

Sedimentation Effects on the Water Supply of APG

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Background

- The APG (South) Water Treatment Plant (WTP) produces an average of 1.2 MGD of potable water from the Winters Run Stream
- APG is not permitted to withdraw water from the stream during periods of low flow (15.6 cfs)
- Typically during Maryland summers drought conditions prevent water uptake

Background Cont'd

- In 2007 the WTP was forced to shut down from 3-20 August and 29 August - 6 November
- When water cannot be pumped from the stream, potable water is supplied by the County
- County charges \$2.62 per Kgal of potable water
- The 87 days of closure cost APG ~ \$300,000

Project Goals

- Evaluate localized stream flow
- Document sedimentation characteristics of the stream in and around the raw water intake
- Address any major concerns

Study Approach

- Evaluate the current stream bathymetry
- Evaluate flow conditions (velocity and direction)
- Develop recommendations and cost estimates for an necessary modifications

Stream Morphology

- A small dam backs up water in the stream so it can be withdrawn through the plant's intake structure
- Storm events and increased sedimentation have created a "Y" in the stream bed previous to the dam
- Increased sedimentation in Winters Run has:
 - Diverted the majority of the stream flow to the upper fork of the "Y", away from the intake
 - Decreased the operating depth of Winters Run at the intake
- Raw water solids are a concern during low-flow conditions



Stream Morphology Cont'd

- Stream flow data is measured by a USGS monitoring station

	Monthly Average Discharge (cfs)											
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2005	116	79	146	151	73	53	73	22	13	148	56	109
2006	96	92	52	84	56	449	119	35	85	85	174	89
2007	101	75	151	142	54	38	30	24	11			
AVG	104	82	117	126	61	180	74	27	36	116	115	99

Bathymetry

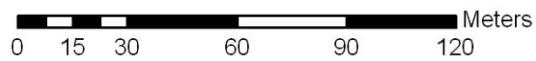
- Compilation of depth measurements of a body of water into a topographic map
- Survey was conducted using a portable sonar system and a handheld GPS navigational system

Velocity Measurements -
APG-S Drinking Water Treatment Plant

Winters Run

- Velocity measurement locations
- Depth measurement locations

Image: National Agricultural Imagery Program (NAIP)
1 meter ground sample distance
June 2005



Depth Model -
APG-S Drinking Water Treatment Plant

Winters Run



Depth Measurement

Depth (ft)






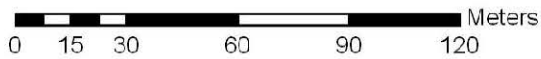
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-  2.88 - 4.52
-  4.52 - 7.15
-  7.15 - 12.67



Image: National Agricultural Imagery Program (NAIP)
Raster Grid derived using Inverse Distance Weighted
1 meter ground sample distance
16 March 2008



Velocity Profile

- Measurements taken using a portable flowmeter
- Flowmeter uses an electromagnetic sensor to measure velocity and has an accuracy of $\pm 2\%$
- Handheld GPS determined location of velocity measurements

Velocity Model -
APG-S Drinking Water Treatment Plant

Winters Run



Velocity Measurement

Velocity (ft/s)






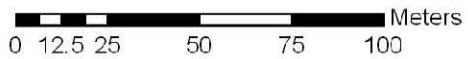
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-  0.1601 - 0.2862



Image: National Agricultural Imagery Program (NAIP)
1 meter ground sample distance
Raster Grid derived with Inverse Distance Weighted
16 March 2008



Conclusions

- Depth profile of Winters Run is very shallow
- These flow conditions will continue indefinitely, without any significant changes to the stream
- If sedimentation is allowed to continue, it is possible flow to the intake may become blocked
- The low-flow issue cannot be solved, but there are other issues that need to be addressed

Alternatives Evaluation

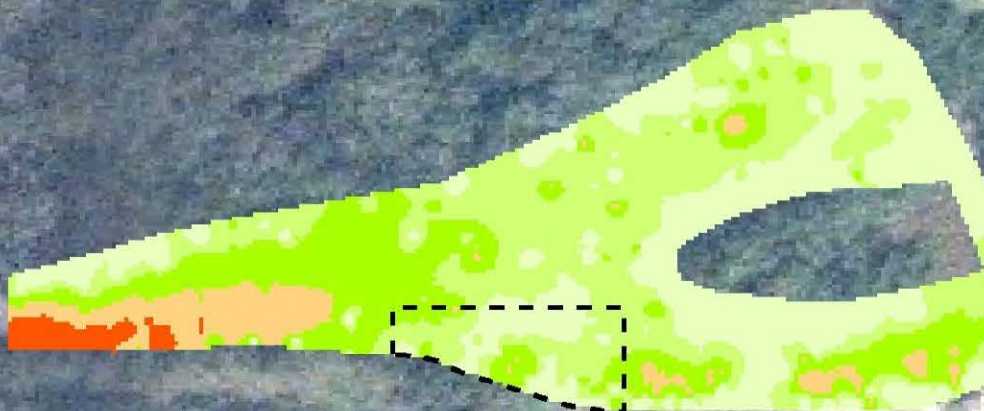
- Dredging
- Intake extension
- No action

Dredging

- Dredging was performed 25 years previous near the intake extending the depth to 10 feet
- Re-dredging to a depth of 10 feet would require the removal of ~4500 BCY of sediment
- Treatment costs will be reduced due to decreased particulate matter in the intake water

Depth Model -
APG-S Drinking Water Treatment Plant

Winters Run



 Dredge area - 1469 yd sq

Depth Measurement

Depth (ft)






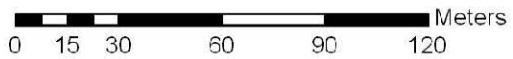
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Image: National Agricultural Imagery Program (NAIP)
Raster Grid derived using Inverse Distance Weighted
1 meter ground sample distance
16 March 2008



Dredging Cost Analysis

Project Breakdown	Costs (\$)
Labor	31,000
Equipment	29,000
Sub Total	60,000
Design/Planning (10%)	6,000
Contingency (30%)	18,000
Cost Factor	(6,000)
TOTAL	78,000
TOTAL (accounting for 2008 inflation)	82,000

Intake Pipe Extension

- Extend to intake pipe to the upper, slightly deeper, and faster moving fork of Winters Run
- 20-inch cast iron pipe that lies approximately 4 feet below the water surface (at average flow)
- 180 feet long pipe
- Dredging would also be required to maintain the gravity feed currently used

Depth Model -
APG-S Drinking Water Treatment Plant

Winters Run



Depth Measurement

Depth (ft)






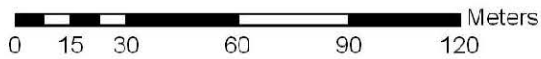
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Raster Grid derived using Inverse Distance Weighted
1 meter ground sample distance
16 March 2008



Intake Extension Cost Analysis

Project Breakdown	Costs (\$)
Piping	
Labor	4,250
Materials	650
Equipment	2,000
Dredging	
Labor	5,000
Equipment	5,000
Excavation and Fill	6,450
Soil Stabilization	1,000
Sub Total	24,350
Design/Planning (10%)	2,500
Contingency (30%)	7,500
Cost Factor	(2,500)
TOTAL	31,850
TOTAL (accounting for 2008 inflation)	32,800

Recommendations

- Dredge Winters Run around the WTP intake
 - Will decrease particulate matter in the intake water
 - Will prevent sedimentation from completely blocking flow to the water intake
 - More expensive than intake extension
 - Results last longer

Questions?

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