AGRICULTURAL TVET COLLEGE	

MODEL TTLM

SMALL SCALE IRRIGATION DEVELOPMENT LEVEL-IV

Learning Guide- 1

Unit of competency: plan irrigation project

Module title: planning irrigation project

LG code: AGR SSI4M 01LO1-LO5

TTLM Code: AGR SSI3 TTLM 1218V1

Nominal duration: 80Hrs

Instruction sheet	Learning guide- 1

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:–

- Select site
- Prepare contour map and use topographic map
- Decide cropping pattern
- Carry out socio- economic Studies
- Standardize the project Plan

This guide will also assist you to attain the learning outcome stated in the cover page specifically, upon completion of this Learning Guide, you will be able to –

- Conducting reconnaissance survey
- Planning irrigation project
- Surveying existing land use
- Assessing proximity of water resource
- Delineating command area based on land use map of the area
- Prepare contour map and use topographic map
- Making tools and equipment available.
- Choosing detail of work
- Identifying natural contour line
- Delineating command area using GPS
- Compiling and analyzing relevant information
- Interpreting topographic map and aerial photo
- Interpreting statistical data and measurements
- Developing contour map of the project area.
- Decide cropping pattern
- Identifying types of crops
- Identifying types of crops based on preference of project owner
- Identifying types of crops based land use suitability
- Identifying types of crops based on economic importance.

- Identifying crops based on their agro ecological zones
- Selecting crops
- Identifying and characterizing crops
- Selecting crops in terms of water requirement
- Selecting crops in terms of growing season
- Selecting crops in terms of growth stage
- Selecting crops in terms of sowing system
- Carry out socio- economic studies
- Making collaboration with different disciplines & stakeholders.
- Identifying cultural values and practices of local community
- Assessing labor availability
- Identifying major economic advantages.
- Surveying community awareness.
- Making environmental issue considerations.
- Quantifying cost benefit ratio and project life time
- Standardize the project Plan
- Managing project cycle.
- Following SMART Planning principles

Learning Activities

1. Read the specific objectives of this Learning Guide.
2. Read the information written in the "Information Sheets.
3. Accomplish the "Self-check" at the end of each learning outcomes.
4. If you earned a satisfactory evaluation proceed to the next "Information Sheet". However,

if you acting is unsatisfactory, see your teacher for further instructions or go back to the Learning Activity.

5. Submit your accomplished Self-check. This will form part of your training portfolio
6. Follow the steps and procedure list on the operation sheet
7. Do the "LAP test" and Request your teacher to evaluate your performance

Information sheet-01	Select site

Project can also be defined as a set of inputs and outputs required to achieve a particular goal. Projects can range from simple to complex and can be managed by one person or a hundred. Projects are often described and delegated by a manager or executive. They go over their expectations and goals and it's up to the team to manage logistics and execute the project in a timely manner. Sometimes deadlines can be given or a time limitation. For good project productivity, some teams break the project up into individual tasks so they can manage accountability and utilize team strengths.

1.1 Conducting reconnaissance survey

Once it is decided to prepare irrigation scheme for any region the first issue to be decided is about its location. Before undertaking **reconnaissance**, an office study of the proposal is made on the basis of the available topographical maps and other data to explore prima-facie feasibility of a project. In these studies a very rough scope of the project and its tentative location can also be decided.

Reconnaissance surveys on a small scale i.e. 1:100 000 to 1:250 000 are useful for broad resource inventory, the identification of promising areas for development, and to provide a basis for more detailed study. Mapping units are usually compound and provide only estimates of the **proportions** of the conditions for the various land suitability categories. The 'land system' method of survey is often used and it may suffice to broadly distinguish land which is promising for specific kinds of irrigated agriculture from land which is not. Economic studies at this, stage broadly indicate levels of production and income.

Reconnaissance survey: is the process of obtaining information about existing and past land use practices by sending out small group of professionals or using air craft e.t.c. As describe bove, the primary objective of reconnaissance survey is to review the previous land use practice and made decision on what type of land use practice has to be use.

The data that has to be assessed during Reconnaissance survey are;

- Topographic data of the area
- Rainfall data of the area

- soil survey data of the area
- water resource potential of the area
- socio economic data

1.1. Planning irrigation project

Proper system planning and design is essential to Irrigation Water Management (IWM) and requires the thoughtful consideration of many elements. Selecting a system must include the following major items: Management, water, soil, and crops.

1. Management – The irrigator and planner need to collaborate in order to develop the best plan. The discussion of desired system type needs to include an understanding of management, operation, and maintenance requirements.

2. Water – The source, whether surface or ground, and the quantity, quality, availability, and flow rate, are needed to determine the type of system that is appropriate. Most sources of ground water require power, no matter which type of system is planned. With micro irrigation, a ground water source might only need an inline screen to clean the water while a surface water source would require a sophisticated filtration system. Some sources, due to high salinity (EC), may not be suitable for sprinkler irrigation. A micro irrigation system works best with a constant source while a surface system can operate on a longer interval between water applications. A surface system, in turn, requires a relatively high flow for most efficient application, while sprinkler or micro irrigation systems can function well at a lower rate of application.

3. Soil – Many soil qualities are important when planning an irrigation system. Soil texture is a good indicator of water holding capacity (whc), permeability, and transmissivity. Whc is particularly important when considering a surface system, due to intervals between irrigations. Permeability plays a key role in surface system design, and to a lesser extent, sprinklers. Transmissivity, the ability of water to move through the soil, is important when considering a point source of irrigation, such as with drip emitters. The water needs to be able to move into and through the root zone.

4. Crops – Selection of crops to be grown can be limited due to water quality and quantity. High salinity (EC) can cause yield reduction and even crop failure, depending upon the crop planted.

Other important considerations should include growing season and location.

1. Growing season - The length of growing season is important for crop selection and also is important for justifying the expense for any system planned
2. Location - System structures and hardware must be able to withstand climate extremes of temperature, humidity, precipitation, or wind. Proximity to wildlife, cattle, and humans also suggest necessary precautions to consider.

Proper planning can help ensure that the best system will be installed.

1.1. 2 surveying existing land use

An inventory of current land uses in the community is an important first step. It is important to find out if a land use inventory for your community or GIS layers that could be used for this task are available from an agency within your community, such as the engineering office or your county or regional planning commission. The information gathered in this step is used to produce a map of current uses by amount and type (e.g., residential, commercial, institutional). Typical methods for determining current land use involve windshield (conducted from a vehicle) and walking surveys. A windshield survey is useful for large areas such as rural or suburban areas. In an urban area, where land uses are more dense a walking survey may be best. Surveys may be supplemented by aerial photo interpretation, assessment records from your local assessor and field checks. Aerial photos can also provide building footprints and assist in locating other landscape features. In addition web resources, such as WISCLAND (DNR) can be useful for rural areas. An evaluation of current land use conditions is necessary in preparing the land use element. Evaluating the current land use patterns, densities and relationships will assist you in determining land available to meet your community's future land use needs.

1.2. Assessing Water resource proximity

In planning and developing an irrigation project, source(s) of water should be identified so as to ensure continuous water supply. In water resource development, harmonization of the different demands for water, establishment of irrigation priority rights between upstream and downstream users, and consideration of the rights of the existing users of water from flood, which may be modified by dams, is essential. It requires a formal institutional approach based on local experience. If the project is based on groundwater resource, sustainability of the resource should be considered.

The water needed to supply an irrigation scheme is taken from a water source. The most common sources of water for irrigation include rivers, reservoirs and lakes, and groundwater.

You should also examine the location of your field relative to possible water sources. Consider both the distance and elevation difference between field and water source. There will be a cost to convey water from a distant source to the field, and there will be an annual operating cost to pump water from a lower elevation to a higher one. Try to estimate the total cost of pumping and delivering water from each source to your field before making a choice. For example, it may be cheaper to drill a well at the field to be irrigated than to pump water from a distant river or lake.

The volume of water available for irrigation must be determined. After establishing the hydrological availability, the suitability of the water sources and competing water needs within the basin should be assessed. The quality of the water also helps determine the suitability of the water source.

Investigations of water resources should be considered an integral part of the land resources evaluation process. The activities of those involved (hydrologists, hydrogeologists, engineers, agriculturists and economists) should be appropriately scheduled. Costly water resources surveys in areas where the land later proves unsuitable for irrigation are wasteful; vice versa, detailed land and soil surveys for irrigated agriculture can be wasteful in areas where water supplies later prove inadequate.

The volume of water obtainable for irrigation will depend on the outcome of hydrological studies of surface water, and hydro geological studies of groundwater (subsurface water). These are the water supply aspects. The water demand aspects include studies and field work to estimate irrigation water requirements and crop water requirements. An important part of the evaluation is the matching of water supplies and water demand (requirement) by mutual adjustments involving cooperative work between water resources specialists, engineers and agriculturists.

i. Hydrological studies: Studies may be carried out at national level, at river basin level, at the project development level, and at farm or field level. Surface water resources may be progressively developed, first using diversion structures to regulate run-off-river stream flow, secondly, with the addition of storage, and later, to full control, including flood control.

Existing data, and data collected during the investigations from stream measuring devices (e.g. stage posts, formula-calibrated weirs, current meters and velocity-area rated stations) can be used to estimate run-off and catchment yields, divertible volumes of water, amounts of water for storage, subsurface flows of water, flood peaks and volumes, etc.

ii. Hydro geological studies: Investigations of groundwater resources are generally carried out at the level of the whole hydro geological basin or aquifer. The studies include observations of water levels and quality in existing open wells and tube wells, and specially drilled observation wells.

iii. Irrigation water requirements: Meteorological data and field studies are usually necessary to estimate crop water requirement, effective precipitation, run-on, groundwater contribution, soil water storage, run-off, seepage and percolation, conveyance losses, and leaching requirements. Irrigation water supplies and their control often determine water volumes used by farmers, therefore water management may be as important as physical factors in matching the available supply to the requirements.

iv. Water quality data: Water quality for agricultural use can be evaluated using field and laboratory analyses. The electrical conductivity of, and other simple tests on, samples of irrigation water can be measured in the field using portable conductivity bridges, pH meters and testing kits. For example, having tools-of-the-trade for the testing of groundwater in wells obviates the need for transporting water samples. Local analyses of carbonate, bicarbonate and nitrate may be required where storage of samples may lead to chemical changes and inaccurate results.

In arid and semi-arid areas it will be necessary to predict the salt balance and the water balance for a project area to evaluate leaching requirements, and the drainage needed to maintain the land in a productive condition. In rehabilitation projects, water samples may be analyzed at different points of the network.

Water for drip irrigation and for other techniques where there is a potential clogging problem can be evaluated on the basis of measurements of the suspended solids and chemical or biological properties of the water.

1.3. Delineating Command area

Mapping: Existing maps (topographic maps) and aerial photographs are intensively used in the irrigation planning process (i.e. delineating the Command area). In addition, for example, women and men farmers' detailed local knowledge could be mapped for information on: existing water sources and water use; hydrological units and drainage system; agricultural lands, crop varieties and locations; and soil characteristics.

Command Area Development

envisaged execution of on-farm development works like field channels, land leveling, field drains and conjunctive use of ground and surface water; the rotational system of water distribution to ensure equitable and timely supply of water to each holding; and evolving and propagating crop patterns and water management practices appropriate to each command area. Other ancillary activities like construction of link roads, go downs and market centers, arrangements for supply of inputs and credits, agricultural extension and development of ground water for conjunctive use are also taken up as part of the relevant sectoral programs in the State Plan. Initially, the emphasis of the programme was on the development of infra-structure required to deliver the water to the farmers' field. At the time of formulating the Plan, the progress in implementing the full package of on- farm development works was found to be very limited. A variety of constraints were identified. These included: absence of up-to-date land records, resistance of farmers to land consolidation, inadequate flow of institutional credit and organizational weaknesses. Experience had also shown that once the farmers are assured of timely and adequate supply of water, they take up some of the OFD works such as land leveling.

Self-Check 1	Written Test

Name: __________________________ Date: ________________

Directions: Answer all the questions listed below.

1. Why site reconnaissance survey is important for irrigation project plane?(7pt)
2. What are the major essential items used for Proper system planning and design to Irrigation Water Management (6pt)
3. How to Assess proximity of water resource for irrigation development plane ?(5pt)
4. How to be Delineate command area based on land use map of the area?(6pt)

Note: Satisfactory rating - 12points above Unsatisfactory - below 12 points

You can ask you teacher for the copy of the correct answers.

Information sheet 2	Prepare contour map and use topographic map

Introduction

Contour line (also **isocline**, **isopleth**, or **isarithm**) of a function of two variables is a curve along which the function has a constant value, so that the curve joins points of equal value. It is a plane section of the three-dimensional graph of the function $f(x, y)$ parallel to the x, y plane. In cartography, a contour line (often just called a "contour") joins points of equal elevation (height) above a given level, such as level. A **contour map** is a map illustrated with contour lines, for example a topographic map, which thus shows valleys and hills, and the steepness or gentleness of slopes. The **contour interval** of a contour map is the difference in elevation between successive contour lines.

a **topographic map** is a type of map characterized by large-scale detail and quantitative representation of relief, usually using contour lines, but historically using a variety of methods. Traditional definitions require a topographic map to show both natural and man-made features. A topographic survey is typically published as a map series, made up of two or more map sheets that combine to form the whole map. A contour line is a line connecting places of equal elevation.

Tape meter, line level, theodolite, tripod, chaining pins, ranging pole, staff, clinometers, Global positioning system, compass, Auger, core sampler, spatula, oven, pressure apparatus, sensitive balance, sieve, soil grinder, hydro meter, shaker and measuring cylinder, thermometer, stop watch.

- **Electronic theodolites**

In modern electronic theodolites, the readout of the horizontal and vertical circles is usually done with a rotary encoder. These produce signals indicating the altitude and azimuth of the telescope which are fed to a microprocessor. CCD sensors have been added to the focal plane of the telescope allowing both auto-targeting and the automated measurement of residual target offset. All this is implemented in embedded software of the processor.

Many modern theodolites are equipped with integrated electro-optical distance measuring devices, generally infrared based, allowing the measurement in one step of complete three-dimensional vectors—albeit in instrument-defined polar co-ordinates, which can then be transformed to a pre-existing co-ordinate system in the area by means of a sufficient number of control points. This technique is called a resection solution or free station position surveying and is widely used in mapping surveying.

Figure 2.1 A typical modern electronic theodolite: Nikon DTM-520

- **Clinometer**

is an instrument used for measuring angles of slope (or tilt), elevation, or depression of an object with respect to gravity's direction. It is also known as a tilt indicator, tilt sensor, tilt meter, slope alert, slope gauge, gradient meter, gradiometer, level gauge, level meter, declinometer, and pitch & roll indicator. Clinometers measure both inclines (positive slopes, as seen by an observer looking upwards) and declines (negative slopes, as seen by an observer looking downward) using three different units of measure: degrees, percent, and topo (see Grade (slope) for details). Astrolabes are inclinometers that were used for navigation and locating astronomical objects from ancient times to the Renaissance.

A tilt sensor can measure the tilting in often two axes of a reference plane in two axes. In contrast, a full motion would use at least three axes and often additional sensors. One way to measure tilt angle with reference to the earth's ground plane, is to use an accelerometer. Typical applications can be found in the industry and in game controllers. In aircraft, the "ball" in turn coordinators or turn and bank indicators is sometimes referred to as an inclinometer.

Figure 2.2 Clinometer

Measuring tape is a flexible ruler and used to measure distance. It consists of a ribbon of cloth, plastic, fiber glass, or metal strip with linear-measurement markings. It is a common measuring tool. Its design allows for a measure of great length to be easily carried in pocket or toolkit and permits one to measure around curves or corners. Today it is ubiquitous, even appearing in miniature form as a keychain fob, or novelty item. Surveyors use tape measures in lengths of over 100 m.

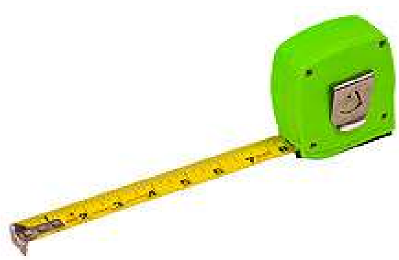


Figure 1.3 Measuring tapes

Field books we sell high-quality Surveying Field Books, Engineering Field Books, Mining Field Books, Cross Section Field Books, Miners Field Books, Engineers Journals, Engineers Log Books, and Level Field Books. These field books work great for making field notes or keeping a field journal, logbook, or notebook. Most have grid lines and tables, graph paper, and some are hard cover, some are soft cover bound and spiral bound.

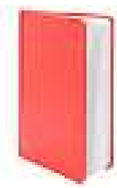


Figure 2.4 Field books

Special forms: used as an element on your landing page. They are commonly found on landing and contact pages, and allow users to input the requested data and then forward this data to you via email. They can also be used to allow the users to access special content upon submitting the form, such as a free guide, eBook or subscription to an email newsletter.

Levels and transit levels shop our selection of levels and transit levels. Many different users from land surveyors, builders, swimming pool contractors to concrete pros and anyone wanting to work from a level reference can benefit from using a level. These levels are many times called by various names such as; Optical Levels, Surveyors Levels, Transit Levels, Builders Levels, or Builders Transit Levels.

Figure 2.5 Levels and transit level

Topographic map is a type of map characterized by large-scale detail and quantitative representation of relief, usually using contour lines, but historically using a variety of methods. Traditional definitions require a topographic map to show both natural and man-made features. A topographic survey is typically published as a map series, made up of two or more map sheets that combine to form the whole map. A contour line is a line connecting places of equal elevation.

Electronic distance measuring instrument is a surveying instrument for measuring distance electronically between two points through electromagnetic waves.

Electronic distance measurement (EDM) is a method of determining the length between two points, using phase changes, that occur as electromagnetic energy waves travels from one end of the line to the other end. As a background, there are three methods of measuring distance between two points:

GPS is a device that is capable of receiving information from GPS satellites and then to calculate the device's geographical position. Using suitable software, the device may display the position on a map, and it may offer directions. The Global Positioning System (GPS) is a global navigation satellite system (GNSS) made up of a network of a minimum of 24, but currently 30, satellites placed into orbit by the U.S. Department of Defense.

GPS devices may be able to indicate:

- traffic congestion and alternative routes,
- the roads or paths available
- roads or paths that might be taken to get to the destination,
- if some roads are busy (now or historically) the best route to take,
- The location of food, banks, hotels, fuel, airports or other places of interests,
- the shortest route between the two locations,
- the different options to drive on highway or back roads.

Figure 2.6 GPS

✓ **Chain and Tape:** chains or tapes are used to measure distances on the field.

A chain is made up of connected steel segments, or links, which each measure 20 cm. Sometimes a special joint or a tally marker is attached every 5 meters. Usually, a chain has a total length of 20 meters, including one handle at each end.

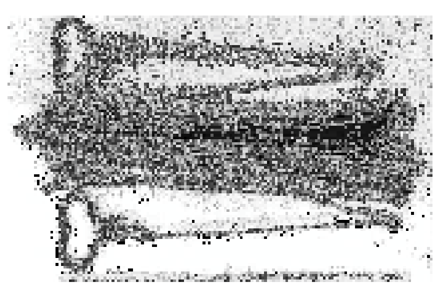
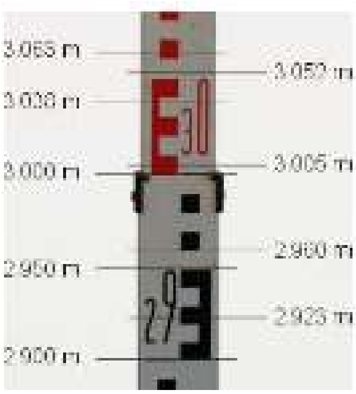


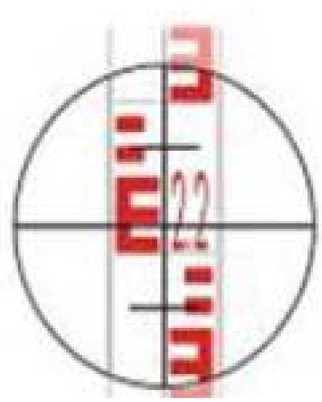
Figure 2.7 chain

- ✓ **Ranging poles** are straight round stalks, 3 to 4 cm thick and about 2 m long. They are made of wood or metal. Ranging poles can also be home made from strong straight bamboo or tree branches. Remember ranging poles may never be curved. Ranging **poles** are usually painted with alternate red-white or black-white bands. If possible, wooden ranging poles are reinforced at the bottom end by metal points.

Figure 2.8Ranging pole

- ✓ **The leveling staff:** is a graduated rod of rectangular section. It is usually made of thick wood. It may be of fiberglass or metal.





A. Fig.2.9 graduated staff B. fig.2.10 reading the stuff where the two large cross hairs meet & the reading is 2.22m

- ✓ Auger, core sampler, Soil core sampling equipment is used to collect virtually undisturbed soil core samples for soil profiling and environmental investigations.

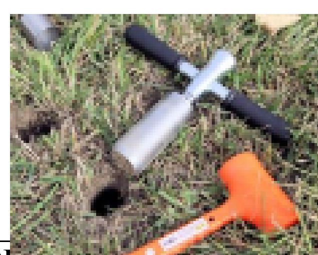


Figure 2.11 auger/core samplers

- ✓ Spatula, Unique spatula both scoops material and instantly displays weight. Balance with digital display is located in the easy-grip handle. The weighing range is 0 to 300.0 grams and 0 to 10.580 ounces. Readability is 0.1 gram and 0.005 ounce. Level position repeatability is 0.1 gram and accuracy is.
- ✓ An **analytical balance** (often called a "lab balance") is a class of balance designed to measure small mass in the sub-milligram range. The measuring pan of an analytical balance (0.1 mg or better) is inside a transparent enclosure with doors so that dust does not collect and so any air currents in the room do not affect the balance's operation. This enclosure is often called a draft shield.
- ✓ **Measuring Cylinder and hose,** each regulator is designed to fit a specific type of cylinder valve and a regulator that fits one type of valve will not fit any of the others. The valve on Propane cylinders has a screw thread and only accommodates Propane regulators.
- ✓ **Stop watch** is a handheld time piece designed to measure the amount of time that elapses between its activation and deactivation. A large digital version of a stopwatch designed for viewing at a distance, as in a sports stadium, is called a **stop clock**. In manual timing, the clock is started and stopped by a person pressing a button. In fully automatic time, both starting and stopping are triggered automatically, by sensors.
- ✓ A **tripod** is a portable three-legged frame or stand, used as a platform for supporting the weight and maintaining the stability of some other object. A tripod provides stability against downward forces and horizontal forces and movements about horizontal axes. The positioning of the three legs away from the vertical center allows the tripod better leverage for resisting lateral forces.

Figure 2.12 Reading of tripod

- ✓ A **hygrometer** is an instrument used to measure the amount of humidity and water vapor in the atmosphere, in soil, or in confined spaces.

Figure 2.13 Hygrometer

- ✓ S**ieve**, or **sifter**, is a device for separating wanted elements from unwanted material or for characterizing the particle size distribution of a sample, typically using a woven screen such as a mesh or net or metal. (Ruhlman.M and Bourdain, 2007). The word "sift" derives from "sieve". In cooking, a sifter is used to separate and break up clumps in dry ingredients such as flour, as well as to aerate and combine them. A **strainer** is a form of sieve used to separate solids from liquid.

Figure 2.14 Sieve

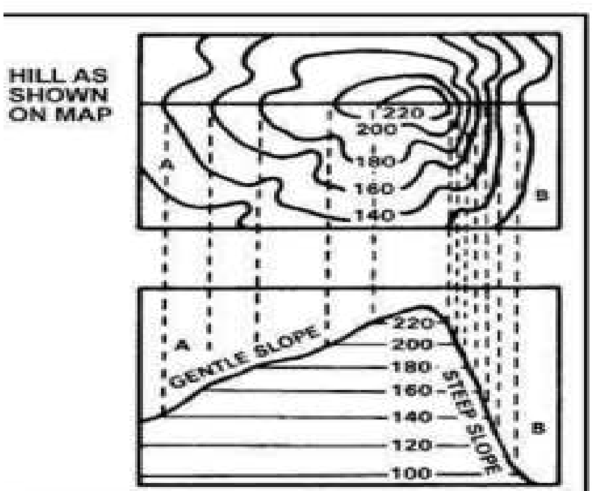
2.2. Choosing Details of work as per design requirements

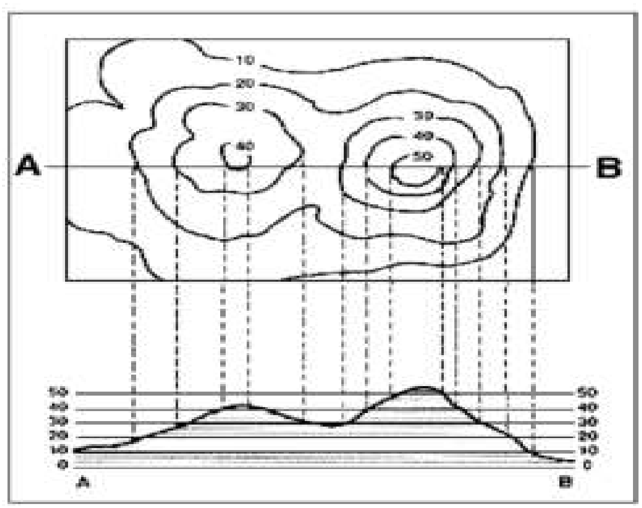
<u>Detailed</u> surveys may be required separately for soils and topography. Soil surveys, typically at scales of 1:10 000 to 1:25 000, with soils series and phases as the main soil mapping units, are used for project planning and implementation and for some surveys at village or catchment level, including layout of farms and irrigation systems. If topography is an important consideration in delineating land to be brought under command by gravity irrigation, a more intensive survey (e.g. at 1:5 000) may be required for land levelling and engineering applications.

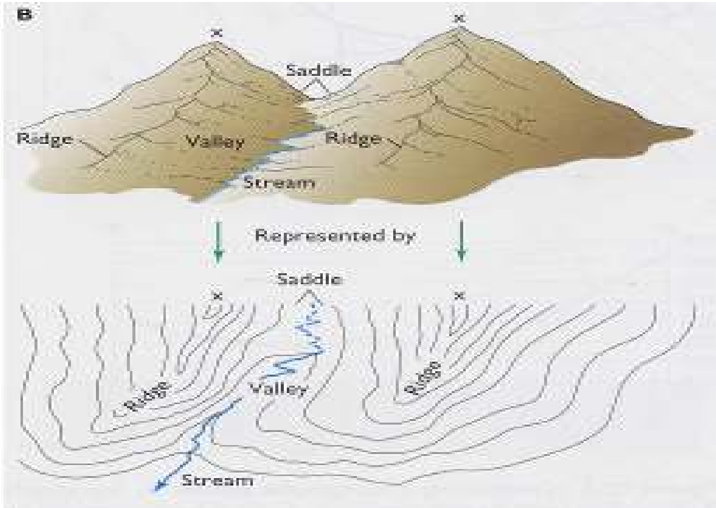
<u>Very detailed</u> surveys, at scales of 1:5 000 or larger, are necessary where small contour intervals must be mapped in order to determine slope classes, or align irrigation and drainage channels.

2.3. Identification of Natural contour lines

Elevation features are described on maps by use of contour lines. A contour line on a map is the line you would trace out on the terrain if you were to walk along a path of constant elevation. Making the mental translation from contour lines on a map to the terrain around you takes practice.







The relationship of contours on a map (below) to topography.

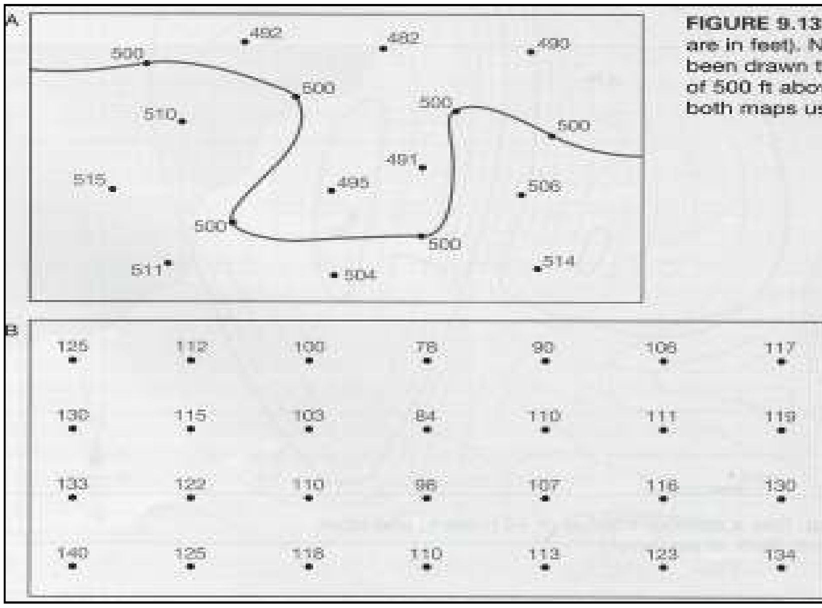
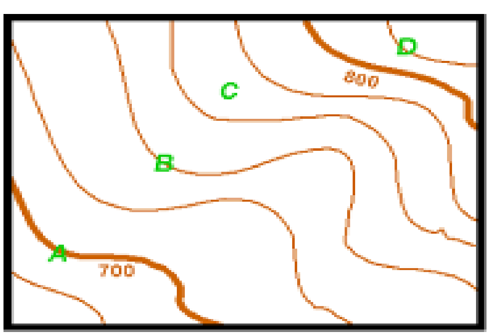


FIGURE 9.13 Topographic map construction (elevations are in feet). Notice in map **A** that a 500-ft contour line has been drawn through all of the points that have an elevation of 500 ft above mean sea level. Can you finish contouring both maps using a contour interval of 10 ft?



QUESTION: What are the **elevations** of points **A** through **D**?

A = ________________

B = ________________

C = ________________

D = ________________

2.4. Interpretation of Aerial photographs and topo map

Aerial photographs often are used in the same manner as maps and it might be useful if we note at the start the advantages and limitations of each medium.

An aerial photograph has the following advantages over a line map:

1. It is a pictorial representation of the ground that shows far greater detail than a line map. This distinction is greatest in wilderness areas where there are few or no cultural features.
2. Because aerial photographs are much more cheaply produced than maps, most areas are photographed more frequently than they are mapped and aerial photographs thus are usually more current.
3. Related to (2) is the fact that a sequence of aerial photographs can provide a more detailed account of landscape change over time than is available from topographic maps.

An aerial photograph has the following disadvantages over line maps:

1. Because of various distortions, aerial photographs rarely show features in their correct horizontal positions. That is, there is planform distortion that must be corrected in order to accurately measure distances on aerial photographs. This distortion varies from negligible in very low-relief areas to distinctly significant in hilly and particularly in mountainous regions.
2. Hills, valleys, and the general lay of the land may not be seen on aerial photographs unless Stereoscopic viewing equipment is available. Heights and slopes cannot be measured from photographs without special equipment.
3. Ground features may be too small or obscured by vegetation or otherwise too difficult to identify or classify on aerial photographs.
4. Related to (3) is the fact that a good topographic map has a wealth of information about the landscape shown in symbols, labels and various other annotations that simply are not available on an aerial photograph. Geographers make use of both maps and aerial photographs as complementary sources of landscape data and as storage for spatial data. Used together, aerial photographs and maps offset or eliminate some of the limitations noted above.

2.4.1. Interpretation of Aerial photographs

"Novice photo interpreters often encounter difficulties when presented with their first aerial photograph. Aerial photographs are different from "regular" photos in at least three important ways:

A. Objects are portrayed from an overhead (and unfamiliar) position.
B. very often, infrared wavelengths are recorded, and
C. photos are taken at scales most people are unaccustomed to seeing

These "basic elements" can aid in identifying objects on aerial photographs.

- ✓ **Tone** (also called Hue or Color) -- Tone refers to the relative brightness or color of elements on a photograph. It is, perhaps, the most basic of the interpretive elements because without tonal differences none of the other elements could be discerned.
- ✓ **Size** -- The size of objects must be considered in the context of the scale of a photograph. The scale will help you determine if an object is a stock pond or Lake Minnetonka.
- ✓ **Shape** -- refers to the general outline of objects. Regular geometric shapes are usually indicators of human presence and use. Some objects can be identified almost solely on the basis of their shapes.
    - the Pentagon Building
    - (American) football fields
    - cloverleaf highway interchanges
- ✓ **Texture** -- The impression of "smoothness" or "roughness" of image features is caused by the frequency of change of tone in photographs. It is produced by a set of features too small to identify individually. Grass, cement, and water generally appear "smooth", while a forest canopy may appear "rough".
- ✓ **Pattern** (spatial arrangement) -- The patterns formed by objects in a photo can be diagnostic. Consider the difference between (1) the random pattern formed by an unmanaged area of trees and (2) the evenly spaced rows formed by an orchard.
- ✓ **Shadow** -- Shadows aid interpreters in determining the height of objects in aerial photographs. However, they also obscure objects lying within them.
- ✓ **Site** -- refers to topographic or geographic location. This characteristic of photographs is especially important in identifying vegetation types and landforms. For example, large circular depressions in the ground are readily identified as sinkholes in central Florida, where the bedrock consists of limestone. This identification would make little sense, however, if the site were underlain by granite.
- ✓ **Association** -- Some objects are always found in association with other objects. The context of an object can provide insight into what it is. For instance, a nuclear power plant is not (generally) going to be found in the midst of single-family housing. "

2.4.2. Interpretation of topographic map

Contour lines on a map show topography or changes in elevation. They reveal the location of slopes, depressions, ridges, cliffs, height of mountains and hills, and other topographical features.

A contour line is a brown line on a map that connects all points of the same elevation. They tend to parallel each other, each approximately the shape of the one above it and the one below it. In Figure 2-15, compare the topographic map with the landscape perspective.

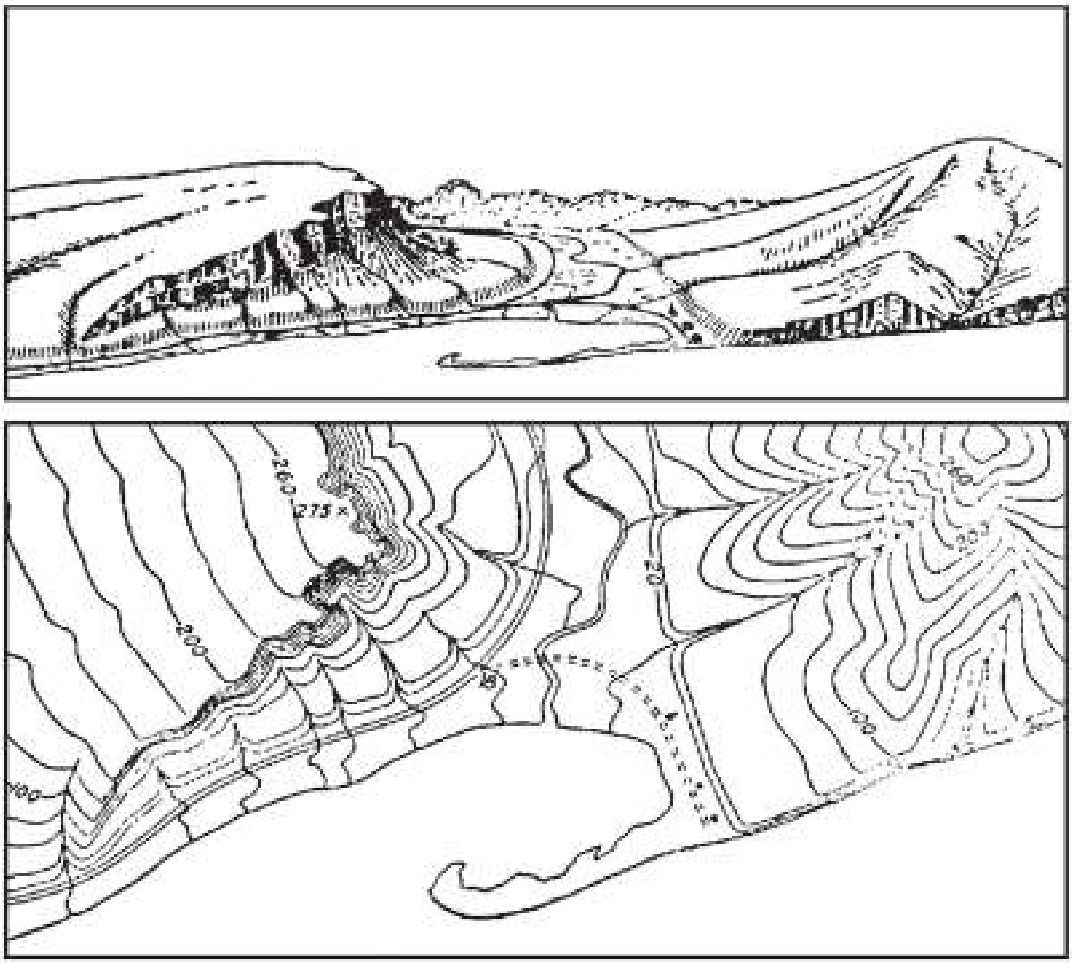


Figure 2-15. A contour map and what it looks like from a landscape perspective. Note that contour lines are far apart or level land and almost touch for cliffs.

Contour Characteristics

Contours have general characteristics; some of which are illustrated in Figures 2-16 and 2-17.

- ✓ Concentric circles of contour lines indicate a hill.
- ✓ Evenly spaced contours indicate uniform slope.
- ✓ Widely spaced contours indicate a gentle slope.
- ✓ Widely spaced contours at the top of a hill indicate flat hilltop.
- ✓ Close together contours indicate steep slope, wall, or cliff.

- ✓ Close together contours at the top of a hill indicate a pointed hilltop.
- ✓ Crossing or touching contours indicate overhanging cliff.

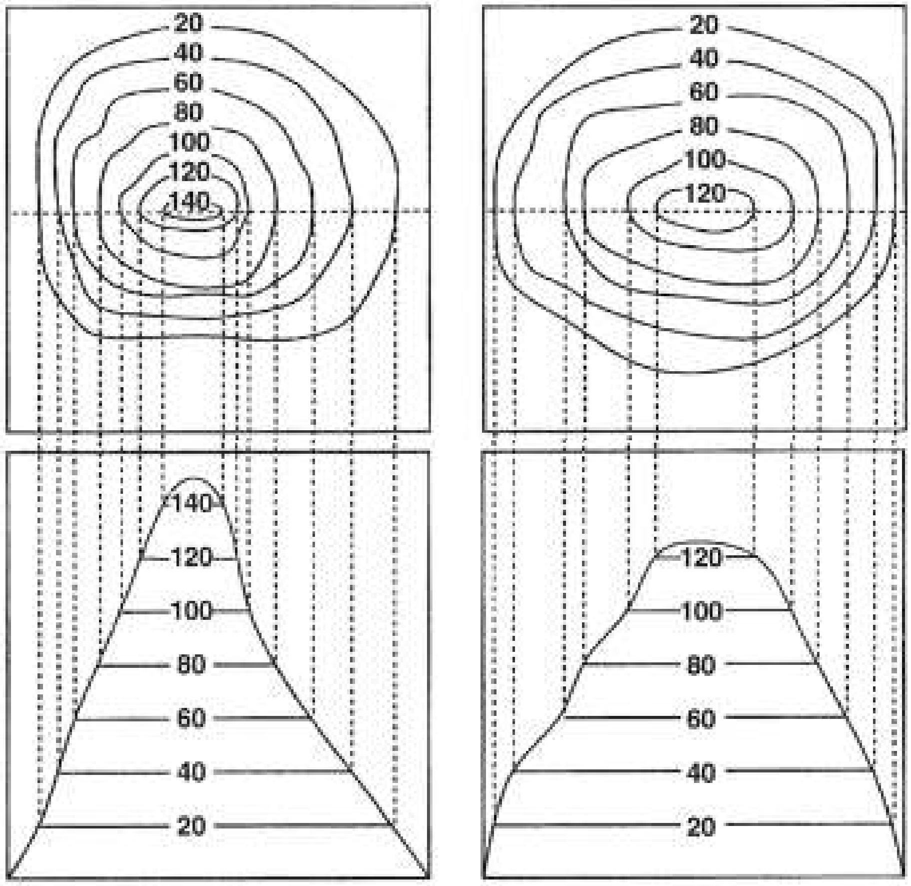


Figure 2-16. Evenly and widely spaced contours indicate type of slope and shape of hilltop.

- ✓ Jagged, rough contours indicate large outcrops of rocks, cliffs, and fractured areas.
- ✓ "V" shape contours indicate stream beds and narrow valleys with the point of the "V" pointing uphill or upstream.
- ✓ "U" shape contours indicate ridges with the bottom of the "U" pointing down the ridge. A saddle is a ridge between two hills or summits.
- ✓ "M" or "W" shape contours indicate upstream from stream junctions.
- ✓ Circles with hachures or hatch lines (short lines extending from the contour line at right angles) indicate a depression, pit, or sinkhole.
- ✓ Spot elevations (height of identifiable features) such as mountain summits, road intersections, and surfaces of lakes may also be shown on the map.

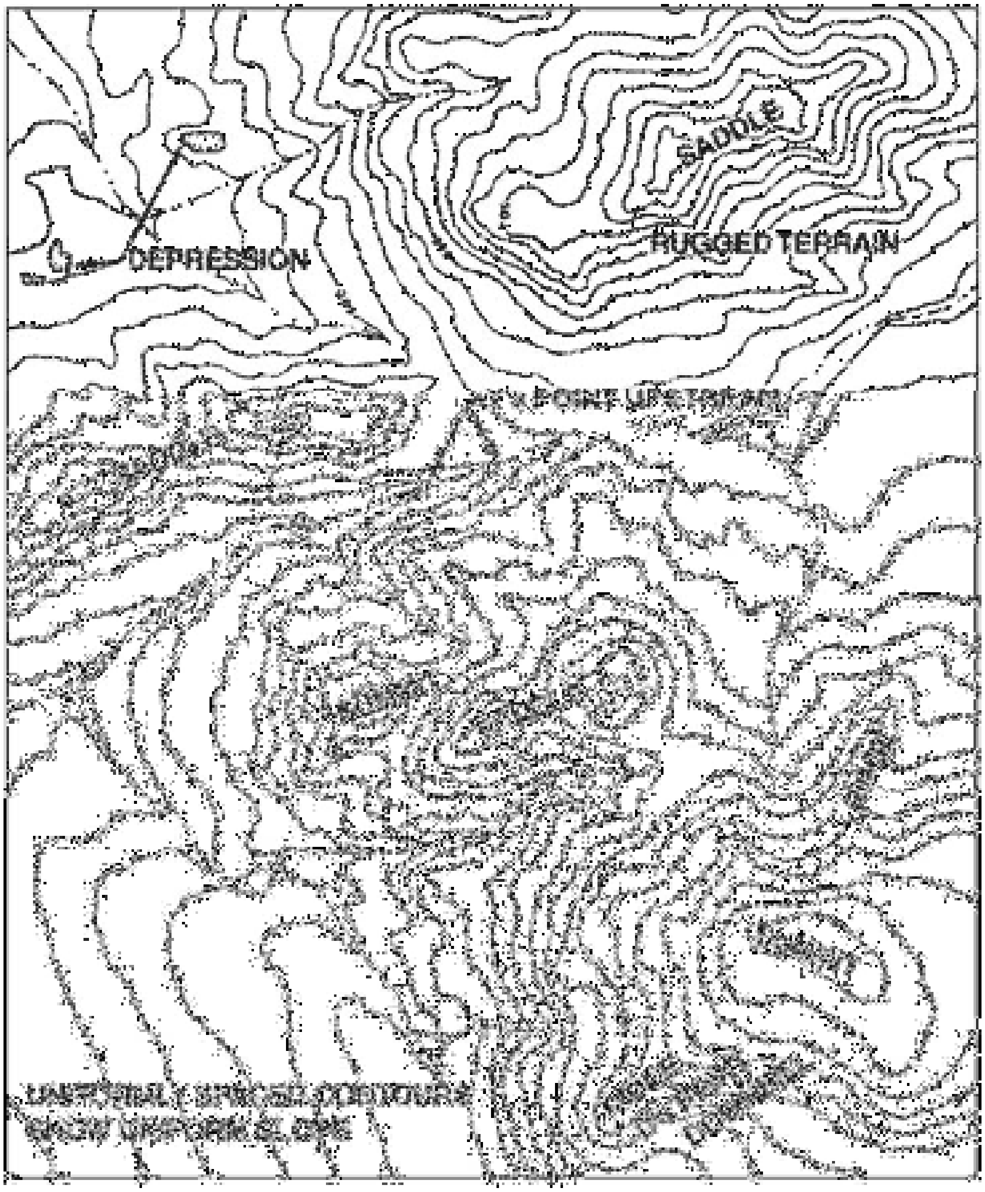


Figure 2-17. Contour lines and topographic features.

Contour Interval: Contour interval is the difference in elevation between two adjacent contour lines. On USGS maps, contour intervals are usually 1, 5, 10, 20, 40, and 80 feet. Occasionally you will find a map with a25 foot contour interval or metric units, but not often. To make the contours easier to read, every fifth one is the **index contour** which is printed darker and has the elevation in feet from mean sea level marked on the line (Figure 2-18). The thinner or lighter colored contour lines are called **intermediate contours**.

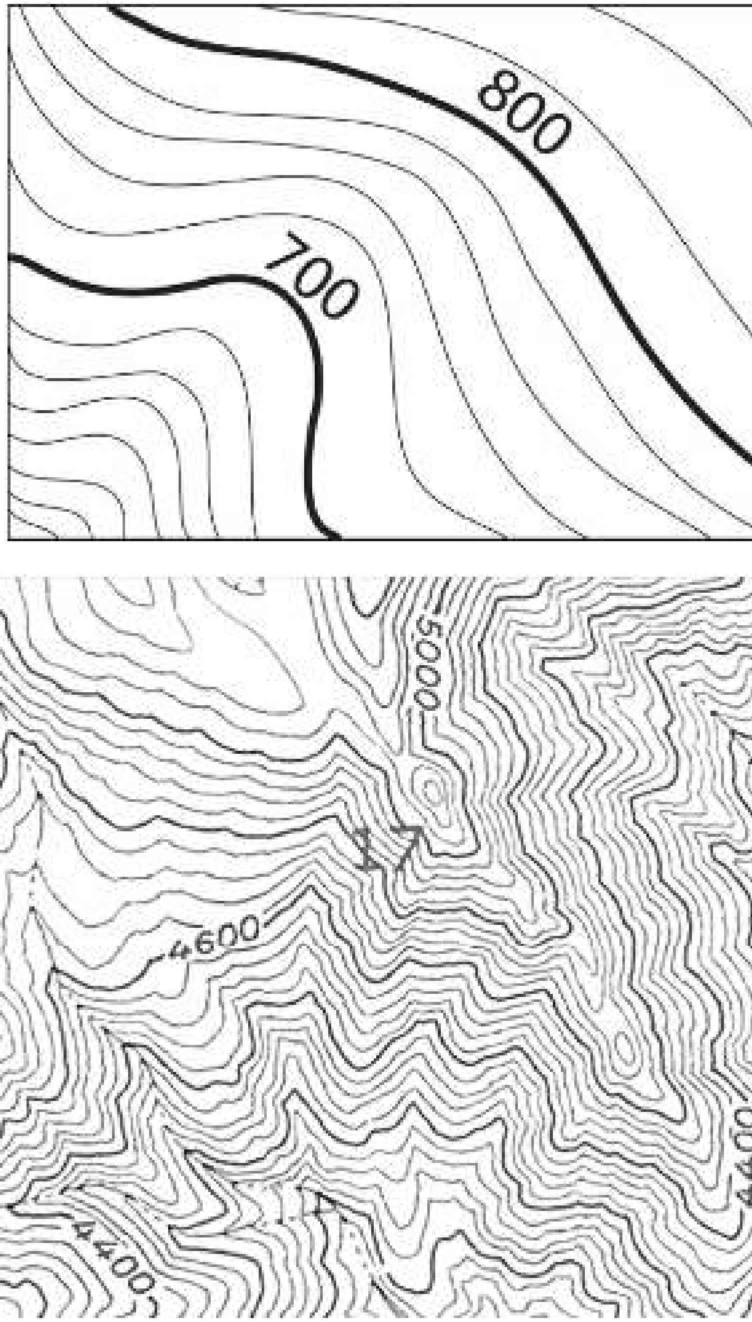


Figure 2-18. Topographic map showing elevation of two index contours (700 and 800).

The contour interval is typically printed at the bottom of the map; however, if the contour interval is unknown, there is a way it can be calculated. Follow the steps in Table 2-1 to calculate the contour interval of the topographic map below.

Steps	Directions
1	Find two index contours near each other: The index contours marked **4400** and **4600.**
2	Determine the difference in elevation between the two index contours: [illegible]
3	[illegible]
4	[illegible]

Self-Check 1	Written Test

Name: _________________________ Date: ________________

Directions: Answer all the questions listed below.

1. List out the tools and equipment used for plan irrigation project? Explain its application (10 pts)

2. What is the advantage and disadvantage of Aerial photograph? (6 pts)

3. How do you interpret Aerial photograph and topographic map? (8pts)

Note: satisfactory Rating-12 and above pts. Unsatisfactory Rating-below 12 pts.

You can ask your teacher for the copy of the correct answers

Operation sheet-1	Prepare and interpret Aerial photograph and topographic map

Objective: Prepare and interpret Aerial photograph and topographic map

Equipment, Tools and Materials: Use appropriate tools and equipment

Procedure.1. to prepare topographic map

1. Plot data on the site map at the appropriate locations using a pen. For example, write groundwater elevation data adjacent to the corresponding monitoring well or plot sand thickness next to the matching borehole location.

2. Determine the contour interval for the map by choosing a number between zero and the largest data value. A contour interval is the frequency with which the lines appear on the map, such as every 10 or 50 units of measure. Use the smallest interval possible without overcrowding the map. For example, if the data points range from 12 to 20, the contour interval may be 1 or 2; however, data points ranging from 12 to 200 may require a contour interval of 10 or 20.

3. Begin contouring by choosing a center contour value and sketching a line connecting points that are equal to that value. Plotted data values that equal the contour line value will be located on the corresponding isocline. However, plotted data values not equal to the contour line value will lie to the sides of the isocline. For example, draw a 10 contour line between the values of 9.8 and 10.6. Since the number 10 is closer to the value 9.8, draw the 10 contour line closer to the 9.8 data point than to the 10.6 data point.

4. Complete all contour lines on the map using the initial contour as a guide. Contours should envelop the site data with an upper and lower contour line. Therefore, a data set from 12 to 20 with a contour interval of 2 will have contours between 10 and 22.

5. Smooth the contours to round the lines and eliminate angles and corners. Use scientific knowledge of the site to guide the final look of the map.

6. Review the map to ensure that it meets the rules of contouring, which include: contour lines do not cross; contour lines never split or form branches; contour lines that cross rivers or streams form a "V" which points upstream; hills and depressions are shown by closed contours; and contour lines that are inferred due to lack of data points are shown with dashes.

7. Label the contour lines with their values. Write the contour values at either the ends of the lines or in the center; however, ensure that the labeling method is consistent throughout the entire map. In addition, orient line labels so that the values are readable without rotating the map.

8. Label the map with a scale, symbol definitions and contour interval information. Place this information together in a corner of the map.

Procedure.2. interpret topographic map

1. Reed Agency or Author Who Created Map at the (upper left corner of map)
2. Reed Map Title (upper right corner of map)
3. Road Classification (bottom right corner of map): Road and trail symbols may be found in this legend.
4. Revision Date (bottom right corner of map): Some maps have a revision date, which is when the map was last updated. If the map is old, it may not be accurate. Refer to the "Map Production Information" block in the bottom left corner for additional information on map dates.
5. Reed Map Scale (bottom center of map)
6. Contour Interval (bottom center of the map): Contour interval is the difference in elevation between two adjacent contour lines.

Procedure.3. interpret aerial photograph

1. **Tone** (also called Hue or Color) -- Tone refers to the relative brightness or color of elements on a photograph.
2. **Size** -- The size of objects must be considered in the context of the scale of a photograph. The scale will help you determine if an object is a stock pond or Lake Minnetonka.
3. **Shape** -- refers to the general outline of objects. Regular geometric shapes are usually indicators of human presence and use. Some objects can be identified almost solely on the basis of their shapes.
    - the Pentagon Building
    - (American) football fields
    - cloverleaf highway interchanges
4. **Texture** -- The impression of "smoothness" or "roughness" of image features is caused by the frequency of change of tone in photographs. It is produced by a set of features too small to identify individually. Grass, cement, and water generally appear "smooth", while a forest canopy may appear "rough".

5. **Pattern** (spatial arrangement) -- The patterns formed by objects in a photo can be diagnostic. Consider the difference between (1) the random pattern formed by an unmanaged area of trees and (2) the evenly spaced rows formed by an orchard.
6. **Shadow** -- Shadows aid interpreters in determining the height of objects in aerial photographs. However, they also obscure objects lying within them.
7. **Site** -- refers to topographic or geographic location. This characteristic of photographs is especially important in identifying vegetation types and landforms. For example, large circular depressions in the ground are readily identified as sinkholes in central Florida, where the bedrock consists of limestone. This identification would make little sense, however, if the site were underlain by granite.
8. **Association** -- Some objects are always found in association with other objects. The context of an object can provide insight into what it is. For instance, a nuclear power plant is not (generally) going to be found in the midst of single-family housing. "

Precaution:

- Before preparing topographic map sure that you use appropriate PPE's. .

LAP Test/ Job Sheet	**Practical Demonstration**

Name: ______________________________ Date: ________________

Time started: ________________________ Time finished: ________________

Instructions:

You are required to perform the following:

Request a set of different activities in preparing and interpret topographic map and aerial photograph then perform the following task in front of your trainer:

- Prepare topographic map
- Interpret topographic map
- Interpret aerial photograph

Information Sheet-3	Decide cropping pattern

The word ‘crop’ refers to plants sown and harvested by man for economic purpose or when several plants similar in respect to life-cycle, morphology or physiology are grown.

Major types of Crops and Their Classification

The crops have been classified on the basis of range of

- Cultivation
- Season in which they are grown
- Duration of crop season
- Taxonomy and
- Their uses

3.1 Identifying types of crops

3.1.1 Identifying types of crops based on preference of project owner

The cropping pattern for a project owner should be such that the selected crops can be successfully grown under the prevailing climate and soil conditions. Furthermore, these crops should be marketable at economic prices. It is therefore necessary that cultivating practices for these crops should be well understood and the planned irrigation system should be compatible with these practices as well as with the physical constraints prevailing at the farm. Paddy rice, for example, requires partial submergence of the rice plants for most of the growing period. Therefore, surface irrigation using basins, either flat level or extremely well graded, would be required for this purpose.

3.1.2 Identifying types of crops based on land use suitability

There are various factors that we are expected to consider during identification of crop types based on land use suitability, such as;

Prevailing farm conditions an environmental scanning should first be conducted. This involves a thorough ocular inspection and other methods to obtain information on the biotic factor that can affect plant growth and yield, soil and climatic conditions prevailing in the area, and accessibility. Here the guiding rule is: know your farm first then select the right crop.

The biotic factor refers to living organisms including ruminant animals, insect and other pests, disease pathogens and weeds, as well as organisms having beneficial effects like civet cat population for the production of *civet coffee* and the abundance of pollinators. Where there is prevalence of a disease in a locality, susceptible crops may be excluded or a resistant variety may be selected.

The topographic features of the land like elevation, slope, and terrain as well as the physical and chemical properties of the soil such as texture, color, organic matter content, pH and fertility levels will determine the crops that are naturally suited. Also, the various climatic factors, such as prevailing climate type, temperature, rainfall, relative humidity, incidence of light, and frequency of typhoons will limit the choice of crops. A stable supply of water within the farm will allow wide possibilities in crop selection.

In addition, the accessibility of the farm to and from the market will influence the choice of crops. For example, cassava and oil palm should be preferably grown in farms with good roads and as close as possible to the market because the harvest is bulky and must be transported immediately due to rapid rate of degradation.

3.1.3 Identifying types of crops based on economic importance.

Currently every activity that peoples perform is related with benefit especially crop production; for those who want to engage in cash crop farming or, at the least, ensure financial sustainability, crop selection must consider marketability and profitability. In general, this means that the crop to be selected must be high yielding. The product, be it the fruit, seed, modified root or stem, flower or foliage or any part, must have an accessible, stable and robust market. With efficient labor and use of inputs, the harvest will realize profit to finance the succeeding farm activities or generate substantial return on investment. However, market and price are dictated by many factors such as the number of competitors, supply and demand, and development of new products, promotional campaign, and agribusiness cycle

3.1.4 Identifying crops based on their agro ecological zones

The impact of food production systems on the environment reflects the characteristics of agro-ecological and socio-economic conditions around the world. For the purposes of this analysis, the following zones were used: warm humid tropics, warm seasonally dry tropics, cool tropics, arid regions, subtropics (summer rains), subtropics (winter rains), temperate zone and boreal zone.

Increased food production is possible in the warmer AEZ, but soil, plant nutrition, pest control and moisture management is critically important. On the other hand, the cooler temperate areas of the world have higher per caput food production because of more favorable soil and climate and capital available for investment.

The current extent of cultivated land throughout the world is about 1 400 million hectares (of which 270 million hectares are irrigated), but there is considerable variation in the percentage of land used for arable cropping in the AEZ. Arable cropping occupies just over 30 percent of the total land area in the temperate zones and the warm seasonally dry tropical zone, with the least amount in the arid zone. The wide range of crops that can be grown in the cool tropics increases the area of cultivated land to between 15 and 20 percent of the total land area.

3.2 Selecting crops

3.2.1 Identifying and characterizing crops

The factors that influencing the choice or identification and characterization of crop are

- Local/national demand (to ensure self-sufficiency or to discourage import)
- Profitability factor (to export, in response to foreign demand)
- Ease of marketing and market demand, etc.

The materialization of the planned cropping pattern is a must for protecting the soil (against salinity, alkalinity, aridity, etc.) and for feeding sufficient water to irrigation network areas.

As a rule, most vegetable crops have a shallow effective root zone depth and respond better to low moisture depletion levels. Consequently, irrigation systems that can provide small amounts of water at short intervals are preferred. In this respect it should be pointed out that through the introduction of localized irrigation to these crops farmers in several countries of the Near East and Africa have reported yield increases of up to 100%. Germination of seeds requires very frequent and light water applications. In this case, sprinkler or localized irrigation may be suitable, especially if the soils are light. The fruit quality of a number of crops, such as tomatoes and cucumbers, is negatively affected when the fruits rest on wet soils. In this case, furrow and drip irrigation are preferable to sprinkler and basin or border strip irrigation. Ponding of water promotes diseases at the neck of trees such as citrus. In this case, systems applying water away from the tree trunk, such as drip and furrow irrigation are preferable.

Under warm and/or desert climates cooling may be required for certain crops, especially in some stages of their growth. In this case a sprinkler irrigation system may be the best alternative. By the same token, in certain climates where frost is a problem, the sprinkler irrigation system, if so designed, may be used for frost protection of part or all of the area under irrigation.

3.2.2 Selecting crops in terms of water requirement

Plants need soil, sunlight, air and water to enable them to live and grow. Water is an essential component of all plant tissue and fulfils three primary functions.

- It keeps plants erect by filling the cells which make up plant tissue
- It acts as a cooling agent in evaporating from the leaves
- Preventing overheating under hot conditions and
- It carries nutrients in solution from the soil into the plants through their roots.

Depending on the crop type, the water requirement varies. Hence, water resources should be planned on the basis of the major crop(s) and cropping pattern.

Crop water requirement is the quantity of water required by the crop in a given period of time and it is express in terms of mm/day, mm/season, or the amount of water needed to replace the transpiration & evaporation losses.

Crop water requirement can be affected by

- Climate,
- Crop type and
- Soil type
- Growing stage(less water at initial stage and highest demand at mid-season stage)

Evapotranspiration varies with climatic conditions in the same way as open water evaporation. When the climate is hot and dry, the rate of evapotranspiration is high; when it is cooler humid the rate is low.

When there is a wind it is higher than when the air is still. Evapotranspiration, like rainfall and evaporation is expressed in terms of depth of water (millimeters), and the rate of evapotranspiration in millimeters per hour (mm/hr). In regions where there are marked seasonal changes in climate there will be corresponding changes in the rate of evapotranspiration; where there is little seasonal climatic change, the rate will be much the same throughout the year.

3.2.3 Selecting crops in terms of growing season

The duration of the total growing season has an enormous influence on the seasonal crop water need. There are, for example, many rice varieties, some with a short growing cycle (e.g. 90 days) and others with a long growing cycle (e.g. 150 days) . This has a strong influence on the seasonal rice water needs: a rice crop which is in the field for 150 days will need in total much more water than a rice crop which is only in the field for 90 days. Of course, for the two rice crops the daily peak water need may still be the same, but the 150 day crop will need this daily amount for a longer period. The time of the year during which crops are grown is also very important.

A certain crop variety grown during the cooler months will need substantially less water than the same crop variety grown during the hotter months. Table below gives some indicative values or approximate values for the duration of the total growing season and water for the various field crops. It is much better to obtain the values locally.

Table - indicative total growing period and approximate values of seasonal crop water needs.

Crop	Total growing period (days)	Crop water need (mm/ total growing period)	Crop	Total growing period (days)	Crop water need (mm/ total growing period)
Alfalfa	100-365	800- 1600	Millet	105-140	
Banana	300-365	1200- 2200	Onion green	70-95	
Barley/ Wheat	120-150	450-650	Onion dry	150-210	350-550
Bean, green	75-90	300-500	Peanut/ground nut	130-140	500-700
Dry	95-110		Pea	90-100	350-500
Cabbage	120-140	350-500	pepper	120-210	600-900
Carrot	100-150		Potato	105-145	500-700
Citrus	240-365	900 -1200	Radish	35-45	
Cotton	180-195	700 – 1300	Rice	90-150	450-700
Cucumber	105-130		Sorghum	120-130	550-650
eggplant	130-140		Soybean	135-150	450-700
Flax	150-220		spinach	60-100	

Grain/small	150-165		Squash	95-120	
Lentil	150-170		Sugar beet	160-230	500-750
Lettuce	150-140		Sugarcane	270-365	1500-2500
Maize sweet,	80-110	500- 800	Sunflower	125-130	600-1000
Grain	125-180		Tobacco	130-160	
Melon	120-160	400-600	Tomato	135-180	400-800

As can be seen from table above there is a large average variation of values not only between crops, but also within one crops type. In general it can be assumed that the growing period for a certain crops is longer when the climate is cool and shorter when the climate is warm.

The choice of crops to be grown and the cropping patterns influence the field layout and irrigation method. However, the choices of crops as well as the cropping programs are influenced by their market potentials. Therefore, an assessment of the existing markets, transport system/road infrastructure, including their potential for development, should be made. Based on the growing season crops can be classified in to:

Monsoon crops: The crops grown in monsoon months from June to Oct-Nov, Require warm, wet weather at major period of crop growth, also required short day length for flowering. E.g. Cotton, Rice, Jowar, bajara.

Cold season's crops: require winter season to grow well from Oct to March month. Crops grow well in cold and dry weather. Require longer day length for flowering. E.g. Wheat, gram, sun flower etc.

Summer crops: crops grown in summer month from March to June. Require warm day weather for major growth period and longer any length for flowering. E.g. Groundnuts, Watermelon, Pumpkins, Gourds.

3.2.4 Selecting crops in terms of growth stage

A fully grown crop will need more water than crop which has just been planted. As has been discussed before, the crop water need or crop evapo-transpiration consists of transpiration by the plant and evaporation from the soil and plant surface. When the plants are very small the evaporation will be more important than the transpiration. When the plants are fully grown the transpiration is more important than the evaporation.

At planting and during the initial stage, the evaporation is more important than the transpiration and the evapo-transpiration or crop water need during the initial stage is estimated at 50 percent of the crop water need during the mid- season stage, when the crop is fully developed.

During the so- called crop development staff the crop water needs gradually increases from 50 percent of the maximum crop water need to the maximum crop water need. The maximum crop water need is reached at the end of the crop development stage which is the beginning of the mid- season stage. With respect to the late season stage which is the period during which the crop ripens and is harvested, a distinction can be made between two groups of crops.

The peak water requirement for sub-tropical fruit is in the summer months, when transpiration is high. The peak water requirement is expressed as mm/day and is the minimum application rate the irrigation system must have. The peak water requirement for sub-tropical fruit is usually between 4mm/day and 6mm/day.

Peak irrigation requirements differ between production areas, with cooler, moist areas having a lower peak requirement than warmer and drier areas. The peak irrigation requirement for a specific area is determined from historical evaporation-pan data and crop factors.

3.2.5 Selecting crops in terms of sowing system

There are various methods of sowing are available starting from traditional broadcasting up to modernized planting. Therefore different crops need different sowing systems when establishing a new date plantation; certain actions need to be implemented to ensure the long term success of the plantation. One of these actions involves the initial land preparation which should be done prior to transplanting of the plant material (offshoots or tissue culture-derived plants).

The purpose of land preparation is to provide the necessary soil conditions which will enhance the successful establishment of the young offshoots or the tissue culture plants received from the nursery. Considering the nature of the date palm, one cannot "save" on this operation and hope for long term sustainability of the plantation.

The aim is to enable the date grower to plan and structure the implementation process in advance, ensuring the successful establishment of the date plantation. Planning forms part of the initial preparation and will help to limiting unnecessary stoppages during the implementation phase.

Critical factors to consider during this planning exercise are summarized as follows:

- Availability and quality of irrigation water
- Field selection
- Mechanical actions to be implemented
- Chemical needs for pre-plant soil improvement
- Tools and equipment needed for date cultivation
- Labor needs
- Irrigation design and installation
- Leaching schedule
- Hole preparation
- Financial requirements and
- Time schedule.

Self-Check 3	**Written Test**

Name: ___________________________ Date: ________________

Directions: Answer all the questions listed below

1. List and explain the criteria's that we expected to consider during land use suitability analysis. (8pts)

2. Briefly explain the cropping patter of different crops (8pts)

Note: Satisfactory rating - 8 points and above Unsatisfactory - below 8 points

You can ask your teacher for the copy of the correct answers

Information sheet-4	**Carry out socio- economic studies**

Introduction

The project's objectives and expectations cannot be realized unless farmers' considerations on benefits and costs, feasibility and desirability and their priorities in life match that which the project requires of them. At times, smallholders' priorities differ from the project's priorities. Hence the need to assess the acceptability and desirability of the farmers to participate in the development of the irrigation scheme. The nature of the population must be understood in order to match the rate of development with the absorptive capacity. Elements such as the level of literacy, farming knowledge and skills, past experience with irrigation, gender issues and attitudes to change are among the several parameters to be considered when analyzing the social aspects of the project.

As a rule, irrigation development brings cultural shock to a smallholder community. With mono modal rainfall conditions, smallholders work for a few months in a year under rain fed conditions. In a sense they are under-employed and have ample time to attend to their social aspects of the society. In contrast to this, irrigated crop production requires almost daily attention throughout the year if it is to be profitable. How able the community is to adjust to these and other changes becomes critically important and should be thoroughly discussed with the farmers.

4.1 Making collaboration with different disciplines & stakeholders.

Teams of experts often do the planning and advisory work. These are normally specialists from different disciplines, hence the term multidisciplinary teams. In the context of irrigation projects, such teams can consist of an irrigation engineer, agronomist, economist, sociologist, credit specialist, etc.

Since socio-economic and gender issues are crosscutting, all team members would need to focus on these issues in their specific fields of expertise or discipline. For this reason, it is important that each team member's Terms of Reference (ToRs) includes specific reference to these issues.

For example, the roles of an irrigation engineer would refer to collecting data on the roles and responsibilities of women and men of different socio-economic groups in water management, irrigation scheme construction and maintenance, and the assessment of socio-economic and gender issues related to proposed irrigation activities. Likewise, the ToRs for an agronomist would need to include references to: collecting data on the gender division of labour in irrigated agricultural production for each socio-economic group, identifying the problems and needs of both women and men in crop production, and assessing socio-economic and gender issues related to proposed agricultural activities.

Definition of roles of stakeholders

There is a need to clearly define the role of each stakeholder in order to avoid the possibility of role conflict. Usually, the main players are the farmers and the irrigation agency, normally a government institution. The responsibilities of the agency are technical in nature. They include field surveys, such as water resources assessment, topographic soil and socio-economic surveys, designs, technical and financial project appraisal, the supervision of construction and irrigation extension. On their part farmers provide the land for irrigation, organize finance for development (if not provided by the government or donors), and provide labour for surveys and construction activities and any other assistance that the project may require. The farmers should form an Irrigation Management Committee (IMC) or a Water Users Association (WUA) to act as the contact between them and other stakeholders. Such committees operate based on bye-laws established and adopted by the farmers during general meetings, and also oversee the operation and maintenance of the irrigation infrastructure.

Involvement of Socio-economic and Gender Expertise

Even if all team members and staff have responsibility for socio-economic and gender issues in their respective disciplines, it is often advisable to have one person appointed to advise specifically on socio-economic and gender issues and to co-ordinate the activities in this field. Therefore, during preparation and design, implementation and M&E, socio-economic and gender expertise needs to be part of the teams of staff and/or consultants capabilities. This expertise could be included in the person of one socio-economic and gender expert, who would work solely on these issues. It could also be an expert in another discipline who has socio-economic and gender expertise, e.g. a sociologist, PRA expert, agronomist, or irrigation engineer. This expert, in addition to focusing on his or her own discipline, would ensure that socio-economic and gender issues are integrated throughout the four stages of the project, and advise other team members.

Stakeholder Analysis and Participation

The planning of new irrigation development or the upgrading of existing systems is increasingly based on the process of stakeholder participation. A stakeholder approach to irrigation development requires an understanding of priority problems and recognition of the stake of all participants in achieving the success of any irrigation project.

4.2 Identifying cultural values and practices of local community

Culture: The culture of a society is the accepted way of doing things in that particular society. It is the way in which people live, their customs, traditions, methods of cultivation and so on. The culture of a society is learned by each individual member of that society. Children are not born with this knowledge; they learn by seeing how older children and adults behave. As they grow up, older members of their family or kinship group teach them about the customs and traditions of the group and the society. Later still, they may be initiated more fully into the society at ceremonies where they are taught traditional habits and customs, and their expected role.

Culture is not an accidental collection of customs and habits but has been evolved by the people to help them in their conduct of life. Each aspect of the culture of a society has a definite purpose and function and is, therefore, related to all the other aspects of its culture. This is important to remember when planning extension programs. Changes in one aspect of culture may have an effect on other aspects of that culture. If changes in one aspect of culture are introduced, and these are likely to have an unacceptable effect on other aspects, then a program may have little chance of success. This is one reason why local leaders and farm people should help in planning an extension program. They will know whether or not the changes proposed will be acceptable to the society.

The more an extension agent learns about and comes to respect the culture of the people with whom he works, the more he will be accepted by them. He will also be more sensitive to the type of advice and support that will be useful.

There are five particular aspects of local culture that the extension agent should be aware of: the farming system, land tenure, inheritance, ceremonies and festivals, and traditional means of com

The implementation of irrigation projects will bring changes in land use pattern and intensity, land and labor productivity, household resource requirements, and tenure issues, which require management and institutional consideration. These socio-economic and institutional factors affect irrigation development.

4.3 Assessing labor availability

For the implementation of irrigation projects, a huge amount of human labor will be required depending on whether the project will be human labor based, or a mechanized one. This point should be taken into account while planning for an irrigation project.

Irrigated crop production is a year-round lab our demanding enterprise. Hence, the issue of the lab our demand of a particular irrigation activity is very important. Farmers normally have on-farm and off-farm activities prior to irrigation development. Irrigation will therefore introduce extra demands on the people's lab our.

According to Chancellor and Hide (1996), some countries in sub-Saharan Africa experience lab our shortages due to use of lab our intensive technologies and the migration of male lab our urban centers. Consequently, women make up the bulk of lab our agricultural activities which result in them being over-burdened.

It is therefore necessary, during scheme planning, to evaluate the lab our requirements of the planned irrigation design alternatives versus the estimated available labour in order to determine when and where shortages may occur. Each alternative will have its own labour requirements and these should be discussed with the farmers. The assessment should also capture issues related to labour and gender so that the design minimizes over-working, especially of women who already have many other activities to attend to. Therefore, irrigation technology options should be gender-sensitive (FAO, 1998). For example, the use of a drag-hose sprinkler demands light work that is limited to moving the tripod and hose from one position to the next.

4.4 Identifying major economic advantages.

A major problem affecting irrigation development projects is the high cost of construction yielding low benefits from agriculture. To achieve efficiency, irrigation investments must be fully recoverable, that is, the present value of public revenues to be generated from the project must be at least equal to the present value of cost. Who should pay for the cost (and in what proportion) depends on the distribution of benefits from irrigation. The beneficiary farmers must pay the cost in proportion to the benefits they receive.

Several factors affect the benefits from an irrigation project: low price of the crops, the prevailing low yields, and the high input costs are examples. All these factors are linked to the management level, and may vary from location to location, and region to region. Truly functioning credit systems for small-scale farmers or effective agricultural extension services may influence the prevailing situations.

4.5 Surveying community awareness.

The project's objectives and expectations cannot be realized unless farmers' considerations on benefits and costs, feasibility and desirability and their priorities in life match that which the project requires of them. At times, smallholders' priorities differ from the project's priorities. Hence the need to assess the acceptability and desirability of the farmers to participate in the development of the irrigation scheme. The nature of the population must be understood in order to match the rate of development with the absorptive capacity. Elements such as the level of literacy, farming knowledge and skills, past experience with irrigation, gender issues and attitudes to change are among the several parameters to be considered when analyzing the social aspects of the project.

To improve on the performance of the irrigation scheme and the productivity of water, it is important to instill best practice at planning, through detailed analysis of physical as well as social assets and limitations. This is because implementations of the identified technical solutions depend on the extent of understanding and addressing socio-economic issues first, followed by policy and biophysical constraints. Therefore, planners, engineers, technicians, managers and social workers charged with the responsibility of irrigation should initiate the process of participatory planning for harmonious working and ultimate improvement of the efficiency of the whole system.

4.6 Making environmental issue considerations.

On the one hand, diversion of existing river- flow in the dry zone may affect downstream users in terms of quantity or quality or both. On the other hand, wet zone rivers may have large unutilized water resources owing through heavily populated areas. In such a case, any large scale water resource development in these areas would involve displacement of people and property, which is socially and politically undesirable. These points should be taken into consideration and the regional or national benefits should be optimized.

Other environmental issues such as drainage effluents, siltation and sedimentation, water logging, development of salinity and acidity in soils, emission of methane gas from agricultural fields, distortion of natural habitat and bio-diversity, etc. should be considered while planning an irrigation project

Impact of Irrigation on Environment and Ecosystem

A fast growing population in the world requires a growth in agricultural output. Irrigation is often a condition for agricultural intensification in arid and semiarid regions. Current agricultural practices involve deliberately maintaining ecosystems in a highly simplified, disturbed, and nutrient-rich state. Intensification of agriculture to bridge the gap between food production and food needs in many countries have already transformed the environment and ecosystem. The recent intensification of agriculture, and the prospects of future intensification, will have major detrimental impacts on the non agricultural and aquatic ecosystems of the world.

4.7 Quantifying cost benefit ratio and project life time

To calculate the profitability of an enterprise or a project, a cost-benefit analysis (CBA) is often used. CBA is a widely used financial and economic appraisal tool for projects. It is particularly useful when a choice has to be made out of several projects (selection), and when the project involves a stream of benefits and costs over time, covering more than one year (from several to dozens of years (usually 20 years is taken as a maximum).

In the agricultural sector, CBA is used also for agricultural projects or large estates, examples being irrigation projects and estates with perennial crops and corresponding processing facilities, e.g. palm oil. The basic idea here is to find out if the investment in construction and yearly maintenance and operational costs of the irrigation scheme is justified in terms of a higher agricultural production and agricultural incomes (benefits).

Project cost and benefits

A detailed project benefit-cost analysis is developed for the selected alternatives. Depending on need, a benefit-cost analysis can be limited to individual landowners and their ability to pay the cost of water and make a net profit with irrigation improvements. Current and reasonable values must be assigned to all components of the project.

Project costs:

- Engineering planning and design, contract administration, construction inspection, permits. On-farm land preparation, irrigation system(s), and distribution facilities.
- Cost of water to landowner, which includes costs of:
- Conveyance, distribution and delivery facilities and all associated structures.
- Water source diversion facilities, wells and pumps, storage reservoir.
- Fishery and wildlife mitigation, maintaining or reconstructing wetlands.
- Management, operation and maintenance of facilities (buildings, staff, equipment)

Note: For a total project benefit-cost analysis, costs must also include all landowner ownership and operation expenses.

Project Benefits:

- Economic, social, and environmental benefits for on-farm, community, and regional levels.
- Power generation revenue (as applicable).
- Other benefits including fishery, wildlife, and recreation use of reservoirs and open canals.

It may be difficult and time consuming to determine all impacts on soil, water, air, plants, animals, and humans (SWAPA+H). For a true benefit-to-cost analysis, dollar values need to be assigned to community benefits including aesthetics, nongame wildlife, environment, social welfare, and economic improvement to community, state, and region.

Self-Check 4	Written Test

Name: _________________________ Date: _______________

Directions: Answer all the questions listed below.

1. Why is important to Making collaboration with different disciplines & stakeholders to study socio- economic studies on irrigation project?(7pt)
2. How to Quantifying cost benefit ratio and project life time in irrigation project plan?(6pt)
3. why to Assess labor availability for irrigation project plane ?(5pt)
4. what are the major economic advantages of irrigation project plane?(6pt)

Note: Satisfactory rating - 12points above Unsatisfactory - below 12 points

You can ask you teacher for the copy of the correct answers.

Information sheet-5	Standardize the project Plan

5.1 Managing project cycle.

The term "**project**" could therefore be taken to mean a group of activities undertaken to produce a Project Purpose in a fixed time frame. In development terms a "**program**" is taken to mean a series of projects whose objectives together contribute to a common Overall Objective, at sector, country or even multi-country level.

Projects differ in size, scope cost and time, but all have the following characteristics:

- A **start** and a **finish**
- A **life cycle** involving a series of phases in between the beginning and end
- A **budget**
- A set of **activities** which are sequential, unique and non-repetitive
- Use of **resources** which may require coordinating
- Centralized **responsibilities** for management and implementation
- Defined **roles** and **relationships** for participants in the project

Project Cycle Management

The way in which projects are planned and carried out follows a sequence beginning with an agreed strategy, which leads to an idea for a specific action, oriented to-wards achieving a set of objectives, which then is formulated, implemented, and evaluated with a view to improving the strategy and further action.

Project Cycle Management is an approach to managing projects. It determines particular phases of the Project, and outlines specific actions and approaches to be taken within these phases. The PCM approach provides for planning and review processes throughout a cycle, and allows for multiple project cycles to be supported.

The project cycle also provides a structure to ensure that stakeholders are consulted and relevant information is available throughout the life of the project, so that informed decisions can be made at key stages in the life of a project.

The Project Cycle

Six stages are typically identified in the project cycle (Figure 2). They are:

I **Identification**: generation of the initial project idea and preliminary design

II **Preparation**: detailed design of the project addressing technical and operational aspects

III **Appraisal**: analysis of the project from technical, financial, economic, gender, social, institutional and environmental perspectives

IV **Proposal preparation, approval and financing**: writing the project proposal, securing approval for implementation and arranging sources of finance

V **Implementation and monitoring**: implementation of project activities, with on-going checks on progress and feedback

VI **Evaluation**: periodic review of project with feedback for next project cycle

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PCM and LFA(Project Cycle Management ,Logical Framework Approach)

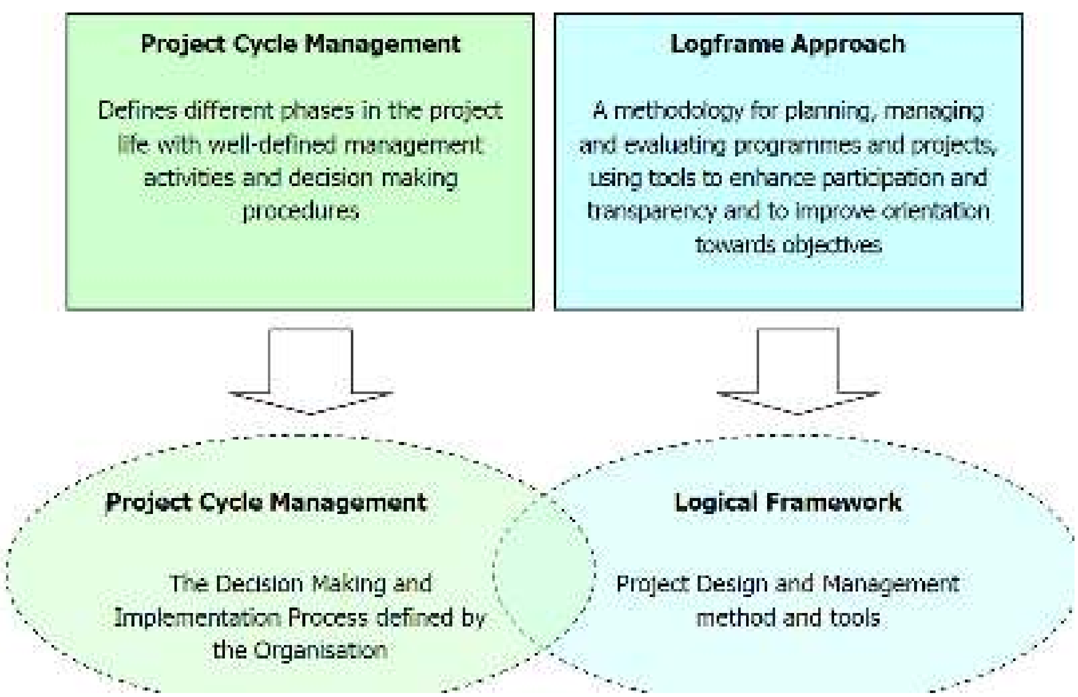
PCM reflects the decision-making and implementation process; the methodology applied for planning, managing, evaluating projects is the Logical Framework Approach.

Project Cycle Management

Defines different phases in the project life with well-defined management activities and decision making procedures

Log frame Approach

A methodology for planning, managing and evaluating programs and projects, using tools to enhance participation and transparency and to improve orientation towards objectives



The EU Project Cycle

The European Union is a major funder of development programs across the world, and one of the biggest single programs operates in South Africa. In their approach to funding the EU uses a particular form of Project Cycle Management to enable it to ensure that it funds projects that are consistent with its objectives, and are likely to achieve the desired impact. In particular the **EU needs to ensure the following:**

- That projects respect and contribute to overarching policy objectives of the EC such as respect of human rights, poverty alleviation and to cross-cutting issues such as gender equality, protection of the environment;
- That projects are relevant to an agreed strategy and to the real problems of target groups and beneficiaries;
- That projects are feasible, meaning that objectives can be realistically achieved within the constraints of the operating environment and the capabilities of the implementing agencies;
- That benefits generated by projects are sustainable.

PCM is seen as an important mechanism for these principles to be achieved.

The generic project cycle for external aid programs defined by the European Commission and all member states has six phases. In practice, the duration and importance of each phase may vary for different projects. The phases are as follows:

5.2 Following SMART planning principles

SMART Action Planning

The SMART model was developed by psychologists as a tool to help people set and reach their goals.

S—Specific

M—Measureable

A—Agreed

R—Realistic

T—Time-bound

Specific

Is your goal well defined? Avoid setting unclear or vague objectives; instead be as precise as possible.

- Instead of: To get all equipment in a good state
- Make it specific: Contact the maintenance company to repair centrifuge with label

Measurable

Be clear how will you know when you have achieved your goal. Using numbers, dates and times is one way to represent clear objectives.

- Instead of: To get better results
- Make it measurable: Bring down the false positivity rate in EQA to max 3%

Agreed

Actions need to be carried out by someone. It is therefore crucial to assign each SMART action point to a specific person. This person can be held accountable for timely implementation of the action point and this makes follow-up easier for the manager.

Realistic

Setting impossible goals will only end in disappointment. Make your goals challenging, but realistic.

- Instead of: Become accredited in 16 months' time
- Make it attainable: Achieve completion of LQSI tool phase 1 in nine months' time

Time-bound

Set a time scale for completion of each goal. Even if you have to review this as you progress, it will help to keep you motivated.

- Instead of: Do the Facility and Safety assessment
- Make it time-bound: Do the Facility and Safety assessment before the 27th of February 2012

An example of how you can formulate a good action point

Deadline: Person assigned: Specific action: Date of formulating action point.

Example:

The aim of SMART goals is to create realistic goals that produce an outcome. Often when setting goals, people will think big and get discouraged if they don't meet their goals. While the College encourages our registrants to think big, we also want to ensure registrants are creating achievable goals with practical results. The process is not meant to be daunting or overwhelming.

Self-Check 5	Written Test

Name: _________________________ Date: _______________

Directions: Answer all the questions listed below.

1. List The Project Cycle and explain briefly according to irrigation project plane?(5pt)
2. What are the characteristics made the Projects differ from one from the others?(7pt)
3. What is the major difference between Project Cycle Management Log frame Approach?(6pt)
4. What is the importance of project Following SMART Planning principles?(6pt)
5. Defines different phases in the project life with well-defined management activities and decision making procedures? (6pt)

Note: Satisfactory rating – 15 points above Unsatisfactory - below 15 points

You can ask you teacher for the copy of the correct answers.

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