Approved Capacity Webcast Series

Session 1: Introduction to Approved Capacity and Water Production Projections

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Webcast Audio

- Audio will be broadcast through a one-way audio stream directly to your computer speakers or headphones
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Contact Hours

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  - Participants' names and operator ID
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Agenda

- Purpose and benefits of the Approved Capacity document
- Key definitions
- Essential chemicals and redundancy requirements
- Determining the limiting component using the equivalent maximum-day concept
- Basis-of-design tables
- Planning requirements/water production projections
- Q&A

Approved Capacity Document

- “Planning and Design Criteria for Establishing Approved Capacity for: 1) Surface Water and Ground Water Supply Sources, 2) Drinking Water Treatment Plants (WTPs), and 3) Source/WTP Systems”
- Rule-by-reference in OAC rule 3745-91-08 (effective 5/20/10)

Approved Capacity Subcommittee of Ohio AWWA Technology Committee

- Tim Wolfe, Chair
  MWH Americas
- John Arduini
  Ohio EPA Central Office
- Tom Bell-Games
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- Dave Bornino
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Benefits of the Approved Capacity Document

- Planning criteria allows water systems to plan for growth and develop strategies for managing water supply/demand issues
- Defines the necessary infrastructure capacities and redundancies to meet the drinking water regulations
- Clarifies what is a plan approval violation as it relates to approved capacity
- Water systems retain their established approved capacities until they apply for an increase/decrease
- Specifies the criteria and standards Ohio EPA will use to evaluate a plan submittal

Purpose

- To provide, in a manner efficient and free of unnecessary delays, a framework for obtaining an approved capacity for:
  - Water-supply sources,
  - Drinking water treatment plants (WTPs), and
  - Source/WTP system
- Distribution systems not specifically addressed
- Does not apply to small public water systems using only ground water covered under the “Guidelines for Design of Small Public Water Systems” (aka Greenbook)

Definition of Key Terms

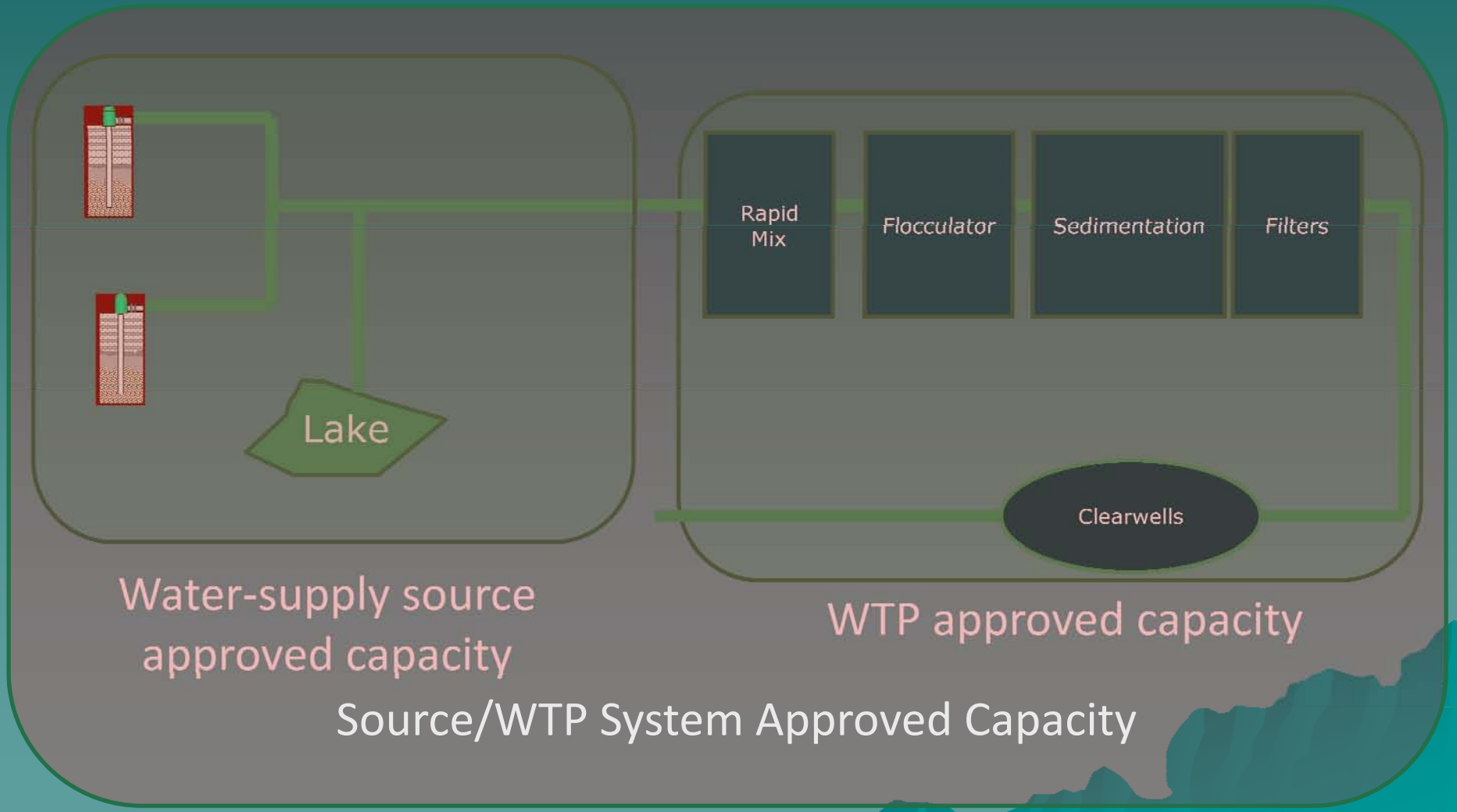
Approved Capacity

- "Approved Capacity" means the allowable rate at which water may be processed by a component of a water-supply source or WTP.
  - Approved capacity of a water-supply source or WTP is based on a **limiting component.**
  - Approved capacity of a source/WTP system is the **lesser between** the approved capacity of the water-supply source and WTP

The Big Picture

- Determine component capacities
- Use equivalent maximum-day concept to determine the limiting component, which is the basis for the approved capacity of water-supply source and WTP
- Lesser of approved capacities for water-supply source and WTP determines approved capacity of source/WTP system
- If increase in approved capacity is needed, look at increasing capacity of limiting component

Source/WTP System Approved Capacity



Component Capacity

- "Component capacity" means the allowable rate not to be exceeded over a period of time
- Design criteria:
  - Average-day production
  - Maximum-day production

Component capacity: average-day production

- The period of time is:
  - a 12-month period, or
  - the period during the year the component is in operation - if the component is not operated the entire 365 days during the year

Component capacity: maximum-day production

- The period of time is:
  - a one-day period, or
  - the period during the day the component is in operation - if the component is not operated the entire 24 during the day

Water-supply source

"Water-supply source" is a compilation of all water-supply source components for either a surface or ground water water-supply source

Water-supply source component

- Surface water-supply sources:
  - River or Stream,
  - Natural lake,
  - On-line storage,
  - Off-line storage,
  - Intake,
  - Source-water pumping (e.g., pumping upstream of off-line storage, or pumping directly to the WTP), and
  - Combinations of the above

Water-supply source component

- Groundwater Water-supply sources:
  - Aquifer,
  - Well field,
  - Well pumping (e.g., for vertical wells, for horizontal collector wells, etc.)
  - Off-line storage,
  - Source-water pumping (e.g., pumping upstream of off-line storage, or pumping directly to the WTP), and
  - Combinations of the above

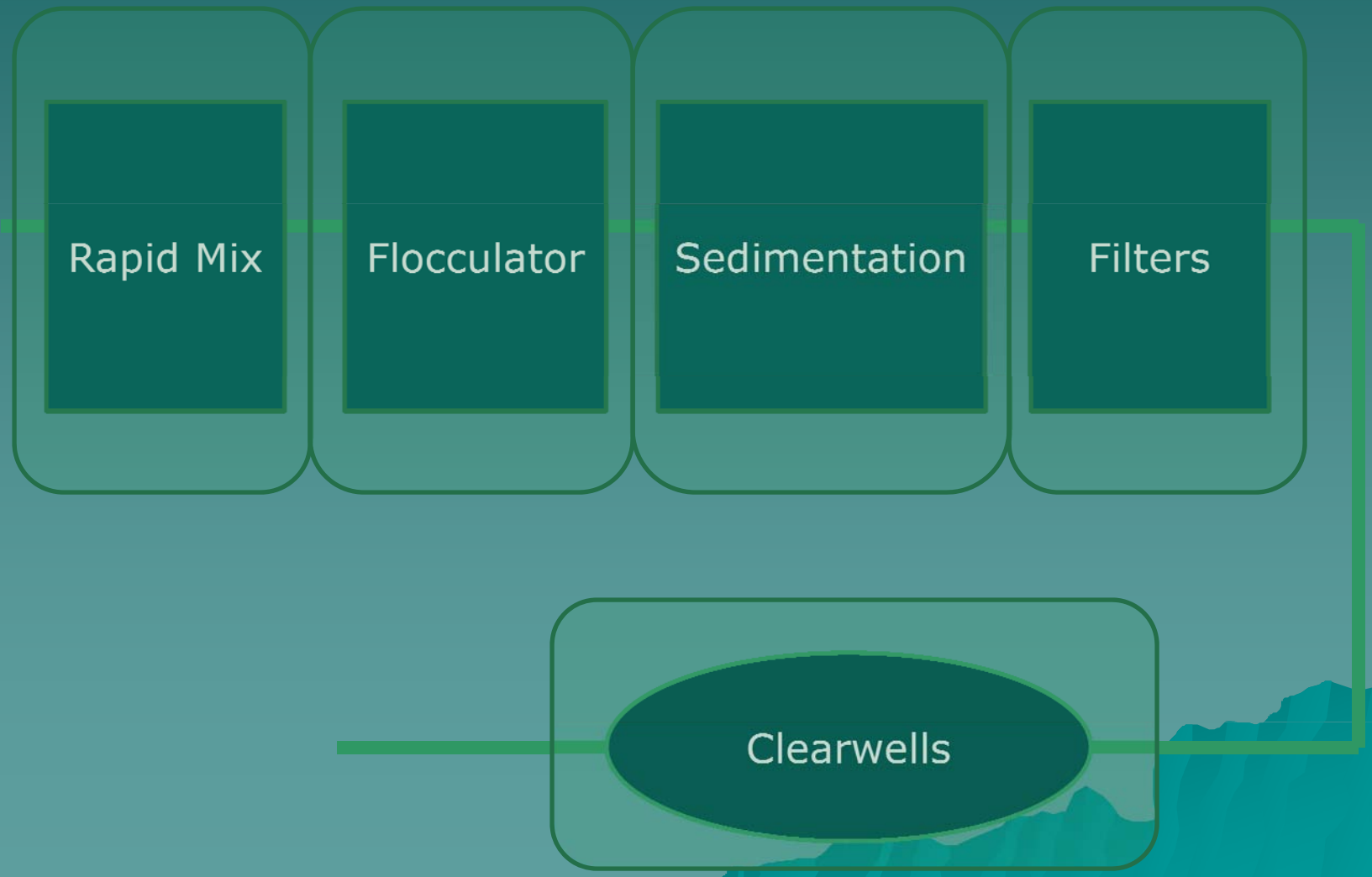
Water treatment plant

"Water treatment plant" is a compilation of all WTP components in the water treatment plant

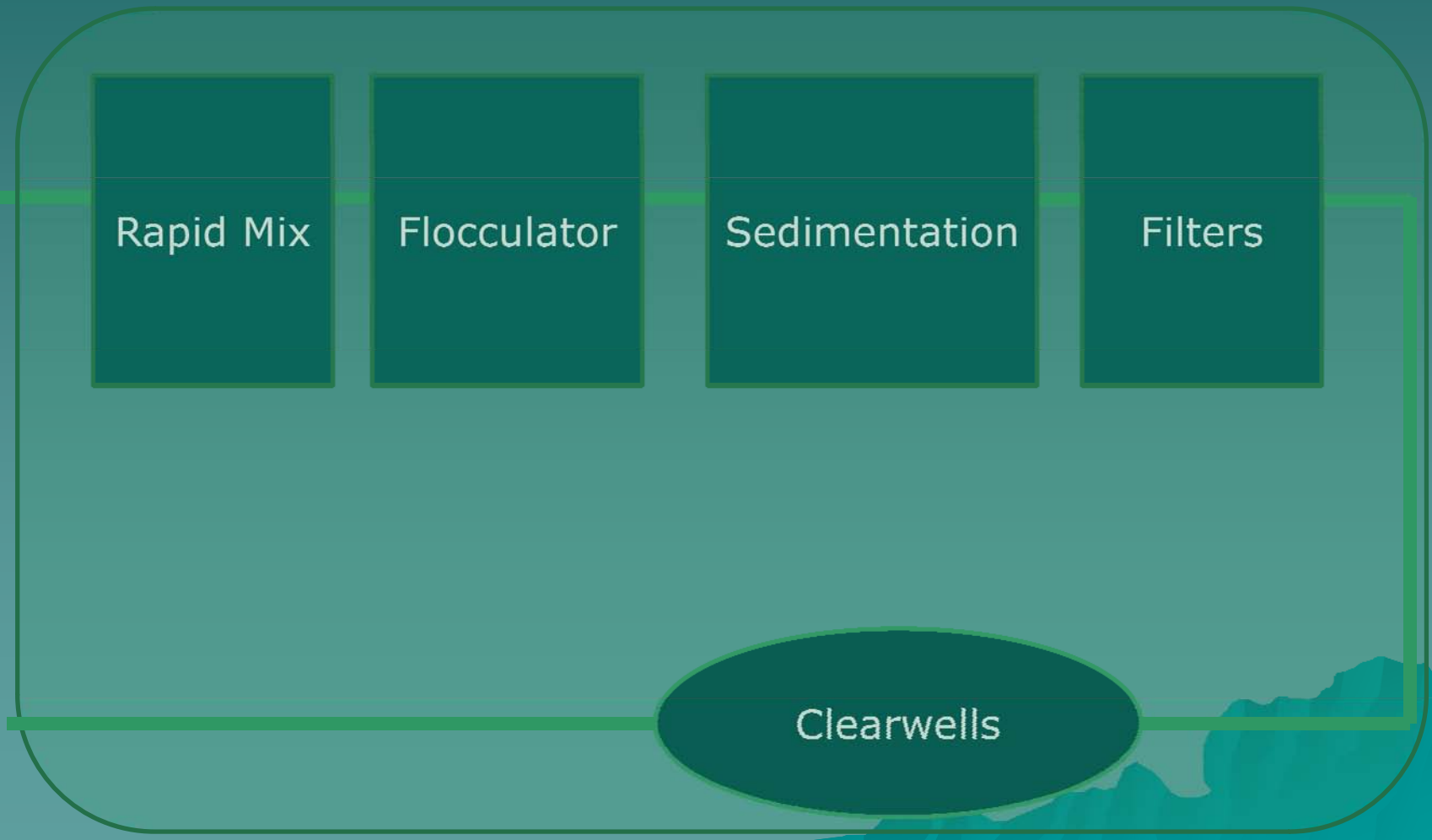
WTP components

- A unit-treatment process (e.g., pre-sedimentation, rapid-mix, flocculation, sedimentation, filtration, stabilization, etc.);
- Essential chemical storage-and-feed facilities;
- Disinfection (e.g., chorine, chloramines, chlorine dioxide, ozone or UV generation and/or contacting facilities); and
- WTP pumping (e.g., intermediate pumping between components within the WTP, finished-water pumping to convey finished water to the distribution system, etc.)

WTP Component Capacity



WTP Approved Capacity



Source/WTP system

- "Source/WTP system" means a WTP and its water-supply source(s)
  - Public water systems with more than one WTP will be given a source/WTP system approved capacity from Ohio EPA for each source/WTP system

Limiting Component

"Limiting component" for a water-supply source or WTP is determined by converting a component capacity to equivalent maximum-day capacity so components can be compared on a common numerical basis.

Equivalent Maximum-Day Capacity

"Equivalent maximum-day capacity" means the maximum-day production a component of a water-supply source or WTP would be able to help support [based on the public water system's projected design-year production ratios of either: a) maximum-day to average-day, or b) peak-hour to maximum-day]

Production

"Production" is the rate at which finished water leaves the WTP to satisfy customer water demands (e.g. domestic, commercial, public, fire flow, and industrial) and accounted for and unaccounted for water losses.

Approved Capacity of the Water-Supply Source

- "Approved capacity of a water-supply source" must be large enough that source water can be delivered to the WTP at a flow rate equivalent to the:
  - Design-year average-day production on a continuous basis, and
  - Design-year maximum-day production on at least a one-day basis

Approved Capacity of the WTP

- Must be large enough that finished water can be:
  - Processed at a flow rate equivalent to the design-year maximum-day production (TSS Section 2.1),
  - Disinfected at a flow rate equivalent to the design-year peak-hour of treatment rate, and
  - Delivered to the distribution system at a flow rate equivalent to the design-year peak-hour production

Approved Capacity of the Source/WTP system

- Must be large enough that finished water can be delivered to the distribution system at a flow rate equivalent to the design year peak-hour production
- For a public water system with more than one source/WTP system, the sum of the approved capacities of the source/WTP systems must be large enough to deliver finished water to the distribution system at a flow rate equivalent to the design-year peak-hour production

Example of a WTP that is Operated less than 24 Hours per Day

- The projected, Max.-day water demand in the design year to be supplied by a WTP is 1 MGD. This particular WTP is to be regularly operated one, 8-hour shift each day. Therefore, the Approved Capacity of this WTP must be at least 3 MGD:

$$\frac{1\ \text{MG}}{8\ \text{hours}} \times \frac{24\ \text{hours}}{\text{Day}} = \frac{3\ \text{MG}}{\text{Day}} = 3\ \text{MGD}$$

Note: Distribution storage is full at the end of the 8-hour shift, and almost empty at the beginning of the next shift.

Another Way of Looking at this Example is . . .

- The Approved Capacity is 3 MGD for a WTP. This particular WTP is regularly operated one, 8-hour shift each day. Therefore, during the 8-hour shift this WTP can not process more than 1 MG of water:

$$\frac{3\ \text{MG}}{\text{Day}} \times \frac{\text{Day}}{24\ \text{hours}} \times \frac{8\ \text{hours}}{\text{shift}} = 1\ \text{MG per shift}$$

Note: Distribution storage is full at the end of the 8-hour shift, and almost empty at the beginning of the next shift.

Essential Chemicals

Essential Chemicals

- Coagulant for surface water treatment
- Polymer(s) if necessary to meet enhanced surface water treatment turbidity standards
- Disinfectant
- Corrosion-control chemicals where required to meet water-quality parameters for lead and copper corrosion control
- Fluoride (for PWSs required by law to feed)
- Oxidant where required for arsenic removal
- Any chemical required during a demonstration study to obtain Ohio EPA approval of an alternative technology

Essential Chemicals – Storage and Redundancy

- Only “Essential” chemicals are required to have 30 days of storage
- Only “Essential” chemicals are required to have redundancy in feed pumps

Determining the Limiting Component Using the Equivalent Maximum-Day Concept

The Limiting Component is Determined Based on Equiv., Max.-day Capacity

- **The limiting:**
  - 1) Water-supply Source component (e.g., river, aquifer, etc.), or
  - 2) WTP component (e.g., rapid-mix unit, finished-water pump station, etc.),

  can only be determined by comparing components on a common "numerical" basis

- Therefore, the component capacity of each component is converted to an **"Equivalent Max.-day Capacity"** so the numerical values for components can be compared on a common and equal basis (i.e., a common denominator)

Equiv. Max.-day Capacity can be thought of as . . .

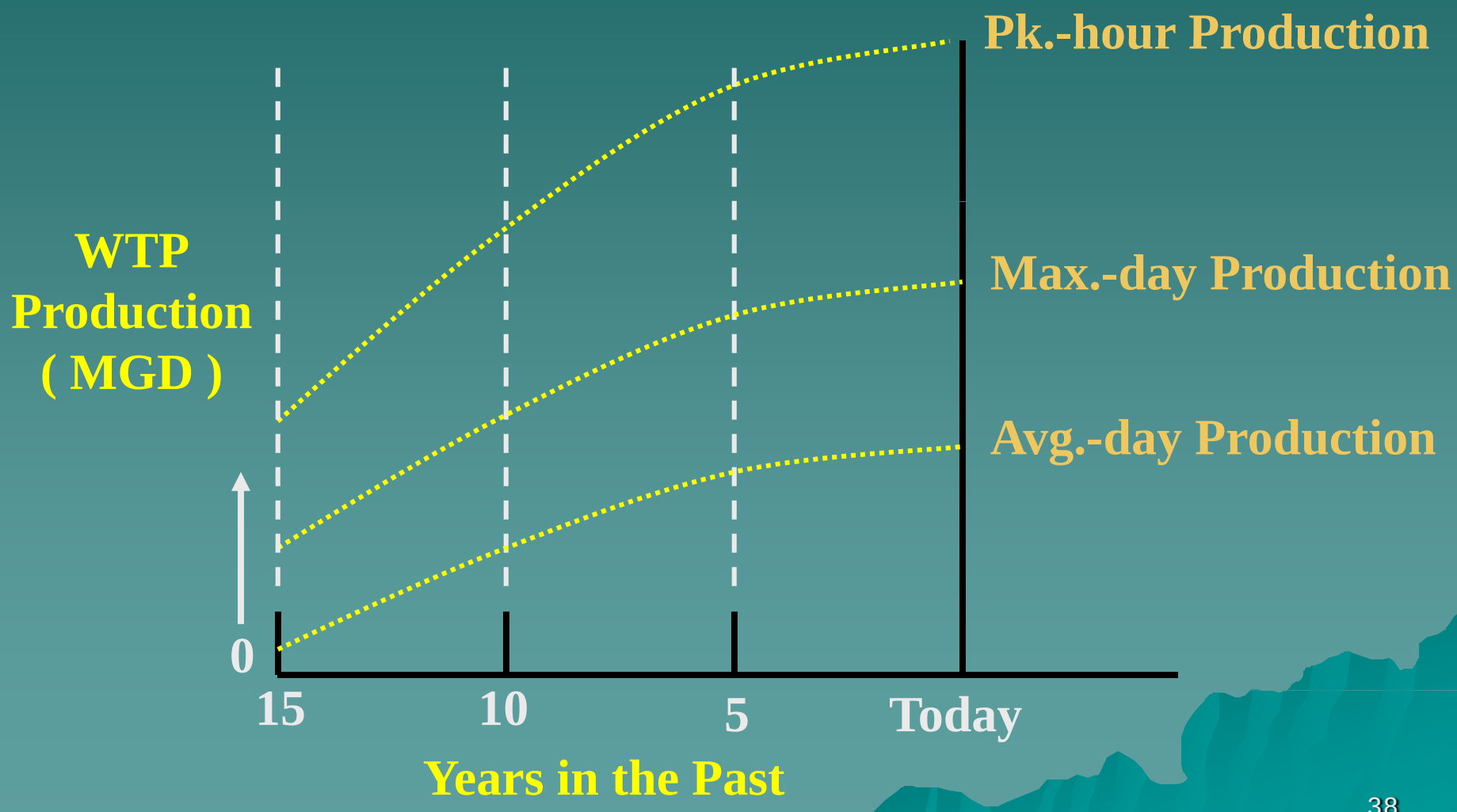
. . . The equivalent max.-day production that particular component could support based on the water system's production ratios of:

- $\frac{\text{Max.-day}}{\text{Avg.-day}}$ (typically 1.2 - 2.5)

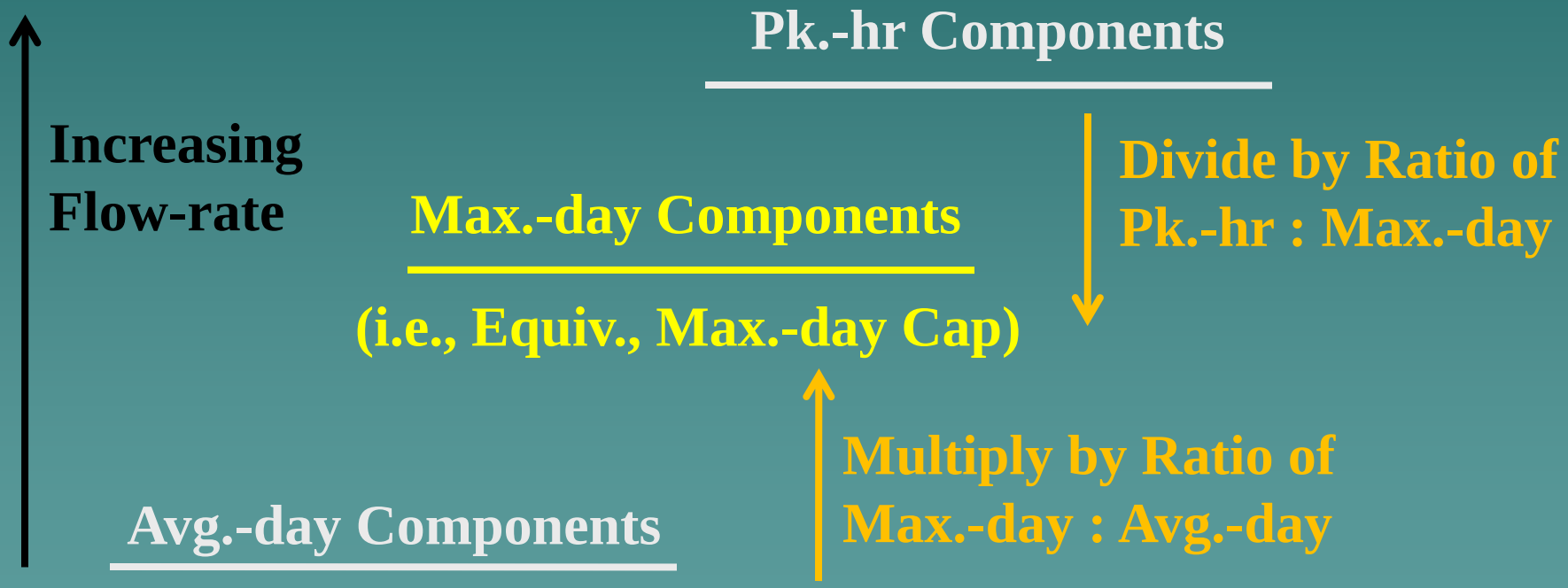
and

- $\frac{\text{Pk.-hour}}{\text{Max.-day}}$ (typically 1.3 - 2.0)

Historic WTP Production for a Rapidly-growing Water System



A Common Denominator Allows Comparison of Components



For Components based on Supplying Avg.-day Production . . .

. . . The Component Capacity is converted to an "Equivalent Max.-day Capacity" by:

'Multiplying' the Component Capacity by the ratio of Max.-day to Avg.-day production:

E.g., a well field's component capacity is 5.0 MGD, and the water system's ratio of Max.-day to Avg.-day production is 1.25:

$$\frac{5.0 \text{ MGD Avg.-day}}{1} \times \frac{1.25 \text{ Max.-day}}{\text{Avg.-day}} = \textbf{6.25 MGD Equiv. Max.-day}$$

For Components based on Supplying Pk.-hr Water Production . . .

. . . The Component Capacity is converted to an "Equivalent Max.-day Capacity" by:

'Dividing' the Component Capacity by the ratio of Pk.-hr to Max.-day production:

E.g., a finished-water pump station's component capacity is 10.0 MGD, and the water system's ratio of Pk.-hr to Max.-day production is 1.4:

$$\frac{10.0 \text{ MGD } \cancel{\text{Pk.-hr}}}{1} \times \frac{\text{Max.-day}}{1.4 \ \cancel{\text{Pk.-hr}}} = \textbf{7.1 Equiv. Max.-day}$$

Basis-of-Design (B-o-D) Tables

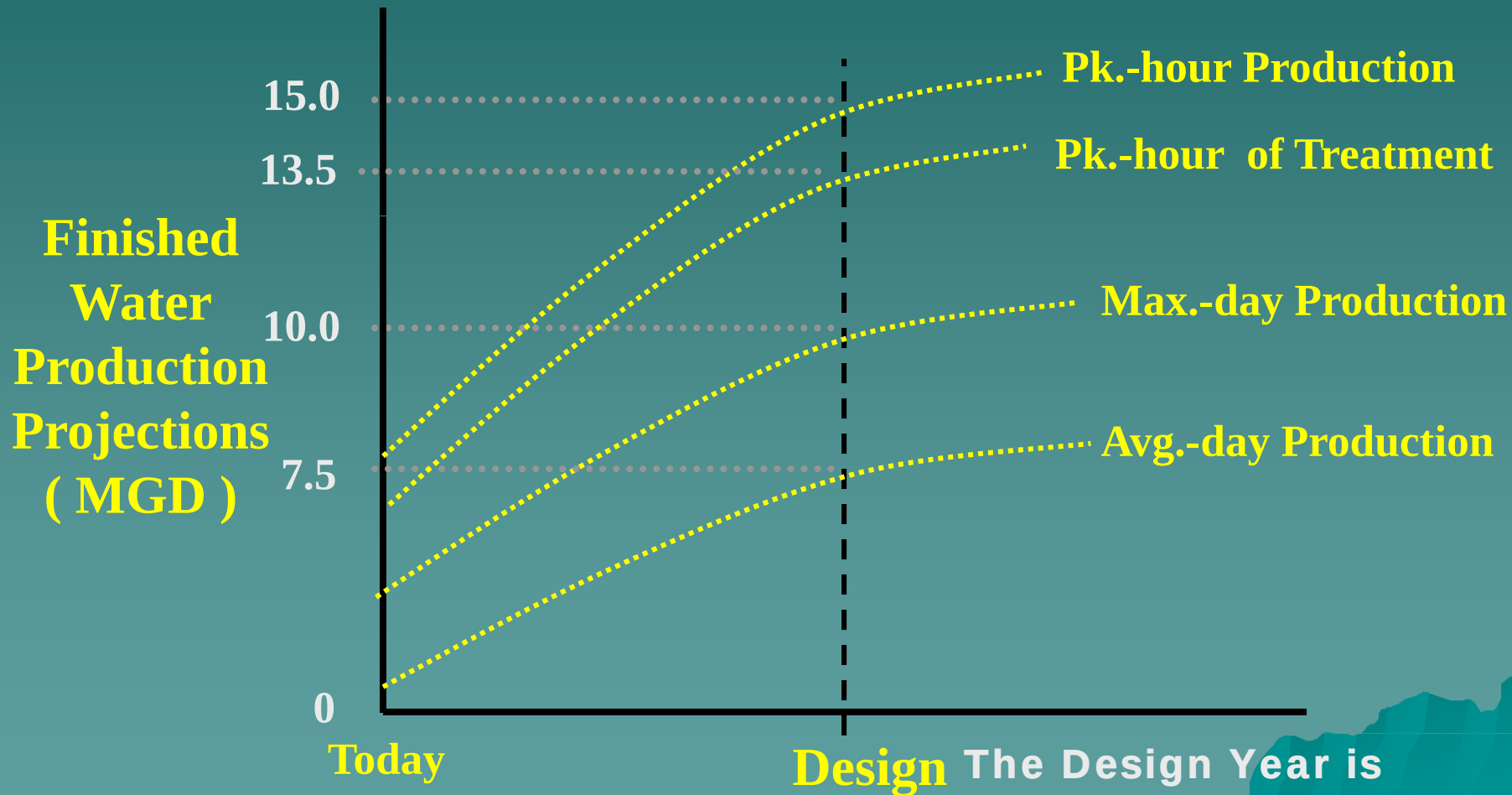
The Basis-of-Design Table Contains Information in Eight (8) Columns

1) Component of Water-supply source and WTP
2) Number of units, and Characteristics of units
3) Design standards (Design professionals' suggestions)
4) Component Design criteria
5) Whether the component design criteria is Required ("Shalls/Musts" of TSS) or Recommended ("Shoulds")
6) Component capacity
7) Finished-water flow rate (production) on which the component capacity is based (Avg.-day, etc. – and, the Ratio used to calculate Equiv., Max.-day capacity)
8) Equiv., Max.-day capacity for each Component, and Approved Capacity of the Water-supply source and the WTP (based on the Limiting component, respectively)

EXAMPLE

Determining the Approved Capacity of a Source/WTP System

WTP Production Projections Show this is a Growing Water System



The Design Year is 15 years in the future for this water system

Determining Approved Capacity of a Source/WTP System (cont)

This PWS wants to expand its 7.5-MGD water system to an approved capacity of 10.0 MGD (i.e., to be able to meet the projected, Max.-day production in the design year)

The ratio of Projected, Pk.-hour : Max.-day production is:

$$\frac{15.0 \text{ MGD}}{10.0 \text{ MGD}} = 1.50$$

The ratio of Projected, Pk.-hour treatment rate : Max.-day production is:

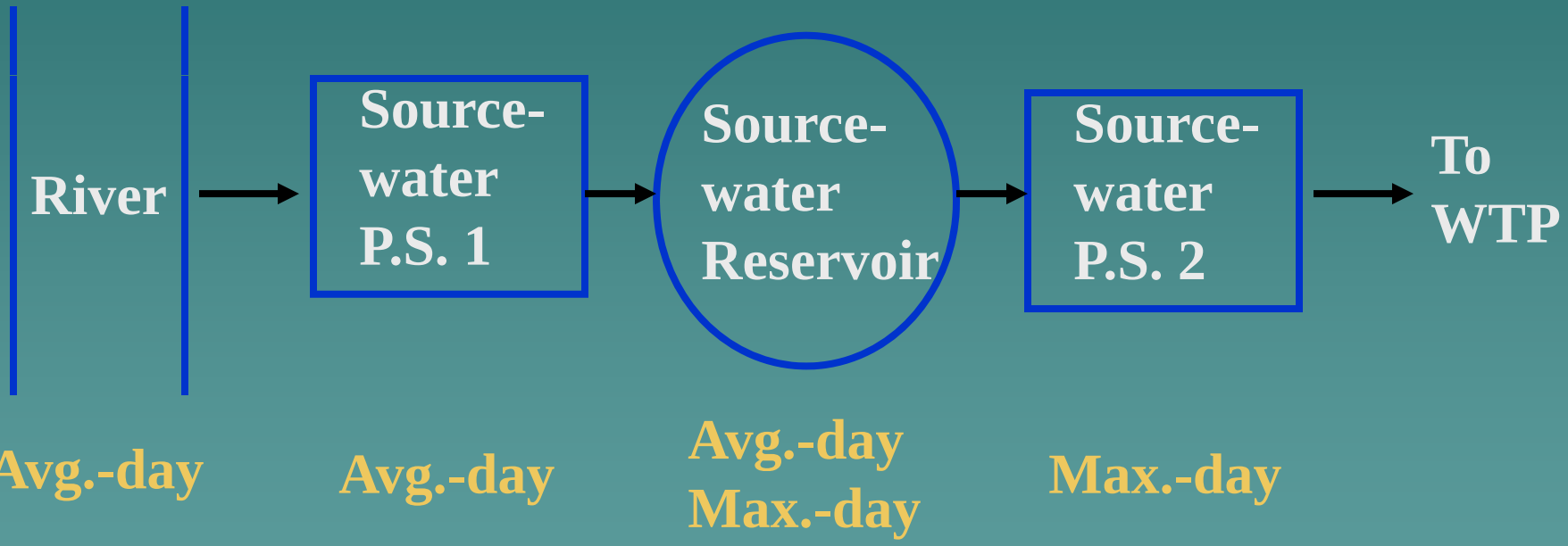
$$\frac{13.5 \text{ MGD}}{10.0 \text{ MGD}} = 1.35$$

The ratio of Projected, Max.-day : Avg.-day production is:

$$\frac{10.0 \text{ MGD}}{7.5 \text{ MGD}} = 1.33$$

Determining Approved Capacity of a Source/WTP System (cont)

Water-supply Source



Flow-rate Basis for Component Design Criteria

Example Basis-of-Design Table for a Water-Supply Source

1 Component	2 # of units	3 Design Standard	4 Design Criteria	5 Req'd / Rec	6 Component Capacity	7 Flow Basis of Comp. Cap. / Ratio	8 Equiv. Max.-day Capacity
River	One		Stable yield based on an engineering submission (1)	Req'd	7.5 MGD	Avg. day 1.33	10.0 MGD
Source-water P.S. 1	Four Pumps		Avg. day w/o largest	Req'd	9.0 MGD	Avg. day 1.33	12.0 MGD
		Max. day w/ all in-service		Rec	12.5 MGD	Max. day 1.0	(2)

(1) Engineering submission based on "USGS, Water-Resources Investigations Report 01-4256"

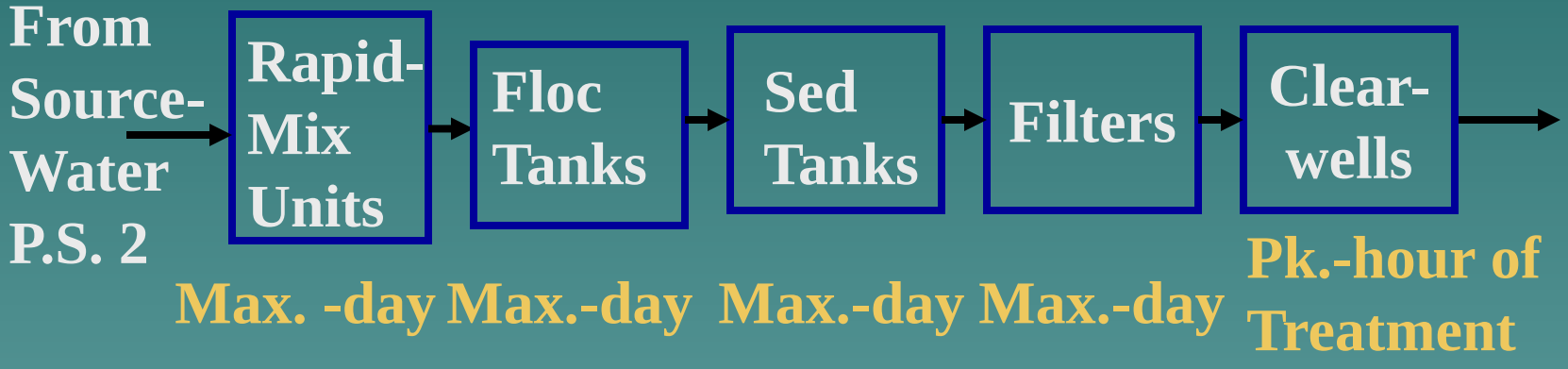
(2) No Equiv. Max-day Capacity based on Design standards or Recommended Design criteria. Only Required Design criteria determines approved capacity.

1 Component	2 # of units	3 Design Standard	4 Design Criteria	5 Req'd / Rec	6 Comp. Capacity	7 Flow Basis of Comp. Cap. / Ratio	8 Equiv. Max.-day Capacity
Source-water Res.	One		Based on an Eng. Submission (3)	Req'd	8.5 MGD	Avg. day 1.33	11.3 MGD
		Storage to Assist w/ Max. day		Rec	12.0 MGD	Max. day 1.0	
Source-water P.S. 2	Five Pumps		Max. day w/o largest	Req'd	12.5 MGD	Max. day 1.0	12.5 MGD
		Pk. hour Trtmnt w/ all in-service		Rec	16.5 MGD	Pk. hour Trtmnt 1.35	

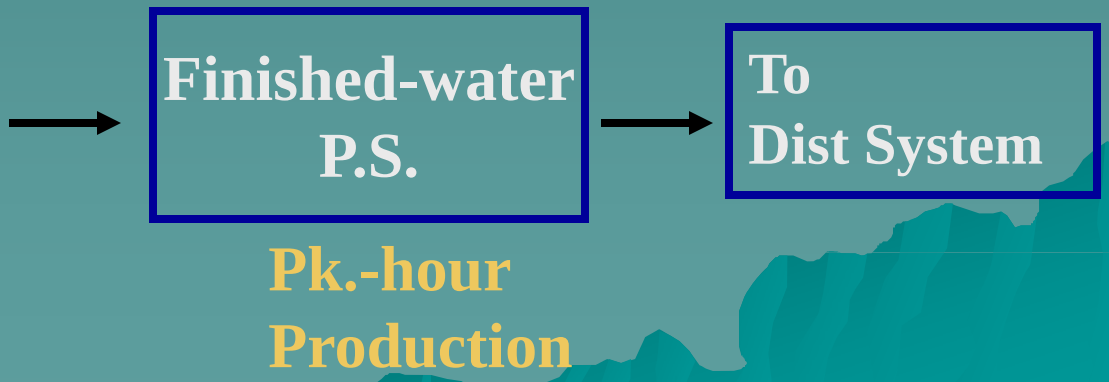
(3) An Engineering submission must justify the River, Source-water P.S. 1 & Source-water Reservoir working closely together as a Single Component.

Determining Approved Capacity of a Source/WTP System (cont)

Water Treatment Plant (WTP)



Flow-rate Basis For Component Design Criteria



Example Basis-of-Design Table for a Water Treatment Plant

1 Component	2 # of units	3 Design Standard	4 Design Criteria	5 Reg'd / Rqc	6 Component Capacity	7 Flow Basis of Comp Cap. / Ratio	8 Equiv. Max.-day Capacity
Rapid mixers	Two		Det Time < 30 sec	Req'd	15.0 MGD	Max. day 1.0	**15.0 MGD**
		G Value of +/- 1,000		Rec	15.0 MGD	Max. day 1.0	
Floc basins	Four		Det Time > 30 min	Rec	12.0 MGD	Max. day 1.0	
		Gt Value of 25 - 100		Rec	12.5 MGD	Max. day 1.0	
Sed basins	Four		Det Time > 4 hrs	Req'd	11.5 MGD	Max. day 1.0	**11.5 MGD**
		Flow-thru Vel < 0.5 fpm		Rec	11.0 MGD	Max. day 1.0	

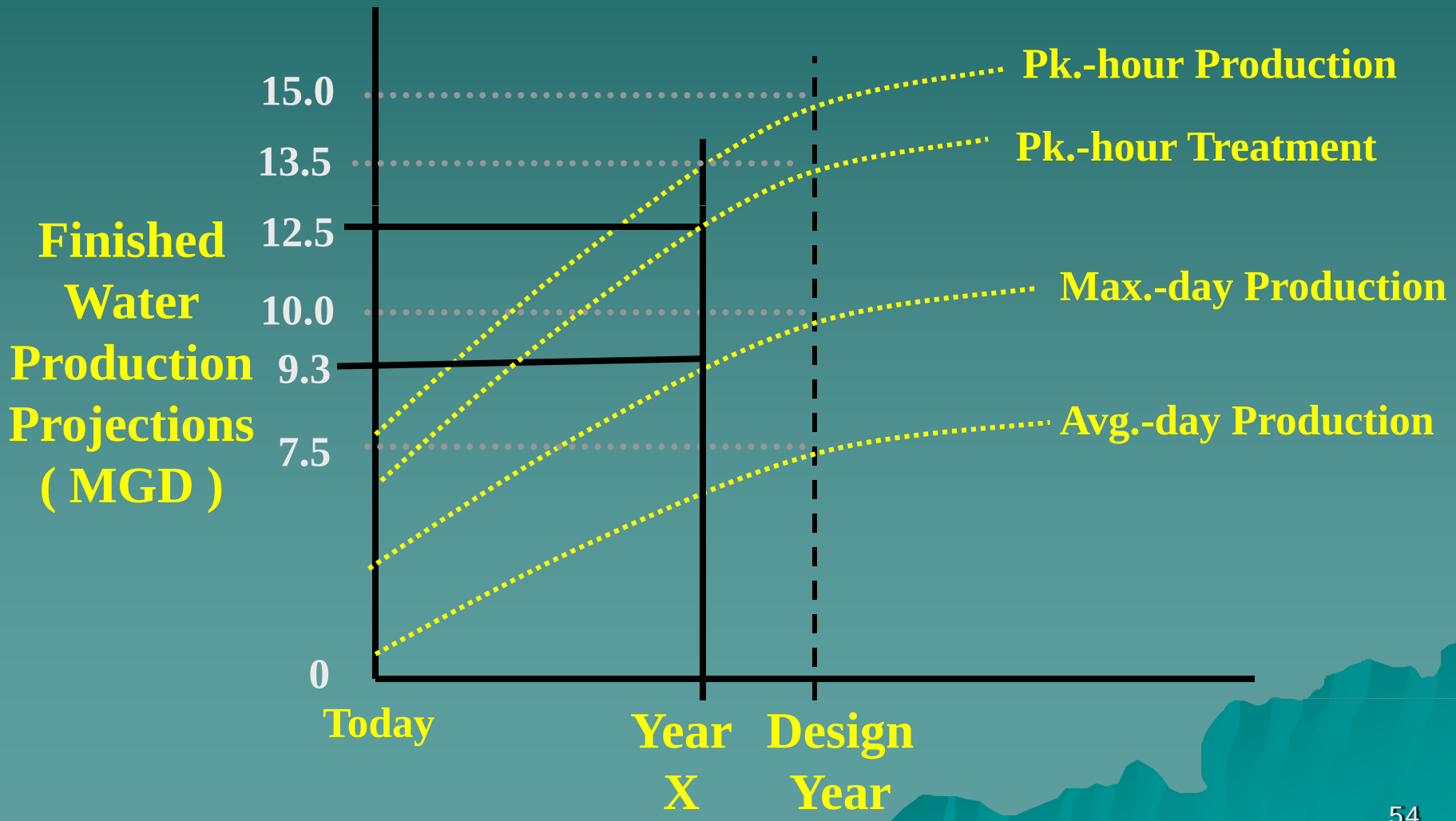
1 Component	2 # of units	3 Design Standard	4 Design Criteria	5 Req'd / Rec	6 Component Capacity	7 Flow Basis of Comp. Cap. / Ratio	8 Equiv. Max.-day Capacity
Filters	Five		Max. day w/o largest	Req'd	12.5 MGD	Max. day 1.0	**12.5 MGD**
		Pk. hour Trtmnt w/ all in-service		Rec	15.5 MGD	Pk. hour of Trtmnt 1.35	
Clear-wells	Two		CT for 0.5-log Giardia	Req'd	12.5 MGD	Pk. hour of Trtmnt 1.35	**9.3 MGD**
		Storage for Pk hr Product.		Rec	16.0 MGD	Pk. hour Product. 1.50	
Finished-water P.S.	Five		Pk. hour w/o largest	Req'd	18.0 MGD	Pk. hour Product. 1.50	**12.0 MGD**
		Fire flow w/ all in-service		Rec	??	Fire flow	

Key Conclusions from the B-o-D Table for the WTP

Essentially, in Year X and beyond (see Figure on next slide) when the Winter, Max.-day production reaches 9.3 MGD (i.e., an associated Pk.-hour of treatment rate of 12.5 MGD has been reached):

The WTP will be first challenged in Year X to meet the required daily CT value in the Winter at a water temperature of 0.5 C

The Clearwell CT Capacity Shortage Occurs in Year X



Approved Capacity of the Source/WTP System

- The Approved capacity of the Water-supply Source is 11.3 MGD
- The Approved capacity of the WTP is 9.3 MGD
- The Approved capacity of the Source/WTP System is 9.3 MGD (lesser of the two)

To Increase the Approved Capacity, the Water System could . . .

- Increase the “C” of CT by increasing the free chlorine residual (i.e., DBPs don’t form as readily in the winter),
- Increase the “T” of CT by increasing the effective volume factor, EVF, of the Clearwells (e.g., install baffles),
- Increase the “T” of CT by maintaining a higher water level in the Clearwells (e.g., install VFDs on finished-water pumps),

To Increase the Approved Capacity, the Water System could also . . .

- Decrease the “Ratio” of Pk.-hour of treatment to Max.-day water production (e.g., install VFDs on both source-water and finished-water pumps),
- Decrease the “Ratio” of Pk.-hour water production to Max.-day water production (e.g., construct additional distribution-system storage),
- Request a “seasonal CT” approved capacity for the Clearwells (particularly if the Summer, Max.-day water production is significantly larger than the Winter, Max.-day water production)

Additional Baffles were Installed to Increase the EVF from 0.4 to 0.6

- The New Equiv. Max.-day Capacity for the clearwell is now:

$$\frac{9.3\ \text{MGD}}{1} \times \frac{0.6}{0.4} = 14.0\ \text{MGD}$$

- Therefore, the Approved Capacity of the WTP is now 11.5 MGD (i.e., the Sed basins are now the Limiting component)
- The Approved Capacity of the Source/WTP System is now 11.3 MGD (i.e., the River, P.S. 1 and Reservoir combination is now the Limiting Component)

Ohio EPA Plan Approval Letters

- Approved Capacity of the "Water-supply Source" is XX MGD – and the Limiting component on which the approved capacity is based,
- Approved Capacity of the "WTP" is YY MGD – and the Limiting component on which the approved capacity is based, and
- Approved Capacity of the "Source/WTP System" is XX or YY MGD – i.e., the smaller of the approved capacities for the Water-supply Source and WTP

Approved capacity determinations are not retro-active

- New approved capacities will be determined by Ohio EPA during plan approval only if the water system is requesting a change of its water-supply source or WTP approved capacities

- Otherwise, the water-supply source, WTP and source/WTP system approved capacities from the most recent plan approval will be restated in the plan approval letter

Planning Requirements/ Water Production Projections

Planning Requirements

- Who
  - Public water systems serving political subdivisions as defined in ORC Section 6119.011(B) or regulated by the PUCO
- What
  - Water production projections
    - 5 year historical data, 5 and 10 years into the future
  - Compare projections to source/WTP approved capacity
    - If exceed in first 5 years, start planning and design
    - If exceeds during years 5-10, start planning
    - If does not exceed during first 10 years, OK for now

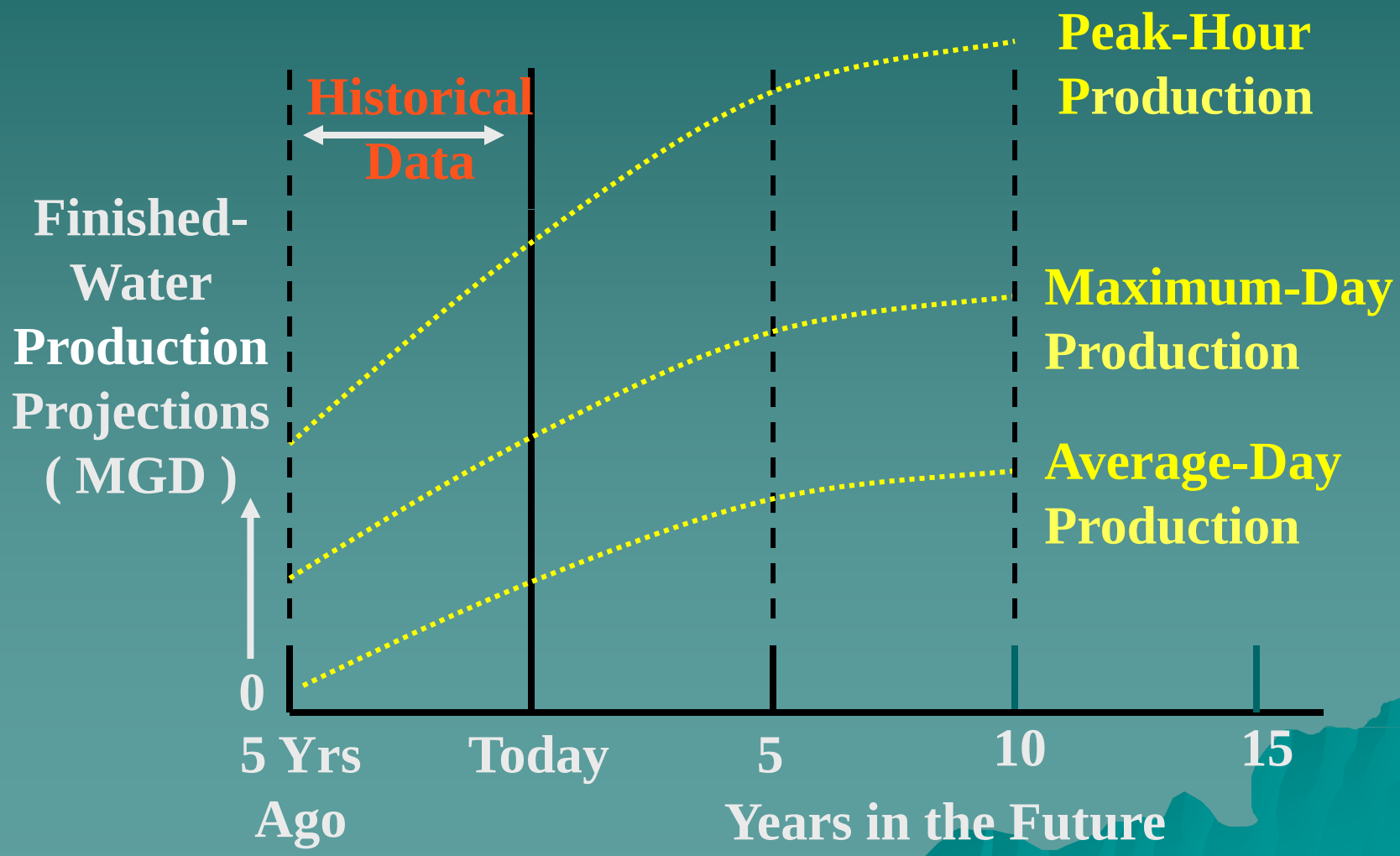
Planning Requirements

- When
  - Required when requesting a change in the approved capacity of the source/WTP system
  - Recommended every five years
- Why
  - Ensure a public water system is prepared to continue providing an adequate quantity of quality finished-water to meet its customers' future demands
  - Assists operators in demonstrating to elected officials when expansion is needed

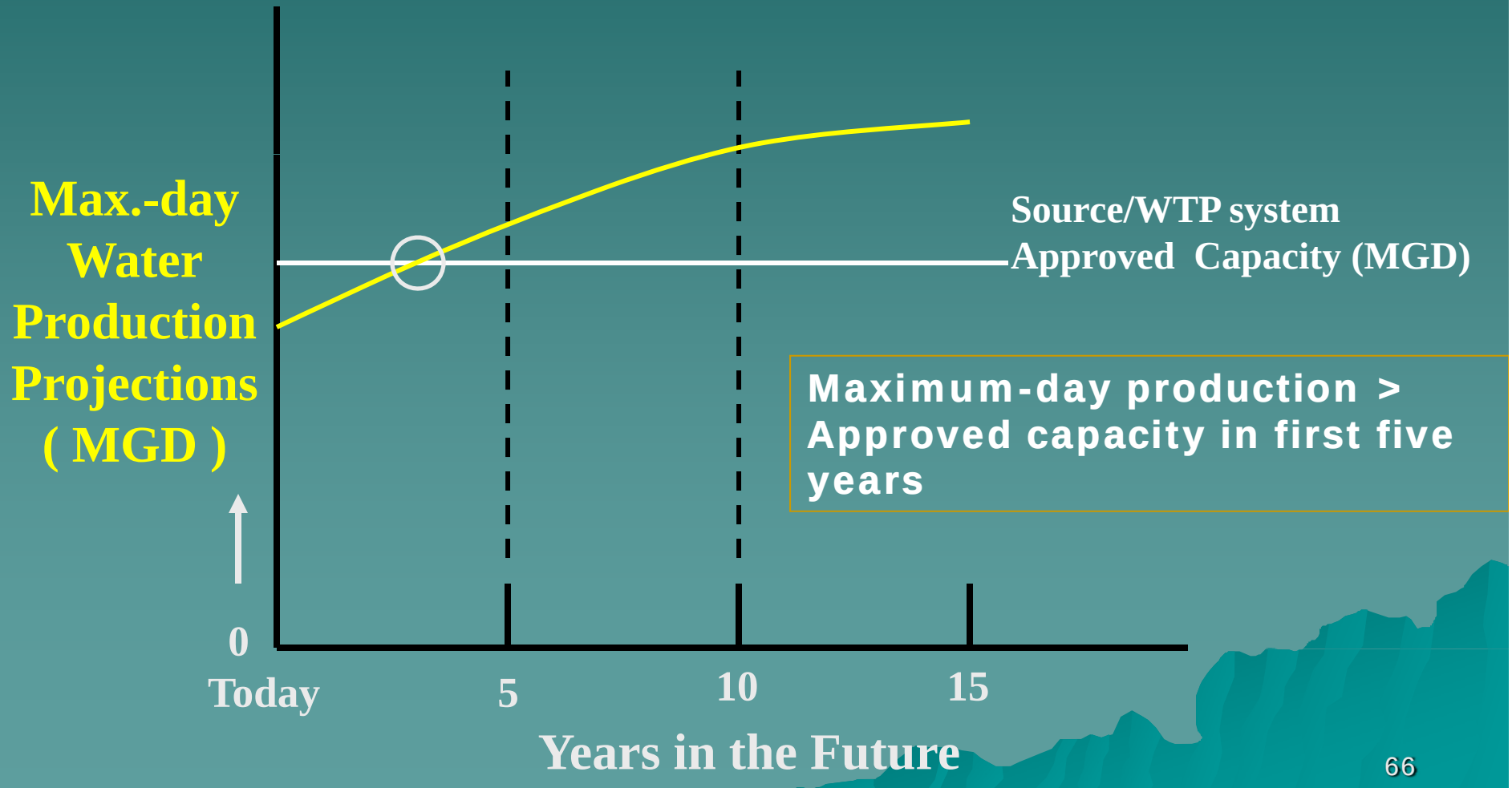
Planning to Construction Timeline

- Takes 5-10 years from conception to operation
  - 1 year planning
  - 0.5 year preliminary design
  - 1 year detail design
  - 0.5 year plan approval
  - 2 years construction (includes bidding, construction, start-up, etc.)

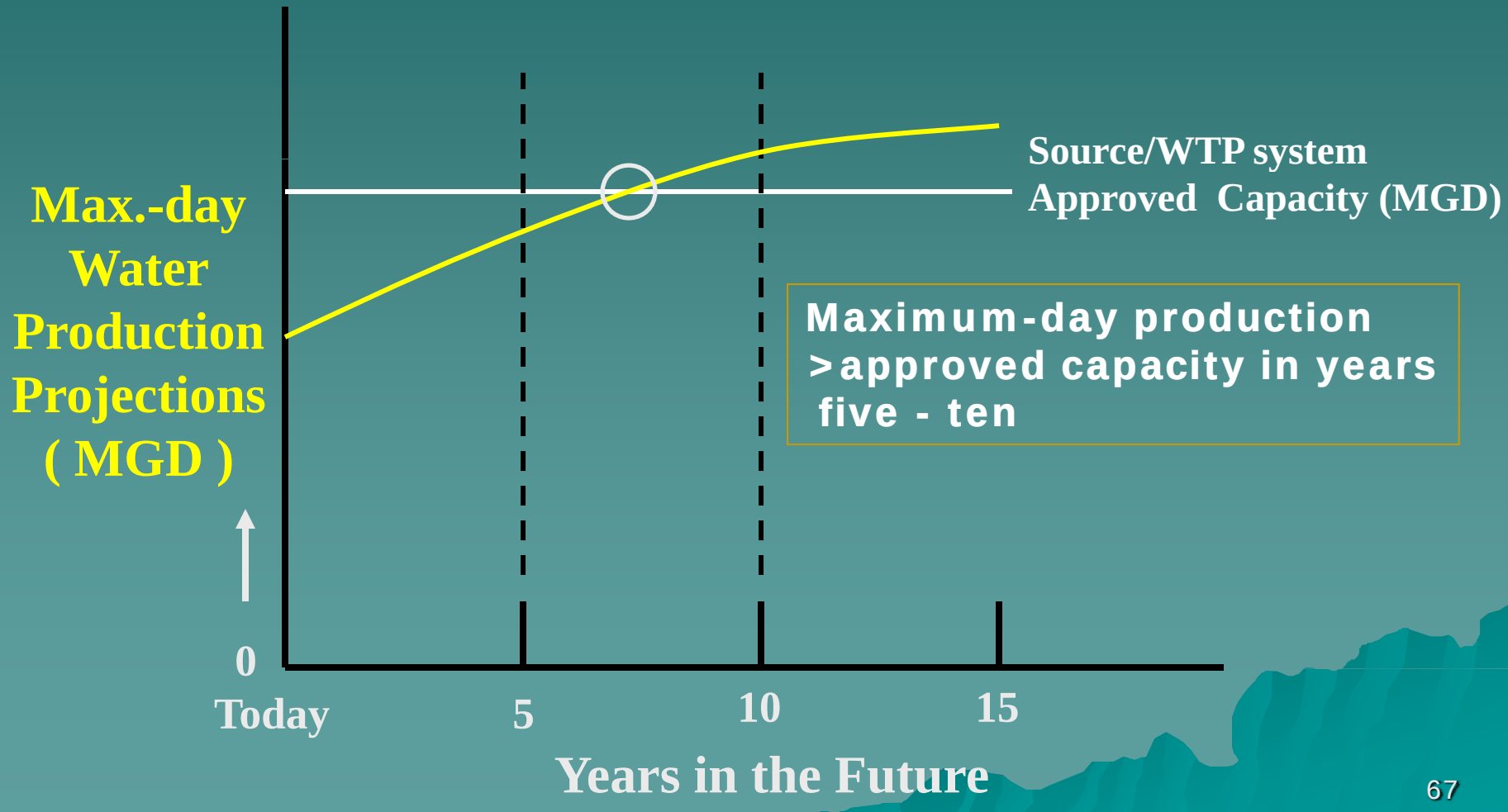
Water Production Projections



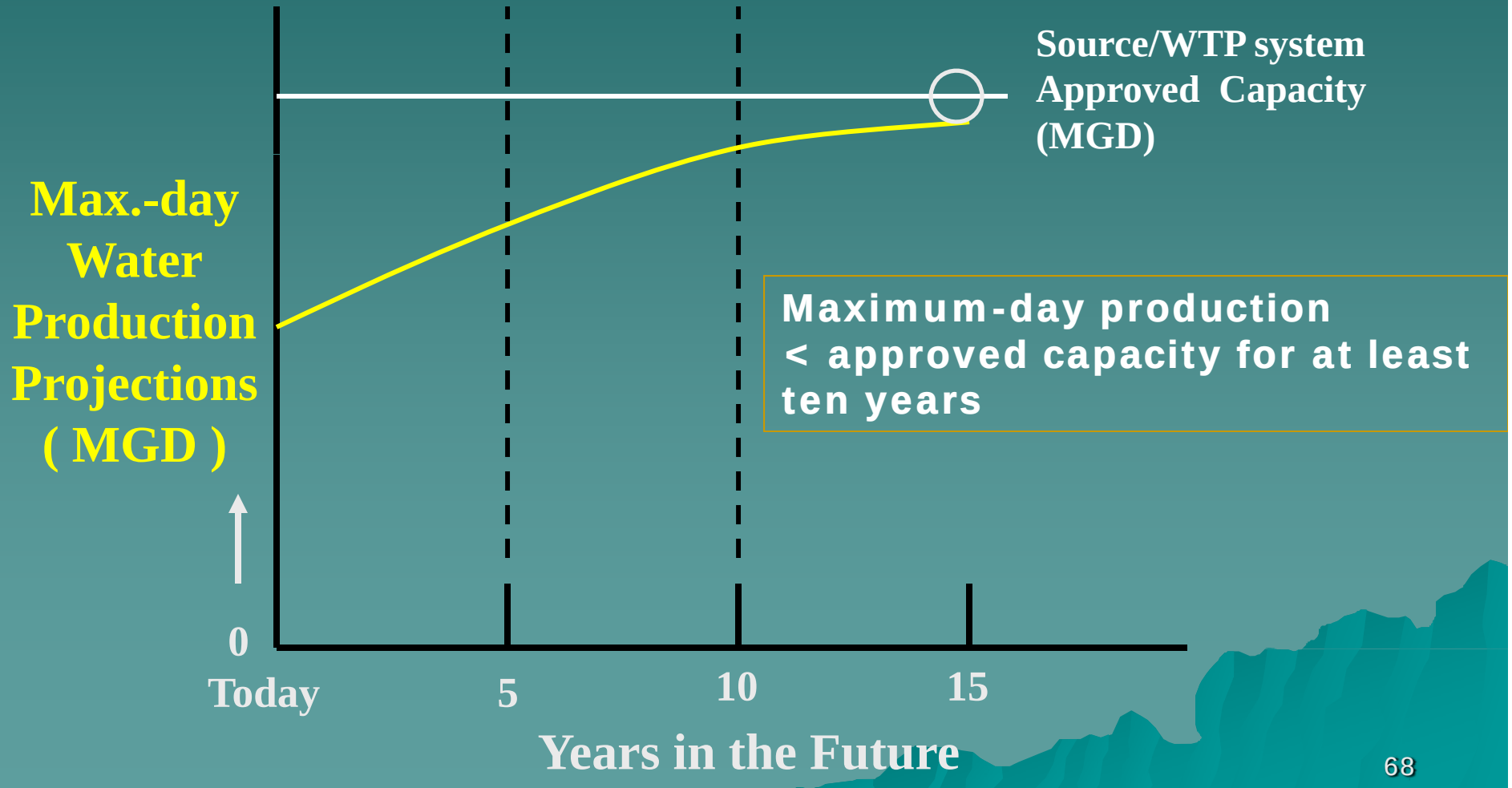
Example: Water System Should Start Both Planning and Design



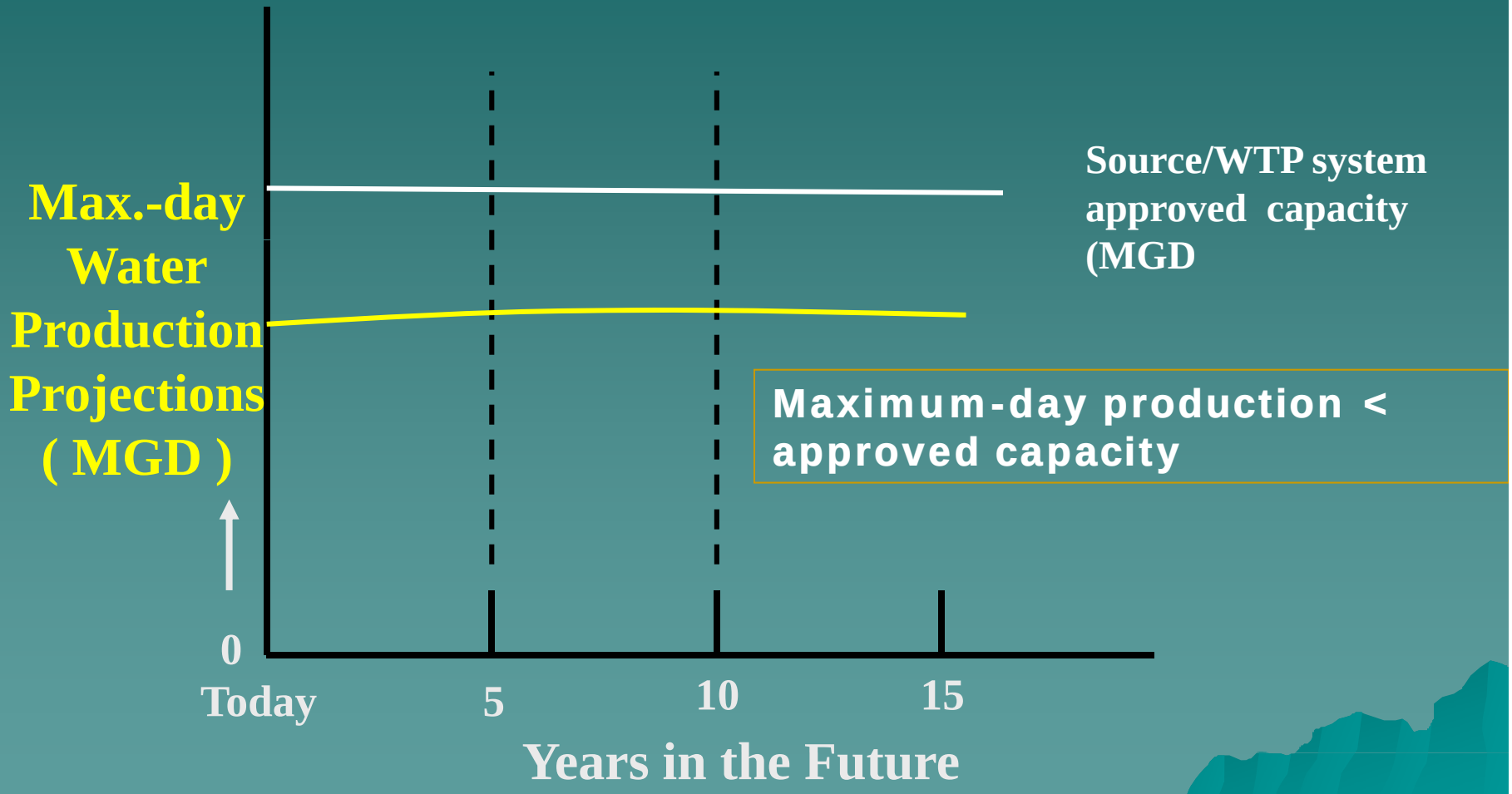
Example: Water System Should at Least Start Planning



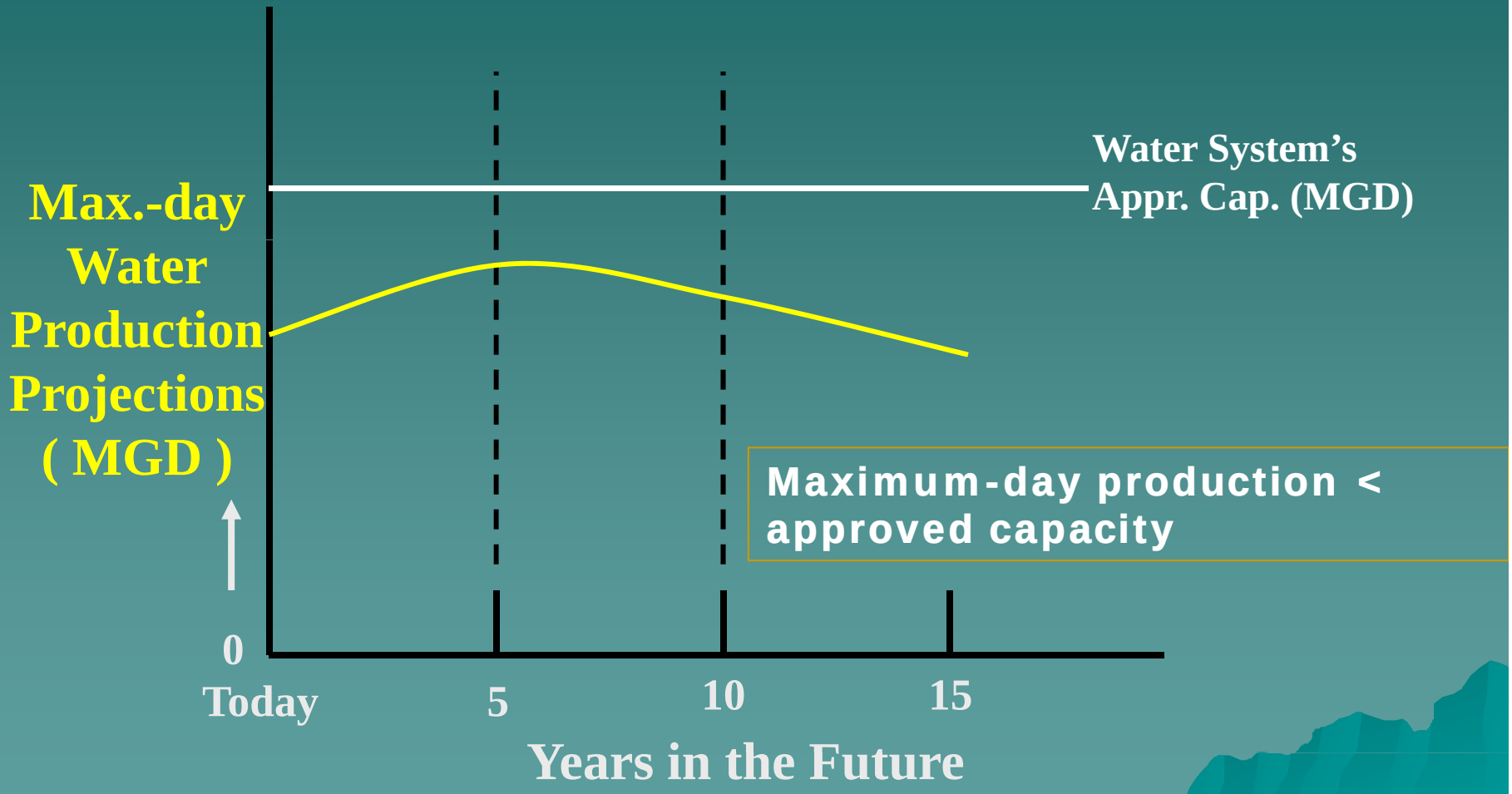
Example: Water System is OK for Now



Example: Water System is OK



Example: Water System is OK



Ohio EPA Worksheet for Simple Water Production Projections

- Water production projections can range from simple projections, based primarily on population growth, to complex models with several variables
- Size of the utility will dictate the complexity of the projection
- Ohio EPA has developed an Excel spreadsheet can be used to develop simple projections

Resources

www.epa.ohio.gov/ddagw/pws.aspx

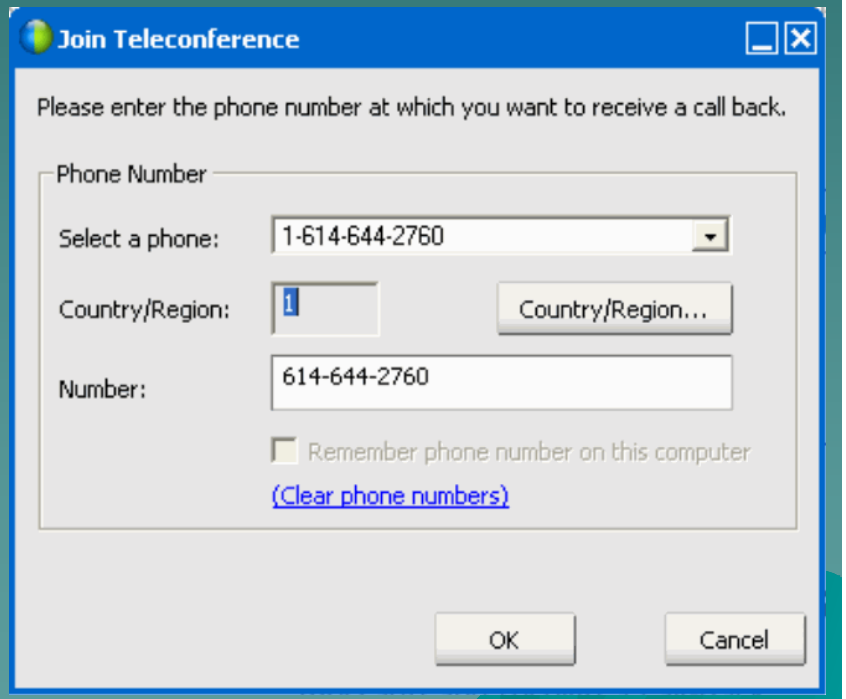
- Approved Capacity document
- Questions & Answers
- Water Production Projections Worksheet

Questions?

During the Q&A session, you will have an option to join the teleconference to ask questions. (If you don't wish to call-in, you can continue to listen over your computer and ask questions via the Chat function).

To join the Q&A teleconference

This box will pop up → Enter your phone number, and you will receive a call placing you into the teleconference.



Again, if you are having trouble, please send a message to Helen Miller using the Chat function for assistance.

Approved Capacity Webcast Series

Session 2: Determining Approved Capacity of Water-Supply Sources, Water Treatment Plants and Source/WTP Systems

March 10, 2011

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