

**INSTREAM  
FLOW STUDIES**

**(IFIM)**



- **IFIM Studies**
- **Operations Modeling**
- **Hydraulic Modeling**
- **Hydrologic Analysis**



**Central Vermont Public Service Corporation (CVPSC), VT** - retained the services of Gomez and Sullivan (GS) to conduct an IFIM study for the Weybridge Hydroelectric Project. The Project, located on Otter Creek in west/central Vermont, is operated as a peaking facility. GS evaluated the relationship between flows and fish habitat for several species, including walleye, rainbow trout, smallmouth bass, and fallfish, as well as macroinvertebrates. Two velocity suitability index (SI) curves were used: one using column velocity and one using nose velocity. For all the evaluation species, SI curves were evaluated and approved by the study team. Four target flows were agreed upon: 140 cfs, 500 cfs, 800 cfs, and 1,600 cfs. The collected data at these flows was used to develop a hydraulic representation of the transects. Hydraulic modeling results were subsequently combined with SI curves for each of the target species/life stages and relationships between habitat and flow (Weighted Useable Area—WUA) were calculated. The habitat results and WUA curves are currently being evaluated and will be used to determine an approximate minimum flow at the Weybridge Project.

**Green Mountain Power Company (GMP), VT** - contracted with GS to conduct IFIM studies below the Essex No. 19 Hydroelectric Project in the project's bypass. GS was responsible for developing detailed habitat maps of the bypass and downstream river reaches. The GS field crew collected cellular depth, velocity, cover and substrate information along 11 transects in both study reaches under a high and low flow. A water surface profile was also collected by the survey crew at each transect and flow. The Water Surface Profile (WSP) hydraulic model was used to simulate hydraulic and habitat conditions over a range of flows between 150 cfs, to the full station load, 2,000 cfs. The target species were smallmouth bass, rainbow trout, walleye, sturgeon and landlocked salmon. To address agency concerns regarding peaking operations, GS linked their operations model of the project to the habitat versus flow plots to generate habitat time series data. The habitat time series data allowed the agencies to see how habitat conditions varied on an hourly basis below the project. The results of the habitat study were used to determine bypass flow needs.

**International Paper Company, Jay, ME** - retained the services of GS to conduct an IFIM Study of the Livermore Falls bypass. The Livermore Falls Hydroelectric Project is located on the Androscoggin River near Livermore Falls, Maine. The physical configuration of the Livermore Falls dam and powerhouse creates a 1,600 foot-long bypassed section of the Androscoggin River. The average annual flow at the project is approximately 3,100 cfs. GS evaluated the relationship between flows in the bypass and fish habitat for four species including brown trout, smallmouth bass, rainbow trout, and Atlantic salmon. In addition, three macroinvertebrate species were evaluated: mayfly, caddisfly and stonefly. For all of the evaluation species, suitability index (SI) curves were evaluated and approved by the collaborative team.

Because of the irregular bedrock of the bypass, and the two-dimensional flow of the river, a combination of hydraulic models were used, depending on the transect. Hydraulic modeling results were subsequently combined with SI curves for each of the target species/life stages, and relationships between habitat and flow were calculated. The habitat results and NWA curves were evaluated using a variety of techniques such as habitat optimization, limiting life stage analysis and habitat mapping. An evaluation of the range of flows providing 80-95% of the optimal habitat was also conducted. All of these techniques were used to "narrow-in" on an acceptable minimum flow.