Town of Beech Mountain

Water & Sewer Study

by:
ROTHROCK ENGINEERING

P. Marion Rothrock, P.E. 7/28/2011

### **OVERVIEW**

- Mid 1960's developer began installing original water & sewer lines
- Developer went bankrupt in 1974
- Town of Beech Mountain incorporated
   1981
- Census Population
  - 0 1980 = 190
  - $\circ$  2000 = 310
  - 0 2010 = 345



- 2001 Geographic Information System (GIS) developed
- GIS has not been kept up-to-date
- Soon will be of little value without significant expenditure
- Need to purchase sub-meter Global Position System (GPS) unit for staff to utilize
- Town Staff collect data on water, sewer, streets, storm inflow, fire protection, etc. to use as events occur
- Update GIS database on monthly basis

### Water Loss

- 2009 Rural Water Association estimated water loss of about 80%
- Rothrock Engineering 2011 study estimated water loss at about 56.19%

## 2010 Water Analysis

- Total finished water pumped into system
  - o 119,663,000 gallons
- Total water billed
  - o 39,631,000 gallons
- Billed water vs. Finished Water = 33.12%
- Estimated Meter Accuracy = 85%

### Areas of Water Loss

- Estimated loss due to meter accuracy
  - o 6,994,000 gallons
  - 0 5.84%
- Estimated Water Breaks & Leaks
  - o 1,200,000 gallons
  - 0 1.00%
- Flushing Fire Hydrants
  - o 679,000 gallons
  - 0.57%
- Billing Adjustments
  - 0 3,925,000
  - 0 3.28%

# Water System

- No significant leaks found
- Systemic Problems
  - Swing joints for all taps = minimum of 6 screwed joints per tap
  - Estimated total 11,900 joints minimum

This will be changed immediately to use high density polyethylene pipe (HDPE) for all future taps

### Victaulic Coupling for plain end pipe

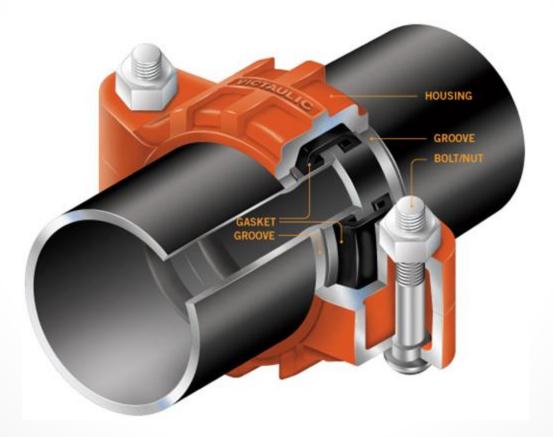


### Plain End Pipe used by Town



## Victaulic Couplings

Estimated over 14,000 joints





### Water Leaks

- Most joints show some leakage when dug out
- Minimum 25,790 joints
- Assume 50% with some leakage
- 67,234,000 Gallons/year Lost
- .0050 GPM/Joint
- .0635 Oz/min./joint

# System Leakage

- 7,675 Gallons Per Hour lost from current system
- Standards of Loss for new system replacing entire 280,000 L.F. existing = 200.41 gal./hr.
- Annual loss with new pipe = 1,755,600 gallons
- Actual loss = 67,230,000 gallons

# Water Quality Problems With Water Age

Location	Days Water Is In Tank
Pinnacle Inn	32.6
The Summit	17.8
Emerald Mountain	17.1
The Meadows II	7.9
The Meadows I	7.1
Parkway	< 2
Spruce Hollow	< 2
Mill Pond	< 2
Ashwood	< 2

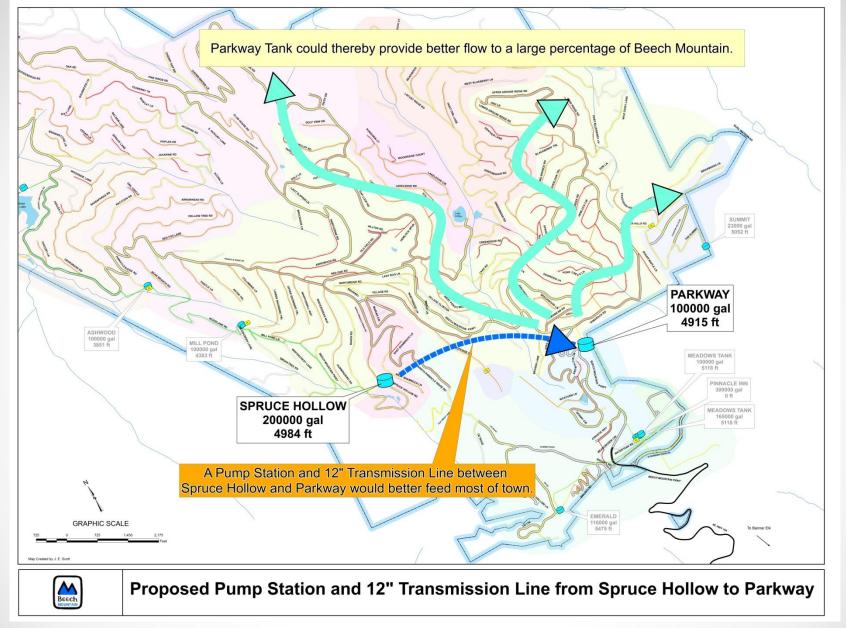
- Town Staff install Tank Mixer in Pinnacle Inn Tk. ASAP
- Commercial Unit cost \$30,000-35,000
- Rothrock Engineering design estimate at <\$2,000 each</li>
- Commercial Auto Flush unit cost \$ 5500
- Estimated cost of unit to be built by Town Staff \$2,000-\$2,500
- First unit to be installed ASAP



## Booster Pump Stations

Pump Station	Age
The Summit	1970's
Parkway	1970's
Pinnacle Inn	1984
Ashwood	1986
Millpond	1986
ALL NEED REBUILDING	

Spruce Hollow to Parkway - new station needed to improve overall system



Spruce Hollow to Parkway - new station needed to improve overall system



- Buckeye Lake Level
  - Has three intakes
    - 6 ½ feet below full pond
    - 13 ½ feet below full pond
    - 23 ½ feet below full pond
  - Summer 2010 dropped to approximately 18" above bottom intake

Buckeye Lake and Buckeye Creek are not adequate for the long term needs of the Town of Beech Mountain

# Buckeye Lake – Water at approx. first intake level



# Buckeye Lake – Water at approx. just above second intake level



# Drought ended at approx. 18" above 3<sup>rd</sup> intake or approx. 22 ft. below full pond

 Estimated water storage at that point was less than 20 days

# Possible Raw Water Solutions

- Raise Existing Dam
- Pump Water from Pond Creek
- Pump Water from Watauga River

# Raise Existing Dam

- Raise Buckeye Lake Dam 10 ft. will increases volume by estimated 21 to 22 million gallons
- At current plant capacity 10 ft. = 21-22 days
- 7Q10 for Buckeye Creek
  - Only 0.32-0.5 MGD
  - Safe yield per NC DENR = 0.064-0.10 MGD

# Pump From Pond Creek

- 7Q10 for Pond Creek estimated = 0.065 0.19 MGD
- NC DENR safe yield = 0.013 0.038 MGD

Not adequate to justify the cost and still would leave Town with insufficient raw water



# Pump from Watauga River

- 7Q10 for Watauga River = 16.2 24.6 MGD
- NC DENR safe yield of 20% = 3.24 4.92 MGD

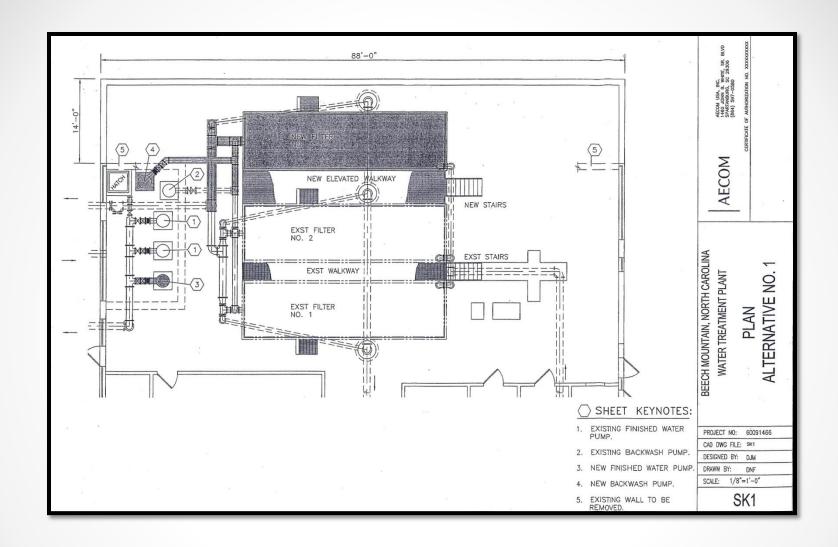
Town of Beech Mountain projected need in 2110 (100 years) = under 3.0 MGD

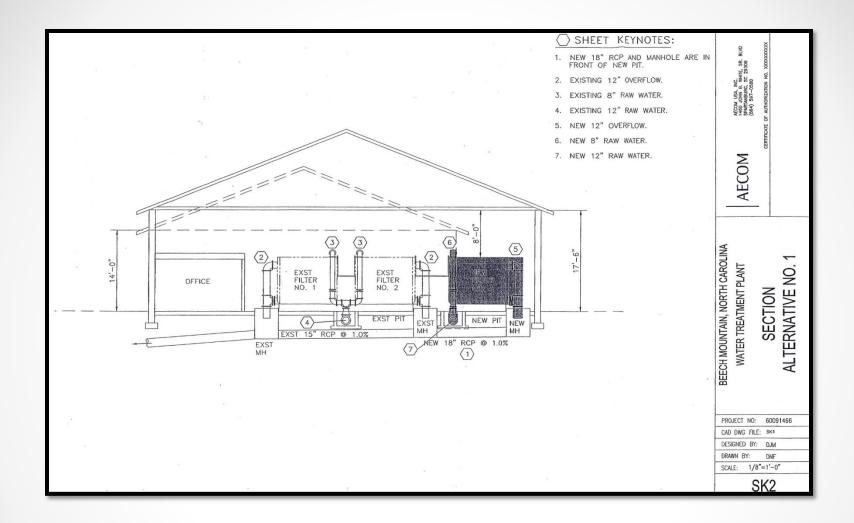
### Water Treatment

- Buckeye Water Treatment Plant went on line in 1986 – 25 years ago
- Useful life of "package" water treatment plant projected to be 20 – 25 years
- June 2009 study projected plant demand to exceed capacity by 2012 (1.0 MGD)

## Water Treatment Alternative #1

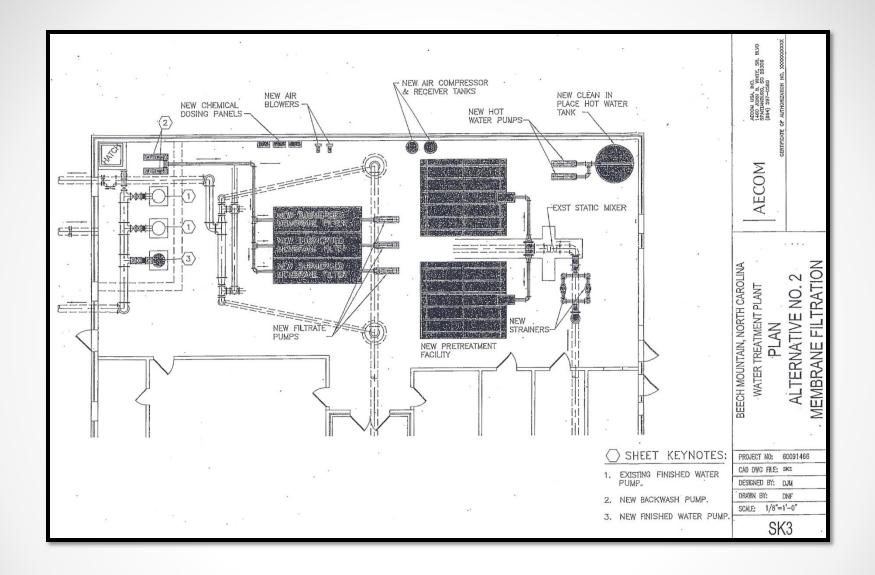
- Use existing package plant and add one more 0.5
   MGD module
- Widen existing building
- Estimated cost = \$2,756,604





## Water Treatment Alternative #2

- New water treatment plant with membrane filters
- Two units of 0.75 MGD each
- Use existing building
  - Note: Existing water treatment plant must operate until any new facility is on line
- Estimated cost = \$3,843,841



## Water Treatment Alternative #3

- New Water Treatment Plant with two Helical up flow clarifiers and conventional sand filters
- Replace existing facility
- Estimated Cost = \$3,512,213



# Existing Water Treatment Plant Condition



Potentially the condition may be such that an emergency situation exists

### Settling tubes



### One corner of WTP w/overhang



#### WTP showing settling of base



#### WTP bottom at base



#### WTP outside wall





# Existing Condition Water Treatment Plant

- Determine extent of current problem w/ultrasound
- Does it require fixing?
- Plan to operate existing plant not less than 6 more years nor more than 10 years
- Replace existing tube filters
- Continue evaluation of success of water loss efforts

#### Key Point

## High Service Pumps

- In service since 1986
- Original Volume
  - o 1,000 GPM
  - o 750 GPM
- Current Volume
  - o 700 750 GPM
    - 25% 30% loss of capacity
  - o 600 650 GPM
    - 15% 20% loss of capacity
  - Lead time for replacement = 26 32 weeks

### Sewer System

Waste Water Treatment Plants

Pond Creek Grassy Gap

- Pond Creek WWTP
  - o .400 MGD
  - o 2010 Flows
    - Min 0.040 MGD
    - Max 1.093 MGD
    - Average 0.135 MGD
  - o Rebuilt 2008 Good Condition
  - Collection Basin
    - 166,036 LF Sewer Lines
    - 857 Man Holes

- Grassy Gap WWTP
  - o 0.080 MGD
  - o 2010 Flows
    - Min 0.003 MGD
    - Max 0.369 MGD
    - Average 0.0383 MGD
  - o Re-built 1996 condition is average
  - o Grassy Gap Collection Basin
    - 125,812 LF Sewer Line
    - 693 Man Holes



#### Infiltration & Inflow

Major problem in all parts of original system

#### Block MH - Missing grout – I & I



#### Block MH – No Grout- I & I



#### Block MH with I and I





### Grassy Gap Lift Station

Grassy Gap Lift Station MUST BE REPLACED

#### Phase I Rehab

- 12,400 LF Sewer Line
- 82 Man Holes

#### STUDY CONCLUSIONS

Key Point

- New Water Treatment Plant Schedule 2020 (online)
  - Estimated cost at that time = \$4,982,000
- New Waste Water Treatment Plant at Grassy Gap
  - Schedule 2024 (online)
  - Estimated cost at that time = \$900,000
- Raw Water Intake from Watauga River
  - Schedule ASAP (projected online 2015)
  - Estimated cost = \$2,250,000

#### Order of Priority

- Existing WTP Cost unknown until true condition is determined
- 2. Reclassification of Watauga River
  - □ 1 3 year process
  - Cost estimate = \$25,000
  - Request Immediate approval to move forward
- Grassy Gap Lift Station \$225,000
- Tube filters for existing WTP
  - Order ASAP after determination that plant repair cost not prohibitive - \$25,000
- 5. Replace finished Water Pumps \$80,000
  - □ One originally at 1,000 GPM now at about 700-750 GPM
  - One originally at 750 GPM now at about 600 GPM



- 6. Basin T0147 & T0337 Draining to Grassy Gap L.S. Phase I 12,400 LF Sewer Line & 82 Man Holes - \$567,000
- 7. Build & Install First Tank Mixer \$3,000
- 8. Build & Install Auto Flush Unit on Water System \$3,000
- 9. Replace First 5,000 LF Water Line \$250,000
- 10. Install Curtin Wall in the clear well to get needed chlorine contact time \$25,000



- 11. Basin Grassy Gap WWTP 5,500 LF Sewer Line& 30 Man Holes \$240,000
- 12. Rebuild booster pump stations & piping for tanks (7 tanks at \$25,000 each) \$175,000
- 13. Pond Creek Plant Basin WWTP 10,700 LF Sewer Line & 70 Man Holes - \$487,750
- 14. Grassy Gap Basin T0338 3,600 LF Sewer Line & 30 Man Holes \$187,000
- 15. Replace 5,000 LF Water Line \$250,000



- 16. Rework Raw Water Pump Station \$80,000
- 17. Replace 5,000 LF Water Line \$250,000
- 18. Install blow off units on dead end lines \$1,500 each -40 = \$60,000
- 19. Pump station & 12" transmission line from Spruce Hollow to Beech Mountain Parkway \$620,000
- 20. Install potassium permanganate feed in raw water \$15,000



- 21. System on raw water for oxidation of iron and manganese \$25,000
- 22. Pond Creek Plant Basin T0336 4,500 LF Sewer Line & 18 Man Holes \$182,250
- 23. Replace 5,000 LF Water Line \$250,000
- <sup>24.</sup> Pond Creek Plant Basin T0344 8" Pipe 4,800 LF Sewer & 25 Man Holes - \$206,000
- 25. Replace 5,000 LF Water Line \$250,000



- 26. Grassy Gap WWTP Basin T0339 3,000 LF Sewer Line & 30 Man Holes \$ 157,500
- 27. Replace 5,000 LF Water Line \$ 250,000
- 28. Pond Creek WWTP Basin T0443 3,000 LF Sewer Line & 30 Man Holes \$ 157,500
- 29. Replace 5,000 LF Water Line \$ 250,000
- 30. Pond Creek WWTP Basin T0344 12" Pipe 10,500 and 60 Man Holes \$461,250



- 31. Replace 5,000 LF Water Line \$ 250,000
- 32. Grassy Gap WWTP Basin T0340 2,800 LF Sewer Line & 22 Man Holes \$ 135,000
- 33. Replace 5,000 LF Water Line \$ 250,000
- 34. Pond Creek WWTP Basin T0335 2,600 LF & 20 Man Holes \$ 124,500
- 35. Replace 5,000 LF Water Line \$ 250,000

Key Point

#### **Identified Need Summary**

Key Point

Water Lines - 53 miles	\$15,990,000
Sewer Line - 80% = 233,478 LF	\$7,588,000
Man Holes - 90% = 1395	\$2,790,000
Other Water & Waste Water System Needs Identified	\$8,132,000
Total Identified Need Summary	\$34,500,000