Water Data Needs and Applications in the Private Sector

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Water is our nature

DHI

WATER • ENVIRONMENT • HEALTH

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Introduction

Our Mission: Transforming Knowledge of Water Into Value and Welfare

Modeling the world of water

- Watersheds & Rivers
- Urban & Industry
- Marine & Coastal

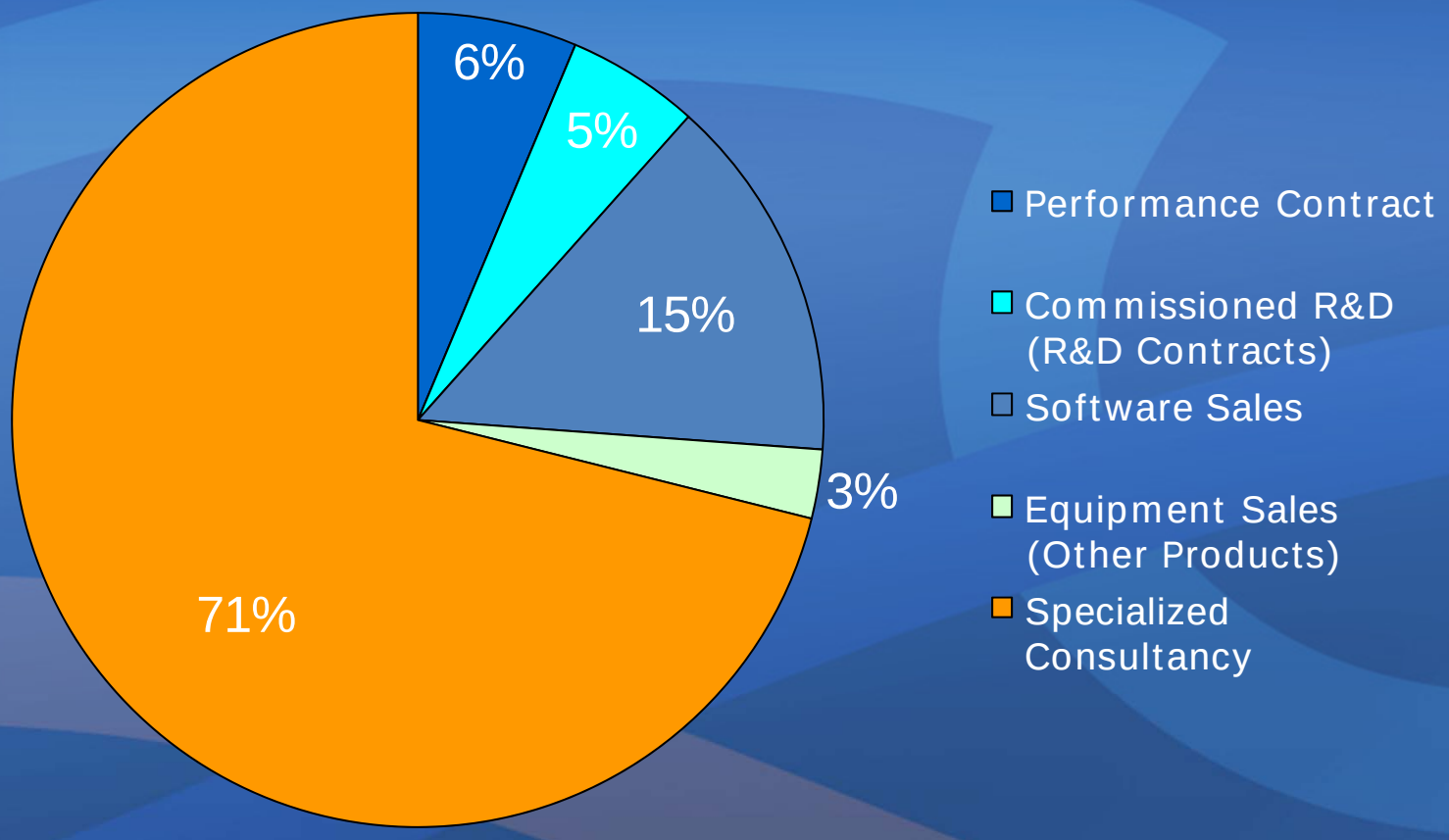
Globally

- 1,000 Staff (850 Professionals)
- Turnover ~$90 million
- Offices in 26 Countries

DHI North America (US and Canada)

- 38 Staff
- Turnover ~$8 million
- 11 offices in North America

Activity by Category



Our Clients

- Federal

  US Army Corps of Engineers, NASA, FEMA, and Bureau of Reclamation

- State

  Department of Environmental Protection, FL
  Water Resources Departments, CA and ID
  Department of Land and Natural Resources, HI
  California Coastal Conservancy, CA

- Local

  Cities – Vancouver, Springfield, Redmond, Chicago, LA
  Counties – King County, Collier, Broward, FL
  Flood Control Districts – Alameda County FCD, CA
  Water Management Districts – South Florida
  Ports – Long Beach, CA

- Private

  Power Utilities – Idaho Power, ID
  Developers – Biale, ID

- Non-Profit McKenzie River Trust, OR

Water data

How data is needed and applied in the private sector

Periodic Studies and Evaluations

- Capital Improvement Programs
  - Sanitary systems
  - Storm water systems
  - Water distribution systems
  - Source water feasibility studies
- New Infrastructure and Upgrades (pipes, bridges, levees)
  - Feasibility studies
  - Design testing
  - Environmental impacts
- Water Rights
  - New water rights
  - Water availability studies

Water data

How data is needed and applied in the private sector

Ongoing Operations

Real Time Monitoring and Control Systems
- Water distribution and sanitary systems
- Storm water control systems
- Hydropower operations
- Flood control

Efficient Irrigation Water Delivery
- Monitor flow
- Gate operations
- Weather conditions

Flood Control
- Precipitation
- Flows
- Water levels

Efficient Port Operations
- Tides (water level),
- River flows
- Water quality

Water data availability

You never have enough data.

Limitations

- Collection is expensive
  - Instrumentation costs
  - Maintenance costs
  - Staffing expertise
- Interpretation
  - QA/QC of the data
  - Data handling
  - Staffing expertise
- Sustainability
  - Often the data does not become useful until after years of collection
  - Must be committed in some cases to long term monitoring (regulatory compliance)

What is water modeling?

Using computers to solve numerical equations representing the physical processes of water movement (conservation of mass, momentum) within the natural and built environments

Common models:

- Hydrologic models
- Hydraulic models (hydrodynamic models)
- Water quality models
- Sediment transport models

Why Model?

Water modeling is used to help society solve problems and better manage water resources

Many times the system is so complex that its too expensive to collect data everywhere so models are used to better understand these systems and “fill in the gaps”

Other uses

- Forecast future conditions
- Assess alternative design or management scenarios
  - water rights transfer
  - climate change
  - ecosystem restoration
  - urban infrastructure improvements

Overview of computer modeling tools

1. Hydrologic models
   a) Compute water budget components (evapotranspiration, infiltration, rainfall-runoff, etc.)
   b) Provide inflows to hydraulic models

2. One-dimensional (1D) hydraulic models
   a) Used to compute discharge and stage
   b) Use cross section and structure data

3. Two-dimensional (2D) hydraulic models
   a) More realistic floodplain flow representation
   b) Use grids or meshes of topographic/bathymetric data

4. Three-dimensional (3D) hydraulic models

Increasing complexity

Data Needs

The more complex the problem, often the more complex the model and the more data needed to support it.

- Bathymetry
- Topography (LiDAR)
- Water level
- Flow
- Velocity
- Facilities operations (dams, gates, weirs etc.)
- Temperature
- Water quality (nutrients, dissolved oxygen algae)
- GIS data (land use, vegetation, infrastructure)
- Snow depth
- Precipitation, Weather radar
- Meteorology (air temperature, wind speed and direction, solar radiation)
- Soil characteristics
- Sediment characteristics (size, type etc.)
- Groundwater flow, temperature and water quality
- Aerial photographs

Where is data needed in modeling?

The more complex the problem, often the more complex the model and the more data needed to support it.

Data Analyses

Studies and analyses to define the problem and understand a physical system

Model Development

Building a numerical model of the real world system

Model Calibration

Calibrating the model to ensure its simulating reality accurately

Model Scenario Development

Using the model to try out management alternatives (land use change, reservoir operations)

Where do we get the data?

- Federal
  - US Army Corps of Engineers
  - Bureau of Reclamation
  - US Geological Survey
  - US EPA
  - NOAA: River Forecast Centers, National Weather Service
- State
  - Department of Environmental Protection\Quality
  - Water Resources Departments
  - Department of Land and Natural Resources
  - California Coastal Conservancy
- Local
  - Regional Agencies: Metro/Tri County
  - Cities
  - Counties
  - Flood Control Districts
  - Water Management Districts
  - Ports
- Private
  - Power Utilities
  - Other Consultants
- Non-Profit
  - McKenzie River Trust
  - The Nature Conservancy

Data handling and storage

- Quality Assurance and Quality Control of data
  - Since DHI receives data from a variety of sources and uses them to build a model we must take “ownership” of the data just as we take responsibility for the model.
- Handling and Archiving
  - Spatial data
    - GIS Layers, LiDAR, Model Grids/Meshes
  - Time series data
    - Databases, processing, MS Excel files
    - Real time control/management systems
- Delivery to client
  - A client’s objectives often require data files to be provided differently than used for the study.
  - Ownership once in the client’s hands?
  - Long term storage of project files at DHI.

Thank you