Su, Wei Ling; Huang, Yu Bo; Kuo, Wan Mu

New Approach of the Water Resource Conservation in Taiwan — an Ecological Check for Reservoir Watershed Project (ECRWP)

12th International Conference on Hydroscience & Engineering
Hydro-Science & Engineering for Environmental Resilience
November 6-10, 2016, Tainan, Taiwan.

New Approach of the Water Resource Conservation in Taiwan — An Ecological Check for Reservoir Watershed Project (ECRWP)

Wei Ling Su[1], Yu Bo Huang[1], Wan Mu Kuo[2]
1. Observer Ecological Consultant Co., Ltd.
2. Water Resources Agency, Conservation Division
Taipei, Taiwan

ABSTRACT

The Ecological Check for Reservoir Watershed Project (ECRWP) is the new resulted protocol to ensure a sustainable environmental management within the reservoir watersheds. The ECRWP focused on ecological assessments, public engagement, and open information, has been implementing in Shihmen, Zengwen, Nanhua and Wushantou reservoirs. The ECRWP is adapted to the engineering lifecycle, including planning, design, construction, operations & maintenance phase, and considered in interdisciplinary fields. Until 2015, we collect the total amount of 328 case studies and feedback to the procedure, formulate the *working manual of ECRWP (draft)*. In response of the need for a more integrated watershed management, as well as the increasing awareness of conservation, the ECRWP has been widely applied and well accepted on reservoir engineering projects.

KEY WORDS: ECRWP, ecological check, watershed management, public engagement, open information, ecologically sensitive area

INTRODUCTION

Extreme weather events, including floods and droughts, are increasing in both frequency and intensity, posing a threat to life and property. The severe conditions and the water shortage has prompted the Water Resources Agency (WRA) to play an active role on the preservation and management of reservoir watersheds. Meanwhile, awareness of the need for watershed conservation is on the rise, demanding public engagement and open information. The Ecological Check for Reservoir Watershed Project (ECRWP) is the new resulted protocol to ensure a sustainable environmental management within the reservoir watersheds. The ECRWP focused on ecological assessments, public engagement, and open information, has been implementing in Shihmen, Zengwen, Nanhua and Wushantou reservoirs.

DEVELOPEMENT

The concept of the ecological checklist was first developed to fit with the phases of construction project life cycle in the Zengwen Reservoir Watershed Remediation Project 2007.

The Ecological Survey & Assessment Specification for catchment management engineering (draft) was originally formulated by WRA between 2009 and 2010, involving a participatory consultation process with governmental engineers, specialists, experts and organizations, as well as a rolling assessment based on field experience.

During the years, the 2010 draft were tested on 112 cases within Shihmen, Zengwen, Nanhua and Wushantou Reservoir Watersheds and the methods modified into a working manual of ECWP.

PROCEDURE

The ECRWP is adapted to the engineering lifecycle, including planning, design, construction, operations & maintenance phase, and considered in interdisciplinary fields. (as Fig.1) The ECRWP includes two main works (as Fig. 2):

(1) Ecologists participate in the engineering projects, providing conservation measures based on data review, field investigation and environmental evaluation to mitigate potential impacts, at the same time documenting the whole process.
(2) Direct and effective communication among engineers, ecologists and interested citizens are established through public engagement and open information.

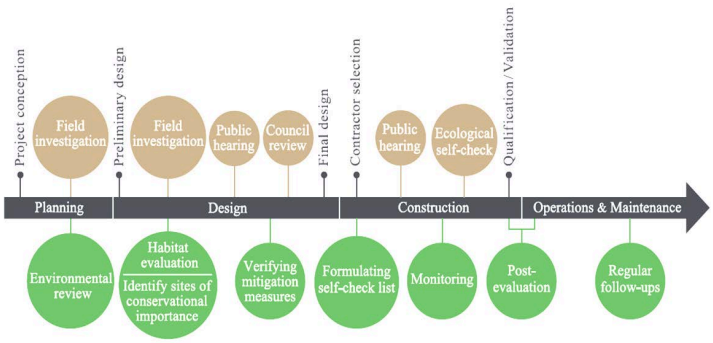

Fig. 1 the procedure of ECRWP.

Fig. 2 main work of ECRWP

ECRWP emphasize the importance of public engagement and open information. In order to facilitate public engagement, the responsible agency is required to hold public hearings during the phases of planning and construction, inviting local organizations, individual residents and stakeholders. Ideally the hearing should provide honest communication and mutual-understanding, allowing local environment and culture knowledge on to be considered.

The main work of ecological assessment is (1) environmental review of the project site, (2) habitat evaluation and ecological survey, (3) mapping of conservational importance, (4) impact assessment and mitigation strategies. Among the assessment, mapping of ecological sensitive areas is the efficient method for optimal design to reduce the ecological effects. (as Fig. 3)

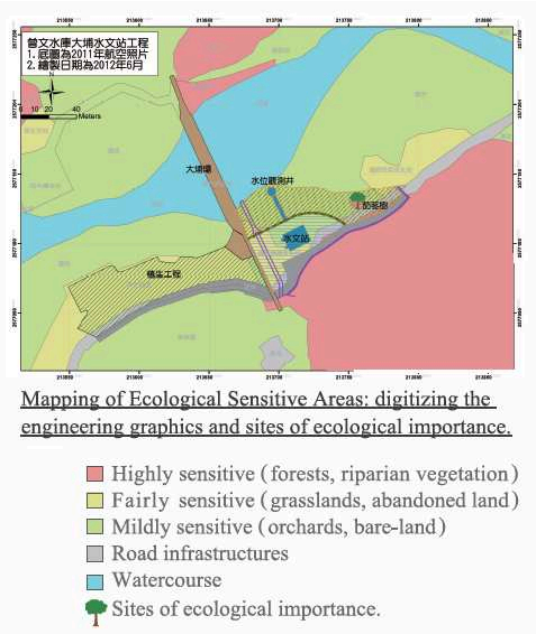

Fig. 3 mapping of ecological sensitive areas.

The ecological check process consisted of field inspections, public engagement, habitat assessments, mapping of ecologically sensitive areas and developing the proper strategies to reduce the impact from engineering projects. The basic philosophy of these strategies is that prevention is better than cure in avoiding the negative effects of ecosystem. Where avoidance or minimization is impossible or impractical, mitigation measures should be designed as an integral part of the scheme. Where mitigation is insufficient or significant residual impacts remain, then compensating measures should be considered as a last resort. (as Fig. 4)

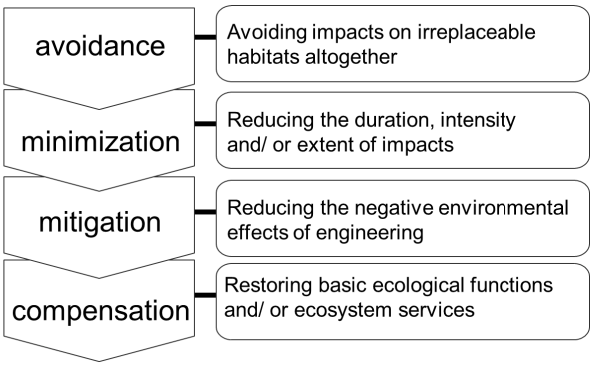

Fig. 4 ecological issues and mitigation hierarchy

ISSUES AND STRATEGIES

The common issues in reservoir watershed projects and upstream engineering projects are (1) protect natural habitats, (2) avoid/restore riparian area, (3) preserve large old trees of ecological importance, (4) avoid irreversible impacts on river ecosystems, (5) control negative side effects during construction phases, (6) avoid hard engineering methods, (7) avoid longitudinal connectivity of waterways, (8) provide wildlife escape ramps, (9) prevent spreading of invasive weeds, (10) consider local culture and land use, (11) protect the identified key species. (as Fig. 5)

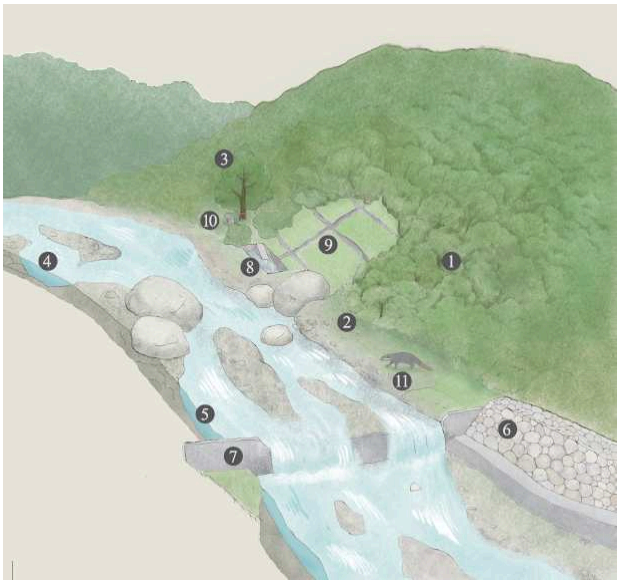

Fig. 5 The common issues in reservoir watershed projects and upstream engineering projects.

In the total of 112 cases, operated by Southern Region Water Resources Office, Chia-Nan Irrigation Association, Taiwan Water Corporation, Tainan City Government, and Chiayi County Government, 37 strategies were avoiding constructions on recovered or sensitive areas, 100 strategies were minimizing the affected areas, 222 strategies were reducing the magnitude of habitat impacts, and 20 strategies were recommending measures of ecological compensations. The strategy of avoidance includes (1) cancelling the proposed project, (2) avoiding ecological impacts on natural forests and watercourses. The strategy of minimization includes (1) restricting the engineering sites, (2) buffer zones around designated sites or habitats of ecological importance such as native trees, rocks or bedrock. The strategy of mitigation includes (1) restricting and managing the extent of operational sites, (2) designing of wildlife-friendly and/or building wildlife escape ramps, (3) reducing noise and pollution during construction phases, (4) proposals for monitoring of environmental conditions, (5) precautionary measures to avoid disturbing the breeding and foraging grounds of key species, (6) re-planting with native plants, preventing the spread of invasive weeds. The strategy of compensation includes (1) transplanting the native saplings, (2) restoring the native environment, (3) planting to stabilize bare soil, (4) habitat reconstruction.

CONCLUSIONS

Until 2015, we collect the total amount of 328 case studies and feedback to the procedure. The overall results of this project were successful in assisting reservoir managers to incorporate conservation engineering practices and refining the procedure. Based on implementing experience and effectiveness evaluation, *the working manual of ECRWP* (draft) was formulated by Water Resource Agency(WRA).

In response of the need for a more integrated watershed management, as well as the increasing awareness of conservation, the ECRWP has been widely applied and well accepted on reservoir engineering projects. We hope that ECRWP will continue to be a useful approach in realizing both watershed management and environmental conservation in the future.

ACKNOWLEDGEMENTS

These projects were funded by Water Resource Agency. The cases we collected is operated by Southern Region Water Resources Office, Chia-Nan Irrigation Association, Taiwan Water Corporation, Tainan City Government, Chiayi County Government, Soil and Water Conservation Bureau, and Forestry Bureau. The author would also like to thank many authorities, engineers and ecologists who spend time and effort on ECRWP.

REFERENCES

Wei-Ling Su, Chia-yun Lu, Yu-Bo Huang, Yen-Hua Chen, Po-Hao Chen, Wei-Han Wu, 2011, Public participation and reservoir conservation in Taiwan, Shihmen area, 2007–2011, The 10th Asia-Pacific NGOs' Environmental Conference (APNEC-10, , Taipei。

王藝峰、蘇維翎、郭萬木、黃于玻，2014，推動水庫集水區治理工程生態檢核經驗分享，第十七屆海峽兩岸多砂河川整治與管理研討會，台灣台中。

朱家興、葛餘恕、黃于玻、朱達仁、蘇維翎、黃鈞漢、呂嘉耘，2011，水庫集水區生態調查評估準則建立與運用研究，100-12.22-石門水庫及其集水區整治計畫(100 年度)委辦計劃成果發表會，國立交通大學，新竹。

朱家興、葛餘恕、黃于玻、朱達仁、蘇維翎、黃鈞漢，2012，水庫集水區生態調查評估準則建立與運用研究（2/2），100 年度水利署委辦計畫成果發表會，逢甲大學，台中。

黃于玻、陳樹群、蘇維翎，2009，保育治理工程生態評估機制之建立，工程環境會刊 No.23，中華民國工程環境學會

觀察家生態顧問有限公司，2013。曾文水庫水域及周邊環境生態資源調查成果報告。經濟部水利署南區水資源局。

觀察家生態顧問有限公司，2014。曾文南化及烏山頭水庫集水區保育治理工程生態檢核制度檢討。經濟部水利署委託。

觀察家生態顧問有限公司，2014。曾文水庫生態資源調查及保育第二次期中報告書修訂本。經濟部水利署南區水資源局委託。

觀察家生態顧問有限公司，2015。曾文水庫生態資源調查及保育期末報告書。經濟部水利署南區水資源局。

財團法人資源及環境保護服務基金會，2010a。保育治理工程之生態改善措施及其生態敏感區之應用(第二年)。農委會水土保持局。

陳志豪、鄭旭涵、彭心燕、林信輝，2010。崩塌地植生復育適用評估因子之分析研究。中華水土保持學報，41(4)：296 -307。