

WATER USE ASSESSMENTS SUPPORTING COMPANY-SPECIFIC GROWTH AND SUSTAINABILITY GOALS

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Abstract—In areas with increasing demand for water, addressing water use objectives has long been a primary environmental objective and key concern among industrial water users including paper mills and other forest product companies. However, in recent years, water use metrics and related information (including population change, climate information, and land use characterization) have gained considerable importance to companies for addressing longer-term goals pertaining to growth and sustainability when it comes to water availability. One effort underway, lead by the National Council for Air & Stream Improvement, Inc. (NCASI), has compiled water metrics and related watershed information as a means for better understanding and projecting the demands for water in various parts of the country. This paper provides details on specific components of the effort to document water-related information on a case-by-case basis, as well as provide summary information and key findings culminating from this assessment.

INTRODUCTION

Many industries rely on access to natural water resources for use in the manufacturing of consumer goods and materials. With an increasing overall population, relocation of inhabitants away from rural areas, as well as the recurrence of droughts in certain parts of the country, forest products companies are more cognizant of information that is vital to supporting their long-term, sustainable water use goals. These goals extend to: a) overall water resources/availability, b) water stewardship, c) protecting against environmental degradation, and d) environmental sustainability in general.

With a greater understanding of the factors and constraints on water resources, companies can be better positioned to interact with other water stakeholders and make better long-term decisions for their facilities and the surrounding environment. Representing pulp and paper manufacturers as well as the wood products industry and forest landowners, NCASI has developed a comprehensive database of water use metrics and watershed-related information for their member companies. This database for water resource managers and ensuing watershed reports for NCASI members offer a means for companies to be helpful water stewards and creates an information resource that is unlike that of any other industry.

Detailed reports for each company (see fig. 1) include available water source and water withdrawal information, population metrics, data on public water needs (including municipal water supplies), water intakes and discharge

information for each facility, local climate information (e.g., subbasin precipitation averages), various watershed characteristics, and upstream/downstream water use information (by use category). Each report generated as part of this effort relied on the compilation and/or assessment of demographic information and various environmental metrics into a database and corresponding GIS (fig. 2). Other components of the database and associated reports include land use composition, change in river flow (near each facility), influent & effluent ratios (i.e., relative to receiving stream & surface water flows), cooling water vs. process flow volumes, as well as a recent addition of information on the presence of threatened and endangered aquatic species (or their critical habitat designations) in mill receiving waters.

DATA SOURCES

The principal data sources for these assessments include the NCASI Environmental Data Resource & Receiving Water Database, Fisher International's global mill database, the National Land Cover Database (NLCD), county population statistics from the U.S. Census Bureau (USCB),² the USGS National Water-Use Information Program,³ EPA's PCS & ICIS databases,⁴ as well as the

² U.S. Department of Commerce - Census Bureau (www.census.gov)

³ U.S. Geological Survey National Water-Use Information Program (water.usgs.gov/watuse/wunwup.html)

⁴ EPA Permit Compliance & Integrated Compliance Information Systems (www.epa.gov/enviro/pcs-icis-overview)

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Citation for proceedings: Stringer, Christina E.; Krauss, Ken W.; Latimer, James S., eds. 2016. Headwaters to estuaries: advances in watershed science and management—Proceedings of the Fifth Interagency Conference on Research in the Watersheds. March 2-5, 2015, North Charleston, South Carolina. e-Gen. Tech. Rep. SRS-211. Asheville, NC: U.S. Department of Agriculture Forest Service, Southern Research Station. 302 p.

Watershed Characterization Report – 020802 [James River Basin] - VA000640X

Mill: Co.-Location **Company:** Riverville Pulp & Paper **Facility location:** Riverville, Virginia
Facil.ID: [110000740958](#) **Drainage basin:** Middle James-Buffalo **Main waterbody:** James River
NHD: 8547805 **Drainage area:** 3,557 miles² **Tributary water(s):** West Island Creek

Water Sources / Withdrawal:

Open water: 824 mi² (3.1% of total land area in drainage basin)

Water: James River (2,667 MGD)

Flow upstream: 3,993 CFS (or 2,581 MGD)

Flow downstream: 4,251 CFS (2,747 MGD)

NCCW source: James River

Mean annual precip.: 41.5"

Other local waterbodies:
(within ~5 miles of facility)

West Island Creek
Buffalo River

Springfield Creek
Allens Creek

Water Discharge:

NPDES Permit: [VA000640X](#) [EPA-ICIS]

Receiving water: James River

Effluent flow: 5.4 MGD

Effluent ratio: 0.12% (of destination)

NCCW ratio: 3.1% / 3.7% (of total influent / effluent)

Change in river flow at mill: +0.06% (from immediate upstream to immediate downstream)

Watershed 1 (facility): Middle James-Buffalo ([02080203](#)) – [303\(d\) impaired waters](#) (Pathogens)

Watershed 2 (upstream): Upper James Wshd. ([02080201](#))

Water near mill: 3.2% of total land area (within 3 miles)

Demographic Information & Water Supply / Needs:

County: Amherst

FIPS: [51009](#)

Population in 2000: 233,142

Population in 2010: 245,910 Δ: +12,768 (increasing)

Figure 1 – Top portion of combined water use/watershed characterization report for an example (i.e., hypothetical) facility scenario.

EPA WATERS database⁵ for CWA §303(d) impairment data. Additional demographic information for this summary was provided by the U.S. Census Bureau (USCB 2012) and obtained from EPA-ECHO⁶ Detailed Facility Reports.

PROCEDURES

Reports were generated to summarize data on industry facilities and their environment, as well as provide references to data sources corresponding to each reporting element. Source references in their electronic form, shown as blue hyperlinks on each report (fig. 1 & 2), provide access to supplementary information, and each batch of reports generated for NCASI member companies is accompanied by a definitions sheet providing detailed descriptions of each piece of information including corresponding data sources.

Each facility water-use/watershed characterization report also contains standard watershed metrics including waterbody identifier (i.e., NHD ComID#), surface

water name and type (i.e., river/stream), stream order, a description of average flow conditions, relative location of the immediate receiving water reach within the watershed, cumulative drainage area, stream network density/bifurcation, etc.,

Watershed information assembled as part of this effort is designed to not only generate facility-specific information useful to companies that comprise the forest products industry, but also to produce a database of water-related and other environmental metrics that can be used as a research tool to analyze information for the industry on a national or regional basis, as well as look for trends in mill demographic and other data over time.

RESULTS AND DISCUSSION

In terms of water sources, one component of the reports is the amount of potentially accessible surface water (or “open water”) nearby, expressed as a percentage of total land area within a set radius from each mill. While this metric may not be specific to the corresponding watershed for some facilities, it provides a crucial piece of water resource information for companies and the industry as whole. Overall, the amount of nearby open water around pulp and paper facilities in the U.S. averages 8.1 percent

⁵ EPA Watershed Assessment, Tracking & Environmental Results System (www.epa.gov/waters)

⁶ EPA Enforcement & Compliance History Online (www.epa-echo.gov)

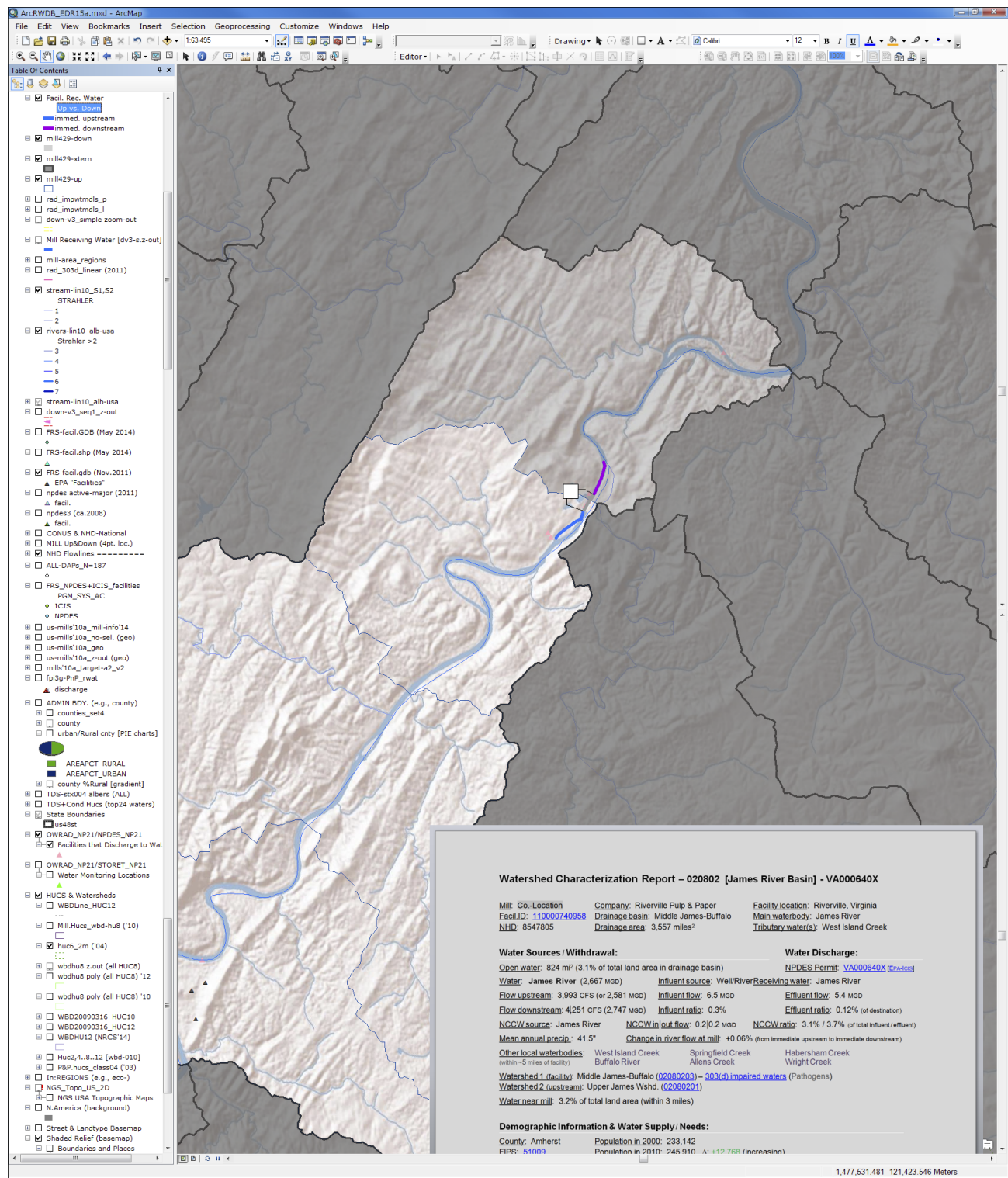


Figure 2—Example facility scenario and lower portion of corresponding mill watershed with upstream area shown (highlighted), downstream area (shaded light gray), surrounding subwatersheds (shaded gray), and example watershed characterization report (embedded graphic).

of the total land area. And, while slightly more than 10 percent of all industry facilities are located in areas in which the surrounding land mass contained greater than 20 percent open water (e.g., large lakes and rivers), the amount of available water is less than 10 percent for about three quarters of all U.S. facilities. It was also noted that about five percent of this industry's mills across the country have less than 1 percent open water nearby.

The surrounding land uses of the watershed also provided important information for individual facilities and, using the database corresponding to this report, can be summarized for broader areas involving multiple facilities or for groups of facilities owned by the same company for making water use decisions. At the national level we found that the area upstream of all facilities currently averages about 58 percent forestland (compared to 51 percent downstream), and approximately 21 percent is classified as agricultural land (compared to 27 percent downstream). Wetlands also comprise a significant area of the industry's watersheds, averaging 7.5 percent of the upstream drainage area (compared to 9.0 percent downstream), whereas grassland and other/mixed land classifications average 6.3 percent upstream (versus only 2.4 percent downstream). Collectively, urban areas comprise only 3.1 percent of upstream drainage areas (and nearly double that amount with 6.1 percent of downstream areas).

Since the composition of urban and agricultural/rural land in the vicinity of a mill can have a dramatic effect on local water availability, we also compiled similar land classification percentages for the urban areas and rural lands around each facility (similar to the metric for water availability) as well as on a per-county basis. Facilities areas were characterized further by population density using Census data and found that the large majority of mill locations are in predominantly rural areas, with an average of 92.5 percent rural (per USDA-ERS definition) across all facilities, and about half (or 51 percent) of facilities with greater than 95 percent rural land. Less than 5 percent of facilities are located in or near cities with greater than 90 percent urban land. On a county-by-county basis, more than half of all U.S. pulp & paper mills are located in counties that are greater than 95 percent rural and more than 75 percent of all facilities are located in counties that are greater than 80 percent rural (Figure 3). While mills located in the same watersheds as metropolitan areas or associated reservoirs potentially face critical water shortages, the large percentage of mills located in rural areas suggests agricultural water use may be of greater importance than city or overall water use.

Demographically, among the more than 200 mills in the U.S., the industry facility associated with the fastest growing population is located near Boston, MA (with a

population increase in the associated county of nearly 19,000 persons over a recent 2-year period), followed by facility locations in counties near Portland, OR (increasing 7,750 over the same 2-year period), near Newark, NJ (increasing 7,650), and near Charleston, SC (increasing by 7,380 persons). It is also worth noting that mills with the highest population densities in the immediate vicinity (i.e., within a 3-mile radius) include a mill located in Tacoma, WA mill with greater than 3,500 inhabitants per square mile (IPSM), followed by two facilities in Green Bay, WI with about 3,200 IPSM. By comparison, and providing a more general characterization of population sparseness for the industry, the average population density for the remaining mills is less than 450 IPSM. Census data also indicated that the trend in population for people living near most facilities increased slightly over a recent 10-year period, but from the most recent comprehensive Census information (USCB 2012), the population at the county level corresponding to mill locations shows a decrease in population for nearly half (i.e., about 46 percent) of our industry's mills.

The NCASI database also contains information on the surface waters utilized by the industry and the corresponding influent (intake) volumes, as well as detailed information on individual facility receiving waters and their corresponding effluent (i.e., discharge) quantities. In terms of average river flow for facilities that discharge to U.S. surface waters, receiving waters across the forest products industry collectively average about 22,000 million gallons per day (MMGD) or about 34,000 cubic feet per second (CFS), and the difference in flow from immediately upstream of the facilities to immediately downstream (while accounting for flow generated from point source discharges) varied from as little as 3 CFS in smaller headwater systems to 15,000 CFS or more in larger river systems. This same metric averages 1,380 CFS across all mill receiving waters. Increases in flow were also documented and expressed as a percentage, which in the U.S. averages a 19 percent increase downstream compared to the corresponding upstream flow for all facilities. As for quantifying influents and effluents relative to total surface water volumes, the proportion of water brought into facilities currently averages 2.1 percent of the corresponding waterbodies throughout the industry, and the percentage of mill effluent discharge volumes to receiving water flow in the immediate reach of the corresponding rivers and streams averages about the same, just 2.0 percent.

Facility water use, including both mill process water and non-contact cooling water, across the country averages about 6.25 MMGD (or 9.7 CFS) per mill. By comparison, total water withdrawals from surface waters from all sources (including for agriculture, other industries, and

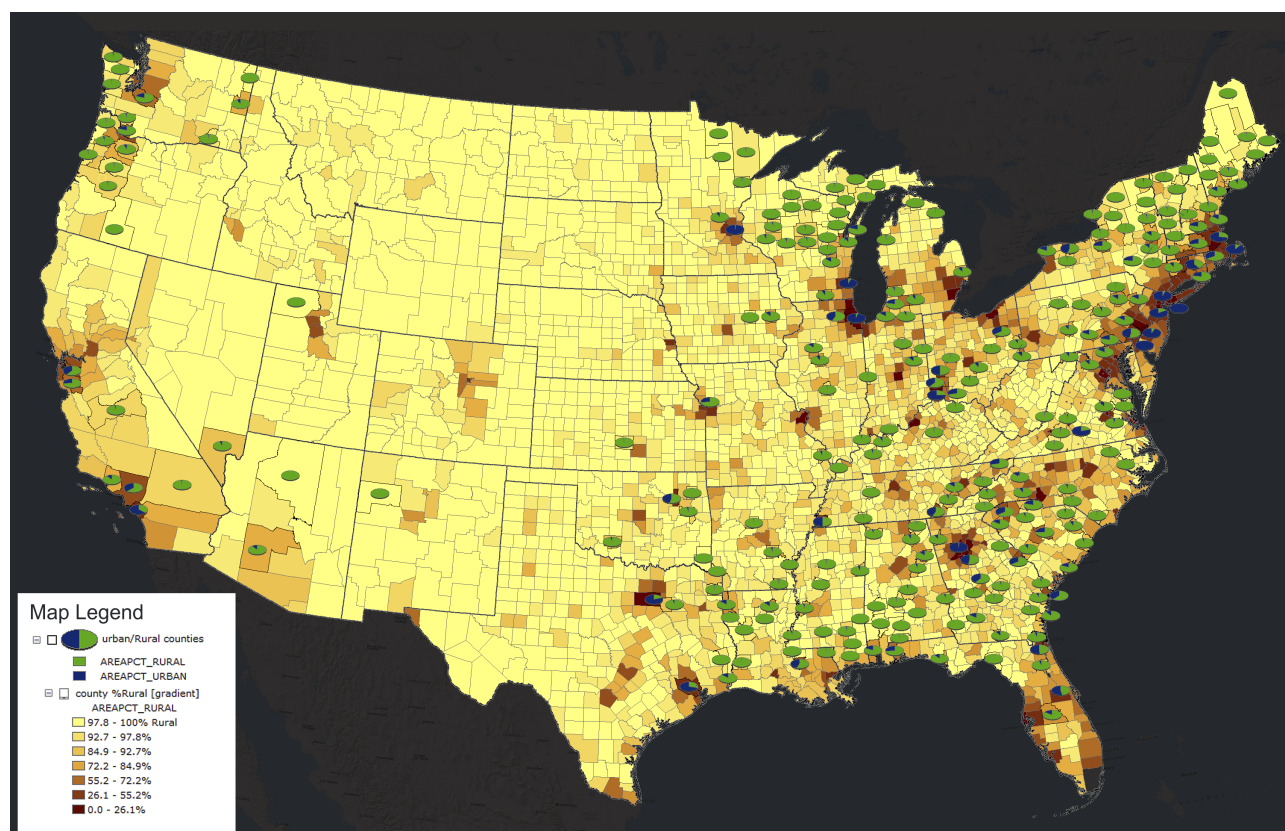


Figure 3—Facility locations showing predominantly rural land settings except for counties located in and around U.S. metropolitan areas.

domestic uses) exceeds 1,000 MMGD in a few industry counties. The average across all counties in which mills operate is 168 MMGD, which represents an average increase of 8 percent (from 154 MMGD) over a recent 10-year period (i.e., 2000 to 2010). In terms of total water use in these counties by category, the vast majority was withdrawn by hydroelectric facilities (70 percent), followed by industrial sources (14 percent), agriculture/irrigation (7 percent), domestic water use (6 percent), as well as mining and other sources (3 percent).

CONCLUSION

Reports generated from this effort summarize data on industry facilities and their environment, and provide detailed characterization reports containing standard watershed metrics, descriptions of average flow conditions and nearby water sources, as well as water use information for this industry and other industrial/non-industrial (e.g., domestic) uses. Assembling this information not only generated facility-specific information useful to NCASI member companies, but also generated a database of water/environment-related

metrics that can be used to analyze information at various scales, as well as look for trends in data over time. Data from these assessments can also be overlapped with water quality assessment information (e.g., EPA CWA §303(d) impairments) to help anticipate which facilities with certain watershed characteristics are more likely to be involved in a water quality improvement (e.g., TMDL) effort. In addition, more recent information on threatened and endangered species in mill receiving waters is helping to identify which industry facilities may require additional considerations for the volumes of water intake and/or discharge flows to not negatively impact aquatic ESA species and/or their critical habitat. Other demographic information used (but not described herein) may also be useful to specific companies or facilities in their water use decisions and related environmental sustainability goals.

LITERATURE CITED

USCB. 2012. Population Estimates – Current Estimates Data (2012 Statistical Abstract). 131st Edition. Washington, DC: U.S. Census Bureau. <http://www.census.gov/popest/data>. [Date accessed: November 17, 2014]