WATER, WATER
WHERE??

With apologies to
SAMUEL TAYLOR COLERIDGE
author
“The Rhyme of the Ancient Mariner”

December 5, 2006
### Waterworks Board

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Note: Responsibilities list represents highlights of effort

- SAB
- CAG
- TAG
Objective

- Is there an “industry standard” or guidance for how much water supply is “enough?”

- There are many differing opinions on what is considered *enough*, ranging from:
  - Supply supported by the overall yield under 10-year drought conditions to meet average daily demand projected for 20 years; to
  - Enough water to withstand a 50-year drought and meet average demand projected for 50 years; to
  - Enough water to withstand a 100-year drought and meet maximum day demand projected for 50 years; to
  - What is vaguely described in ‘10 States Standards’.
IW Growth Policy

• Offer water (retail, wholesale, agreement) within IURC-approved rate structure
• Offer services to “by-passed” areas
• Coordinate with communities affected by providing or extending water services
• Provide for water supply consistent with projected needs of central Indiana

Reference: Adapted from the Indianapolis Department of Waterworks Growth Policy, 030602
Definition: Water Supply

- Volumetric supply availability shouldn’t be confused with supply capacity. Capacity is usually targeted at maximum day demand plus ten percent reserve. (SD)

- Varies widely, dependent on a number of factors (EM):
  - By community;
  - Climate;
  - How diverse the local supply mix is (i.e. vulnerability to shortage);
  - How much "reliability" is affordable;
  - What the economic effects of shortages would be;
  - Risk tolerance;
  - Development community angst/pressure;
  - Etc. (EM)
Planning Challenges 2002

- Insufficient Rated Treatment Capacity to Meet Peak Demand Conditions
- Lack of Sufficient Potable Water Storage
  - Projected Deficit
- Lack of Dependable Supply & Treatment Capacity to Meet Long-Term Demand
  - Projected Deficit
METRICS ADOPTED
by
IW BOARD MAR 06

• Achieve peak day demand 99% of time
• Have storage capacity at 50% of daily average volume
• System pressure minimum 20 PSI with 30 PSI goal
Groundwater Availability

Generalized Aquifer Production Capacity

- Light pink: 10 gallons per minute
- Light magenta: 50 gallons per minute
- Brown: 100 gallons per minute
- Light yellow: 200 gallons per minute
- Light green: 400 gallons per minute
- Green: 600 gallons per minute
- Dark teal: > 1000 gallons per minute

Source: IDNR
Water Production Facilities
Planning Horizon

• Generally, no clear preference for a specific planning horizon; 50 to 100 years is a reasonable timeframe.

• As for safe yield, the most common criteria is the 100-year drought, but some agencies may require a drought of record.

• State agencies often dictate what is appropriate to use for safe yield analysis and planning horizons, as they have often developed a water management program that defines "critical use areas" or similar designations that warrant source evaluations and demand management, together with consideration of environmental requirements such as minimum in-stream flows.
Consumption Trends

Avg Daily Consumption (MGD)

Month

January  February  March  April  May  June  July  August  September  October  November  December

5-yr Avg
1999
2002
2004
Defining the Need for Conservation (Hamilton, Hendricks, Johnson, Marion, and Morgan Counties) vs. Drought Capacities for Indianapolis Water

- Total Projected Max Day Demand (Surface and Groundwater) DOW
- Normal 414.5 mgd

Year:
- 2000
- 2005
- 2010
- 2015
- 2020
- 2025
- 2030
- 2035
- 2040
- 2045
- 2050

Estimated Water Demand (MGD):
- 0
- 100
- 200
- 300
- 400
- 500

5 year Drought
- 10 year Drought
- 25 year Drought
- 50 year Drought
- 100 year drought

- DOW Ave Day Demand
- DOW Max Day Demand
- 5 year drought 310.9 mgd (20%)
- 10 year drought 276.0 mgd (10%)
- 25 year drought 236.7 mgd (4%)
- 40 year drought 219.3 mgd (2.5%)
- 50 year drought 211.6 mgd (2%)
- 100 year drought 189.7 mgd (1%)

Series "10 year drought 276.0 mgd (10%) Point "2020"
More Than one Potential Additional Source of Water

Indianapolis Water System
- Surface Water Intakes
- Water Treatment Plants
- Well Fields
- Proposed Well Fields

- Major Aquifer
- Stream
- Reservoir
- County

- Wabash River Aquifer
- Tippecanoe County
- Mid. Wabash Reservoirs
- River Road Aquifer
- Big Blue River Aquifer
- Shelby County
- East Fork White River Aquifer
- Bartholomew County
- Lake Monroe
- Monroe County
- Brookville Reservoir
Wabash River Aquifer

White River WTP

Route 1
Along US-52 & I-65
~ 66 miles

Route 2
Along Railways
~ 71 miles
White River WTP
Source: Brookville Lake

Transmission

60 mgd

~74 miles
Supply Estimate Considerations

• A geometry-based estimate may grossly underestimate the available storage from a reservoir
• When modeled, the Geist Reservoir was determined to have 487 days storage, as compared to 161 days (estimated using a geometric approach)… 3 times the storage
• If we apply the same factor to Morse Reservoir, supply can be estimated to last 111 – 183 days
Geist Reservoir Volume

![Graph showing the relationship between volume (MG) and surface area (acres) for the Geist Reservoir. The graph includes a table with data points for different stages (feet) and their corresponding surface area, 1996 volume (MG), and 1996 volume (acre-feet).]

Data from Figures 11-8 and 11-9 in Black & Veatch "Water Supply Yield and Demand Evaluation for Indianapolis Water (April 2003)."

Data from USGS "Bathymetric Surveys of Morse and Geist Reservoirs in Central Indiana Made with Acoustic Doppler Current Profiler and Global Positioning System Technology, 1996."
Geist Reservoir Simulation

(25% unusable reservoir volume, 29.3 mgd demand, 5 mgd minimum stream flow)

Remaining Storage (MG)

1933 1943

Unusable Volume Assumption (25%)

487 days

“Empty”
Geist Reservoir – Fall Creek System
Raw Water Yield Estimates

Unusable Volume Assumption (% of Total)

Safe Yield (mgd)

- No Minimum Release from Keystone Dam
- 5 mgd Minimum Release from Keystone Dam

Values shown on the graph:

- 36.7
- 36.1
- 35.5
- 34.8
- 34.2
- 31.9
- 31.3
- 30.6
- 30.0
- 29.3

Graph indicates the relationship between unusable volume assumption and safe yield for different release scenarios from Keystone Dam.
Geist Reservoir – Fall Creek

Surface Water Balance Model

- Precipitation from entire drainage area
- Flow from Mud Creek into Fall Creek
- Fall Creek Flow (Fortville Gage)
- Flow to Fall Creek WTP
- Fall Creek Flow (Millersville Gage)
- Evaporation from reservoir
- Geist Reservoir
- Fall Creek

Precipitation from entire drainage area
Geist Reservoir Supply Estimate

- **Approach 1 – Geometry**
  - Assumes:
    - No inflow to reservoir
    - 29.3 mgd demand
  - 161 days

- **Approach 2 – Model**
  - Assumes:
    - Simulated drought conditions with regard to precipitation and evaporation
    - 29.3 mgd demand
  - 487 days
New WTP Capacity = Yield – Existing WTP Capacity

New WTP Capacity = 1.31 \times 29.3 - 32

New WTP Capacity = 6.4 \text{ mgd}

Assumes: drought of record, 25\% unusable reservoir volume, no groundwater use