Briefing on Sustainable Water Management

Executive Summary

This document synthesizes key challenges and strategic solutions related to sustainable drinking water management. The central thesis is that traditional approaches are insufficient, necessitating a shift towards a multi-faceted strategy encompassing conservation, infrastructure renewal, and holistic management. A "soft path" approach, as outlined by Dr. Peter Gleick, provides a strategic framework that emphasizes efficiency, decentralized infrastructure, and revised regulatory concepts over simply developing new large-scale supply sources.

Water conservation emerges as a critical, immediate imperative. Significant water loss occurs through aging distribution systems, with an estimated 7 billion gallons lost daily in the US to leaks alone. While domestic use is a factor, with the average American using 69.3 gallons daily, the largest consumers of water in the US are thermo-electric power generation (49%) and irrigation (31%). Globally, humanity appropriates 54% of available renewable freshwater, with withdrawals projected to increase significantly.

To address these challenges, an Integrated Water Management (IWM) approach is necessary. IWM treats potable water, wastewater, and stormwater as a single, interconnected system. It emphasizes the linkage between land use and water resources, requires the involvement of all stakeholders—from regulators to consumers—and necessitates coordination across local, state, and federal agencies to overcome jurisdictional complexities. This holistic methodology, supported by tools like GIS, represents the most viable path toward achieving long-term water security.

The "Soft Path" Framework for a Sustainable Water Future

Dr. Peter Gleick of the Pacific Institute proposed a strategic framework for achieving a sustainable water future, moving away from a reliance on large, centralized infrastructure towards more flexible and efficient solutions. These "six soft paths" redefine the approach to water resource management.

1. **Invest in Decentralized Infrastructure:** Shift focus towards smaller, localized water management systems.
2. **Match Water Quality to Use:** Align water quality requirements with their designated end uses, potentially supplying different grades of water for different needs (e.g., potable vs. irrigation).
3. **Challenge Demand Assumptions:** Instead of taking current demand for granted, focus on improving efficiency to "do more with less water."
4. **Expand the Definition of Water Supply:** Broaden the concept of supply to include conservation, efficiency improvements, and water recycling.

5. **Price Water Properly:** Implement pricing structures that reflect the true cost and value of water to encourage conservation.
6. **Expand Regulation and Institutions:** Evolve regulatory and institutional frameworks to support these innovative and integrated management approaches.

The Imperative of Water Conservation

Water conservation is a foundational element of sustainability, driven by escalating demand, system inefficiencies, and unsustainable withdrawal rates. Analysis of global, national, and domestic data reveals the scale of the challenge and highlights key areas for intervention.

Global and National Consumption Context

Global and national water usage statistics underscore the immense pressure on freshwater resources.

- **Global Appropriation:** According to the United Nations Development Programme (UNDP), humanity already appropriates approximately 54% of all available renewable freshwater resources.
    - **Global Use Breakdown:** Irrigated agriculture is the dominant user (70%), followed by industry (22%) and domestic use (8%).
    - **Future Projections:** By 2025, water withdrawals are projected to increase by 50% in the developing world and 18% in the developed world.
- **United States Usage (USGS 2005):** In the US, the primary consumers of water are not households but power generation and agriculture.
    - Thermo-electric power: 49%
    - Irrigation: 31%
    - Public Supply: 11%
    - Other uses (Industrial, Mining, etc.): <10% combined

Sources of Water Loss and Inefficiency

A significant portion of withdrawn water is lost before it ever reaches an end-user due to infrastructure failures and inefficient consumption patterns.

- **Infrastructure Failure:** The water distribution system is a major source of loss.
    - According to the EPA (2007), at least **10%** of water is lost through inadvertent leaks in distribution pipes.
    - The American Society of Civil Engineers (ASCE, 2009) estimates that **7 billion gallons** of water are lost daily to leaks in the US.
    - Water auditing, investment in maintenance, and renewal of existing pipelines are necessary conservation strategies.
- **Domestic Consumption:** While a smaller piece of the national total, domestic use is significant and characterized by inefficiency.
    - A typical American uses **69.3 gallons** of water daily (Water Research Foundation).

    - Leaks within the home account for **13.7%** of this usage, representing a major source of waste.
    - The largest domestic uses are toilets (26.7%) and clothes washers (21.7%).

Domestic Water Use	Percentage of Total
Toilets	26.7%
Clothes Washers	21.7%
Showers	16.8%
Faucets	15.7%
Leaks	13.7%
Other Domestic Uses	2.2%
Baths	1.7%
Dishwashers	1.4%
Source: Water Research Foundation	

Key Conservation Strategies and Sustainable Sourcing

A combination of technological, agricultural, and policy strategies can significantly improve water efficiency and ensure the long-term health of water sources.

- **Agricultural and Landscaping Strategies:**
    - **Drip Irrigation:** Reduces overall water consumption.
    - **No-Till Agriculture:** Reduces water evaporation from soil.
    - **Mulch:** Helps soil retain humidity.
    - **Timing:** Watering at night limits evaporation.
    - **Native Species:** Planting native species adapted to the local climate reduces irrigation needs.
- **Residential and Urban Strategies:**
    - **Rainwater Harvesting:** Collecting rainwater via green roofs or rain barrels.
    - **Water-Efficient Fixtures:** Installing low-flow toilets, showerheads, and faucets.
- **Sustainable Source Management:**
    - **Balance Withdrawals and Recharge:** Planning must be based on a full water cycle to determine a maximum sustainable withdrawal rate.
    - **Maintain Ecological Balance:** Protecting watersheds involves avoiding erosion through measures like riparian buffers and preserving native species and tree cover.
    - **Improve Technology:** Future water security will depend on both efficiency and improved technologies, such as converting wastewater back into usable water.

Integrated Water Management (IWM) as a Holistic Solution

Integrated Water Management (IWM) is a comprehensive approach that moves beyond siloed management of water resources to a holistic, system-wide perspective. It is foundational to implementing a sustainable "soft path."

Core Principles of IWM

IWM is defined by its integration of various systems, disciplines, and goals.

- **System Integration:** It combines the management of potable water, wastewater, and wet-weather flow (stormwater). This approach facilitates the reuse and recycling of water.
- **Disciplinary Integration:** IWM integrates the spatial, environmental, and institutional aspects of water management.
- **Proactive Stance:** The philosophy prioritizes preventive actions over remedial actions, incorporating pollutant fate and transport models into decision-making.
- **Interconnectedness:** IWM recognizes that land and water management are inextricably linked; any modification of land use affects the watershed. It also acknowledges that groundwater and surface water are related and can impact one another.

Essential Components of Implementation

Successful IWM requires broad collaboration and a clear understanding of the complex systems at play.

- **Stakeholder Collaboration:** The planning process must include all stakeholders to be effective. This includes:
    - Regulators
    - Consumers (both industrial and domestic)
    - Land-owners
    - Affected neighboring jurisdictions
- **Overcoming Jurisdictional Hurdles:** Watersheds often encompass multiple counties or states, creating governance challenges.
    - Coordination among local, state, and federal agencies is necessary.
    - Contentious issues can arise regarding jurisdiction over water versus land ownership.
- **Technological Support:** Geographic Information Systems (GIS) are a powerful tool for developing and executing an integrated management plan. GIS can aid with:
    - Water-use forecasting
    - Tracking changes within a watershed
    - Assessing the impacts of new construction
    - Adaptive modeling of the watershed
    - Infrastructure management