by Waterworks
97.5%
140
120
100
80
60
40
20
0
Population in million
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
YEAR
Population in Japan
Population served by Waterworks


Per capita consumption in Kanagawa Prefectural WW
500
400
300
200
100
0
Amount in L/day
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
Year
domestic per capita consumption
average per capita consumption

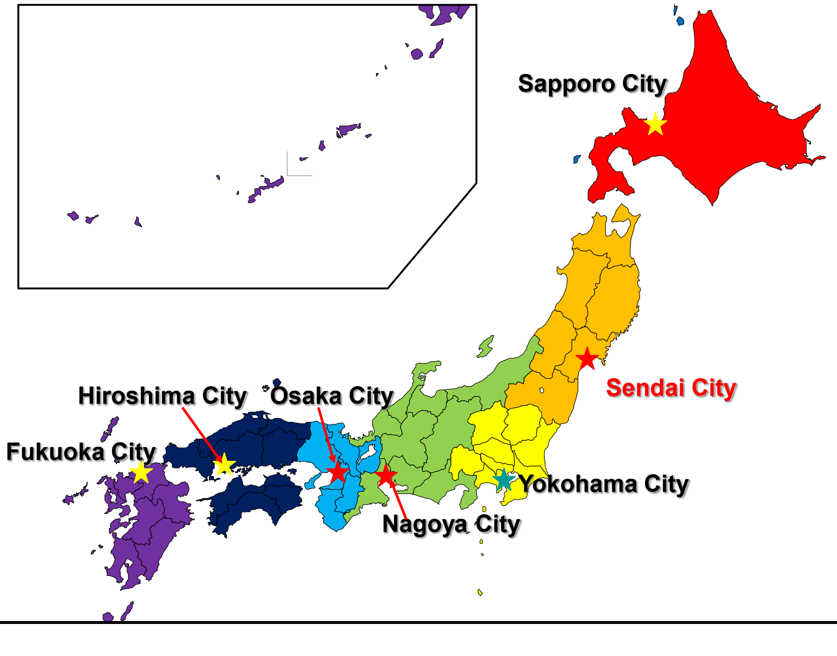

Water Sources of Water Supply in Japan
Total Annual Intake Amount in 2010
15.8 billion m3 / year
Others 3%
Deep Well 13%
River 26%
Shallow Well 7%
Subsoil Water 4%
Lake 1%
Dam 46%
River
Dam
Lake
Subsoil Water
Shallow Well
Deep Well
Others


Annual Intake Amount by Waterworks
(Unit : Billion m3 / Year)
Intake Amount
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
Year
River
Dam
Lake
Subsoil Water
Shallow Well
Deep Well
Others

Overview of Japan Water Works Association (JWWA)



Regional Branches of JWWA



Overview of Japan Water Works Association (JWWA)

Main Activities

- Research and Study on Management & Technology
- Trainings
- International Cooperation
- Inspection & Certification
- Publication
- Annual Conferences
- Lobbying for Industry Issues
- Disaster Relief & Recovery

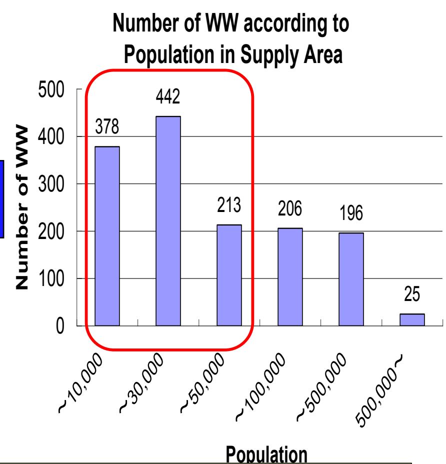
Current circumstances of waterworks in Japan

- Recession & Water saving appliances developed
  → decrease in water income
- Old facilities → facing the time for renewal
- The period in which many staff members retire has started since 2007
- Outsourcing of O&M of water supply facilities are increasing
- Unbalanced staff configuration (the young is few).
- Worrying about the succession of technical skills to young generation.

Number of Waterworks in Japan

Waterworks In Japan (8,351 No.)

- 17% — Large Public WW (1,465 No.)
- 1% — Bulk Water Supply (101 No.)
- 82% — Small Public WW (6,886 No.)



Rate of small WW less than 50,000 population in supply area is 70%

11

Purposes of JWWA's Training service

- To develop and improve human resources of water supply utilities
- To develop private sectors' capacity → To motivate cooperation between the public and private sectors

Current JWWA's Training services

18 courses and 173 times of training services are held regularly every year.

Track record of JWWA's Training Services in 2010

Number of sessions : 196

Total number of days : 603

Number of participants : 7,441

Training courses according to rank

Title of Training course	Content	Target	Days	Times
Basic course of WS	Basic information about WS business	New clerical & technical staff	3	3
On clerical affairs for WW	Clerical affairs for WW	Management staff	4 5	2
For executive management staff of WW	Challenges for management of WS	Executive management staff	2	2
For WS engineers in each block	O&M of facilities and water quality	Engineers of WW and private Co.	2	7
For WS engineers	Overall techniques for WS	Young & middle aged engineer	9 10	1 1
For newly appointed Director Generals of WW	Acquired knowledge for Directors	Newly appointed Director Generals	3	1
For Technical Directors of WW	Technical challenges for WS	Technical Directors	2	1

Training courses according to job

Title of Training course	Content	Target	Days	Times
On clerical affairs for WW	Affairs	Management staff	3	1
Practical training seminar on consumption tax	Account of consumption tax	Management staff	2	1
Practical course; countermeasures for cases of water rate non-payment	Countermeasures for cases of water rate non-payment	Management staff	2	4
Specialized course for WS engineers	Water treatment facilities	Engineers	5	1
ditto	Mechanical and electrical installation	Engineers	5	1
ditto	Water service installation	Engineers	5	1
ditto	Water quality management	Engineers	5	1

Continued

Title of training course	Content	Target	Days	Times
Specialized course for WS engineers	Water transmission and distribution facilities	Engineers	5	1
ditto	Advanced water treatment facilities	Engineers	5	1
Practical training course on equipment and technology of water purification plant, etc.	Practice of O&M of Pumping facilities etc.	Engineers	4	7
Water leak prevention course	Techniques against leakage	Engineers	3	3
Pipe laying design	Design, drawing and cost estimate	Engineers	3	9

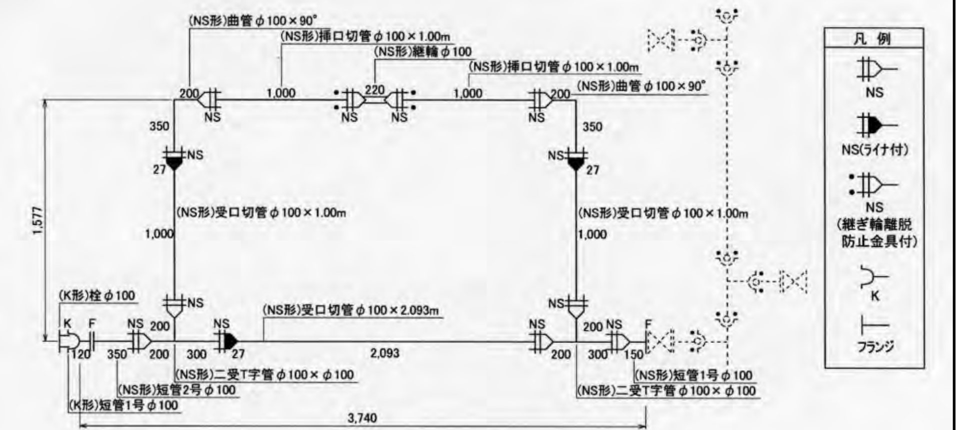
The Kawaguchi Training Center

JWWA's main training facilities constructed in 1993

Training Room at the JWWA Headquarters in Tokyo

Training Facilities for Pipeline Laying
Practical Small Diameter Fitting

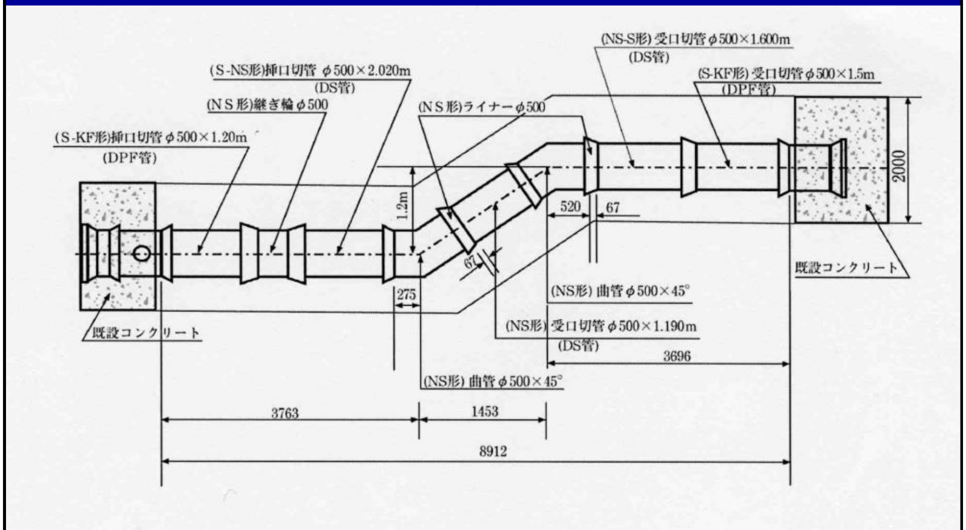
Layout for practical training on distribution pipe laying Small Diameter (φ100 mm)



Training Facilities for Pipeline Laying
Practical Large Diameter Fitting

Pipe Laying Practice inside the Trench

Layout for practical training on distribution pipe laying
Large Diameter (φ500mm)



Training Facilities for Pumping Equipment

Dismantling and Assembling Practice of Pump

Thank you for your attention

JICA

ALJAZARI ACADEMY

Urban Sector Planning & Management Services Unit (Pvt.) Ltd
A Public Sector Company
Government of the Punjab

O&M of Tube Well and Pump Facility (W1221)

O&M of Water Distribution System (Module 1)

Water Safety Plan linked with Distribution Pipelines & Reservoir

Zia Mustafa (Water Specialist)
Ramisha Taseer (Research Associate)

October 2016

Outline of the Presentation

- Introduction
- Developing Water Safety Plan
- Water Safety Plan for Water Distribution System

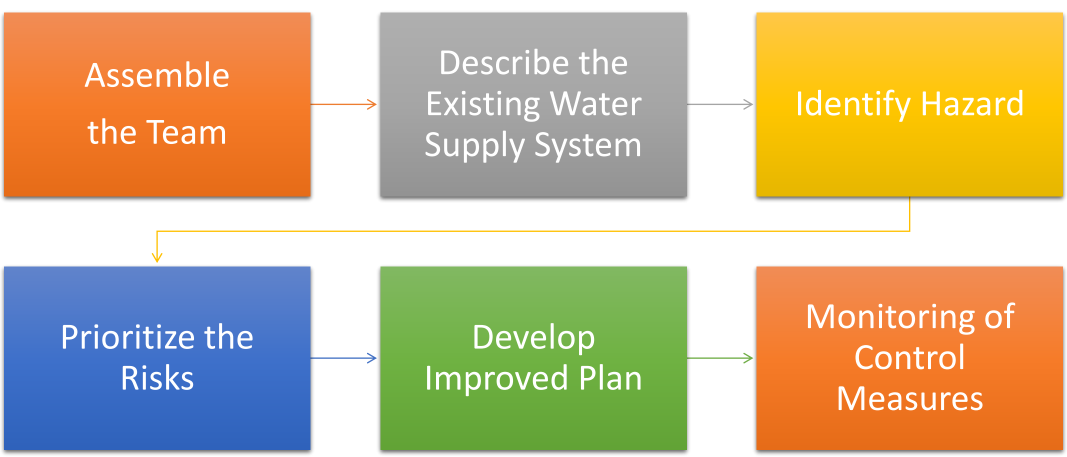
Introduction

"Water Safety Plan is a tool to address the water quality concerns from source to tap in distribution system incorporating possible expected hazards, their possible associated risk setting (risk levels) and finally control measures to address those hazards"

Introduction…..Contd.

Health Impacts of Poor Water Quality

Developing Water Safety Plan



Assembling the Team

- ✓Assemble of team with adequate operational experience
- ✓Major role of team is to identify possible hazards linked with poor water quality in water distribution system and apply control measures in turn

System Assessment

- ✓ Assessment of existing water supply system
- ✓ Developing system flow diagrams from source up to consumers

System Assessment…contd.

Ground Water Abstraction → **Chlorination** → **Distribution System** → **Consumers**

System Flow Diagram based on Groundwater Source

System Assessment…contd.

Surface Water Abstraction → Water Treatment Plant → Reservoir → Distribution System → Consumers

System Flow Diagram based on Surface Water Source

Hazard Identification and Setting Risk Level

- ✓Identification of possible potential hazards
- ✓Prioritizing risks associated with hazards
- ✓Risk level determining

Risk Level = Frequency x Severity

Hazard Analysis and Setting Setting Risk Level

Hazard Analysis **Risk level matrix**

Frequency of hazard			Severity of damage: Almost no	Requires consideration	Slightly significant	Important	Worst
			No effects observed	unsatisfactory , but not serious enough for people to turn to other drinking water	Serious enough to turn to other drinking water	May affect health	May result in fatalities
			1	2	3	4	5
Frequently	Every month	5	5	10	15	20	25
Often	Once every few months	4	4	8	12	16	20
Occasion-ally	Once every 1 to 3 years	3	3	6	9	12	15
Rarely	Once every 3 to 10 years	2	2	4	6	8	10
Almost never	Once every10 years or less frequently	1	1	2	3	4	5

Water Safety Plan(WSP) For Water Distribution System

Sr. No.	Hazard Type	Problems with associated hazard	Control Measures	Key Responsibility
	Water Source			
1	Microbial and chemical Hazards	• Deterioration of water quality	• Good practices of source protection through installation of filtration plant • Implementation of Industrial Effluent Standards and Volume Controls	SDO, Supervisor, Operator

Water Safety Plan(WSP) For Water Distribution System

Sr. No.	Hazard Type	Problems with associated hazard	Control Measures	Key Responsibility
	Transmission Mains			
1	Microbial Hazard	• Poor water quality due to source contamination • Deposits of sediments • Disinfection failure due to high loads of organic contents in water from source	• Stop the flow of water by closing valves of problem area • Provide a temporary bypass or alternative supply line, if possible • Water sampling and its testing	SDO, Supervisor, Sub Engineer

Water Safety Plan(WSP) For Water Distribution System

Sr. No.	Hazard Type	Problems with associated hazard	Control Measures	Key Responsibility
2	Structural Hazard	• Contamination due to poor jointing • Deterioration of pipe materials • Ingress of contaminated water from leaking valves	• Apply periodic Inspection of supply lines • Gradual replacement of old aged pipe infrastructure • Exercising of valves	SDO, Supervisor, Sub Engineer

Water Safety Plan(WSP) For Water Distribution System

Sr. No.	Hazard Type	Problems with associated hazard	Control Measures	Key Responsibility
	Reservoir			
1	Microbial hazard	• Poor water quality due to inadequate disinfection method	• Minimizing ingress of contamination to system • Fitting alarms triggered by low disinfectant level • Ensure inspection covers and ventilator covers remain in place	SDO, Supervisor, Sub Engineer

Water Safety Plan(WSP) For Water Distribution System

Sr. No.	Hazard Type	Problems with associated hazard	Control Measures	Key Responsibility
2	Structural failure hazard	• leakage through reservoir • leakage from partially open valves • taste in water due to internal corrosion of pipelines • deterioration of internal lining	• Regular reservoir inspections • Proper opening/closing of valves • Proper pipe material as per specifications should be used • Relining/painting of internal surface • Routine inspection to see any failure in piping and lining	SDO, Supervisor, Sub Engineer

Water Safety Plan(WSP) For Water Distribution System

Sr. No.	Hazard Type	Problems with associated hazard	Control Measures	Key Responsibility
Distribution Supply lines				
1	Microbial and Chemical Hazards	• Low chlorine residual in distribution system • Ingress of contamination due to pressure fluctuations	• Maintain chlorine residual in the system as per requirement • Pressure Management • Apply flushing of pipelines	SDO, Supervisor, Sub Engineer

Water Safety Plan(WSP) For Water Distribution System

Sr. No.	Hazard Type	Problems with associated hazard	Control Measures	Key Responsibility
		• Contamination during water main repair due to debris, soil or groundwater remaining in the main after repairs	• Disinfection prior to commissioning of water main • Follow design specifications for water supply system	SDO, Supervisor, Sub Engineer

Water Safety Plan For Water Distribution System

Sr. No.	Hazard Type	Problems with associated hazard	Control Measures	Key Responsibility
		• Cross connection between water system and another system carrying non-potable water		
2	Structural failure hazard	• Ingress of contamination due to main burst • Ingress of contamination due to cracks in pipelines • Ingress of contamination due to improper closure of valves	• Maintenance of pipelines and valves • Use of approved pipeline types	SDO, Supervisor, Sub Engineer

Developing, Implementing & Maintaining an Improved/Upgrade Plan

- Overview effectiveness of existing procedures
- Improving procedures With clear roles & duties
- Implementing updated or new control measures

Monitoring of Control Measures

- ✓ Important for reviewing effectiveness of water safety plan
- ✓ Measuring residual chlorine, pH, turbidity, pressure changes in service area and periodic inspection of infrastructure

Contact

Zia Mustafa
Water Specialist

O&M of Tube Well and Pump Facility (W1221)

O&M of Water Distribution System (Module 1)

Health, Safety, Environment (HSE) linked with Water Distribution System

Zia Mustafa (Water Specialist)
Ramisha Taseer (Research Associate)

October 2016

Outline of Presentation

- Health, Safety and Environment (HSE)
- Assessing Unsafe Working Conditions at Sites
- Components of HSE Activities
- HSE Action Plan for Water Distribution System

Health, Safety and Environment (HSE)

"An important tool regarding maintaining health, safety and environmental considerations for any operational activity of water distribution system which is necessary to safeguard the workers health, apply safe practices at work place, reduce injuries due to accidents at sites and maintain general environmental conditions at site"

Unsafe Working Conditions at Sites

Components of HSE Activities

Hazard Identification

↓

Job Safety Analysis

↓

HSE Training Programme

↓

Control Measures

Hazard Identification

- Site inspections
- Reviewing specifications of Pipe Materials & SOPs
- Types of Hazards
  - Physical Hazards
  - Chemical Hazards
  - Biological Hazards

Hazard Identification

SAFETY FIRST!

Job Safety Analysis (JSA)

- ✓ Providing information on possible hazards related to work
- ✓ Safety precaution to be taken at work site
- ✓ Information to Workers about possible hazards, its associated risks and Measures to curtail it

HSE Training Programme

- Necessary for reducing frequency of accidents
- Employee awareness related to HSE procedures
- HSE Trainings should at least cover the following:
  - Identification of health hazards & risk assessment
  - Hazardous material management
  - Emergency preparedness and response
  - Safety Procedures related to Job
  - First Aid

Control Measures

1. Use Personal Protective Equipment

- Enforcement of wearing PPE at work place

Control Measures

2. Placing Safety Signage at Work Site

Barricades

Control Measures

3. Use of Flagging , Warning Signs, Traffic Cones

Traffic Cones

Tripping Hazard

Noise Hazards

Falling Hazard

Skull protection

HSE Action Plan for Water Distribution System

Sr. No.	Activity	Hazards	Impacts of Hazards	Control Measures
1	Delivery and unloading of pipes	Pipes may move/roll or be tampered with by others	Injury to persons generally	• Provide secure stockpile area for pipes and fittings • Unload and stack pipes strictly in accordance with the manufacturers' recommendations • Minimize height of pallets / stockpile • Use PPE
			Lifting injury Swinging load	• Correct manual handling techniques • Use mechanical aids where possible • Maintain control of loads when lifting & moving

HSE Action Plan for Water Distribution System

Sr. No.	Activity	Hazards	Impacts of Hazards	Control Measures
2	Site Securing	Hazard to public	Injury to public	• Provide the appropriate fencing and/or barricades as per site risk assessment • Apply appropriate signage and pedestrian control • Devise and implement system for site inspection and security
		Traffic	Personal injury to public and workers due to vehicle accidents	• Traffic Control Plan • Keep area clean & clear of obstacles
		Inadequate Access	Slips, trips and falls, abrasions, strains and sprains, manual handling injuries such as back damage	• Conduct site inspection to ensure that access is adequate for the task activities • Use safety shoes, hard hats, Gloves, etc.

HSE Action Plan for Water Distribution System

Sr. No.	Activity	Hazards	Impacts of Hazards	Control Measures
3	Locating existing services	Damage to Existing underground services	damage to service	• Check relevant Authority (e.g. power, water, gas, council) records for location of services
4	Excavation Work	Hazard in handling equipment	Noise, falling objects causing injury Damage to existing surfaces Material spillage	• Use appropriate (PPE) – hardhat, hearing protection etc. • Maintain a safety working area around moving machines • Ensure appropriate plant noise control • Maintain Appropriate spillage control techniques
		Storage of materials	Falling objects	• No materials to be placed or stacked near the edge of any excavation

HSE Action Plan for Water Distribution System

Sr. No.	Activity	Hazards	Impacts of Hazards	Control Measures
		Collapse of trench, falling objects	Injury during Accessing trenches/conduits	• Keeping safe distance from edge of trench • Materials not to be placed or stacked near the edge of trench • All trenches to have safety barricades when left open for a period of time
5	Installing pipe and fittings on bed	Collapse of trench, falling objects	Injury during Accessing trenches/conduits Lifting injury Swinging load	• String only sufficient pipes for day's work • Return all pipes not laid at end of day to secure stockpile areas • Use safety shoes , gloves, goggles , hard hats
6	Dosing of Chlorine	Concentrated solutions handling	Splashes can cause burns and eye damage	• Gloves ,protective eye glasses, overalls

HSE Action Plan for Water Distribution System

Sr. No.	Activity	Hazards	Impacts of Hazards	Control Measures
7	Cleaning and inspection of storage reservoirs	Accidental flooding , Fall while combining on roof top	Personal injury	• Install railing around stairs • Wear hard hats, safety shoes
8	Repairing pipelines	Collapse of trenches	Cuts, bruises, electric shocks, Fractures, Minor and major injuries by vehicle strike	• Reduction of allowed vehicle speeds in work zones • Use of high-visibility safety apparel for workers in the vicinity of traffic • For night work, provision of proper illumination for the work space, while controlling glare so as not to blind workers and passing motorists • Locate all underground utilities before digging • Use of hard hats, goggles, safety shoes

HSE Action Plan for Water Distribution System

Sr. No.	Activity	Hazards	Impacts of Hazards	Control Measures
9	Materials Checking	Handling and storage of hazardous materials (chlorine)	Risk of various injuries and illnesses	• Handling and storage to be done according to instructions given in Materials Safety Data Sheets (MSDS)
10	Documentation and Data Control	Lack of Proper system for HSE Documentation and Data Control	Retrieval of some vital HSE information is rendered almost impossible	• Develop procedures for efficient management of HSE documentation and data control
11	House Keeping	Unsafe Work conditions	Risk to staff and Fire hazard	• Apply better house keeping practices at work places

Contact

Zia Mustafa
Water Specialist

Assignment 3

Preparation of Water Safety Plan (WSP)

Guidelines for Preparing Assignment

Sr. No.	Hazards in Distribution System	Type	Control Measures

Assignment 4

Preparation of HSE Plan For O&M of Water Supply System

Guidelines for Preparing Assignment

Sr. No.	Activity	Impact	Control Measures

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Course Code: W1221

O&M of Water Distribution System
Module 1

Participant Lecture Notes

Lecture 1

2016

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1. Lecture Information

Course Title: O&M of Tube Well and Pump Facility	**Course Code:** W1221
Module Title: O&M of Water Distribution System	**Module No:** 1
Lecture Topic: Key Issues in Water Distribution System	**Lecture Duration:** 45 Minutes

2. Water Distribution System (WDS)

2.1 Introduction

The utility service providers including WASA Lahore, WASA Faisalabad, WASA Multan, WASA Rawalpindi and WASA Gujranwala are providing water and sanitation services in respective cities, along with Punjab Public Health Engineering Department (PHED) mainly responsible for providing the above services in the urban as well as rural areas remaining other than the Five (5) WASAs jurisdiction in Punjab Province (Before creation of WASAs, all water and sanitation services provision in the Province was mandated by PHED).

The adequate and efficient delivery of providing water supply services to consumers is a pivotal parameter to achieve the Millennium Development Goals (MDGs) which at present is translated into Sustainable Development Goals. The utility service providers in this regard are still lacking beyond the set targets under the above. The current deficiencies in basic utility infrastructure is further inhabiting the economic growth as well as deteriorating the quality of life resulting increased poverty among the communities. Therefore, for improving the service delivery of Five WASAs, it is imperative to firstly analyze the current deficiencies in Five WASAs, key issues in running the system and then bring improvement in the identified gaps in Five WASAs that will not only improve the service delivery of WASAs but also result measureable improvement in health outcome.

The present water distribution system in Five WASAs vary from each other. In case of WASA Lahore, Multan and Gujranwala, major source of water is through groundwater (tube wells) whereas in cities of Faisalabad and Rawalpindi (utility services provided by WASA Faisalabad, WASA Rawalpindi), major source is based on surface water (after treatment supply to consumers) and groundwater through installation of small capacity tube wells. The existing systems are designed to meet the peak hourly demand. In addition, some control valves (gate valves, air valves, drain valves etc.) have also been installed in the system. In some areas of distribution systems (walled city), old Galvanized Iron (GI) pipes of smaller diameters exist which are causing high head losses and depriving the consumers of reliable water supply. In addition, some areas are also connected to dead ends where water quality concerns are evident. Further, the residents at the remote points are also not getting the desired quantity of water with adequate pressure.

This lecture has been divided into different activities which will be carried out, the detail is as under.

2.2 Group Discussion

The Lecturer will first invite discussions regarding major issues being faced by Five WASAs in operating the water supply system and will summarize the discussions by adding further detail into it. Afterwards, the Lecturer will share the information of water supply system of five WASAs to training participants.

2.3 Existing Water Distribution System in Five WASAs

The water distribution system generally includes tube wells, reservoirs (for storage, equalizing and distribution purpose), pipes, valves, hydrants and appurtenances for conveying water system. The description of water distribution system in each WASA is given in the following paragraphs:

<u>WASA Lahore</u>

In case of WASA Lahore, water distribution system comprises tube wells, pipes, valves, hydrants and overhead reservoirs. Most of the tube wells pump directly into the system, few are connected with overhead reservoirs. The only existing water reservoir in working condition in the city is situated at Lange Mandi (Pani Wala Talab) with a capacity of one million gallons, feeded by four (4) tube wells of 4 cusecs capacity each. This reservoir was constructed in year 1876 under the British Rule and is partially feeding the walled city.

The existing water supply system in the city is based on groundwater and about 528 tube wells are abstracting water from ground to feed directly into the system at supplying water about 14-18 hours in a day. Majority of tube wells are of four (4) cusecs and two (2) cusecs capacity, however, one (1) cusec capacity tube wells also exist at WASA Lahore. The aquifer underlying is unconfined alluvium comprising sand, silt and gravel. The reported thickness of aquifer in Lahore is 1,400 feet. The depth to water table is reported as 125-150 feet and groundwater is declining 6 feet per year due to excessive abstraction of water through tube wells. The total length of water distribution supply lines in WASA Lahore is about 5,444 km.

WASA Faisalabad

At present, about 60% of population in the city is provided with piped water supply facilities. 93.5 MGD of water is being supplied to the consumers. About 15 MGD of water is being augmented in the system through French Project which include 10 MGD of water being supplied through Jhal water treatment plant and about 5 MGD water through installation of 10 tube wells upstream of Rakh Branch Canal. The present water demand to meet the needs of present population is 145 MGD therefore, indicating a deficit of 36.5 MGD in the system. The total water supply connections including domestic, commercial and industrial are 270,451.

Recently, WASA Faisalabad has made different development interventions including enhancement of water resources through French Project with the assistance of JICA, establishment of citizen liaison cell, establishment of water bottling plant etc. The future envisaged Plans also include preparation/Updation of Master Plan, augmentation of water resources by treatment of surface water from Gogera and Jhang Branch Canals, expansion of existing water supply system & rehabilitation of existing machinery, augmentation of Jhal water treatment plant etc.

WASA Multan

At present, about 65% of population in the city is provided with piped water supply facilities. The existing water supply system in Multan is mainly based on groundwater. About 221 MGD (408 cusecs) of water is being supplied to the residential areas from about 102 tube wells with capacity of four (04) cusecs each. The aquifer underlying is unconfined alluvium comprising of sand and clay and is bounded by Chenab River in northwest and the Sutlej River to the southeast. The quality of water is sweet and is fit for drinking purpose. All the tube wells in the city pump directly into distribution system. The depth to water table is reported as 70-80 ft. in Multan. The tube wells are generally installed at depth of 425 ft. at which ground strata available is in good condition. Due to excessive abstraction, the water table is depleting 3.0 ft. per year at different locations.

There also exist reservoirs (18 Nos., 2.35 Million Gallons capacity) in the city, however, these are nonfunctional at the moment. The distribution of water is made through main and distribution pipelines of 3 inches to 24 inches diameter with length of 231 km and 1,049 km respectively. The distribution system is designed for a demand of 50 Gallons Per Capita per Day (GPCD). The supplied water is on intermittent basis and supply is made for duration of 6 hours in a day (2 hrs. in the morning, 2 hrs. in afternoon and 2hrs in the evening).

Further, about thirty two (32) water filtration plants, with capacity of 1,000 gallons/hr. each have been installed in WASA jurisdiction. These plants are further sub divided into twenty (20) arsenic plants and twelve (12) filtration plants to provide treated water to the consumers. These plants are not meant for providing treated water to distribution system, however, the consumers from the adjoining areas come at the plant and fill the bottles for drinking purpose. The feed water for these plants are tube wells. The 1,000 Gallons/hr. capacity water filtration plants comprise sand filter, jumbo filter (5 micron filter media size), activated carbon filter, arsenic removal filter, jumbo filter (1 micron filter media size) and ultrafiltration.

WASA Rawalpindi

At present, about 90% of population in the city is provided with water supply facilities. The major water sources are surface water treatment plants (2 Nos., Rawal Water Treatment Plant and Sanjani Water Treatment Plant) and tube wells (362 Nos., 0.25 cusecs capacity each) in the WASA service area. About 29 MGD of treated water is being supplied in the city through Rawal Water Treatment Plant (23 MGD) and Sanjani Water Treatment Plant (6 MGD) whereas tube wells are contributing about 39 MGD of water to consumers. The groundwater beneath is mixture of confined and unconfined acquirer from where water is abstracted through tube wells. The transmission and distribution of water is made through pipelines of 3 inches to 54 inches diameter with length of 1,250 km. The distribution system is designed for a demand of 40 Gallons Per Capita per Day (GPCD). The supplied water is on intermittent basis and supply is provided for duration of 2-4 hours in a day. In addition, no metering system exists in the city to ensure supplied water to the consumers.

WASA Gujranwala

At present, about 40% of population in the city is provided with piped water supply facilities. About 39 MGD of water from 67 tube wells (4 & 2 cusecs capacity) is being supplied to consumers by WASA through direct pumping for duration of 10-12 hours in a day. There are leakages in the distribution network and hundred percent water connections are unmetered resulting in high wastage of water.

There also exist about ten (10) overhead reservoirs (total capacity 1.58 Million Gallons) in the city of which eight are in working conditions and two (2) are abandoned. The eight working reservoirs include four (04) reservoirs of 300,000 gallons capacity and four (04) of 50,000 gallons capacity respectively. The existing distribution network within WASA service area comprises 481 km of water supply lines with diameter ranging from 3 inches to 24 inches. Asbestos Cement (AC) pipes Polyvinyl Chloride (PVC) Pipes and Galvanized Iron (GI) pipes have been used for distribution system. The distribution system is designed for a demand of 50 Gallons Per Capita per Day.
Water quality is satisfactory in the WASA service area as Gujranwala lies in sweet water zone and water is not contaminated with bacteria and other viruses.

The salient features of water supply system of Five (5) WASAs in Punjab Province is given in Table 1.1

Table 1.1: Salient Features of Water Supply System in Five WASAs (Year 2014-15)

Sr. No.	Water Supply Parameters	WASA Lahore	WASA Faisalabad	WASA Multan	WASA Rawalpindi	WASA Gujranwala
1	Water Source	Ground water	Combination of Ground and Surface Water	Ground water	Combination of Ground and Surface Water	Ground water
2	Total Population (Millions)	9.2	7.19	4.22	4.57	4.66
3	Population Served (Millions)	5.89	1.9	1.43	1.65	0.21
4	WASA served water supply area (km^2)	350	225	365.3	276	25.2
5	Number of Tube wells	528	77	102	362	67
6	Water Coverage	90 %	60 %	65 %	90%	40%

7	Average amount of water supplied (MGD)	450 MGD	93.5 MGD	221 MGD	68 MGD	39 MGD
8	Average per capita water supplied	80 GPCD	25 GPCD	50 GPCD	40 GPCD	50 GPCD
9	Supply Hours	14-18	6-7	6	2-4	10-12
10	NRW (% age)	38.4 %	32.9 %	22 %	43 %	39 %
11	Metering Ratio	5 %	1 %	-	-	-
12	Reservoirs (No. and Capacity)	52, 3.16 Million Gallons	44, 2.2 Million Gallons	18, 2.35 Million Gallons	36, 2.77 Million Gallons	10, 1.58 Million Gallons
13	Total length of Distribution System	5,544 km	1,218 Km	1,280 Km	1,200 Km	481 Km
14	Total Annual O&M Cost (Rs. Million)	7,354	1,652	1,075	700	643
15	Total water supply connections	636,338	270,451	66,900	114,655	26,091

2.4 Key Issues in Water Distribution System

Major key issues encountered in water distribution system after carrying out requisite site visits and discussions with WASA officials are discussed as under:

2.4.1 Nonrevenue Water (NRW)

For every water distribution system, prior to execution, some allowance of unaccounted for water (water losses through leakages in transmission and distribution mains, service connections, illegal connections etc.) is adopted for design of schemes. However, after execution of schemes, water losses in the form of leakages occur more frequently and in more intensity as was the system originally designed to contain it. These losses termed as Non-Revenue Water (NRW) has become an emerging challenge across Five WASAs to improve their existing water distribution systems. It has been observed that this problem is more pronounced in developing counties as compared to developed countries, which is generally reported as 35 % in developing countries.

This NRW can be defined as the difference in water put into the supply and the amount of water to be billed to consumption. It comprises three main components as i) unbilled authorized consumption (water used for public buildings, parks etc.), physical losses (leakages from transmission and distribution mains, valves etc.) and commercial losses (illegal connections, inaccuracies in meters, water theft etc.)

Table 1.2 gives an assessment of Revenue and Non-Revenue water in Five WASAs which shows that about 91 MGD of water is being lost in lieu of NRW against 238 MGD of supplied water at Lahore whereas 8 MGD of water is lost in terms of NRW at Gujranwala against supply of 21 MGD, although this value is minimum among Five WASAs. Figure 1.1 shows graphical presentation of amount of Distributed, Revenue and Non-Revenue water in Five WASAs.

Table 1.2: Present Status of Revenue and Non-Revenue Water across Five WASAs

(Year 2014-15)

Sr. No.	Name of WASA	Distributed Water (MGD)	Revenue Water (MGD)	Non-Revenue Water (MGD)
1	WASA Lahore	238	147	91
2	WASA Faisalabad	112	76	36
3	WASA Rawalpindi	81	46	35
4	WASA Multan	45	36	9
5	WASA Gujranwala	21	13	8

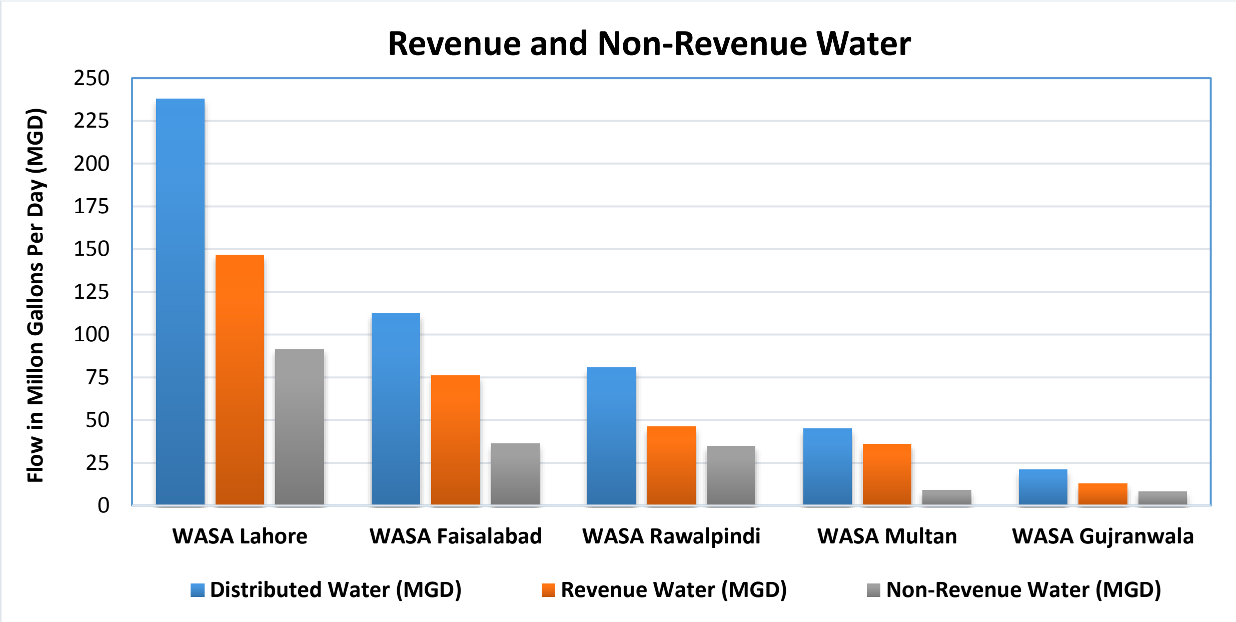

Figure 1.1: NRW Scenario in Five WASAs

From the above figure, it can be realized that NRW is varying on an alarming level and this situation necessitates the need and putting responsibility on five WASAs to develop hundred percent metering system, to account for actually consumed water by the consumers and further replace gradually the old aged pipes in the system. Although among different WASAs, replacement of pipes under Gastro project are being carried out, however, for improving the existing system of each WASA, this should be taken on priority basis. By reducing the leakages in the system will not only improve the water pressure in the system but will also bring improvement in the revenue collection of Five WASAs.

It has been observed after several site visits and discussions with WASA officials that the major contributing factors for NRW among all WASAs include old aged pipe infrastructure, absence of metering system, low pressure in the system, poor maintenance, invisible leaks (due to lack of early detection of buried pipeline leakages) and intermittent water supply. However, the most concerned among above is the presence of old aged pipes in the system. It has also been learnt that old aged pipe lines are contributing about 45 % leakages, inadequate corrosion protection contributing 25% leakages and poorly maintained valves, joints contributing 15 % water losses in the system.

2.4.2 Metering

The metering of water supply within Five WASAs is still in early stage of development. None of WASA has installed meters to ensure supplied water to consumers, except WASA Lahore and WASA Faisalabad, with the share of 30% and 1 % respectively. Out of 30% meters installed, only 5 % are in working conditions (Refer Plate 1). As informed by WASA officials, the major factor responsible for nonfunctioning of meters is the insertion of pressurized air in the installed meters blowing in the vicinity of areas and further rotation of meters, when getting intermittent supply at various intervals in the system.

Due to the absence of meters across Five (5) WASAs, the utility service providers are charging the consumers on flat rate basis, which is not as per actual consumption used by consumers. As a result of it, bills issued are on flat rate basis on the basis of plot size and not on the basis of meters. The Table 1.3 shows metering ratio in Five WASAs.

Table 1.3: Metering Ratio in Five WASAs

Sr. No.	Name of WASA	Metering Ratio
1	WASA Lahore	5 %
2	WASA Faisalabad	1 %
3	WASA Gujranwala	-
4	WASA Multan	-
5	WASA Rawalpindi	-

Plate 1: Domestic Meter at Consumer End

In order to address this problem, installation of extensive meters are required among all WASAs to ensure that consumers pay for their actual consumption. In this context, the domestic as well as non-domestic connections are required to be metered. This will not only check the wastage by consumers but also enable WASA to save revenues on the development of new water sources.

2.4.3 Tariff

At present, all WASAs collect revenues in lieu of providing water and sanitation services through tariff which is imposed on the basis of flat rate, due to absence of meters in the system. The tariff applied in different WASAs are on the basis of plot size varying from 5 Marla to more than 20 Marla for domestic as well as Non domestic connections, although at Rawalpindi and Multan WASAs, commercial connections are not charged on the basis of plot size, rather, it is on actually built assets and on the basis of ferrule size (especially in case of WASA Multan) respectively. Table 1.4 shows comparison of tariff levied on consumers for unmetered domestic connections by Five WASAs in Punjab Province.

Table 1.4: Water Supply Tariff (Rs. / Month) in Five WASAs

Sr. No.	Connections	Plot Size	WASA Lahore	WASA Faisalabad	WASA Rawalpindi	WASA Multan	WASA Gujranwala
1	Unmetered Connections (Domestic)	5 Marla	52	145	98	60	100
		7 Marla	78	242	160	100	125
		10 Marla	131	242	220	100	150
		1 Kanal	223	322	300	175	250
		Above 1 Kanal	311	644	500	250	325
		Above 2 Kanal	311	966	706	250	600

The above table indicates that tariff is lying in the range of Rs. 52 to Rs. 145 per month for five Marla Plot size, with WASA Faisalabad charging maximum tariff of Rs. 145 per month. It is evident from the above table that for 1 Kanal plot size, Tariff is ranging between Rs.31 to Rs. 364, with WASA Faisalabad charging highest tariff of Rs. 644 per month. This situation is also shown graphically in Figure 1.2 which indicates comparison of domestic tariff on unmetered connections in Five WASAs.

It has been observed that the present tariff rates charged by all WASAs for water supply are well below cost price, therefore, a gradual increase of the tariff is necessarily required to ensure equality between cost and tariff. This will not only improve the WASAs financial position but also recover O&M cost from the revenue collection from the consumers in terms of levied tariff on metering system, however, it is suggested that it should be based on an affordable cost to the consumers.

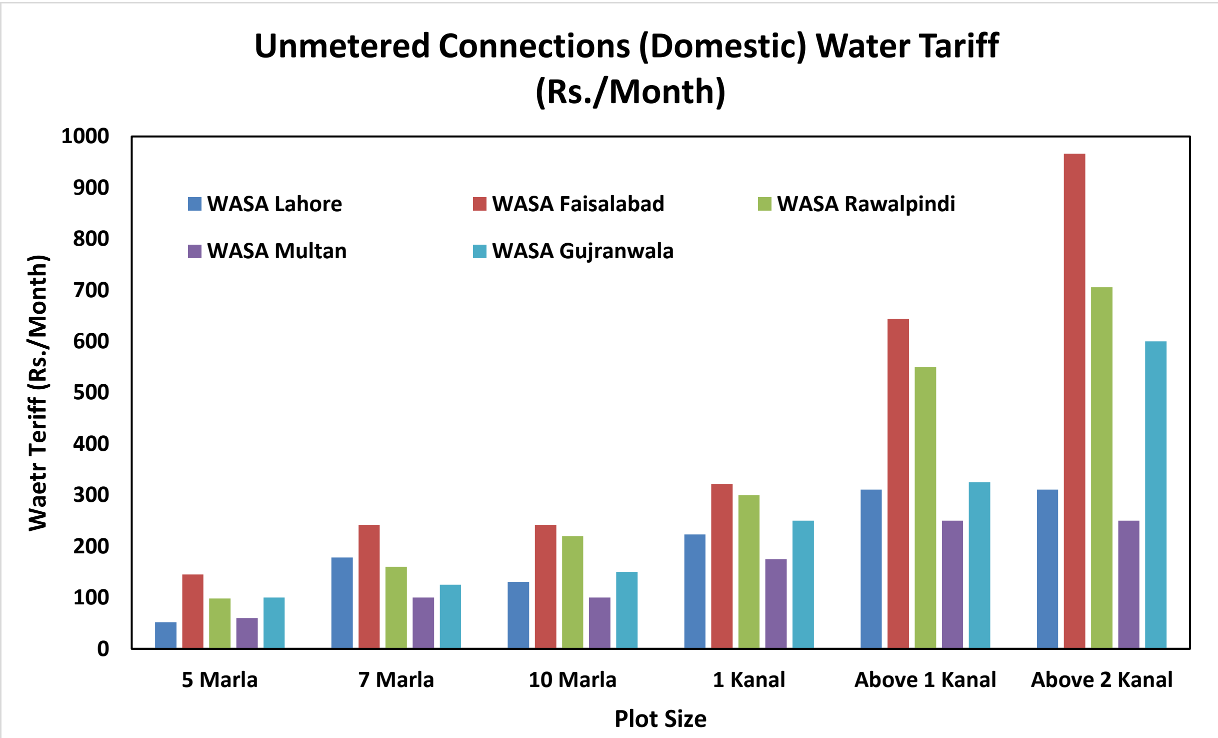

Figure 1.2: Domestic Tariff on Un Metered Connections

2.4.4 Intermittent Water Supply

All the WASAs in Punjab Province are supplying water on intermittent basis for a duration varying from 2 to 18 hours at Lahore, Faisalabad, Gujranwala, Multan and Rawalpindi. The detail of supply hours of different WASAs has already been discussed in previous sub sections. From the existing situation of Five WASAs discussed earlier, it is evident that WASA Lahore is supplying water for maximum duration of 14 to 18 hours among other WASAs and WASA Rawalpindi is supplying water to consumers for minimum duration of 2-4 hours in a day. However, supplying water on intermittent basis is a major contributing factor for inducing contaminated water in the system, especially when consumers (majority of consumers installed their own pumps in all WASAs) suck water from the water mains during non-supply hours. As a result of this, negative pressure is being developed in the system which introduces contaminated water, particularly in vicinity of sewer/drain.

It is also important to indicate here that the adopted practice of supplying water through direct pumping on intermittent basis by five WASAs is the prevailing feasible option under present energy crisis situation which is further aggravated due to high energy costs involved for running the pumps installed at tube well chambers. However, to combat this situation, it is recommended to fully operationalize the already constructed reservoirs for balancing the water demand which at the moment are nonfunctional and only a small number of these are in working condition and are supplying water to consumers.

2.4.5 Low Pressure

Low pressure in water distribution system is more pronounced in areas distant from tube wells which are lacking in getting water of desired pressure. The areas adjacent to tube wells are having good pressures, however, pressure reduces in outer areas. This situation is more or less the same in all WASAs. The present capacity of surface and groundwater sources among Five WASAs is sufficient to meet the average water demand except at WASA Lahore, however, it becomes reduced during peak hour duration demand.

2.4.6 Aging Network

The pipes used for supplying water to consumers by Five WASAs include Asbestos Cement (AC), Ductile Iron (DI), Galvanized Iron (GI), Poly Vinyl Chloride (PVC), High Density Poly Ethylene Pipe (HDPE), Cast Iron (CI) and Mild Steel (MS) Pipe. The AC pipes have mainly been laid more than ninety (90%) in all WASAs along with small contribution of other pipes. The pipe infrastructure laid in all WASAs are very old, more than fifty years ago and as a result, corrosion, pipe leakages and water contamination problems are evident in the system. The leakages not only are contributing less flow (mostly from faulty joints, corrosive portion of pipes) but also effect the availability of adequate water of desired pressure to consumes. As an impact of aging pipes in the system, the carrying capacity of pipes become reducing and pipes cannot sustain high pressure and there are likely chances of bursting of the pipelines upon high pressure. The useful life of different pipe materials used by WASA are given in Table 1.5.

Table 1.5: Age of Pipe Materials used by WASA

Sr. No.	Pipe Material	Age
1	Asbestos Pipes	40 Years
2	Ductile Iron (DI)	30 Years
3	Poly Vinyl Chloride (PVC)	30 Years
4	Cast Iron (CI)	100 Years
5	Galvanized Iron (GI)	25 Years
6	Mild Steel (MS)	40 Years

Although, the water supply pipes deteriorate with the passage of time, however, gradual replacement of the old aged pipes is the most concerned challenging factor reducing leakages and water quality concerns in all WASAs. The five WASAs in this context are replacing old pipe lines in their system through different programs initiated by Government of the Punjab. However, another aspect in which all WASAs are lacking is the absence of equipment for identification of buried pipeline leakages which is resulting wastage of water without knowing its exact location and volume in the system which needs to be addressed by all WASAs.

2.4.7 Water Quality

The water quality among five WASAs varies from each other. WASA Lahore, WASA Multan and WASA Gujranwala are abstracting water from the ground through tube wells and at WASA Faisalabad and WASA Rawalpindi, water is being supplied to consumers through combination of surface and groundwater. The water quality in Multan, Rawalpindi and Gujranwala Districts is relatively good and water is not contaminated with bacteria and other viruses. However, for WASA Lahore and WASA Faisalabad, water quality is of moderate level with arsenic levels at nearly equal to border line value of permissible WHO Guideline value. The water of Faisalabad is also reported as saline and water is not fit for drinking purpose, although in the analysis, Total Dissolved Solids (TDS) are within range, however, it is varying at different locations in the city. In order to address this problem, WASA Faisalabad is gradually shifting to surface water sources, although 3.5 MGD of water treatment plant (with small contribution to Faisalabad water supply demand) comprising slow sand and rapid sand filters already exist at Jhal Khanuana, still these plants are abandoned due to construction of underpass near the plant site. The water quality analysis results of tube wells and surface water sources of Five WASAs are given in Table 1.6 and Table 1.7 respectively.

Table 1.6: Water Quality Analysis Results of Five WASAs (Year 2016-17)

Sr. No.	Water Quality Parameter	WHO Permissible Guideline Value	Water Quality Analysis Results				
			WASA Lahore (Ali Park)	WASA Faisalabad (Mansoora Abad)	WASA Gujranwala (Ratta Road Tube well)	WASA Rawalpindi (Zafar ul Haq Road, UC 42)	WASA Multan (Chowk Nawan Shehr)
1	Appearance	Clear	Clear	Clear	Clear	Clear	Clear
2	Temperature	-	-	-	25 ^{o}C	18	NA
3	Turbidity	5 NTU	0.76	0	0.51	2.5	Unobjectionable
4	pH	6.5-8.5	8.1	7.55	7.1	7.15	6.52
5	Alkalinity	500 mg/l	160		50	200	110
6	Hardness as CaCO3	500 mg/l	136	182	50	175	140
7	Electrical Conductivity	2000 uS/cm	453	432	204	865	710
8	Calcium	200 mg/l	37.6	32	32	61	45
9	Total Dissolved Solids (TDS)	1000 mg/l	285.3	250	143	604	345
10	Chlorides	200 mg/l	37	10	52	10	130
11	Fluoride	< 1.5 mg/l	NA	NA	0.06	NA	NA
12	Arsenic	0.05 mg/l, or	49.2	6.34	0.01	-	Nil
13	Fecal Coliform	Nil/100 ml	Nil	Nil	Nil	Nil	Nil

Table 1.7: Surface Water Quality Analysis of WASA Faisalabad and WASA Rawalpindi (Year 2016-17)

Sr. No.	Water Quality Parameter	WHO Permissible Guideline Value	Surface Water Quality Analysis Results	
			WASA Faisalabad (Rakh Branch Canal)	WASA Rawalpindi (Rawal Water Treatment Plant, Treated Water)
1.	Temperature	-	22	15
2	Color	15 True Color	Colorless	Colorless
3	Odor	Odorless	Odorless	Odorless
4	Taste	Un objectionable	-	-
5	pH	6.5-8.5	7.5	7.28
6	Electrical Conductivity	-	206	790
7	Turbidity	< 5 NTU	21	3.48
8	Total Dissolved Solids	1000 mg/l	143	395
9	Total Solids	-	195	-
10	Total Suspended Solids	-	52	-
12	Calcium	75-200 mg/l	143	56
13	Magnesium	50-150 mg/l	54	-
14	Total Hardness	10-500 mg/l	4	164
15	Carbonates	-	Nil	-
16	Bicarbonates	-	116	-
17	Chlorides	250 mg/l	26	12

It is evident from Table 1.7 that treated water quality of Rawal Water Treatment Plant, Islamabad is good, and all the parameters are within prescribed limits of WHO Guideline values. However, water quality analysis of Rakh Branch Canal near Novelty Pull, Faisalabad indicates that canal water is turbid which shows presence of suspended solids in water, however, all other physical, chemical and bacteriological parameters are within permissible range of WHO Guideline values. Therefore, water at Faisalabad after treatment can be supplied to consumers.

2.4.8 Cross Connections

Cross connection is an important concerning problem common in all WASAs, which is causing contamination of water supply lines in vicinity of sewer/drain. This problem is mainly due to the supplied water on intermittent basis. The old aged pipe infrastructure having structurally week, carrying cracks and corrosion, with leaking joints suck contamination from sewer when pumps are stopped. In order to address this problem, proper horizontal and vertical clearance between water supply pipe and sewer/drain pipe are required to be adopted.

2.4.9 Lack of Records

After carrying out visits to different WASAs, it has been observed that majority of field offices of WASAs lack in maintaining records related to distribution maps, operational and maintenance data, pipe leakages data, water quality analysis results and listing of replacement of goods. Due to the absence of the above data, operational activities some times are affected, although the experienced staff available at field offices handle the problem effectively. However, for a sustainable water supply system, maintaining the operational data is of great significance to operate the system more efficiently.

2.4.10 Inadequate Operation and Maintenance

The pre-requisite for a successful utility provider to operate the system efficiently demands adequate operation and maintenance of the system so that problems at consumers end (less pressure, water quality problem at tap etc.) could be resolved more effectively at much earlier stage. Among all WASAs, after the construction of utility assets, it is handed over to operations department which carry different activities to run the system effectively. However, on the other way around, inadequate O&M results in reduced useful life of the components of the system with outcome of early replacement of components before its due time.

The maintenance in a broader spectrum could be of two types, routine as well as preventive maintenance. Routine maintenance includes replacing the parts of the system components when not in working condition or damaged. However, for preventive maintenance, the activities for maintenance are planned earlier which include visit of networks through road patrolling, cleaning and greasing of mechanical components, maintaining spare goods in the store to keep utility infrastructure in a good working condition.

It is worth mentioning that government is spending several billions of rupees on the development of infrastructure and schemes and these become fail due to unsustainability owing to poor operation and maintenance practices, therefore, all WASAs which already have had large operational departments should invest on the training of their staff, enhancement of technical knowledge through trainings so that they could be able to operate the utility systems in a more organized manner.

2.4.11 Financial Constraints

After discussions with WASA officials and site visits, it was learnt that all the WASAs are suffering from severe financial constraints, expenditures are more than the collected revenue per annum. The government is also providing subsidy of Rs. 200 Million to every WASA for not increasing tariff levied on consumers. Despite all efforts going on, the financial situation of every WASA is still effecting badly every year. The reason behind is the more spending on power cost (about 70% in all WASAs) due to pumping of water through tube wells. In addition, collection of revenue through tariff is quite below the operating cost.

Therefore, to address the financial constraint, increase in tariff is required as per actual consumption, however, on an affordability cost of consumers.

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ACADEMY

Course Code: W1221

O&M of Water Distribution System
Module 1

Participant Lecture Notes
Lecture 2

2016

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1. Lecture Information

Course Title: O&M of Tube Well and Pump Facility	**Course Code:** W1221
Module Title: O&M of Water Distribution System	**Module No:** 1
Lecture Topic: Operation and Maintenance of Water Supply Pipelines and Valves	**Lecture Duration:** 120 Minutes

2. Operation and Maintenance of Water Supply Pipelines and Valves

2.1 Introduction

For any water supply scheme, after execution on the ground, it is the operation and maintenance of the system which plays pivotal role in delivering the reliable and adequate supply of water to the consumers. Aimed this situation, Five WASAs are operating their water supply systems efficiently, however, still the improved service delivery further requires effective operational management of water supply system which at present is also a requirement of meeting sustainable development goals regarding water sector (Ensuring availability and sustainable management of water for all) under UNO Declaration. Although, the rapid urbanization coupled with population increase has produced increased pressure on utility service providers which at present are facing problems due to number of prevailing issues including wastage of water (NRW), inadequate tariff on flat rate basis, aging pipe infrastructure, lack of human resources, absence of training program for human capital etc. Therefore, it is imperative for Five WASAs to improve their operations through adopting better operational practices that will result improved service delivery to consumers.

Regarding O&M of water supply sector, following are the major components:

i) Water supply pipelines
ii) Control Valves (Air valves, Drain valves, Gate/Sluice Valves)
iii) Overhead Reservoirs
iv) Fire Hydrants

This lecture has been divided into different activities which will be carried out, the detail is as under:

2.2 Group Discussion

The lecturer will first invite discussions regarding major challenges being faced by five WASAs in running the system and afterwards will summarize the discussion and highlight the importance of operation and maintenance activities needed to operate the system. In the discussion, pictorial examples of snaps indicating inappropriate O&M will also be shown (Refer Plates 1-2).

Plate 1: An Example of Inappropriate O&M

Plate 2: Improper Storage of Damaged Valves and Pipes in Stock Yard

2.3 Description of Operation and Maintenance (O&M) Activities

2.3.1 Operation

Operation is a terminology which is used to refer daily operations of various components of water supply system such as pipelines, valves, overhead reservoirs, fire hydrants, equipment to deliver reliable and safe supply of water with adequate pressure.

2.3.2Arrangement of Water Supply System

The planning and Design of a water supply system is dependent on many factors including source of water, transmission of water to overhead Reservoir, then onward distribution through distribution pipelines to community. Generally, two types of sources exist:

A) Surface Water
B) Groundwater

The description of surface and groundwater sources is given in Figure 1.1

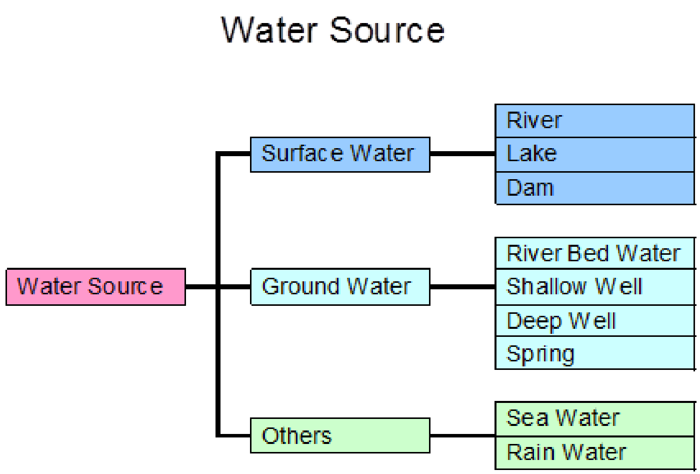


Figure 1.1: Type of Water Sources

In perspective of status of groundwater of five WASAs, it has been observed that groundwater is declining day to day in five utility service areas and it is perassumed that groundwater after 10 years will not be in sufficient quantity to cope the water demand of future population. Therefore, it is imperative to gradually shift to surface water source. In surface water treatment, water after treatment from water treatment plant can be transmitted to reservoir and then distributed to consumers. Figures 1.2 and 1.3 indicate a general arrangement of supply of water through tube well and on the basis of surface water treatment.

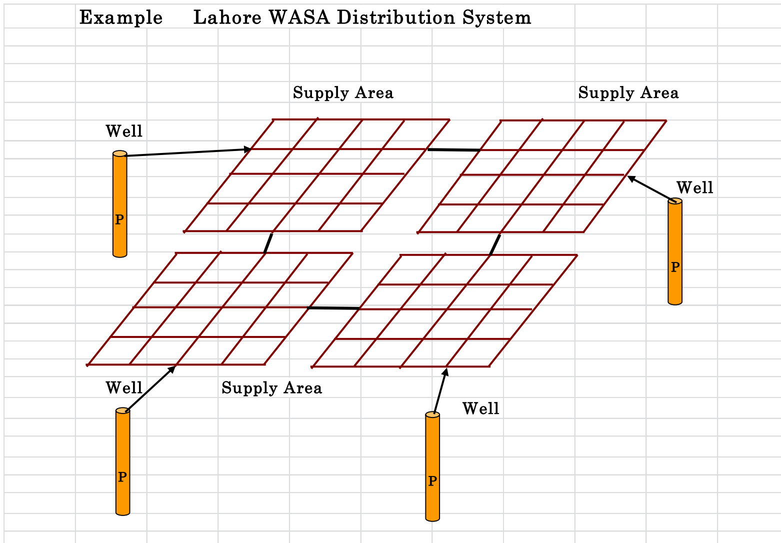


Figure 1.2: Water Supply System based on Groundwater (Tube well)

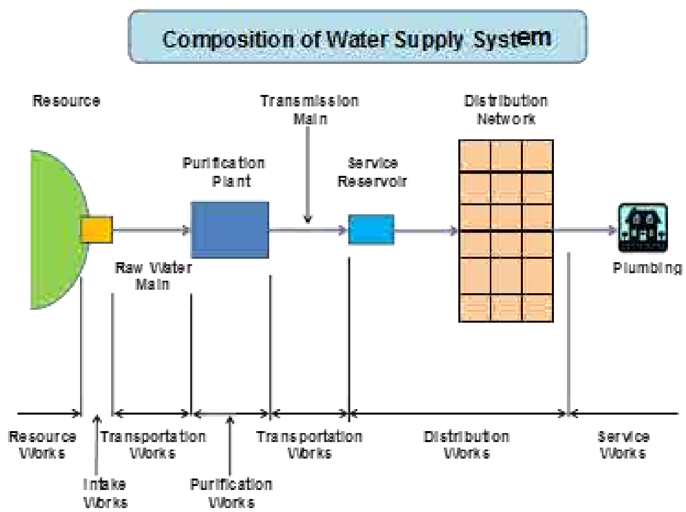


Figure 1.3: Water Supply System based on Surface Water (from intake to Distribution)

In comparison of above two systems, it is obvious that water supply system based on groundwater caters less cost as compared to surface water treatment option. However, due to increase in water quality concerns in all WASAs, the shifting towards surface water treatment has become a requisite to provide treated water to consumers. In this context, it has been observed that the water quality of surface water treatment plant is generally good which in turn reduces water borne diseases linked with contamination present in water and also builds the confidence of public for improved service delivery by utility service providers.

2.3.2 Components of Water Distribution System

The water distribution system includes water resource development, tube wells, pipes, valves, hydrants and appurtenances, the detail is as under:

2.3.2.1 Water Source Development

For any water supply scheme, a staged approach to water source development is necessary for effective use of resources. Though Punjab's major water supply is dependent on ground water sources, but for broader understanding of resources Table 1.1 gives some assessment of different water sources be used as a checklist of major factors considered when assessing and selecting suitable water sources. If a range of water sources is available and choice has to be made, use the matrix ranking to analyze the options. To decide which sources to exploit consider following questions during your source assessment:

- Estimate the yield of existing sources: Is the yield sufficient to meet the demand of water?
- Carry out sanitary survey (Refer Water Safety Plan Lecture 3 for further details) of the existing sources: What measures are needed to safeguard the quality of the source water?
- Determine the time, materials and equipment needed to protect, improve and further develop the existing sources. Compare the advantage of using the existing sources against the development of new sources

Table 1.1 : A Guide to Water Source Selection

Source	Surface water		Groundwater		
	River, Stream, Lake	Rainfall Collection (Rainwater Harvesting)	Spring	Shallow Well	Deep Well
Yield	May be seasonally variable – assess lowest yields	Unlikely to meet total demand; may be used as supplement	Seasonally variable; wide variation between yields of springs	Seasonally variable; wide variation between yields of wells	Yield fairly constant except in droughts; wide variation in

					yields between boreholes
Collection	Stream diversion or pumped abstraction Control access	Collect from roofs or divert surface runoff to ground tanks	Protect and develop gravity flow to supply	Protect and cover; hand or motor pump to storage	Motor pump to storage;
Notes	Often easily accessible and developed if source is near.	Simple to implement if material and equipment is available	Good source Quick to develop for communities small in size.	Needs good organization. It depends on type of soil to be digged for water.	Expensive, High Skills, Specialized Equipment, and time for all type of soils.

Ground Water

The main source of water source in Punjab in most of the WASAs is ground water, which is discussed as under:

Groundwater is water underground that fills the natural openings in rocks and sediments. Recharge is the process whereby rainwater percolates through the soil, and through fractures and joints in rock, until it reaches the water table and joins the groundwater flow system. Like surface water, water underground flows under the influence of gravity. Consequently, groundwater is likely to be closer to the ground surface in the bottom of the valley than at the top of a hill.

Groundwater movement is slower than the movement of water in streams and rivers under the same topography gradient. This is because of the resistance to flow caused by the interconnected system of pore spaces, fractures or solution cavities in rock. The speed of movement is also dependent on the hydraulic gradient. In some alluvial aquifers and rock fractures, the flow rate may be up to a few meters per day, but in other less permeable aquifers, the flow rate is the order of a few meters per year.
A consequence of the slow movement of groundwater is that the water has time to dissolve chemicals from the soils and rock through which it passes. The longer the time spend underground, and the more soluble the rock, the higher will be the level of dissolved solids in the groundwater, indicated by the electric conductivity (EC) . EC

can be measured with a hand-held, battery powered EC meter. If water sampled from a well source has a 'low salinity' (a low EC of say 150μS/cm) then the water may not have had much time to dissolve minerals in the rock. This could mean the water has moved relatively quickly through the aquifer and the any pollution of the upstream groundwater could also move quickly to the well. A slightly saline water (EC of say 1200 -1800μS/cm) may indicate that the groundwater has followed a long travel path. Figure 1.4 and 1.5 show the overview of hydrological cycle and groundwater flow through ground strata.

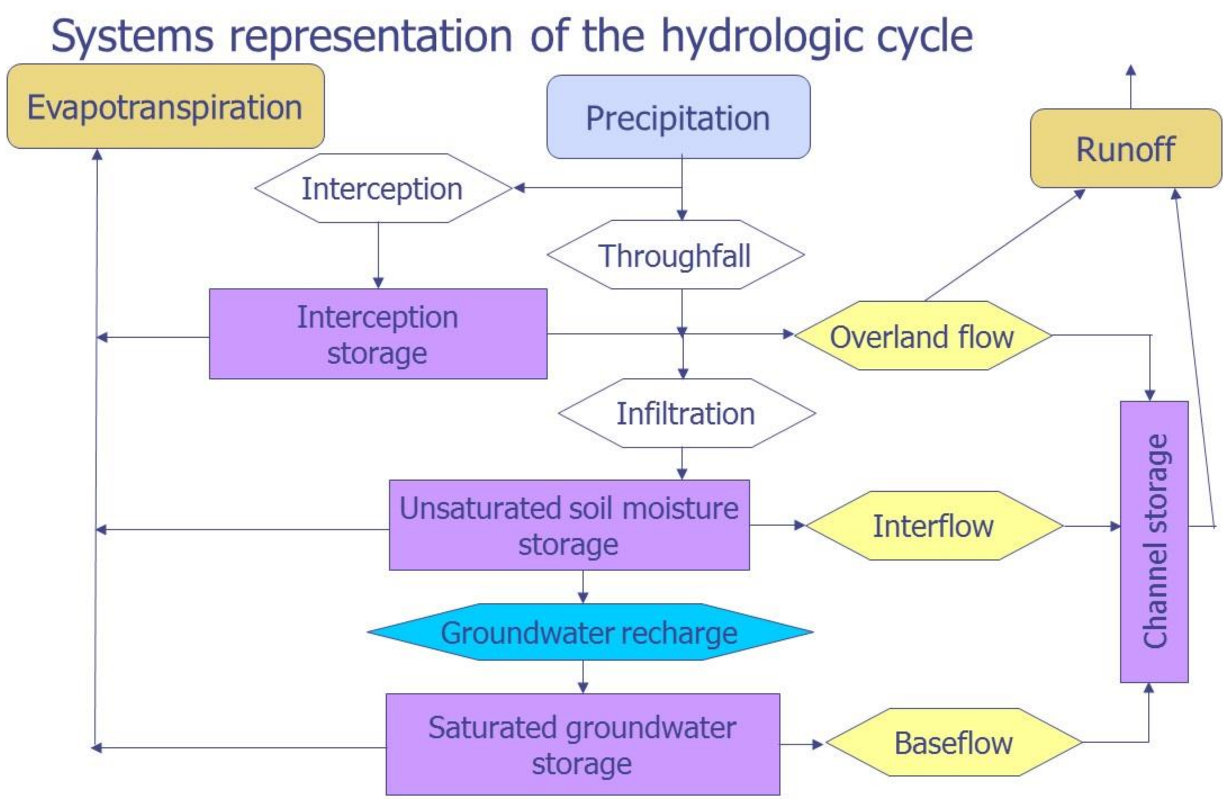
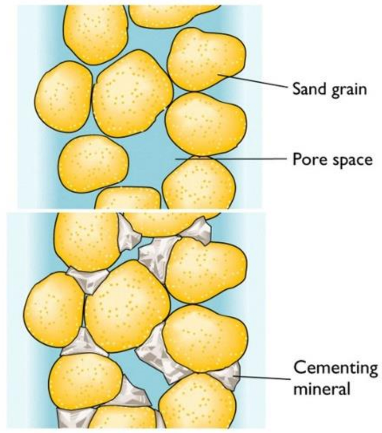
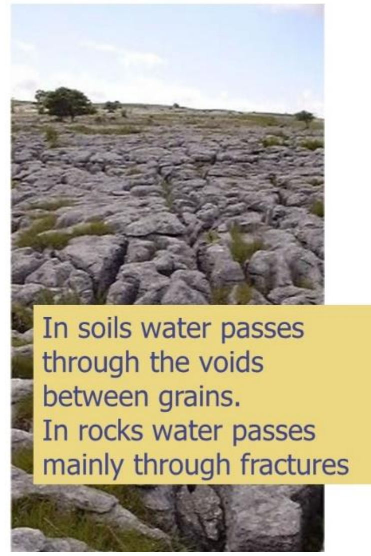
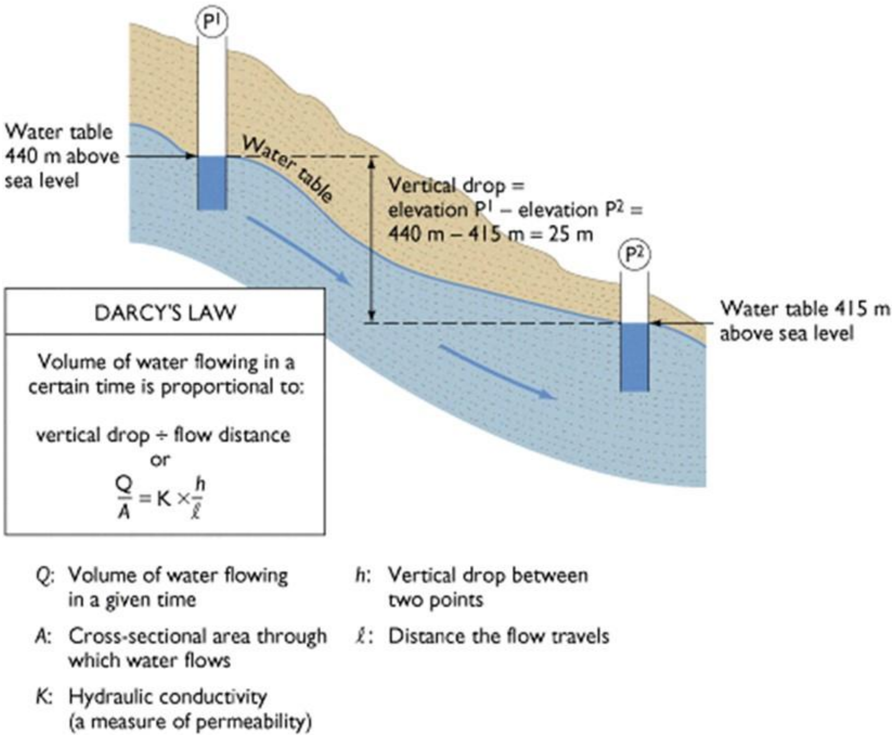


Figure 1.4: Overview of Hydrological Cycle

How Water Flows Through Soil and Rock







BOX E - Classification of Geomaterials:

- Aquifer – soil/rock that can store and transmit water (k>1m/d -for a good aquifer k>30m/d) e.g. gravel, sand, chalk, fractured sandstone.
- Aquiclude – soil/rock that can store water but cannot easily transmit it (k<10^{-5}m/d) e.g. clay.
- Aquifuge – soil/rock that cannot store or transmit water (k<10^{-5}m/d & very low porosity + wide discontinuity spacing) e.g. granite (un-fractured).
- Aquitard – soil/rock that can store and transmit water but their permeability is not sufficient to allow the completion of production wells (eg clays, shales and dense crystalline rocks)

Ground Water Flow :

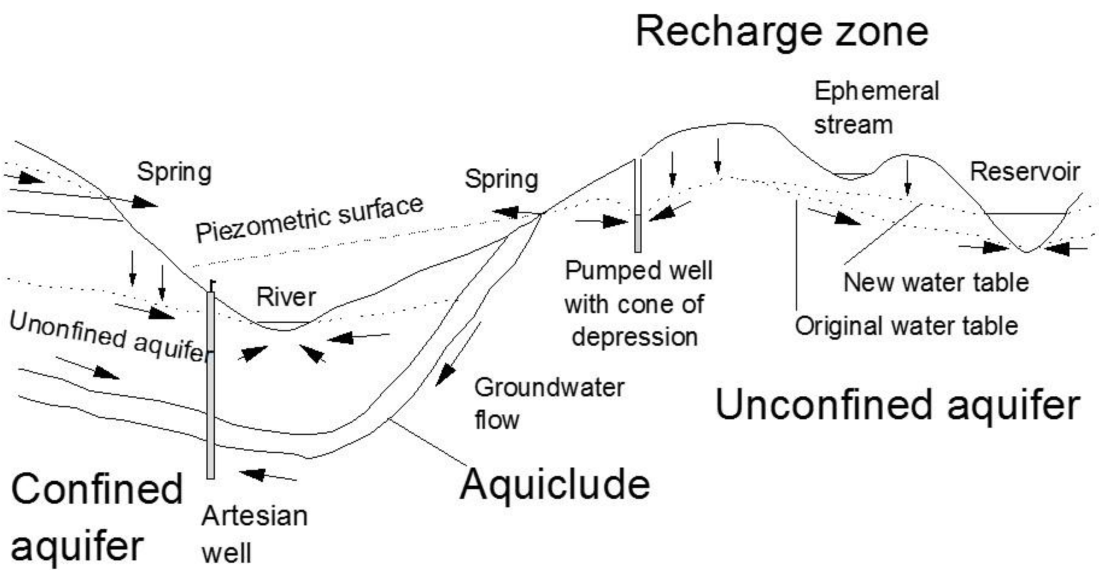


Figure 1.5: Groundwater Flow through Strata

2.3.2.2 Tube well

Tube well is a water well used to draw groundwater to supply onward to consumers. Two types of wells are common given as under:

1. Shallow Wells (Depth of well is less than 30 meters)
2. Deep Wells (Depth of well is more than 30 meters)

The detail of major components of tube well are as under:

a) Housing Pipe/Casing Pipe
b) Strainer/Screen Pipe
c) Blind Pipe
d) Bail Plug
e) Vertical Turbine Pump

Housing Pipe

Housing Pipe is used to maintain an open access in the earth and to prevent any entrance of surrounding formations.

Strainer/Screen Pipe

The strainer is used to keep sand and gravel out of well while allowing groundwater and water from formations to enter into the well.

Blind Pipe

A Plain pipe with no slots which is fixed against an impervious strata.

<u>Bail Plug</u>
Bail Plug is provided at the bottom of pipe and strainer assembly.

<u>Gravel Pack</u>
Gravel is placed around the outside of the screen to prevent sand from entering into the well and to stabilize the well assembly.

<u>Vertical Turbine Pump</u>
Vertical turbine pump is most commonly used in tube well in almost all WASAs, except in WASA Rawalpindi (where submersible pumps have been installed). The vertical turbine pump is driven by a shaft rotated by a motor on the surface. The shaft turns the impellers within the pump housing while the water moves up the column.

2.3.2.3 Service Reservoirs

Service reservoirs are introduced into a water distribution system to provide temporary storage facilities for treated water so that the widely fluctuating daily demand on the system can be met by provision of the minimum pumping capacity and the smallest delivery mains.
As these tank are used for storage of treated water, it is essential that these tanks should be covered and that there should be no leakage in or out that may lead to pollution of the supply.
Common sizes for service reservoirs supply water between ½ to 3 days community supply and they are usually in the form of large rectangular reinforced concrete tanks, with internal columns and concrete roof slab, or in the form of water tower of various shapes.
Obviously the size of the service reservoir required for a particular system will depend on the demand placed on that system.

<u>Functions of Service Reservoir:</u>
Service reservoirs fulfill some or all of the following functions:

- To provide a reserve of treated water that will minimize interruptions of supply due to pump failure or failure of mains,
- To enable a widely fluctuating demand to be satisfied by a constant rate of pumping or treatment and/or by intermittent pumping, and through smaller mains than would otherwise be needed to meet peak rates of demand,
- To act as a break pressure tank where the range of elevation of an area served from a common storage reservoir makes it necessary to sub-divide the distribution system into zones,
- To permit a reduction in the size of distribution mains below that which would be required

in the absence of a reservoir, or to act as an alternative to partial duplication of an existing main as the demand increases,

- To provide a reserve of water for fighting in isolated areas.

Secondary Functions:

- May act as a central storage facility for supplies form 2 or 3 sources so that management problems are alleviated,
- Water at inlet and outlet to the tank is aerated, resulting in fresher water.

2.3.2.4 Distribution Pipelines

Eight pipe materials are extensively used for transmission and distribution of water in water supply system and include Mild Steel (MS), Ductile Iron (DI), Asbestos Cement (AC), Galvanized Iron (GI), Poly Vinyl Chloride (PVC), Unplasticized Polyvinyl Chloride (uPVC), and High Density Polyethylene Pipe (HDPE). These material are widely available and are manufactured and tested according to very stringent codes and standards. The merits and demerits of the above pipes are given in Table 1.2

Table 1.2: Merits and Demerits of Transmission and Distribution Pipes

Sr. No.	Pipe Material	Advantages	Disadvantages
1	Mild Steel (MS)	- High strength for supporting earth loads -Low in cost -Easily handled and transported - Can withstand up to 65 Bar Pressure	- Poor corrosion resistance -Must be lined and protected on the outside against corrosion
2	Ductile Iron (DI)	- High strength for supporting earth loads, less brittle than CI, lighter than CI - Can withstand up to 25 Bar Pressure	- Heavy weight -May require wrapping or cathodic protection in corrosive soils or water, typically lined to limit corrosion

3	Asbestos Cement (AC)	-Rigid -Light weight in long lengths -High tensile strength -Easily tapped, cut -Low friction to water flow -Corrosion resistant to most soils and water -Flexible joints can be used to allow some deflection	-No longer used in new constructions because under corrosive conditions, it can release asbestos fibers harmful to human health -Easy breakage when bent -Difficult to locate
4	Cast Iron (CI)	-Inexpensive -Durable -Ability to withstand high pressure -Easy to install -Leak location straightforward	-Heavy , Brittle, -Corrodes in soft water, water with high chloride reduces carrying capacity -Leaves a metallic taste in water due to leaching of iron
5	Poly Vinyl Chloride (PVC)	-Inert and stable material -Resists corrosion -Cheap -Easy to install -Smooth interior surface -Very low frictional losses	-Very brittle (break or crack easily) - less flame resistant - at higher temperature their strength reduces
6	Unplasticized Polyvinyl Chloride (uPVC)	-Good corrosion resistance -Light weight -Ease of jointing -Low cost -Smooth internal surface	-Brittle susceptible to impact damage -Degradation by certain organic compounds -Susceptible to poor installation practice
7	Galvanized Iron (GI)	-Low initial cost -Toughness -Long life -Easy inspection -Fast assembly	-Contain lead and Corrode easily -Deposits buildup causing blockages
8	High Density Polyethylene (HDPE)	-Flexible -Easily transported because can be rolled -Used in trenchless installations -Lightweight -Resistant to cracking	-Difficult to locate -Fusion jointing require skilled installer and special equipment -Not suitable for large diameters

2.3.2.4.1 Design of Water Distribution Systems (Basics)

The design of water distribution systems requires a knowledge of :

- Demand – not only the total average demand, but also the pattern of demand variation and the likely simultaneous demand from a number of properties
- Mains capacities
- Pressure to be maintained in parts of the system.
- Storage capacity required.

The lecture notes give a guide to factors that should be taken into account, the requirements for individual applications will be defined via national, regional, and local standards

A number of methods of distribution network analysis exist, although the choice is effectively between computer based method like EPANET, WATERGEMS or manual calculations for a small network. This course focuses on EPANET which can be downloaded from website freely, whereas WaterGEMS is expensive software modeling tool.

Following Box D shows Method of Analysis for Water Distribution Network and basic principal :

Box D Methods of Analysis

Exact Mathematics --------------------------Network of "n" separate mains (or elements) hence "n" unknown flows and "n" unknown head losses. Giving 2n simultaneous equations to be solved (Linear) (very difficult and impractical)

Trial and Error --------------------------------Network subject to a number of trials which gradually approach a balance (very time consuming and laborious)

Graphical Methods ----------------------------Producing head loss v/s quantity flow graphs for each main may assist a numerical trial.

Analogue Computer ----------------------------Electrical Model h----------voltage

Q--------- current

(can use transistor electronics)

Hardy Cross Relaxation Method-----------------Assumed flows tried on a circuit >determine flow error

$q = - \sum h / n \sum (h/Q)$

where it is assumed that $h = kQ^n$ Assumed flows are corrected evenly by flow error and a further trial balance made. After several trials q should become insignificantly small (although sometimes individual q values will increase before decreasing with further trials) this method is applicable for small networks. Digital Computers ------------------------------Basically computer programs use 3 conditions Q/h relationship $\Sigma Q = 0$ $\Sigma h = 0$ in any circuit or loop. No convergence formulae necessary but number of trials is greater. EPANET is free software, other commercially available software are WaterCAD, WaterGEMS and WatNET etc.

2.3.2.5 Valves

Following are the valves used in distribution system.

A) Gate Valve/Butterfly Valves

Gate valves are used to provide complete isolation of any section of pipeline by providing electrically/manually operated gate/butterfly valves at selected intervals depending upon the alignment of the supply line.

All isolation valves are placed in reinforced concrete chamber. Provision is also provided for blind flanged take off branches in all chambers for future extension of water supply to other reroute area, if required. Figure 1.6 shows sketch of a gate valve used in distribution system.

Valves should not be closed suddenly as this will cause an immediate increase in pressure (water hammer) which could damage pipe and fittings. Gate valves avoid sudden closure problems because they can only be screwed down relatively slowly. Overtightening gate valves can damage the mating faces and valve threads.

Gate valves should be inspected for leaking valve stems. The stem seal may be a compression packing or an “O” ring. Packing must be tightened only enough to prevent leakage and no further. Packed glands can be temporarily repaired with natural string or other material which expands when wet.

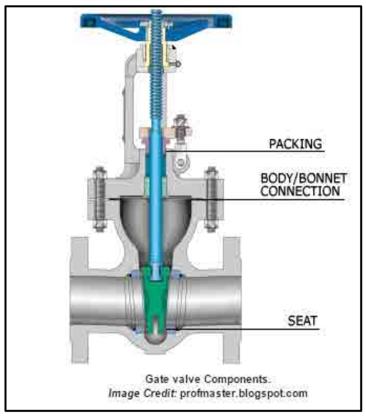


Figure 1.6: Sketch of Gate Valve

B) Air Release Valve

Air Release Valves are used to remove air during pipe filling and to avoid sub atmospheric conditions during transient flows. Air release valves will also be installed at all summit points in the pipelines. Generally, air release valves are double orifice type fitted with isolated gate valves. The air valves will be installed in well ventilated reinforced concrete chamber. Figure 1.7 shows sketch of Air release valve.

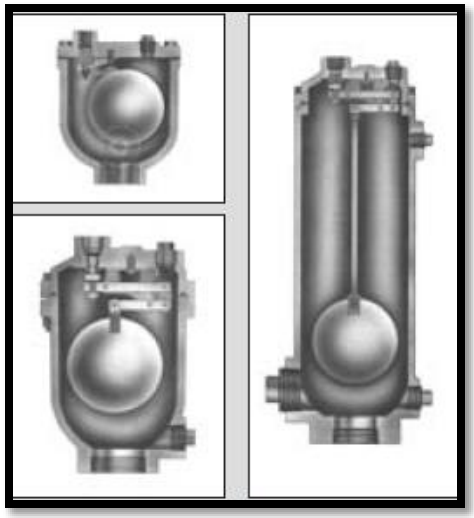


Figure 1.7: Sketch of Air Release Valve

C) Drain Valve/ Wash Outs

At low points in water distribution system, drain valves/wash outs are provided to facilitate the emptying of pipeline for inspection or repair etc. or to drain off the sediments at low points. A tee branch takes off from the pipeline to discharge into a natural ditch through a controlling gate valve. The drain valve is generally installed in a concrete chamber.

D) Altitude Valves

Altitude valves are generally used at Reservoir. An altitude valve is similar in design to a pressure reducing valve and can be adjusted to allow water to fill a reservoir at a controlled rate and is activated by the water pressure from the reservoir to close automatically when the reservoir is full.

E) Pressure Relief Valves

Pressure relief valves are used to reduce pressure in supply lines (mainly transmission lines) caused due to water hammer (A rapid increase in pressure in a water system is called surge or water hammer). Common causes of water hammer include starting or stopping a large pump or opening or closing a valve quickly. Pressure relief valves can be installed at points on a water system to release some of the high-pressure water created by the water hammer.

F) Check Valves/ Non return/reflux

Check valves are used at generally pumping station to prevent back flow of water. A check valve uses a hinged disc which close flow openings when the flow is reversed. Check valves are often equipped with a weight and spring that assists the valve in closing rapidly under flow reversal.

2.3.2.6 Fire Hydrant

A hydrant is an outlet provided in a water distribution main or sub main to tap water for its use during fire. Purposefully, it can also serve the filling of water tankers, if required. During a fire, nearby hydrant is connected to fire hose and water obtained from hydrant is used for extinguishing the fire.

Generally, the type of fire hydrant used in service areas maintained by utility service providers is post type fire hydrant, which lies 0.9m to 1.2 meter above the ground. The post fire hydrant consists of a barrel of Cast Iron (CI) with connection to water main. There is a valve stem with a leather valve at its lower end. The valve stem at the top is connected to a nut to regulate the flow. For opening the hydrant, the nut is opened so as to raise leather valve up and thereby admitting water into hydrant barrel. The hydrant is provided with two, three or four outlet openings. Plate 3 shows Post Type Fir Hydrant in green town area under WASA Lahore Jurisdiction.

Plate 3: Post Type Fire Hydrant at Green Town, Lahore

2.3.4 Operational Action Plan

For ensuring the supply without any interruption and meeting the safe water requirements without any contamination, an operational action plan has emerged as an important tool to be implemented in field including different operational issues, its causes and mitigation measures in the form of different checks to operate the system sustainably. Further, different operational issues like leakages in supply lines, low pressure, and absence of recording pressure in supply lines through pressure gauges etc. has further emphasized the need of operational plan to be developed for improved O&M practices.

The Lecturer will also share the operational action plan (Refer Table 1.3) with training participants for improved O&M development, to apply different checks for efficient operations.

Table 1.3: Operational Action Plan

Sr. No.	Problem	Possible Cause	Mitigation Measures	Key Responsibility
1	Non availability of updated Water Supply Maps	No GIS Map available at WASA operational offices	- Update water supply Maps with clear description of pipe sizes (diameter), location of valves with updated information of pipes replaced after repair - Ensure availability of updated Maps at respective sub division offices	Sub Divisional Officer (SDO), Supervisor
2	Taste and Odor	- High Chlorine Residual - Presence of salts in water	- Lower Chlorine Doze - Apply routine flushing of supply lines or appropriate treatment method	SDO, Supervisor and Operator
3	Turbidity	Due to presence of Silt or Clay in water (suspended solids)	- Apply flushing of pipelines and appropriate treatment Method	SDO, Supervisor and Operator
4	Coliforms or Bacteria	Water contaminated due to inadequate chlorine or ingress of contamination transmitted from sewer line in vicinity of water supply line (due to corroded old aged water supply pipes)	- Increase chlorine doze as per requirement of WHO Guidelines	SDO, Supervisor and Operator
5	Pipeline Leakages	- Corrosion, - old aged pipe infrastructure, - absence of leak detection equipment for	- Repair the Pipeline leakages with appropriate method and material - Ensure Gradual replacement of old aged	Supervisor and Operator

		identification of buried pipe line leakages	pipe infrastructure in the network - Conduct Water Audit on regular basis	
6	House Connection Leakages	- Corroded and substandard material of pipe used for House Connection - Illegal or unauthorized connections - Poor plumbing practices inside house	- Ensure Polyethylene Pipe for House Connection - Ensure provision of meters at consumer end - Ensure standard pipe material for House connection	Supervisor and Operator
7	Leakages of Valves	- Corrosion of Valves - Presence of contaminants in water - Poor maintenance - Worn packing material	- Ensure Periodic Inspection of valve chambers (Air release, sluice valve chamber, drain valve chamber etc.) - Ensure that stuffing boxes of valve are properly packed to prevent leakages - Ensure replacement of ball of air release valve upon requirement - Ensure the valve chambers completely dry. - Lubricate gland bolts with suitable lubricant - Replace cover/bonnet gasket after certain duration	Supervisor and Operator

8	Low Pressure	-Under Capacity pipes present in the system, distant from tube well - Corrosion of pipelines - leakages in supply lines - Interruption of supply from source - Valve in system partially closed	- Control buried pipeline leakages - Replace under capacity pipes with increased sizes as per water demand of the area - Replace gradually old aged pipes in the network - Inspect the valve chamber condition in service areas to identify leakages	SDO, Supervisor and Operator
9	Lack of recording Water abstraction at source and consumption by community	- Absence or presence of faulty bulk flow meters at source (tube well) - Absence of consumer meters	- Provide Bulk Flow meters at sources for recording the flow and ensure hundred percent consumers metering in the system	Supervisor and Operator
10	Loss of Residual Chlorine	- Inadequate quantity of Chlorine Solution (Sodium Hypochlorite) at tube well chamber - Some operational problems linked with chlorine feed pump to supply chlorine in main line at tube well chamber	- Replace Chlorine solution tanks on regular basis at tube well chambers - Check condition of chlorine feed pump to deliver required amount of chlorine solution tank	Supervisor and Operator
11	Lack of Monitoring of Pressure at source and in distribution system	- Absence of pressure gauges at various tube wells - Faulty Pressure gauges	- Ensure presence of pressure gauges at all tube wells - Make repair of faulty pressure gauges on priority basis	SDO, Supervisor and Operator
12	Water loss	-Old and deteriorating pipe network -illegal connections	All connections (domestic and commercial) need to be metered.	SDO, Supervisor and Operator

13	Cross Connection Control	Ingress of contamination from sewer line to water supply lines due to intermittent supply (mainly due to corroded water supply pipe network and rusted leaking faulty joints)	- Proper horizontal and Vertical Clearance between water supply and sewer/drain pipe need to be provided.	SDO, Supervisor and Operator
14	Defective Meters	- Repair Problems - Rotation of meters due to pressurized air and starting of supply on intermittent basis	- Replace defective meters with new meters	SDO, Supervisor and Operator
15	Improper Metering	-Majority connections are unmetered - Faulty Meters	- Ensure metering system at consumers end - Ensure routine repair of meters	Executive Engineer, SDO, Supervisor and Operator
16	Leakages through Reservoirs	- Structural cracks in reservoirs - Internal corrosion of connected piping (inlet, outlet, overflow, bypass pipe) - Improper closure of valves	- Inspect the reservoir on regular intervals from inside and outside - Inspection of connecting pipes and valves on regular basis - Monitor water levels in Reservoirs on regular basis.	Supervisor and Operator

2.3.5 Maintenance

Maintenance refers to contain all the system components (supply pipes, valves, equipment etc.) in a good optimum working order by repair and maintenance. The maintenance can be divided into different types such as i) Routine Maintenance ii) Preventive Maintenance, the detail is as under:

2.3.5.1 Routine Maintenance

The routine maintenance refers to accomplish repair and replacement of parts of the system (pipes, valves, fittings etc.) when damaged or leakages becomes evident from them. This routine maintenance is necessary for running the water supply system effectively.

In addition to above, some emergency repairs may also occur such as outbreak of pipe lines, break down of some equipment. For that purpose, all utility service providers must have a plan of action to deal with emergencies.

2.3.5.2 Preventive Maintenance

The preventive maintenance includes planned activities for maintenance of the system which include visit of networks through road patrolling, cleaning and lubricating the mechanical parts, flushing of pipelines especially dead end supply lines to avoid contamination, maintenance of valve chambers, maintaining utility service goods in stores, replacement of spares with limited design life. For preventive maintenance, the operator should have adequate knowledge of the system, the availability of tools and spare parts in stores, information about different pipe sizes available in store, valves and jointing material.

In addition to above, the planned maintenance of any distribution system being operated by any of WASA further requires defining the clear roles and responsibilities of the staff, availability of proper tools, proper skills adhered by them to do the job effectively. Table 1.4 shows a preventive schedule of activities to be adopted in Five WASAs.

Table 1.4: Required Preventive Maintenance Activities in Five WASAs

Sr. No.	Activity	Frequency of Duration	Key Responsibility
1	Flushing of Pipe Lines	Fortnightly	Supervisor and Operator
2	Patrolling of Water Supply Network (To over view Leakages)	Every Month	Supervisor and Operator
3	Water Quality Analysis	Fortnightly	Laboratory Incharge and WASA Sub Division Staff
4	Checking of Pressure in Supply Lines	Daily	Supervisor and Operator
5	Inspection of Bulk Flow Meters	Every Month	Supervisor and Operator

6	Inspection of Consumer Meters	Every Month	Supervisor and Operator
7	Reservoir Cleaning	After every 6 Months	Operators
8	Inspection of Valve Chamber	Every Month	Supervisor and Operator

In addition to the activities as per table 1.4, the Lecturer will also share Repair Action Plan (Table 1.5) with training participants for their implementation during field work, required to ensure the system to be operated on sustainable basis.

Table 1.5: Repair Action Plan

Sr. No.	Problem	Possible Causes	Mitigation Measures	Key Personnel Responsibility
1	Corrosion of Pipe Line	- Due to completion of service life of pipe - Excess dosage of chlorine in pipeline, adversely affecting material of pipe	- Ensure replacement of corroded pipe portion with new pipe - Painting of pipelines if present on ground (especially walled city) - Ensure chlorine dosage as per requirement	Supervisor and Operator
2	Leakages through Pipelines	-External or Internal pipe Metal Loss due to developed cracks - Faulty and corroded Joints - Aging Pipe Network	- Ensure Replacement of damaged pipe portion with new one - Undertake Regular maintenance audit in service areas	Supervisor and Operator
3	Leakages of Valves (at seat, at cover/bonnet, at gland packing)	- Corrosion of seat - Settling of Gasket as a result of temperature variations - Worn packing material - Poor maintenance	- Ensure reseating of valve disc - Retighten the bolts at bonnet - Retight the gland packing at nuts - Check opening and closing of valve - Ensure periodic inspection of valve chambers	Supervisor and Operator
4	Valves hard to operate	- Damaged Seat - Valve not fully lubricated	- Provide valves with proper lubrication	Supervisor and Operator

5	Ineffective inventory control system for spare parts and supplies	- Poor Inventory System, based on recording listing of spare parts in registers	- Ensure computerized system at stock yards - Provide adequate inventory of maintenance items	

2.3.6 Updation of Water Distribution System Mapping

One of the major concern regarding improved operations of utility service providers is the presence of updated maps of the water distribution system in respective sub division of WASA. The updated map should include all the system information including location of tube wells, distribution mains (diameters), location of hydrants, location of various controlling valves (gate valve, air release valve, drain valve), reservoirs and different zones of variation of pressures.

The updated maps of the water distribution system will be required to carry out maintenance of the system in more appropriate way thereby leading a major mile stone for sustainable O&M.

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ACADEMY

OJT Implementation Plan

Lecture Topic: Checking of Residual Chlorine in Supply Area **Date :** October 27, 2016

Academy Trainer(s):- Mr. Tajiku Okubo, Mr. Zia Mustafa **OJT Trainer(s):** Mr. Tajiku Okubo, Mr. Zia Mustafa

Day	Place	Target knowledge & skills	Equipment/ Machinery/ Material	Step by step procedure	Time	Evaluation
October 27, 2016	Green Town WASA Sub Division	- The Participants would be able to measure the Residual Chlorine in supply area - Ability to identify contamination in different segments of the supply area	DPD (N,N Diethyl-P-Phenylenediamine)	- Put free available chlorine reagent in sample tube. - Fill sample tube with water - Cap the tube and shake. - The color of violet indicates the amount of free chlorine present. Compare with standard colors to determine the	Whole Day	The Participants will provide Reflection Report after site visit.

				amount of chlorine residual. - Put total chlorine reagent in sample tube and shake - Wait 3 minute then once again compare with standard color to determine amount of total chlorine - Subtract free available chlorine (chlorine residual) from total chlorine to determine combined chlorine.		

ALJAZARI
ACADEMY

OJT Implementation Plan

Lecture Topic: Checking of Pressure in Supply Area **Date :** October 27, 2016

Academy Trainer(s):- Mr. Tajiku Okubo, Mr. Zia Mustafa **OJT Trainer(s):** Mr. Tajiku Okubo, Mr. Zia Mustafa

Day	Place	Target knowledge & skills	Equipment/ Machinery/ Material	Step by step procedure	Time	Evaluation
October 27, 2016	Green Town WASA Sub Division	- The Participants would be able to operate and measure the pressure in supply area - Ability to identify low pressure areas in distribution network to address improvement in water distribution network	Pressure Recorder FJN -501 (through graph inside the gauge for specific hours)	- Unfasten the clip and open the front cover. - Push down the pen lifter to lift up the lift arm, Remove chart paper holder by pulling upward, remove the used one and put new chart. - Before mounting the chart paper, check battery	Whole Day	The Participants will provide Reflection Report after site visit.

				status. Turn the knob to 4 hour position and confirm if the Led light ON and OFF for 1 minute than status is good, if Led does not light up, change the batteries. - Remove the cap of cartridge pen and fit on pen holder, Release the Pen lifter and put down the pen arm so that the pen point will touch the chart paper softly (After use remove the pen from arm and place cap back on it to be avoid from dry of pen tip). - Confirm if the pen point is located on the line of zero, if it is not on zero, adjust it with the help of screw on the arm of pen. - Route the chart paper Disc so that		

				the pen point will come to the starting point, when the recording work is finished then pen point will come to the starting point. - Always turn the knob to OFF, before changing chart paper. - Close the front cover after cleaning the water proof packing. - Connect the hose with meter (valve side) - After use, remove the connecting hose after releasing air completely by use of Air bleed knob. - Pour out some water from valve for removal of dirt as well as air, with whom you want to attach pressure recorder.		

Course Code: W1221

O&M of Water Distribution System
Module 1

Participant Lecture Notes

Lecture 3

2016

1. Lecture Information

Course Title: O&M of Tube Well and Pump Facility	**Course Code:** W1221
Module Title: O&M of Water Distribution System	**Module No:** 1
Lecture Topic: Water Safety Plan linked with Distribution Pipelines and Reservoir	**Lecture Duration:** 120 Minutes

2. Water Safety Plan linked with Distribution Pipelines and Reservoir

2.1 Introduction

Water quality has emerged as one of the key issues adversely affecting the health of wellbeing, with spread of water borne diseases. Conventionally, water quality is measured at selected points (at various tube wells), however, need for management of water quality from source up to distribution taps still remains important challenge for service delivery providers. In the perspective of five (5) WASAs, it has been observed that some of the WASAs (WASA Lahore, WASA Multan, WASA Gujranwala) are using groundwater for supply to consumers whereas, rest of two WASAs (WASA Rawalpindi, WASA Faisalabad) are using combination of groundwater and surface water. In this regards, water quality of five WASAs also varies from each others. The reported water quality in Multan, Rawalpindi and Gujranwala Districts is relatively good and water is not contaminated with bacteria and other viruses. However, for Lahore and Faisalabad Districts, the reported water quality is of moderate level with arsenic levels at nearly equal to border line value of permissible WHO Guideline value. Therefore, for addressing the concerns of safe drinking water, it is imperative to develop water safety plan incorporating safe water concerns from source to distribution system. The WSP developed would cover probable potential water quality hazards, its major causes and control measures in distribution system. The WSP generally comprises the following components:

a) Assembly of Team for preparing WSP
b) Description of Existing Water Supply System
c) Identification of Hazards
d) Prioritization of the Risks
e) Development and Implementation of an Improved Plan
f) Monitoring of Control Measures

This lecture has been divided into different activities which will be carried out, the detail is as under:

2.2 Current Management Approaches

There is a wide range of both chemical and microbial contaminants that may be found in drinking-water, some of which can have adverse health effects on consumers. These can be derived from a number of sources including, in some instances, the water treatment process. Understanding the nature of sources of contamination and how these may enter the water supply is critical for assuring water safety. For instance, arsenic has become a major international **concern** in groundwater where it occurs from a geological source and it is primarily controlled through source selection.

BOX 1.1
Water supply systems can be considered as a number of steps aimed at assuring the safety of drinking-water, including:
• preventing pollution of source waters;
• selective water harvesting;
• controlled storage;
• treatment prior to distribution;
• protection during distribution; and
• safe storage within the home and, in some circumstances, treatment at the point of use.
These steps can function as barriers, where activities are designed to minimize the likelihood of contaminants entering the water supply or reduce or eliminate contaminants already present in the supply. With the multiple barrier approach, each barrier provides an incremental reduction in the risk of water becoming unsafe. If there is a failure at one point, the other barriers continue to provide protection

2.3 Framework for Safe Drinking Water and Water Safety Plans.

The Guidelines for Drinking-water Quality WHO outlines, a preventive management framework for safe drinking-water that comprises five components (summarized in Box 1.2), three of which combine to form the water safety plan.

BOX 1.2
Key components:
• Health based targets (based on an evaluation of health concerns).

• System assessment (to determine whether the water supply chain (from source through treatment to the point of consumption) as a whole can deliver water of a quality that meets the health-based targets.
• Operational monitoring of the control measures in the supply chain, which are of particular importance in securing drinking-water safety.
• Manangement plans (documenting the system assessment and monitoring; describing actions to be taken in normal operation and incident conditions – including upgrade and improvement), documentation and communication.
• A system of independent surveillance that verifies that the above are operating properly.

A water safety plan, therefore, comprises system assessment and design, operational monitoring and management plans (including documentation and communication).
The objectives of a water safety plan are to ensure safe drinking-water through good water supply practice, that is:
• to prevent contamination of source waters;
• to treat the water to reduce or remove contamination that could be present to the extent necessary to meet the water quality targets; and
• to prevent re-contamination during storage, distribution and handling of drinking-water.

2.4 Group Discussion

The lecturer will first invite discussions regarding water quality problems being faced by five WASAs, with their remedy adopted by these WASAs and afterwards will summarize the discussion and highlight the importance of development of WSP. In the discussion, pictorial example of snap indicating hand allergic spots due to excessive arsenic concentration in water as a result of poor water quality will also be shown (Refer Plate 1).

Plate 1: Example of Waterborne Diseases in Children

2.5 Description of Water Safety Plan (WSP)

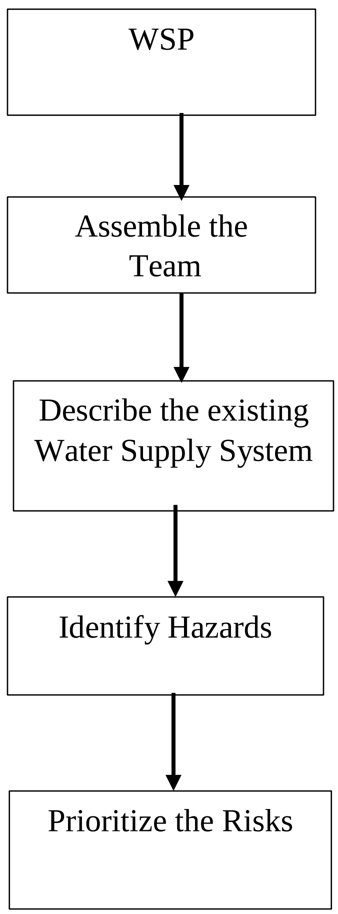
The Lecturer will first share the definition of WSP with training participants, then onward detailed components of WSP would be discussed.

2.5.1 Definition of WSP

Water Safety Plan is a tool to address the water quality concerns from source to tap in distribution system incorporating possible expected hazards, their possible associated risk setting (risk levels) and finally control measures to address those hazards.

2.5.2 Developing Water Safety Plan (WSP)

The Lecturer will discuss major components of WSP in detail with training participants. Figure 1.1 shows detailed framework of water safety plan involving different activities for its development.



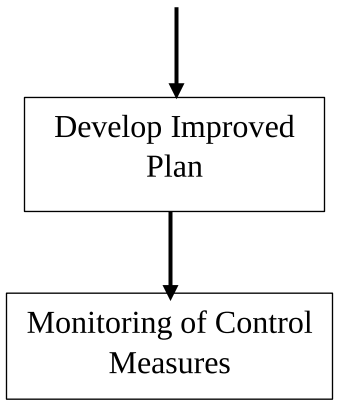


Figure 1.1: Water Safety Plan (WSP) Framework

The detail of various components of WSP is as under:

A) Assemble the Team for WSP

The first step for WSP includes assemble of a dedicated team with adequate operational experience of running the utility, mainly taken from WASAs. The major role of team would be to identify all possible hazards, linked with water quality of distribution system and implementation of control measures in lieu of wsp as a part of their daily routine activities.

B) System Assessment

The second step for WSP is the assessment of existing water supply system, including location of tube wells, their capacity, supply line sizes (diameter), flow rate, location of valves, Fire Hydrants, water quality data in the form of reports at different locations, treatment processes, disinfectant used etc. A system Flow Diagram will also be developed covering detail of all components of water supply system from source up to consumers. In comparison of five (5) WASAs, it has been observed that in case of WASA Rawalpindi and WASA Faisalabad, the source of water is combination of groundwater and surface water whereas for WASA Lahore, WASA Faisalabad and WASA Gujranwala, source of water is groundwater. The system flow diagram based on ground and surface water sources is shown in Figure 1.2 & 1.3

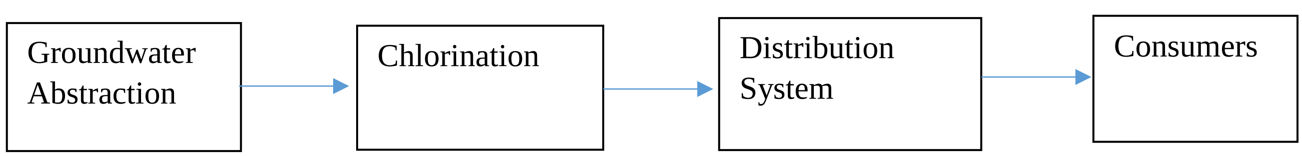


Figure 1.2: System Flow Diagram based on Groundwater Source (WASA Lahore, WASA Multan and WASA Gujranwala)

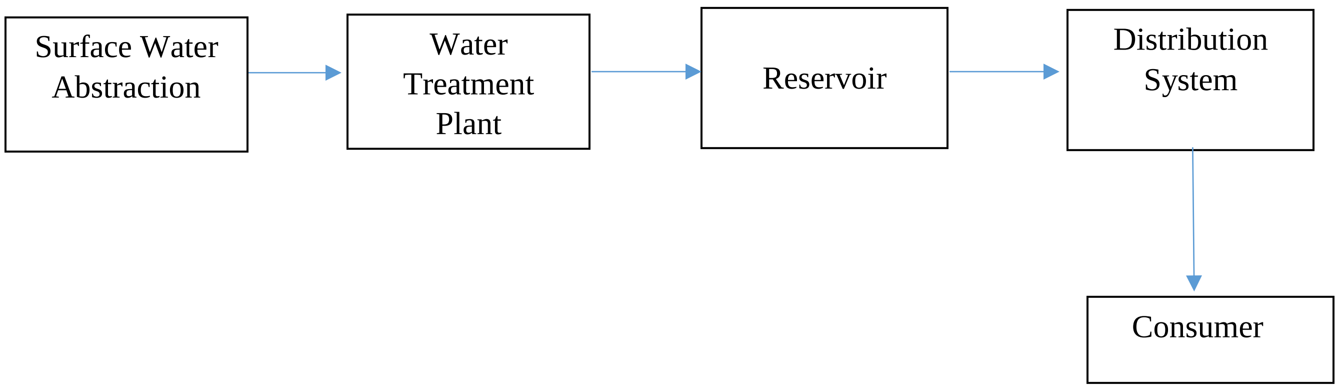


Figure 1.3: System Flow Diagram based on Surface Water (WASA Rawalpindi, WASA Faisalabad)

After developing the conceptual flow diagram of the system, it is essential to confirm the detail of all the components of water supply system (as indicated in system flow diagram) in field as a first step of developing WSP.

C) Hazard Identification and Setting Risk Level

After system Assessment, hazard identification and setting of risk level is required to be determined and in this regard, hazard identification can be defined as the identification of possible potential hazards adversely affecting the quality of water from source to distribution supply lines. Then prioritization of risks associated with different hazards is calculated and risk level is determined. Table 1.1 shows a detail of hazard analysis, associated risk levels with frequency of hazard to be occurred on monthly basis, once in few months, once every 1-3 years, once every 3-10 years.

Table 1.1: Hazard Analysis and Setting Risk Level

Hazard Analysis **Risk level matrix**

				Severity of damage				
				Almost no	Requires consideration	Slightly significant	Important	Worst
				No effects observed	unsatisfactory, but not serious enough for people to turn to other drinking water	Serious enough to turn to other drinking water	May affect health	May result in fatalities
				1	2	3	4	5
Frequency of hazard	Frequently	Every month	5	5	10	15	20	25
	Often	Once every few months	4	4	8	12	16	20
	Occasion-ally	Once every 1 to 3 years	3	3	6	9	12	15
	Rarely	Once every 3 to 10 years	2	2	4	6	8	10
	Almost never	Once every10 years or less frequently	1	1	2	3	4	5

From the above table, the frequency of hazard level 5 indicates high frequency of occurring and level 1 indicates minimum frequency level. The risk level can be calculated by the following formula.

Risk Level = Frequency x Severity

Further, to elaborate the potential hazards linked with Distribution System including physical hazards (presence of sediments in water), chemical hazards (chemical agents like copper, lead etc.) and biological hazards (bacteria, protozoa etc.) , their risk severity and then control measures to combat the hazard at each stage, a plan would be required to address all these aspects.

The Lecturer will then share the Water Safety Plan (Refer Table 1.2) for water distribution system with training participants to enhance their knowledge regarding safe water supply from source to distribution system.

Table 1.2: Water Safety Plan (WSP) for Water Distribution System

Sr. No.	Hazard type	Problems with associated hazard	Control Measures	Key Responsibility
	Water Source			
1	Microbial and chemical Hazards	-Deterioration of water quality due to Natural Factors (seasonal variations, soil aggressiveness) -Deterioration of water quality due to wastewater discharges (major source of pathogens) -Deterioration of water quality from surface runoff infiltration (pesticides, fertilizers, livestock and agricultural)	-Good practices of source protection through installation of filtration plant -Implementation of Industrial effluent standards and volume controls -Implementation of Codes of practice on agricultural chemical use and slurry spreading	SDO, Supervisor, Operator
	Transmission Mains			
1	Microbial Hazard	- poor water quality due to source contamination - deposits of sediments - disinfection failure due to high loads of organic contents in water from source	- Stop the flow of water by closing valves of problem area - Provide a temporary bypass or alternative supply line, if possible - Water sampling and its testing	SDO, Supervisor, Sub Engineer
2	Structural Hazard	-Contamination due to poor jointing - Deterioration of pipe materials - Ingress of contaminated water from leaking valves	-Apply periodic Inspection of supply lines - Gradual replacement of old aged pipe infrastructure - exercising of valves	SDO, Supervisor, Sub Engineer

	Reservoir			
1	Microbial hazard	-Poor water quality due to inadequate disinfection method - shorter detention times	-Minimizing ingress of contamination to system and lengthening reservoir detention times. -Fitting alarms triggered by low disinfectant level. -Ensure inspection covers and ventilator covers remain in place	SDO, Supervisor, Sub Engineer
2	Structural failure hazard	- leakage of water through reservoir - leakage from partially open valves - taste in water due to internal corrosion of pipelines - deterioration of internal lining of reservoir	-Regular reservoir inspections (external and internal) -Proper opening/closing of valves - proper pipe material as per specifications should be used - relining/ painting of internal surface - routine inspection to see any failure in piping and lining	SDO, Supervisor, Sub Engineer
	Distribution Supply lines			
1	Microbial and Chemical Hazards	- Low chlorine residual in distribution system - Ingress of contamination due to pressure fluctuations -Reversed flows due to quick opening or closing of valves -Contamination due to unapproved material use for piping -Contamination by backflow due to unauthorized connections	- Maintain chlorine residual in the system as per requirement - Pressure Management - Apply flushing of pipelines - Disinfection prior to commissioning of water main - Follow design specifications for water supply system	SDO, Supervisor, Sub Engineer

		- contamination during water main repair due to debris, soil or groundwater remaining in the main after repairs -Cross connection between water system and another system carrying non-potable water		
2	Structural failure hazard	-Ingress of contamination due to main burst - ingress of contamination due to cracks in pipelines -ingress of contamination due to improper closure of valves	- repairing and rehabilitation of pipelines - routine preventive maintenance of pipelines and valves - use of approved pipeline types	SDO, Supervisor, Sub Engineer

D) Develop, Implement and Maintain an Improved/Upgrade Plan

Another important step in devising WSP is to overview the effectiveness of existing procedures adopted by utility service providers for water quality concerns and if these procedures are not adequate to address water quality issues, the upgradation of the plan will be needed to be developed through improved procedures to control the potential hazards associated with water supply system. This step would further require putting clear roles and responsibilities of the utility personnel to identify hazards in supply system and then onward implement control measures.

E) Monitoring of Control Measures

The monitoring of control measures is an important concern to review the effectiveness of water safety plan. Various tests that need to be applied in daily operations of WASA regarding water quality include measuring turbidity, pH, chlorine residual, pressure changes in the service area and periodic inspections of infrastructure.

In addition, some activities like active leakage detection and its prevention, treatment of water through multi barrier (in different stages in case of surface water source), pressure management would further ensure the safe water to consumers.

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Course Code: W1221

O&M of Water Distribution System
Module 1

Participant Lecture Notes - HSE
Lecture 4

2016

1. Lecture Information

Course Title: O&M of Tube Well and Pump Facility	**Course Code:** W1221
Module Title: O&M of Water Distribution System	**Module No:** 1
Lecture Topic: Health Safety Environment (HSE) linked with Water Distribution System	**Lecture Duration:** 60 Minutes

2. Health Safety Environment (HSE) linked with Water Distribution System

The Health, Safety, Environment (HSE) has received much attention from economists both in government and industry. Although costs are often considerable, and regulations mandatory, the resulting benefits through a healthier workforce and increased productivity are potentially large enough to more than pay for the costs. Most studies focus on the benefits related to improved health.

Generally, Benefit studies such as cost of illness comprise of three main types - national, company and individual. Most studies were done at the department level. These studies measured a range of benefits in estimating cost-benefit ratios or the costs of illness. A range of benefits of occupational safety and health interventions are presented in Table 1.1. Studies have shown that the benefits included have important implications for conclusions. For example, Fahs et al (1997) argues that econometric models to estimate net social benefits of occupational risk reduction significantly underestimate the net social benefits due to omitting the economic benefits of healthier workers. Conversely, they argue that the models tend to overestimate the social costs of industry regulation, since potential savings in averted health care costs are ignored for worker whose occupational disease is prevented. Another choice for benefit inclusion concerns which occupationally related injuries and diseases to include, since some will account for the majority of costs.

Table 1.1. Health and Non-Health Benefits of Occupational Safety

Benefits related to health effects	Benefits unrelated to health effects
Individuals	Individuals
Health benefits Income losses & fringe benefits averted from reduced illness or injury	Improved job satisfaction Improved working climate

Medical care costs avoided Non-medical rehabilitation costs Unpaid family or community care Reduced home production and leisure time of worker Reduced avertive expenditures due to safer environment	
Departmental	Departmental
Medical care costs avoided Non-medical rehabilitation costs Absenteeism or sick leave (productivity impact) Personnel turnover costs and friction costs Administration costs of sickness absence Reduced liabilities and legal costs Reduced danger money in wages Reduced avertive expenditures due to safer environment Reduced social security disability benefits	Productivity of new machinery Improved quality of products Competitiveness of regulated industry Improved working climate Less damaged equipment Company image effects Impact on non-economic company values
National	
Lost production Morbidity (days spent not producing/earning) Mortality (loss of production) Police and fire services not used	

(Source: Mossink et al, 1998)

Production losses, medical costs and avertive costs saved as a result of improved HSE has been shown to be enormous, even for developed countries that already have strict occupational safety regulations. Mossink et al (1998) emphasise the need to take a societal perspective, as investments at the department level eventually means less expenditure by government on health care and less expenditure by individuals on avertive or corrective behaviour (Aaltonen and Soderqvist, 1988). Non-health benefits have been given little attention, although several studies have recognised increased productivity due to rationalisation associated with HSE interventions, as well as less damaged equipment and buildings through less accidents and fires. For the individual, there may be greater job satisfaction and improved working climate, but no studies have examined these benefits.

With more specific to HSE conditions at work places, it is essential to maintain health, safety, environmental conditions at work places to protect workers workers and general public from potential hazards associated with unsafe work practices, injuries resulting due to accidents at site has emerged as one of the basic requirement under OHSAS 18001 standards for water distribution pipelines and appurtenances for their repair or new installation. In comparison of five WASAs, it has been observed that no HSE practices are adopted while working in field for water distribution system except partially reporting of accidents or injuries. Therefore, this still remains a challenge for five WASAs to opt good safety practices for workers and general public in field to safeguard them from work hazards. Further, as per OHSAS standards 18001 and 18002 for ensuring HSE Management system at sites, it is imperative to firstly assess the potential hazards with reference to health and safety aspects, determine their risk levels and then implement control measures in the form of a Action Plan to curtail these hazards.

This lecture has been divided into different activities which will be carried out, the detail is as under:

2.1 Group Discussion

The lecturer will first invite discussions regarding HSE practices being implemented by five WASAs and afterwards will summarize the discussion and highlight the importance of HSE while working in Field. In the discussion, pictorial example of snaps (Refer Plates 1-2) of unsafe conditions during repair of water supply lines and valves in field will also be shown.

Plates 1-2: Example of Unsafe Working Conditions at Site

2.2 Description of Health, Safety, Environment (HSE)

The Lecturer will first share the definition of HSE with training participants then onward detailed components of HSE would be discussed.

2.3.1 Definition of HSE and its Components

HSE is an important tool regarding maintaining health, safety and environmental considerations (as per requirement of OHSAS 18001 standards) for any operational activity of water distribution system which is necessary to safeguard the workers' health, apply safe practices at work place, reduce injuries due to accidents at sites and maintain general environmental conditions at site.

Health

The absence of disease, for example asbestos creates a health risk because if you inhale asbestos dust you may contract lung cancer. The protection of the bodies and minds of people from illness resulting from the materials, processes or procedures used in the workplace.

Safety

The absence of risk of serious personal injury for example walking under a load suspended from a crane during a lifting operation is not safe because if load falls serious personnel injuries or death could result. Staying out of danger area results safety and protection of people from physical injury. The borderline between health and safety is ill-defined and the two words are normally used together to indicate concern for the physical and mental well-being of the individual at the place of work.

Environment Protection

The environment protection include arrangements to cover those activities in the workplace which affect the environment (in the form of flora, fauna, water, air and soil) and, possibly, the health and safety of employees and others. Such activities include waste and effluent disposal and atmospheric pollution.

Welfare

The provision of facilities to maintain the health and well-being of individuals at the workplace. Welfare facilities include washing and sanitation arrangements, the provision of drinking water, heating, lighting, and accommodation for clothing, seating (when required by the work activity), eating and rest rooms. First aid arrangements are also considered as welfare facilities.

2.3.2 Detail of HSE Activities

The Lecturer will discuss the various activities involved for maintaining HSE at sites which include the following.

A) Hazard Identification
B) Job Safety Analysis (JSA)
C) HSE Training Program
D) Control Measures

A) Hazard Identification

A hazard is the potential of a substance, activity or process to cause harm. Hazards take many forms including, for example, chemicals, electricity and working from a ladder. A hazard can be ranked relativeother hazards or to a possible level of danger. A risk is the likelihood of a substance, activity or process to cause harm. A risk can be reduced and the hazard controlled by good management. It is very important to distinguish between a hazard and a risk – the two terms are often confused and activities such as construction work are called high risk when they are high hazard. Although the hazard will continue to be high, the risks will be reduced as controls are implemented. The level of risk remaining when controls have been adopted is known as the residual risk. There should only be high residual risk where there is poor health and safety management and inadequate control measure.

Hazard Identification is the evaluation of all possible potential hazards where associated system of work (repair/new installation) with distribution system could cause an incident. Identification of hazards is carried out using site inspections. The specifications of pipe materials and valves and standard SOPs are also reviewed.

Following the identification of all possible sources of likely hazards from laying or repair of pipelines, the ranking of risk levels (high, medium or low) needs to be applied to implement mitigation measures for priority risks. There exists three types of hazards generally emanating from water distribution system.

i) Physical Hazards
ii) Chemical Hazards
iii) Biological Hazards

i) <u>Physical Hazards</u>

Physical hazards is the exposure to adverse weather conditions causing heat strokes among workers.

ii) Chemical Hazards

Chemical hazards produce injuries due to exposure to disinfectant used in water distribution system. Generally, sodium hypochlorite is used in solution form at tube well chambers for disinfection purpose and it is toxic and causes irritation to eyes and skin.

iii) Biological Hazards

Biological hazard is exposure to pathogenic microorganism (bacteria) due to accidental contact between drinking water and wastewater.

B) Arrangements for Health and Safety

The arrangements section of the health and safety policy gives details of the specific systems and procedures used to assist in the implementation of the policy statement. This will include health and safety rules and procedures and the provision of facilities such as a first aid room and wash rooms. It is common for risk assessments (manual handling and PPE assessments) to be included in the arrangements section particularly for those hazards referred to in the policy statement. It is important that arrangements for fire and other emergencies and for information, instruction, training and supervision are also covered.

The following list covers the more common items normally included in the arrangements section of the health and safety policy:

➤ Employee health and safety code of practice

➤ Accident and illness reporting and investigation procedures

➤ Emergency procedures, first aid

➤ Procedures for undertaking risk assessments

➤ Control of exposure to specific hazards (noise, vibration, radiation, manual handling, hazardous substances etc.)

➤ Machinery safety (including safe systems of work,
lifting and pressure equipment)

➤ Electrical equipment (maintenance and testing)

➤ Maintenance procedures

➤ Permits to work procedures

- Use of personal protective equipment monitoring procedures including health and safety inspections and audits
- Procedures for the control and safety of contractors and visitors
- Provision of welfare facilities
- Training procedures and arrangements
- Catering and food hygiene procedures
- Arrangements for consultation with employees
- Terms of reference and constitution of the safety committee
- Procedures and arrangements for waste disposal

B) Job Safety Analysis (JSA)

Job Safety Analysis (JSA) is a tool to determine the possible hazards that could occur from job tasks. It also entails the information to be provided to the workers on possible hazards and its associated risks and measures to curtail those hazards. In this regard, health, safety trainings are imperative steps in reducing accident rates and improved safety performance at sites. These trainings are also important part for effective health and safety management.

C) HSE Training Program

HSE trainings are integral part for reducing frequency of accidents and to ensure implementation of various HSE procedures. Apart from sending some participants to occasional training sessions, HSE is generally a neglected area across five WASAs. There is no formal system of briefing the contract staff of WASA regarding HSE aspects linked with water distribution system.

To combat this situation, procedures should be prepared to ensure that employees working at each relevant function and level are aware of importance of HSE procedures and requirements of OHSAS 18001 standards. In this context, formal HSE trainings and awareness should be imparted to all WASA personnel. The trainings at least should cover the following.

i) Identification of health hazards, their risk assessment and control measures
ii) Hazardous Material Management as per Material Safety Data Sheets (MSDS)
iii) Emergency Preparedness and Response
iv) Occupational health hazards and safety procedures
v) First Aid

It is also suggested to start professional certification courses such as International General Certificate in Occupational Health and Safety organized by NEBOSH UK.

D) Control Measures

i) Personal Protective Equipment (PPE)

The use of Personal Protective Equipment (PPE) during course of work is an important consideration to safeguard the workers from any potential accidents which may cause injury to them. In this regard, the training on the use of PPE is also required mandatory. PPEs generally include, safety helmets, safety shoes, gloves, eye protection etc. Further to address the use of PPE, it is essential to identify the areas requiring specific use of PPEs. System also needs to be developed to enforce to wear safety hats and safety shoes while working in field.

ii) Safety Signage

Adequate safety signage in the form of warning signs, ribbon tape, barriers, traffic cones and person with flag during construction to manage traffic at construction site and access roads need to be placed to warn the traffic regarding work ahead in progress. Plates 3 shows a type of traffic signage to be used during repair or construction of water supply lines.

Plate 3: Example of safety sign during construction of water supply system

iii) HSE Action Plan

An HSE Plan would be required to identify potential hazards, its causes and control measures to implement HSE activities during field work of water distribution system. Table 1.2 shows a detailed HSE Action Plan to be implemented by utility service providers for ensuring safety of workers, health and environment from adverse impacts arising from work places.

Table 1.2: HSE Action Plan for Water Distribution System

Sr. No.	ACTIVITY	Hazards	Impacts of Hazards	Control Measures
1	Delivery and unloading of pipes	Pipes may move/roll or be tampered with by others	Injury to persons generally	-Provide secure stockpile area for pipes and fittings. -Unload and stack pipes strictly in accordance with the manufacturers' recommendations Minimize height of pallets / stockpile. Use PPE
		Pipes and fittings	Lifting injury Swinging load	Correct manual handling techniques. Use mechanical aids where possible. Maintain control of loads when lifting & moving.
2	Secure Site	Public safety	Injury to public	Provide the appropriate fencing and/or barricades as per site risk assessment. Apply appropriate signage and pedestrian control. Devise and implement system for site inspection and security.
		Traffic	Personal injury to public and workers due to	Traffic Control Plan Keep area clean & clear of obstacles.

			vehicle accidents	
		Inadequate Access	Slips, trips and falls, abrasions, strains and sprains; manual handling injuries such as back damage	Conduct site inspection to ensure that access is adequate for the task activities. Use safety shoes, hard hats, Gloves, etc.
3	Locate existing services	Existing underground services	damage service	Check relevant Authority (e.g. power, water, gas, council) records for location of services. If in doubt uses experienced/accredited service locators.
4	Excavation	Work Place	Noise, falling objects Damage to existing surfaces Material spillage	Use appropriate Personal Protective Equipment (PPE) – hardhat, hearing protection etc. Maintain a safety working area around moving plant. Protect surfaces from plant movements. Ensure appropriate plant noise control. Maintain Appropriate spillage control techniques
		Storage of materials	Falling objects	No materials to be placed or stacked near the edge of any excavation.

		Accessing trenches/conduits	Collapse of trench, falling objects	Keeping safe distance from edge of trench Materials not to be placed or stacked near the edge of trench. All trenches to have safety barricades when left open for a period of time.
5	Install pipe and fittings on bed	Accessing trenches/conduits Lifting injury Swinging load	Collapse of trench, falling objects	String only sufficient pipes for day's work. Return all pipes not laid at end of day to secure stockpile areas. Use safety shoes , gloves, goggles , hard hats
6	Dosing of Chlorine	Concentrated solutions handling	Splashes can cause burns and eye damage	Gloves ,protective eye glasses, overalls
7	Cleaning and inspection of storage reservoirs	Climbing on roof top, accidental flooding	Personal injury	Install railing around ladder, wear hard hats, safety shoes
8	Repairing pipelines	Collapse of trenches working on roads	Cuts, bruises, electric shocks, Fractures, Minor and major injuries by vehicle strike	Reduction of allowed vehicle speeds in work zones, Use of high-visibility safety apparel for workers in the vicinity of traffic, For night work, provision of proper illumination for the work space, while controlling glare so as

				not to blind workers and passing motorists Locate all underground utilities before digging Use of hard hats, goggles, safety shoes, overalls
9	Materials Checking	Handling and storage of hazardous materials (chlorine)	Risk of various injuries and illnesses	Handling and storage to be done according to instructions given in Materials Safety Data Sheets (MSDS).
10	Documentation and Data Control	Lack of Proper system for HSE Documentation and Data Control	Retrieval of some vital HSE information is rendered almost impossible	Develop procedures for efficient management of HSE documentation and data control
11	House Keeping	Unsafe Work conditions	Risk to staff and Fire hazard	Apply better housekeeping practices at work places