
Making the Land Use – Water Quality Connection

An Assessment of Land Use
and Water Resource
Planning in North Carolina

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In the summer of 1998, the N.C. Division of Community Assistance funded a study by the authors to examine the state of water quality planning in North Carolina. The study included a survey and evaluation of comprehensive/land use plans across the state. This article addresses the findings from the survey and evaluations, and proposes guidelines for effective land use and water resource planning.

From the study we conclude North Carolina communities are not yet addressing water quality in their comprehensive plans for future urban growth. The local administrators we surveyed say water quality issues are important – particularly the protection of public water supplies – but the plans we evaluated do not reflect the magnitude of this concern. The plans, most notably, fail to recognize the connection between land use and water resource planning, evidenced by their general inattention to water quality issues and development suitability analyses.

Part of the problem lies in the uneven quality of planning itself. For example, we found that inadequate attention to the planning information base tended to cut across all subjects, not just water resource issues. A small minority of communities have separate documents addressing water resources, such as public water or sewer service area extension plans and stormwater management ordinances. But the existence of such documents does not remedy the failure of comprehensiveness. The connections between land use and water quality must be addressed in a comprehensive land use, environmental, and infrastructure planning process. The failure to draw those connections adequately will ultimately handicap any policies or programs intended to address water quality.

Methodology

The study included a survey of local administrators in every municipality and county in the state. We received survey responses from 99 of the state's

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100 counties, 47 municipalities with populations over 10,000, and 283 municipalities with fewer than 10,000 people.¹ The study also involved an evaluation of plans from 44 counties, 22 cities with populations over 10,000, and 32 cities with fewer than 10,000 people.

The survey asked administrators about the importance of particular water quality issues to the community. The survey also asked whether the community had a comprehensive or land use plan, and ordinances relevant to water quality. (See Figure 1 for the list of survey questions.)

The plan evaluation instrument addressed both quality and scope of content in the 98 plans surveyed. The instrument reflects our conviction that land use and water quality are inextricably related, and that water resources can be adequately protected only by inclusion in good comprehensive land use planning. We divided the evaluation into five elements: participation, values, information base, policies, and implementation. We recorded inclusion or omission of particular issues in plan component, and evaluated the quality of the treatment of some plan elements. (See Figure 2 for an outline of the evaluation instrument.)

Survey of Communities

Our survey revealed that the overwhelming majority of local administrators believe protection of public water supplies is the most important water resource issue faced by their community. We asked local officials to rate a list of 17 possible water quality issues as "very important," "somewhat important," or "not important." Table 1 lists the issues most often listed as "very important." Some 85 percent of North Carolina counties and municipalities listed protection of public water supplies as a "very important" issue; and the proportion goes over 90 percent for cities. The plan evaluations revealed a similar emphasis – the strategy and value evidenced in the largest number of plans was "urban growth and demand for water supply."

Perhaps most notable is the number of issues ranked as very important by a significant share of respondents. At least half of local officials rated the following as "very important:" expanding wastewater collection/treatment capacity (56 percent); protection/improvement of stream corridors (54 percent for all places, but 61 percent in the

Table 1. Top 5 issues rated "very important" (ranked by percentage)

CAMA Region

1. Protection of public water supplies (83)
2. Stormwater runoff (66)
3. Preservation/improvement of stream corridor (61)
4. Expanding wastewater collection-treatment capacity (56)
5. Failing septic tanks (56)

All Regions

1. Protection of public water supplies (85)
2. Expanding wastewater collection-treatment capacity (56)
3. Preservation/improvement of stream corridor (54)
4. Stormwater runoff (51)
5. Erosion and sedimentation (48)

CAMA region); and stormwater runoff (51 percent for all places, but 66 percent in the CAMA region and 61 percent of cities).

There is some variation in response by region and type of government. Generally, counties and towns placed higher importance on failing septic tanks, agriculture runoff, protection of shellfish/fish habitats, and landfills. Cities were more concerned with stormwater runoff, floodplain management, small wastewater treatment plants, and brownfields than were towns and counties.

Different areas of the state also have varying concerns. Erosion and sedimentation were considered very important to 61 percent of mountain communities (compared to 48 percent of all places). Governments in the region affected by the N.C. Coastal Area Management Act (CAMA) answered "very important" more than other governments for almost all water quality issues, and significantly more in particular for protection of habitats and failing septic tanks. When asked, "what is the *most* important water quality issue?," half of the communities cite protection of public water supplies. The proportion was fairly constant over all types of jurisdictions and regions of the state. Wastewater collection was the most important water quality issue for 17 percent of

Figure 1. Sample of survey questions

- Does your area have a plan which specifies the desired land use pattern or development policies for your jurisdiction?
- Does the plan specifically account for any state designated stream classifications?
- Has the land use plan significantly influenced any water quality policy debates in the last five years?
- Was the location for the most recent wastewater treatment plant selected before or after the current plan was written? If after, was selection of the site influenced by the current plan?
- Is any part of your jurisdiction serviced by a separate water related utility?
- Does your area have: Natural Hazard Mitigation plan, capital improvement program or plan, public water service area extension plan, public sewer service area extension plan, zoning ordinance, subdivision control ordinance, flood damage prevention ordinance, stormwater management ordinance?

Figure 2. Summary of plan evaluation

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| <ol style="list-style-type: none"> 1. Participation: Forms of public participation mentioned <ul style="list-style-type: none"> • Explanation of plan making process • Explanation of planning, the plan's purpose, or mission statement 2. Values: Predominant values in plan <ul style="list-style-type: none"> • Method used to express values (e.g. explicit or implicit, in one place or dispersed) • What goal drives the water quality focus of the plan 3. Data Collection & Analysis: (elements scored from 0-2) <ul style="list-style-type: none"> • <i>General elements:</i> population, economy, existing land uses, etc. • <i>Land/Environmental:</i> soil/geology; topography; land cover; habitats; etc. • <i>Water:</i> water supply surface water; groundwater; sedimentation; etc. • <i>Other:</i> air quality; solid waste disposal; development suitability; etc. • <i>Demand/Capacity Analysis:</i> future land/wastewater treatment/water demand; etc. • <i>Existing policies:</i> state, federal, local policies and/or requirements 4. Intended Policies (elements scored 1 if referenced, included, or proposed, 0 if not) <ul style="list-style-type: none"> • <i>Policies characteristics:</i> are policies specific or general, incorporate extra-local strategies | <ul style="list-style-type: none"> • <i>Characterization:</i> verbal policies, land use designation, small area plans, land classification system • <i>Regulations:</i> density bonuses, impact fees, urban growth boundary, etc. ▪ <i>Intergovernmental:</i> mechanisms for intergovernmental coordination regarding development, water quality, or wastewater treatment • <i>Plan extensions:</i> e.g. water supply plan, watershed management plan, small area plan, capital improvement plan <ol style="list-style-type: none"> 5. Water Quality Policies (same as above) <ul style="list-style-type: none"> • <i>Water quality issues addressed:</i> e.g. sewer service area, agricultural runoff, wetlands • <i>Water quality tools:</i> e.g. riparian buffers, water conservation, critical areas • <i>Characterization of policies:</i> characterize values driving water quality strategies 6. Overall Quality Rating: <ul style="list-style-type: none"> • Implementation • Monitoring and evaluation • Water quality • Development management mindset (e.g. growth accommodating) • Complete plan |
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places, a concern that was also fairly constant among all local governments. Next in order of priority were stormwater management and failing septic tanks, though stormwater runoff is the second most cited issue for larger municipalities. Cities exhibited less variation in the issues considered "most important." Ninety-three percent cited one of four issues: protection of public water supplies, expanding wastewater collection/treatment capacity, stormwater runoff, or defining water and sewer areas.

Just over half of all the survey respondents have a land use or comprehensive plan. That figure varied widely by type of government: 91 percent of cities had plans, compared to only 39 percent of towns and 71 percent of counties. The vast majority – 85 percent – of all plans have been formally adopted. Of the remainder, half have been "formally accepted."

Plan Evaluation

We found some indications that comprehensive plans are not following general guidelines for good planning (e.g. those outlined by Kaiser, Godschalk and Chapin in *Urban Land Use Planning* and the *Growing Smart* guidelines published by the American Planning Association). Only a slight majority of plans made connections between goals, objectives, and policies, and only 20 percent prioritized their proposals or strategies. Most plans also lacked evaluation mechanisms or criteria. The evaluation results for three sections, values, information base, and policies are discussed below.

Plan section: Values

The values section of a comprehensive plan provides the goals and objectives that will drive the community's growth management strategies and policies. The authors determined that most plans based their approach on a narrow scope of values. A majority of the plans' values sections recognize the importance of accommodating expanded need for water management systems: 60 percent value growth and demand for wastewater treatment, and 63 percent value growth and demand for water supply. An underlying assumption behind these values seems to be that water is a managed flow for basic domestic needs. Few communities address water as an economic resource for commercial or tourist uses (only 32

percent), or as a natural resource with non-commercial value (also 32 percent).

County governments value water quality matters more than city and town governments, the evaluation results suggest. For example, 42 percent of county governments value water as an economic resource to be protected, while only 17 percent of cities and 25 percent of towns have this perspective. A higher percentage of county plans also emphasize the protection of water as a natural resource – 36 percent – than city (26 percent) and town (31 percent). County plans more often value protection of the public water supply (62 percent, versus 55 percent city and 43 percent town). County and town plans are about equally likely to address growth and demand for wastewater treatment systems (67 percent) and more likely than cities (54 percent). Cities are the most likely jurisdictions to address growth in the demand for water supply (83 percent, versus 74 percent county and 81 percent town). These differences in value orientation may reflect the variation in current capacities: cities are more likely to have large treatment facilities, whereas a growing town or urbanizing county is more likely to be facing the transition from septic systems to treatment plants.

Plan values also varied significantly region to region. As expected, protection of water as an economic resource and natural habitat was more often cited in CAMA communities. Failing wastewater treatment or septic tanks was cited more often for counties than municipalities, and for CAMA more often than non-CAMA communities (again, this may reflect the larger reliance on septic systems by counties and CAMA communities). Growth and demand for wastewater treatment (60 percent overall) were cited for 70 percent of cities, and nearly 70 percent for the fast-growing Piedmont region communities (compared to around 50 percent for other regions). Growth and demand for water supply followed a similar pattern. Protection or enhancement of drinking water quality was identified as a driving value in less than 50 percent of the plans (interesting given the overwhelming prioritization of protection of public water supply by survey respondents). Finally, "meeting state requirements" was cited as the primary value for nearly 70 percent of CAMA plans, compared to 45 percent of all plans, and 68 percent of town plans (See Table 2).

Table 2. Values driving water-related focus of the plan's values and policies sections.

Value	Percent of values sections	Percent of policies sections
Growth and demand for water supply	63	78
Growth and demand for wastewater treatment	60	64
Meeting state requirements	45	47
Protection or enhancement of drinking water quality	40	45
Protection of economic resource	32	35
Protecting water as a natural resource (non-commercial value)	32	37
Protection of aquatic environment (habitat)	24	31
Failing wastewater treatment system	21	26
Protecting water quality for other communities	7	8

Plan section: Information base

Our evaluation of the information base of plans revealed the greatest shortcomings, and gave us some insight into the reason for overall mediocre quality of the plans. The creation of an adequate information base is perhaps the most expensive and time-consuming aspect of plan-making, but it is vital because it affects the quality of the elements that follow. We were particularly dismayed to find a very weak synthesis of those information elements that were included. For example, land suitability analyses were rarely included and few plans adequately treated the relationship among data elements. In most communities, the information base appears to function more as a reflexive preparatory step to policy-making, rather than as a significant part of the policy-making exercise.

The elements that communities included in their planning information base reflect their general values as described above. Over 80 percent of the plans provide adequate discussion of water supply systems and wastewater management, and roughly a quarter of those plans include relatively sophisticated discussion of these issues. However, fewer than half of the plans include projections of future water use or water treatment demands. The plans

Fewer than half of the plans anticipate future water use demand or future wastewater treatment demands.

also include little information about natural water systems, including wetlands, groundwater, and non-water supply surface bodies. The plans' information bases are particularly deficient regarding the sources of hazardous materials, sedimentation, erodible soils, and the effect of agriculture on wetlands. Plans rarely include information on topography and land cover. Development suitability analysis, identification of critical areas, future water and wastewater demand, and even land development projections are included in only about half the plans, and are rarely mapped.

We also compared each plan to a list of water-related information elements, including both natural resource water issues and issues directly related to public water supply. Water supply from surface water, the most commonly included information, is addressed by fewer than 50 percent of the plans. CAMA plans are significantly more likely than non-CAMA plans to include water-related information, particularly natural hazards (92 percent compared to 40 percent non-CAMA), wetlands (78 percent to 24 percent), water quality conditions (58 percent to 26 percent), and agricultural impacts (27 percent to 8 percent).

We were particularly dismayed by the inadequate attention to capacity and suitability analysis. Demand and capacity analysis is needed to provide a consistent set of projections for planning efforts and to ensure that future development patterns do not jeopardize the quality of water supply or other water resource. Just under half of the plans included projections of future land use, water use, or wastewater treatment demands. Fewer than half (46 percent) identified land control areas (i.e. annexation or expansion of extraterritorial

jurisdiction). Land development trends and projections were more commonly analyzed; 60 percent of plans included them, and a third of those plans received high scores for the treatment of the element.

Plan section: Intended policies

The policy sections of most plans consist of general policy statements, rather than specific, measurable actions. Plans are particularly unlikely to include spatially-explicit policies. We characterized each plan as a land use design, development management, and/or land classification plan (plans could be marked as multiple types). 81 percent of plans include verbal statements or actions (sometimes without explicit spatial designations). Just over half of the plans include clusters of policies associated with explicit spatial districts (such as "urban transition districts" or "conservation districts"). Land use designs (for either an entire jurisdiction or small areas within a jurisdiction) are included in just over a third of plans. Those land use plans only occasionally designated areas for future expansion of water and sewer services, or annexation.

Inclusion of water-related strategies

The most notable finding of our study was the difference between the number of communities placing a high priority on public water supply (83 percent) and the number of communities who addressed protection of the public water supply in their policies (barely 50 percent). Fifty-nine percent include provisions for a sewer service area, and 41 percent address on-site wastewater treatment. Policies regarding natural water processes and human impact on these systems are even less common. About a third of the plans specify some sort of wetlands protection, storm water management or sedimentation and erosion prevention. The plans are even less assertive in addressing human pollutants to water systems. Less than 20 percent feature provisions to mitigate agricultural runoff or hazardous materials.

Relatively few plans include development management tools that specifically address water quality. Best management practices (both urban and rural), storm water detention systems, and storm water detention systems are each included in only 20 percent of plans. Critical area or overlay district designation is used by 35 percent of

plans, in large part because CAMA communities are required to use it; the designation is rarely used by non-CAMA communities. Plans more commonly use typical development management tools: zoning or subdivision ordinances (84 percent), infrastructure, provision of services and capital improvements to manage growth (55 percent), control of the type and mix and density of land use (50 percent), and control of structural and site design (48 percent). Particularly in larger communities, water quality issues may be addressed in a separate water resource plan, and some growth management tools may be included in single-issue plans (particularly capital improvement plans). We found that although many communities do have plans in addition to a comprehensive plan, water-related plans are the least common plan extensions. While transportation plans were referenced or proposed in 75 percent of community plans and capital improvement plans in 45 percent; water supply plans were proposed in only 43 percent; open space, recreation, or greenway plans in 40 percent; storm water management plans in 27 percent; watershed management plans in 31 percent; and wastewater treatment plans in 34 percent. The survey questionnaire produced similar results: 35 percent of respondents said they have a capital improvements plan, but fewer than a quarter have public water or sewer service area extension plans. Nearly half have a flood damage prevention ordinance but only 15 percent have a storm water management ordinance.

Are the plans influencing, or influenced by, water quality decisions?

One measure of the quality of a plan's treatment of water resource issues is whether the plan has already been useful in addressing such issues. We asked local administrators to indicate the relationship, if any, between their comprehensive plan and the siting of a wastewater treatment plant. The plan significantly affected the location of the wastewater treatment plant in only 15 percent (4 of 26 communities) of those communities where their current plans were written prior to the location of the wastewater treatment plants. Conversely, the location of the wastewater treatment plants significantly influenced the land use plans in only 20 percent (22 out of 112 communities) of those communities where the wastewater treat-

ment plants were in place when the current plans were written. The percentage is even lower for mountain jurisdictions and for communities under 10,000. Only 17 percent of local jurisdictions with land use plans claim that the plans significantly influenced any water quality policy debates in the last five years. One reason for this lack of connection may be the quality of the plans; most plans we reviewed could not in practice provide guidance for resolving a water quality decision.

Guidelines: Ways to better address water resource issues in land use plans

Good water resource protection can only be accomplished in conjunction with good land use planning. In order to protect water quality, communities must have a land use and water resource plan that work together, although they may be separate documents or included as separate elements in a comprehensive plan. Both the land use plan and the water resource plan must recognize the fundamental reciprocity of the relationship between land use and water resources. The future land use plan must incorporate the technology, economics, and natural processes that govern water resource planning. Similarly, water resource plans must be consistent with proposed future land use patterns. Elements of the plans must be designed in consideration of each other. In addition, they must be developed jointly, each part consistent with and reinforcing the other.

Three elements are critical to the development of this connection.

1. Both land use and water resource plans should be based on a common, consistent, and persuasive set of facts and assumptions. Most importantly, the demand estimates for land and location that drive the land use plan should be based on the same population and economic forecasts as the demand estimates for water and wastewater treatment used in water resource plans. (In that way, both the land use and water resource planning will share the basic assumption about future size and shape of the community to be accommodated.) Similarly, planning should be based on a thorough baseline of information about carrying capacity of the area and potential environmental threats.

2. The two plans should have compatible future spatial designs. For that to happen, the distribution of future land uses and densities should

be analyzed and summarized by existing and proposed water and sewer service areas, as well as by sensitive environmental areas such as watersheds, flood plains, and wetlands. That is, the plan should estimate the future intended population, employment, and water/sewer-sensitive land uses (which represent demand for water and sewer services) not just for the entire jurisdiction but by each separate water and sewer service area. Similarly, high risk impacts should be summarized by sensitive environmental areas.

3. The land use plan should use land suitability maps in exploring options for the future land use pattern of a community. These maps represent assessments of the variation in suitability of areas for future urban development, as well as agricultural and natural resource uses and ecological processes. Those analyses and explorations should include the feasibility and economy of extending water and sewer infrastructure, as well as the usual assessments of accessibility and physical features of the land. In that way, proposed future land use designs can incorporate infrastructure design principles and thus reflect responsible infrastructure planning including water and sewer infrastructure. The suitability analysis should also reflect relative vulnerability of environmental features and processes to land use changes and thus promote environmentally responsible land use designs, as well as water and sewer planning.

The following sections provide further guidance for each element of the community plan.

Information for good planning

The information base, in addition to including specific and consistent assumptions about future population and economic growth, should be informed by studies of existing land use, including classifications based on the impact of the use on water resources. For example, uses might be classified as high risk, medium risk, and low risk to water quality. Land supply should not only be assessed for its market-oriented suitability (i.e., assessing factors that affect the costs of development and consumer preferences about locations), but also for the vulnerability of development to environmental hazards at that location, the vulnerability of environmental systems to development at that location, and the reasonableness of extension of infrastructure.

To conduct the appropriate suitability studies, it is necessary to construct data inventories for at least three categories of natural resources:

- Natural resources to be respected (e.g., state-designated streams and watersheds, groundwater recharge areas, wetlands, and other areas of environmental concern);
- Land characteristics affecting suitability for development and potential of development to cause environmental degradation (e.g., steep slopes, erodible soils); and
- Cultural and historic sites.

In addition to the studies of land use, land supply, and environmental resources, the information base should examine the existing community facilities with special attention to public water supply systems, wastewater management systems, and storm water and flood plain management facilities and policies. These studies should map and inventory the conditions and capacities of existing facilities and proposed changes in those systems; including existing and planned service area boundaries. For larger water supply systems, the inventory should include sources of supply, treatment works, storage facilities, and distribution networks. Where groundwater is used for public water supply sources, the plan should include an assessment of groundwater quality and map the locations of well-heads and well-head protection areas. Any necessary new water supply watersheds should be addressed and delineated. The inventory of wastewater management systems should be equally detailed, with special attention to parts of the system with inadequate capacity and where there are known overflows, bypasses, and threats to public health, including problems in unsewered areas.

The information base should include studies of existing water resource policies, including their geographic boundaries, implications for future land use change, implementation issues, and government capabilities (administrative, financial, legal) to modify and extend its development and environmental management programs. State and federal policies or plans with implications for local development, and their relationship to local policy, should be described. For example, state water quality classifications for segments of streams and lakes should be identified, with related assessments of how well those segments support their designated uses.

Goals, objectives, and priorities

The values section should include both goals - ideal future conditions to which the community aspires - and objectives - which are measurable intermediate achievements leading to progress on goals. Objectives also serve as benchmarks in the monitoring component of the plan (See Figures 3 and 4.)

The values component of the plan should incorporate natural resource goals explicitly, including goals and standards mandated by state and federal policy which the local government is legally or politically bound to implement. For example, state programs such as the water supply watershed classifications include both explicit and implicit water quality protection goals, which should be included in the community's plan. They also include the community's judgments about levels of water and sewer services required and environmental qualities which are valued. These judgments and values will determine infrastructure capacity needs and environmental protection programs.

Intended policies

The proposed policies and programs of the plan should incorporate land-oriented policies, general policies about environmentally sensitive land use patterns and development practices, as well as policy maps of intended service areas, environmentally sensitive areas, and non-urban use areas. Beyond that level of policy, the land use plan can incorporate water and sewer plans and particular environmental protection plans (e.g., a watershed land management plan) by reference or by summarizing them within the land use plan. Ideally, plans should utilize both the land use and land classification formats to indicate the future land development pattern. As described at the beginning of this section, the plans should be developed in conjunction with water resource planning for the community.

A land classification plan should delineate those areas of the planning jurisdiction where development should not occur, such as environmental-conservation areas, areas to be preserved for agriculture, or lands suitable for development only in the long-term. Policies for these areas should be combined in the land classification plan with areas designated environmentally-sensitive

Figure 3. Orange County Comprehensive Plan

This plan's strong information base included information like the following:

Water resources

Watersheds: mapped and analyzed by river basin, with description of existing protection measures, communities serviced, and headwaters.

Geology and groundwater yields: includes description and map of principal rock types, assessment of rainfall and yield by season, and assessment of contamination problems. Also includes tables showing type of water source for all housing units summarized by township and number of wells and well yields for each principal rock type.

Floodplains: includes description and map of 100-year floodplains and alluvial/hydric soils, and a table illustrating the frequency and duration of flooding and water table depth by type of soil.

Wetlands: includes a discussion of the environmental benefits that wetlands provide, an assessment of the type and nature of wetlands in the region, and a description and map of wetlands using information from the National Wetlands Inventory, LANDSAT satellite data, and field surveys.

Land resources

Soil conditions: includes tables and maps showing method of sewage disposal for all housing units by township, assessment of soil limitations for septic tank absorption fields, and for dwellings without basements.

Plant and animal resources

Includes maps of wildlife corridors, vegetation, and habitats, and assigns each natural area a rating for significance, integrity, and threat.

The information base concludes with identification and mapping of primary and secondary conservation areas, and a Development Constraints Map, which consists of overlays for floodplains, steep slopes, and impermeable soils. Primary Conservation areas include "sensitive environmental resources, historically significant sites, and features considered unbuildable because of their limitations or inherent unsuitability for development."

Figure 4. Illustrative goals and policy statement (from Orange County Comprehensive Plan)

Goal Five: Direct growth to areas where it is desirable and can be accommodated

Policies/Actions

5.1 Designate land in water supply watersheds which encircles the water supply impoundment and which drains directly into the impoundment and into the main channels of trunk streams feeding the impoundment as Water Quality Critical Areas, not suitable for moderate to high density residential development or nonresidential development.

Goal Nine: Efficient provision of water and sewer services

Policies/Actions

9.1 Develop and implement a cooperative joint planning process among municipalities and other agencies responsible for water and sewer services in the county, to guide extensions in accordance with the land use plans and policies of the affected jurisdictions.

9.2 Establish a joint Urban Services Area for municipalities A, B, and C that will correspond to the 20-year transition areas of their coordinated municipal land classification plans.

9.3 Prohibit water and sewer services in areas designated Water Quality Critical areas, except to address emergency situations.

Goal ten: Clean and safe water supplies adequate to meet future needs of the residents of the county.

Policies/Actions

10.1 Adopt and implement policies which specify land use patterns and intensities of development in water supply watershed and watershed critical areas that will minimize potential adverse impacts on water quality.

10.2 Designate prime future reservoir sites to protect those areas from adverse development impacts while ensuring that inappropriate restrictions are not placed on a large proportion of the population or land resources of the county.

by state policy and locations where water quality is an issue.

The plan should also include an intended development management program, which may be one integrated program or organized into separate parts. For each component, the development program should specify its content, geographic boundaries or location, relative priority and timing, and the agency responsible for implementation. Finally, the development management program should be followed by a monitoring and evaluation plan that is integrated into the implementation process.

Conclusions

The Coastal Area Management Act: A model?

CAMA has raised the baseline standard of planning, especially regarding water quality issues. CAMA plans (See Figure 5 for CAMA counties) are stronger than plans elsewhere in addressing water management as part of a natural, environmental process. CAMA plans address wetland protection more than Piedmont and mountain municipality plans. Ninety-one percent of CAMA plans provide adequate protection of wetlands, compared to less than 20 percent of non-CAMA plans. Protection of aquatic environment is stronger in CAMA plans – it was evident in 78 percent of CAMA plans compared to about 20 percent of non-CAMA plans. CAMA plans are also consistently stronger than non-CAMA plans in their treatment of water quality issues related to

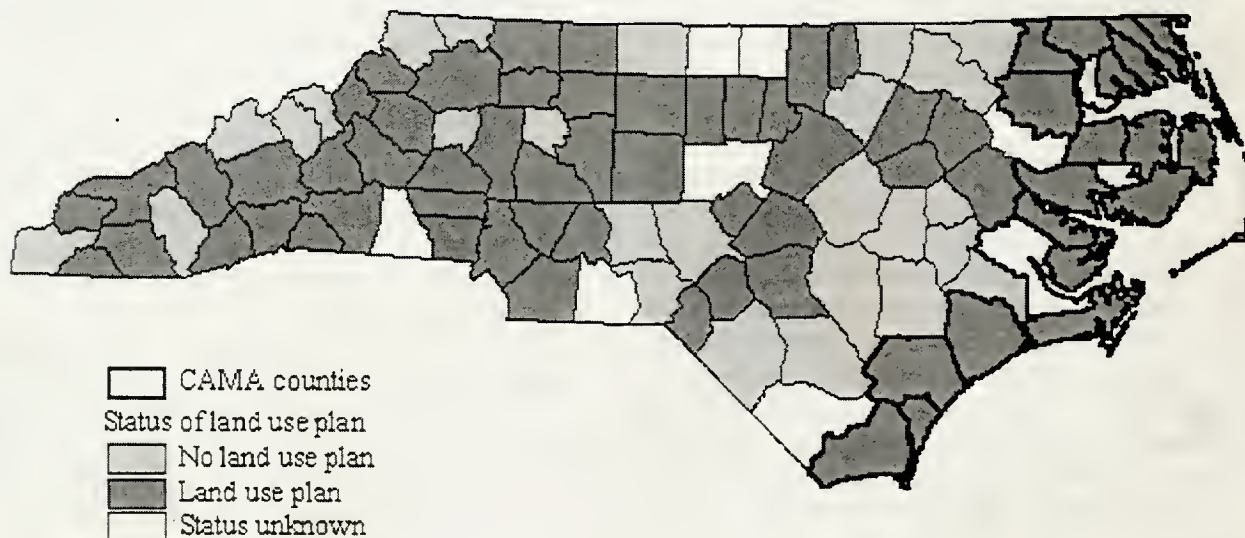
human-made water management systems. Over 75 percent of these plans address protection of the public water supply, sewer service area and on-site wastewater treatment/septic use. However, CAMA produced few model plan elements, and the overall quality ratings of CAMA plans were not significantly better than non-CAMA plans. In particular, CAMA plans are weak in prescribing goals and strong overarching policies. They ranked significantly behind non-CAMA plans in specifying a pattern of future land uses.

Although the CAMA program does not require regional planning efforts, it arose from the focus on the statewide and regional impacts of multiple local plans on water and air quality. By requiring localities to create plans and follow a set of guidelines, CAMA has certainly improved the state of planning in the coastal region, but it has not led to an integrated regional planning effort. CAMA could further improve the state of planning by requiring a stronger connection between information base and strategy, inclusion of a land use design, and regional policy coordination for protection of environmental resources and processes on the coast.

Implications for regional and statewide planning efforts

Community plans, even CAMA plans, do not adequately address statewide requirements or intergovernmental cooperation. Whether a plan accounts for and adequately incorporates existing policies at other levels of government will affect

Figure 5. Status of land use planning in North Carolina, by county.



the implementation of the plan, particularly for issues that have regional implications or that are affected by extraterritorial development patterns. Approximately half of all survey respondents indicated that their plans accounted for state-designated stream and watershed classifications, with significant variation among types of jurisdictions (fewer than 40 percent of municipalities, compared to approximately 70 percent for counties and for CAMA region communities). Fewer than half of the plans mentioned state policies and requirements in their information base, about the same proportion that mentioned other local ordinances and plans. Only 27 percent of the policy sections referenced regionally coordinated or state-wide strategies, and 35 percent proposed mechanisms for intergovernmental coordination.

The existence of consistently strong comprehensive plans across the state will still not ensure the protection of water quality. The types of issues faced by the communities we surveyed reveal the need for regional efforts to protect water resources. For example, Orange County contains streams feeding public water supplies in Orange, Durham, Chatham, Person, and Alamance counties. State requirements can be used to ensure minimum levels of protection of such streams, but in many cases communities will be unable to implement strategies for protection without coordinating with adjacent communities. Existing joint city/county planning efforts provide rough models for interjurisdictional plan-making, but communities need guidance on how to devise intergovernmental strategies for particular resource protection issues that cross county boundaries. The state could promote regional planning by providing such models in conjunction with a set of general planning guidelines similar to those we have out-

lined here. Such guidance could help communities achieve the water resource goals that are so important to the sustainability of their future development. **CP**

Authors' note

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Endnotes

¹ For simplicity, we refer to municipalities under 10,000 population as "towns" and municipalities over 10,000 as "cities."

References

- American Planning Association. August, 1998. *Growing Smart Legislative Guidelines: Model Statutes for Planning and the Management of Change.*
- Kaiser, Edward J., D.R. Godschalk, and F.S. Chapin, Jr. 1995. *Urban Land Use Planning, fourth edition.* Urbana: University of Illinois Press.