

Key Issues:

1- Biological Diversity

Climate Zone:

Df: Cool and Humid

Subjects:

- Post-Project Investigation of River Ecosystem Recovery



Front view of the Tomura Dam

Effects:

- Recovery of ecosystems

Project Name: Tomura Power Plant

Country: Hokkaido Prefecture, Japan (Asia) (N43° E143°)

Implementing Party & Period

- **Project:** Hokkaido Electric Power Co., Inc.
1978 (Completion of construction) -
- **Good Practice:** Hokkaido Electric Power Co., Inc.
1978 - 2003

Key Words:

River Ecosystem, Post-project Ecological Investigation, Dam-and-conduit Type Power Station

Abstract:

A post-project ecological investigation conducted 20 years after the completion of the Tomura Power Station Development Project to investigate the environmental impacts of the project showed that there was no degradation of the self-sustaining function of the river ecosystems. This investigation is the latest of a series of post-project ecological investigations conducted as part of the project. These investigations not only helped facilitate consensus building among the affected/interested local communities with respect to the development of the power station but also contributed significantly to our efforts to win trust from the residents of the affected and/or interested local communities about our environmental consciousness in operating the power station after completion.

1. Outline of the Project

In the early 1970s, the capacity of Hokkaido Electric Power Co., Inc. to generate electricity for eastern Hokkaido had been surpassed by the electricity demand of the area and the gap was being filled using electricity sent from western Hokkaido. To solve this problem, Hokkaido Electric Power Co., Inc. decided to develop a new hydroelectric power station called the Tomura Hydroelectric Power Station in the Mt. Daisetsuzan National Park in the upstream area of the Tokachi River, which is the second largest river in Hokkaido in terms of catchment basin area. Table-1 shows the basic specifications of the Tomura Hydroelectric Power Station. The construction of the dam-and-conduit type power station with a

headrace with a total tailrace length of 1,203m, a total branch conduit length of 5,690m and a total trunk conduit length of 8,570m and a maximum output of 40,000kW was started in October 1975, and the power station was placed into operation in August 1978. Ever since the establishment of the Environmental Agency in 1971, environmental protection measures for the power station has attracted nationwide attention because the project was the first project in Japan to develop a power station in a national park.

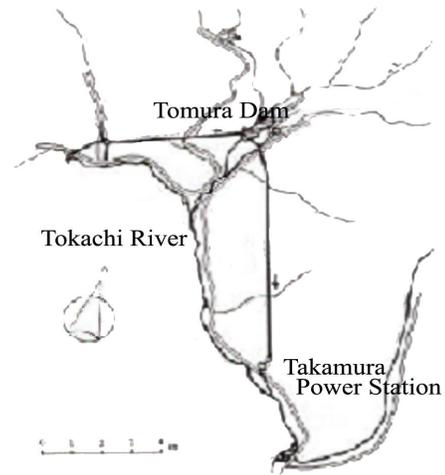


Fig.-1 Location and the main facilities of the Tomura hydroelectric power station

Table-1 Basic specifications of the Tomura hydroelectric power station

Power station name	River	Operational since	Type	Max. output (kW)	Volume of water used (m ³ /s)	Effective head (m)
Tomura	Tokachi and Tomuraushi Rivers (Tokachi River System)	August 1978	Dam-and-conduit type	40,000	33.50	140.50

2. Features of the Project Area

The Project Area is located the southern part of the Mt. Daisetsuzan National Park, which is one of the largest national parks in Japan and which is located in a mountainous area called the Roof of Hokkaido that comprises high volcanoes including Mt. Daisetsuzan, Mt. Tomuraushi, Mt. Tokachidake and Mt. Ishikaridake and folded-mountains. The Mt. Daisetsuzan National Park climatologically belongs to the Subarctic Zone and is rich with mixed forests of needle trees and broad-leafed trees in its low-altitude part and evergreen needle tree forests in its high-altitude part, which provide habitats for many rare wild animals such as piping hares and communities of many rare alpine plants. In particular, the primeval forests of spruce (*Picea jezoensis* and *Abies sachalinensis*) on the plateaus (ranging in height from 600 to 1,100m) in the Tokachi River's origin area are very important needle tree forests that characterize Hokkaido's natural environments, for which reason the area has been designated as a Natural Environment Preservation Area.

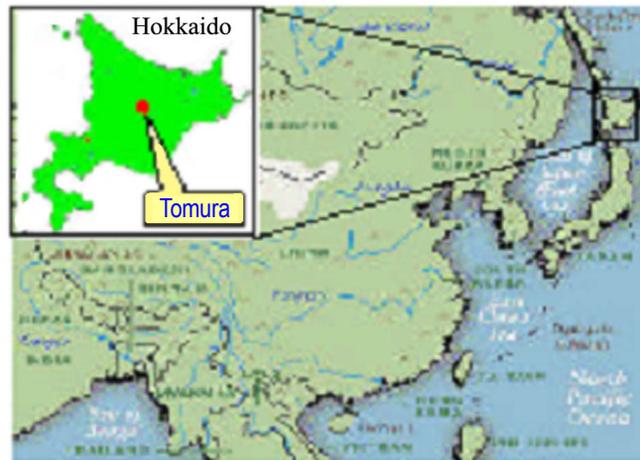


Fig.-2 Location of the project area



Fig.-3 Nature around the Tomura hydroelectric power station

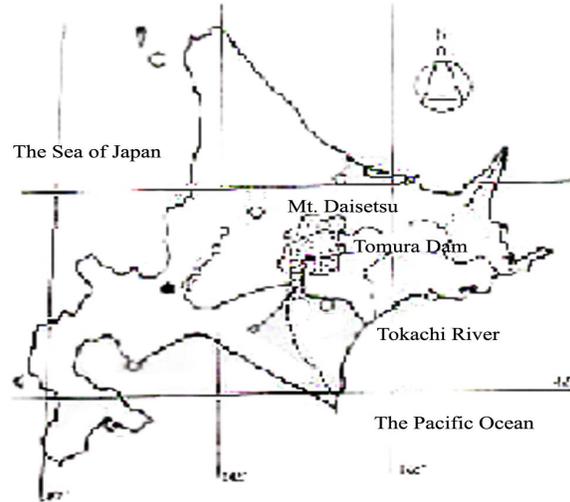


Fig.-4 Location of the Tomura hydroelectric power station

The climate of the area is an inland climate that is categorized as the Pacific Side Eastern Region Climate. The annual mean temperatures of the area is 4.5°C and there are relatively large seasonal temperature variations. The annual mean precipitation and the annual snow cover depth are 1,200mm and approximately 3 to 5m, respectively.

The Project Area is located in an area with relatively gentle slopes and plateaus which ranges in elevation from 370 to 530m. Only a small portion of the Project Area (i.e. the land accommodating part of the outlet and the power station) is privately owned, and the remainder is national natural forests of *Cercidiphyllum japonicum*, *Alnus japonica*, *Abies sachalinensis* and *Picea jezoensis*.

3. Major Impacts

In consideration of the importance of the rich nature surrounding the Project Area, Hokkaido Electric Power Co., Inc. commissioned pre-project ecological natural environment investigations to experts in order to predict the project's impacts on the river ecosystems. The results of the investigations showed that, although some impacts on the biota would be inevitable because of the flow rate reductions in certain parts of the river due to the construction of the power station, the stability of the river ecosystems would be maintained as long as the river is kept from drying and the river flow rates are maintained at certain levels during the periods in which the river flow rates decrease. On the basis of the investigation reports, Hokkaido Electric Power Co., Inc. decided to take the followings in conducting the Project.

- 1) conduct ecological investigations regularly and endeavor to preserve the ecosystems;
- 2) take appropriate measures to prevent river water pollution and endeavor to ensure that the necessary river flow rates are maintained;
- 3) endeavor to protect the forests;
- 4) endeavor to preserve the natural landscapes;
- 5) endeavor to ensure that the construction contractors and workers are fully informed about and fully comply with the environmental protection policies and measures adopted; and
- 6) endeavor to restore the areas altered by the project to their original state wherever possible

On the basis of the above-mentioned basic policies, the major environmental impact factors that were likely to arise from the construction of the power station were identified as follows:

- 1) Reductions in river flow rates caused by the extraction of water for power generation;
- 2) Shrinkage of habitats caused by alterations of land;
- 3) Changes caused to natural landscapes by alterations of land;
- 4) Changes caused to natural environments by construction workers; and
- 5) Ecosystem disturbances caused by alterations of land and/or the construction/installation of power generation facilities.

4. Mitigation Measures

4.1 Environmental Impact Factor-Specific Environmental Protection Measures

The following environmental impact factor-specific environmental protection measures were taken:

Environmental Impact Factor(s)	Countermeasure(s)
River flow rate reductions caused by the extraction of water for power generation	<ul style="list-style-type: none"> • Measures to maintain the flow rate required to maintain the river functions (0.1 to 0.5 m³/s) • Measures to maintain the river depth required to maintain the river functions (0.3 m or more at all times)
Shrinkage of habitats caused by alterations of land	<ul style="list-style-type: none"> • Measures to optimize the locations of the temporary facilities and measures to minimize shrinkage of habitats • Greening of the areas from which project facilities were removed using indigenous plants
Changes caused to natural landscapes by alterations of land	<ul style="list-style-type: none"> • Undergrounding of structures • Use of structure shapes and colors that match the surrounding natural landscapes
Changes caused to natural environments by construction workers	<ul style="list-style-type: none"> • Appropriate disposal of garbage, dust, food leftovers and excrements • Measures to ensure that the workers are fully informed about and fully comply with the environmental protection policies and measures adopted
Ecosystem disturbances caused by alterations of land and/or the construction/installation of power generation facilities	<ul style="list-style-type: none"> • Post-project ecological investigations

4.2 Consensus Building in the Affected and/or Interested Local Communities

Hokkaido Electric Power Co., Inc. endeavored to facilitate the consensus building in the affected/interested local communities with respect to the construction plans and environmental protection measures by frequently organizing explanation and consultation meetings with such local communities.

Although some local residents expressed their doubts during the process about the commitment of Hokkaido Electric Power Co., Inc. to fulfill its obligations confirmed through the consultations, the company finally obtained the local residents' consent to the development of the power station after making a formal statement of its policy for and attitude toward power source development and conducting more than a dozen negotiations.

The statement stated that the company will value the spirit of harmony and cooperation and give high weight to dialogues with the local residents in developing power sources and do its best to protect the surrounding environment before, during and after the project. The main points of the statement are as follows:

Main points of the Hokkaido Electric Power's statement of its policy for and attitude toward power source development

- 1) Development to secure the necessary energy sources
- 2) Establishment of an appropriate balance between the development and environmental protection
- 3) Use of democratic processes in making decisions relating to the operation of the project and the developed facilities

One of the central topics in the above-mentioned negotiations was the importance of taking appropriate environmental protection measures before, during and after the power source development project, and thus attention was focused on the need to ensure that post-project ecological investigations are conducted regularly as a means of preserving the river ecosystems.

4.3 Post-Project Ecological Investigations

A total of 9 post-project ecological investigations were conducted during the period between 1978 and 1998 to investigate the impacts of the development of the power station on the surrounding natural environment. In 1983, the investigation interval was changed from 1 year to 5 years because the results of the investigations conducted up to that year showed that there was no significant change to the ecosystems.

The investigation items and the investigation method are as shown below. The investigation items were reduced to the 4 priority investigation items in 1998 because it had been pointed out by experts in the 1988 investigation report that "it is desirable to continue the monitoring of river ecosystem changes only for the priority investigation items because no significant change was observed in the investigation that is contrary to the results of the predictive evaluation conducted prior to the investigation."

Investigation Items

- 1) Flow Rate and Water Quality: Investigation at 11 locations (twice a year; general parameters, pollution parameters and health-related parameters)
- 2) Fishes and Benthic Organisms: Investigation at 7 locations (once a year; fishes are sampled using casting nets and fishing rods, and benthic organisms are sampled using server net)
- 3) River Basin Vegetation: Investigation at 5 locations (once a year; investigation is made in the defined investigation rectangles and strips)
- 4) Riverbank Forest Insects: Investigation at 5 locations (once a year; examination of fallen insects, spooning, light traps)
- 5) River Basin Mammals: Investigation at 5 locations (once a year; catching for investigation, footprint- and trail-based examination, light census)
- 6) River Basin Birds: Investigation at 5 locations (once a year; line census, fixed-point observation)

The Four Priority Investigation Items

- 1) Flow Rate and Water Quality: Eutrophication of the Tomura Regulating reservoir caused by the inhabitation and growing of fishes in the regulating reservoir
- 2) Fishes and Benthic Organisms: Changes in the rainbow trout resource in the Tomura Regulating reservoir and changes in the inter-species relationship between the rainbow trout and lacustrine char
- 3) River Basin Vegetation: Long-term observation of pioneer broad-leafed trees that covers a long period spanning from their invasion to settlement to growth
- 4) River Basin Birds: Impacts of activities of fishermen in and around the Tomura Regulating reservoir on the propagation of water birds

5. Results of the Mitigation Measures

5.1 Results of the Post-Project Ecological Investigations

The results of the investigations has shown that the construction of the power station has not caused any significant change to the river ecosystems or any degradation of the self-sustaining function of the river ecosystems that is contrary to the results of the predictive evaluations made prior to the investigations. In addition, there has been gradual fading, at least partially, of the direct effects of the construction of the power station as can be seen in the ongoing steady self-recovery of the ecosystems in the altered areas and the development of new ecosystems in the Tomura Regulating reservoir. On the basis of these facts, Hokkaido Electric Power Co., Inc. has concluded that the river ecosystems are recovering steadily and made an application to the Ministry of the Environment, pursuant to the Natural Park Law, for permission to terminate the investigation activities.

A comparison between the results of the predictive evaluations made prior to the investigations and the results of the post-project investigations by investigation item follows.

5.1.1 Flow Rate and Water Quality

Results of the Predictive Evaluations

1) River Depth

A river depth of 30cm or more which is required to maintain the river functions will be maintained (which means that both the river ecosystems and natural landscapes will be sufficiently maintained) as long as the flow rate required to maintain the river functions (which is a requirement for approval under the Natural Park Law) is maintained.

2) Water Quality

There is no factor arising from or associated with the construction of the Tokura Dam or its water intake facilities that causes direct adverse effects on water quality.

Results of the Post-Project Investigations

1) River Depth

The river depths at the measurement locations were equal to or more than the river depth required to maintain the river functions (30cm) and there was no significant difference from the predicted values.

2) Water Quality

The measured values satisfied the standard values for Type AA specified in the environmental protection standard for rivers as well as the requirements specified in the environmental standard for



Fig.-5 The flow rate required to maintain the river functions (Tomura Dam)



Fig.-6 Flow regime downstream of the Tomura Dam (September 2002)

human health, and the impact of the construction of the power station was nearly zero. In addition, it was concluded that there was no impact on the fishes because there had been no time series change in the eutrophication of the Tomura Regulating reservoir.

5.1.2 Fishes and Benthic Organisms

Results of the Predictive Evaluations

The fishes and benthic organisms including the important lacustrine char species will be preserved if certain flow rates are maintained to ensure that the required river depths, flow velocities and river basin area are maintained.

Results of the Post-Project Investigations

1) Fishes

There was no significant change to the fish fauna of the Shii Tokachi River. On the other hand, some changes were found in the fish fauna of the Tomuraushi River downstream of the Tomura Dam including a trend toward relative dominance by rainbow trouts, and the numbers of the fishes artificially introduced shortly before and after the construction of the dam including rainbow trouts and Ezo-chub increased in the Tomura Regulating reservoir and areas upstream of the regulating reservoir. However, it is considered that this is not a direct effect of the dam construction.

2) Benthic Organisms

With regard to benthic organisms, changes attributable to the construction of the dam were observed. The benthic organism fauna in the Tomuraushi River downstream of the dam became one comprising communities of a net type, which is said to be a stable type, as a result of stabilization of the flow regime. In addition, communities dominated by oligochaete appeared in the newly created regulating reservoirs, which implies that the biological diversity of the benthic organisms increased, at least slightly, as a result of the construction of the dam.



Fig.-7 The flow rate required to maintain the river functions (September 2002) (Shii Tokachi water intake facility)



Fig.-8 Flow regime downstream of the Shii Tokachi water intake facility (September 2002)

5.1.3 River Basin Vegetation

Results of the Predictive Evaluations

It is expected that chances of and opportunities for the development of the forests of *Populus maximowiczii* and *Ohbayanagi* (A kind of the willow grown to Hokkaido) which grow on unstable land will decrease as a result of the stabilization of the river watercourse. In stabilized areas, the flora will

change into forests of broad-leaved trees such as *Ulmus Davidiana* and *Cercidiphyllum japonicum* or mixed forests of needle and broad-leaved trees comprising *Ulmus Davidiana*, *Cercidiphyllum japonicum*, *Picea jezoensis* and *Abies sachalinensis*, or needle tree forests.

Results of the Post-Project Investigations

The settlement of pioneer forests after river floods tends to be suppressed because of the suppression of river floods by the dam, but the forests as a whole are recovering. It is expected that these forests will gradually evolve first into stable-land forests and then into forests of *Picea jezoensis*, *Abies sachalinensis* and *Betula ermani*.

5.1.4 Riverbank Forest Insects

Results of the Predictive Evaluations

It is expected that the numbers of insects in the riverbank forests will decrease as a result of the narrowing of river widths caused by the decreases in flow rates. However, if the flow rates required to maintain the river functions are maintained, the vegetation on the old riverbed will recover early to provide new habitats for the insects and thus the impacts will be small.

Results of the Post-Project Investigations

No impact at all is seen at present of the construction of the Tomura Dam on the insects. The insects are steadily settling in the artificially planted landscaping forests to prove that the landscaping forests are no different from natural forests. On the basis of these facts, it can be concluded that the insect fauna is recovering and there is no ecological problem.

5.1.5 River Basin Mammals

Results of the Predictive Evaluations

Because mammals are capable of dispersing and there are wildlife sanctuary and special protection areas close to their original habitats, it is considered that the possibility of a serious adverse impact on their future inhabitation is low.

Results of the Post-Project Investigations

Some changes occurred in the ways some mammals (such as Ezo-Deer(The deer which inhabits Hokkaido) and Kuroten(A kind of the marten which inhabits Hokkaido) inhabit the area, but it is considered that the causes of these changes are the falling of trees during typhoon attacks in 1981, deforestation and the hunting pressure. No evidence of any significant effect of the construction of the dam or any of its associated facilities on the ways mammals inhabit the area was found.

5.1.6 River Basin Birds

Results of the Predictive Evaluations

It is expected that the birds inhabiting the areas where the numbers of fishes and benthic organisms will decrease as a result of the reductions in river flow rates will abandon the areas and move to mountain streams abundant in fishes and benthic organisms. The new dam lake is expected to become a good breeding area for water birds and other wildlife after completion.

Results of the Post-Project Investigations

In the beginning, there were concerns that the numbers of birds inhabiting the river may decrease as a

result of the reductions in flow rates caused by the extraction of water and that activities of fishermen in the new Tomura Regulating reservoir may adversely affect the breeding of water birds. However, the facts that the inhabitation of 14 water bird species has been confirmed in the area since the completion of the regulating reservoir in 1978 and that no significant change in the ways birds inhabit the area has been observed show that no significant change has been caused to the bird habitats in the area.

As an example of the findings of the post-project ecological investigations that allow quantitative evaluation, Table-3 shows the time series changes in the water birds fauna in the Tomura Regulating reservoir area. It is considered that the number of bird species had decreased shortly after the completion of the regulating reservoir as a result of the coming of fishermen to the area, but as the vegetation around the regulating reservoir recovered, it reincreased to an extent where no significant change is observed. Figs.9 and 10 show the status of the recovery of the vegetation around the regulating reservoir.



Fig.-9 Tomura regulating reservoir
(September 2002)

Table-3 Time Series Changes in the Water Bird Fauna in the Tomura Regulating reservoir Area

Species	Year							
	1978	1979	1980	1981	1983	1988	1993	1998
Grey Heron								○
Mandarin Duck	○	○		△	●	△	●	○
Mallard	○	○	●	○			○	○
Green-winged teal	△	○					○	○
Garganey								○
Harlequin duck	△	△	△	△				
Goosander	○	○		△				○
Common sandpiper	○	○				△		
Red-necked phalarope	○	○						
Greater pied kingfisher							○	○
Grey wagtail	○	○				○	○	○
White wagtail	○	○				○	○	○
Japanese pied wagtail		○					○	○
Brown dipper	○	○		○	○	△		○



Fig.-10 Tomura Dam right bank area greened after completion of the project (September 1978)



Fig.-11 Tomura Dam right bank area greened after completion of the project (September 2002)

5.2 Consultations with and Information Disclosure to the Local Residents

Hokkaido Electric Power Co., Inc. has reported the results of the 9 post-project ecological investigations conducted over the period between 1978 and 1998 to the local governments and organizations interested/concerned by means of the submission of investigation reports. These reports were submitted as soon as they were completed. Hokkaido Electric Power Co., Inc. has also kept these local governments and organizations fully informed about the progress status of its post-project environmental protection measures including the greening of areas from which temporary facilities etc. were removed. In addition, the company has made consultations with the local governments and organizations wherever possible before making changes to the investigation method, investigation items, etc. (including site visits for confirmation) to explain the changes to them to ensure that they are fully informed about the changes.

These efforts allowed the company to win trust from the local residents for not only the company's policy for and attitude toward the development of the Tomura Power Station but also its power business as a whole.

6. Reasons for Success

It is considered that the reasons for the success of the project are the company's efforts to predict, from before the commencement of the project, the impacts of the project on the river ecosystems through ecological investigations based on guidance and advice by scholars and experts and incorporate environmental protection measures designed based on the results of the investigations into the designing and implementation of the project wherever possible.

In addition, it is considered that the company's efforts to consult the local residents about its development plan and environmental protection measures from before the commencement of the project and the company's disclosure of all the documents and materials used in the consultations, as well as the company's timely publication of the post-project ecological investigation reports coupled with dialogues with the local residents in relation to the investigations during and after completion of the project to win trust from the local residents allowed the company to complete the project and investigations smoothly without any opposition.

7. Outside Comments

- 1) The Hokkaido Times, Local Edition (Feb.9, 1977)

In the latest round of its negotiation with the Tokachi Regional Council of Trade Unions in relation to the construction of the Tomura Power Station in Shintoku Town and related matters, Hokkaido Electric Power Co., Inc. made a formal exchange of letters with the Council about the “3 basic principles” to reflect the residents’ opinions in the project. The company will be tested for its attitude toward power source development through the Council’s monitoring of the company’s compliance with the 3 basic principles.

- 2) The Hokkaido Times, Local Edition (Aug.12, 1983)

Hokkaido Electric Power Co., Inc. is going to apply to the Ministry of the Environment for permission to extend the intervals of the post-project ecological investigations of the Tomura Power Station’s surrounding environment (Shintoku Town) from the current 1 year to 5 years on the ground that the results of the once-a-year investigations since 1978 show that the ecosystems in the area are steadily recovering helped by the company’s environmental protection measures. The Ministry has shown a positive stance on the proposed change saying that “The Tomura Power Station Project is a landmark event in the sense that it is the first power source development project conducted in a national park that took environmental protection measures in a full-fledged manner. In addition, no case of significant environmental degradation has been reported in relation to the project.”

8. Further Information

8.1 References

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- 15) “Recommendations in relation to the Results of the Tomura Power Station Development Project’s Post-Project Ecological Investigations,” Koji Ito, June 2002 (published by Hokkaido Electric Power Co., Inc.)

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