



FLOOD & DROUGHT MANAGEMENT TOOLS

Chao Phraya Basin Stakeholder Summary Report



บทสรุปสำหรับผู้บริหาร

บทนำ

โครงการจัดทำเครื่องมือสำหรับการบริหารจัดการอุทกภัยและภัยแล้งนี้ได้รับเงินทุนจากกองทุนสิ่งแวดล้อมโลก (Global Environment Facility, GEF) ด้านน่านน้ำนานาชาติ (International Waters, IW) และดำเนินการโดยโครงการสิ่งแวดล้อมแห่งสหประชาชาติ (United Nations Environment Programme, UNEP) ร่วมกับ IWA และ DHI ซึ่งเป็นหน่วยงานปฏิบัติการ

โครงการนี้มีวัตถุประสงค์ที่จะพัฒนาวิธีการดำเนินการและเครื่องมือรวมถึงระบบสนับสนุนการตัดสินใจ (decision support systems, DSS)

สำหรับผนวกข้อมูลเกี่ยวกับอุทกภัยและภัยแล้งและสถานการณ์ด้านการเปลี่ยนแปลงสภาพภูมิอากาศเข้ากับการวางแผนการบริหารจัดการแหล่งน้ำแบบบูรณาการ (integrated water resource management, IWRM),

แผนการสร้างความปลอดภัยในการใช้น้ำ (Water Safety Plan, WSP) และ

การวิเคราะห์ประเด็นปัญหาข้ามพรมแดน (Transboundary Diagnostic Analysis, TDA)

โครงการนี้มีระยะเวลาดำเนินการระหว่างปี พ.ศ. 2557-2561 โดยมีลุ่มน่าน้ำร่อง 3 แห่ง คือ โวลตา (Volta)

ทะเลสาบวิคตอเรีย (Lake Victoria) และ เจ้าพระยา (Chao Phraya)

ที่จะใช้สำหรับพัฒนาและทดสอบวิธีการดำเนินการที่พัฒนาขึ้น

โครงการนี้จะดำเนินการเพื่อตอบสนองความต้องการในการพัฒนาวิธีการดำเนินการที่ใช้งานได้ทั้งในระดับข้ามพรมแดน และระดับท้องถิ่น

โครงการน่านน้ำนานาชาติของกองทุนสิ่งแวดล้อมมีเครื่องมือในการวางแผนที่เน้นในระดับข้ามพรมแดน อย่างไรก็ตามจำเป็นต้องมีการเชื่อมโยงการตัดสินใจระดับภูมิภาคหรือลุ่มน้ำและระดับท้องถิ่นเข้าไปด้วย ซึ่งโครงการนี้จะพิจารณาในส่วนของ การติดต่อสื่อสารระหว่างระดับนี้ด้วย

วิธีการดำเนินการที่จะพัฒนานี้จะใช้เทคโนโลยีที่ไม่มีลิขสิทธิ์ ซึ่งหน่วยงานลุ่มน้ำ หน่วยงานระดับประเทศ หน่วยงานสาธารณูปโภค

และหน่วยงานที่เกี่ยวข้องจะสามารถพัฒนาวิธีการดำเนินงานและเครื่องมือหลังจากที่โครงการนี้เสร็จสมบูรณ์ได้เพื่อที่จะพัฒนาประสบการณ์ในการวางแผนของหน่วยงานตนเอง วิธีการดำเนินการจะเป็นวิธีที่สามารถยืดหยุ่นได้ ตัวอย่างเช่น ผู้มีส่วนได้ส่วนเสียสามารถเลือกดัชนีชี้วัดของตัวเองได้ ระบบจะเชื่อมโยงกับแบบจำลองหลายแบบ (โดยมีแบบจำลอง MIKE และ WEAP เป็นค่าพื้นฐาน)

ระบบต้องสามารถนำไปใช้งานได้เป็นปัจจัยหลักของโครงการนี้

และเน้นที่การใช้งานได้สะดวกและยืดหยุ่นได้เพื่อสนับสนุนในการวางแผน

โครงการนี้จะพัฒนาระบบสนับสนุนการตัดสินใจซึ่งจะมีการทดสอบและใช้งานในลุ่มน่าน้ำร่อง 3 แห่ง อย่างไรก็ตามวิธีการดำเนินการจะสามารถประยุกต์ใช้ได้กับลุ่มน้ำอื่นๆ

โดยโครงการนี้จะดำเนินการจัดทำคู่มือการฝึกอบรมซึ่งจะสามารถนำไปใช้ได้ทั่วไปเมื่อโครงการเสร็จสมบูรณ์ ดังนั้นวิธีการดำเนินการจะสามารถประยุกต์ใช้ได้กับลุ่มน้ำอื่นๆอีกด้วย

วัตถุประสงค์ของโครงการนี้คือการพัฒนาวิธีการดำเนินการที่สามารถนำไปใช้ได้และเชื่อมโยงได้กับวิธีการวางแผนที่ใช้งานอยู่ปัจจุบัน โครงการนี้จะสนับสนุนขั้นตอนการวางแผน ซึ่งจะเชื่อมโยงกับ TDA/SAP, IWRM หรือ WSP แต่จะไม่รวมทุกกิจกรรมไว้ในขั้นตอนการวางแผน แต่จะเน้นไปที่กิจกรรมหลักในขั้นตอนการวางแผน

โดยการพัฒนารอบการใช้งานที่สามารถนำไปใช้ได้และยืดหยุ่นได้

ซึ่งรวมถึงเครื่องมือหลักบางส่วนที่สำคัญสำหรับผู้มีส่วนได้ส่วนเสียสำหรับโครงการนี้

ความยืดหยุ่นได้ของระบบสนับสนุนการตัดสินใจนี้จะช่วยให้สามารถพัฒนาเพิ่มขึ้นและสามารถขยายผลต่อไปได้หลังจากที่โครงการนี้เสร็จสมบูรณ์

ที่สำคัญโครงการนี้จะไม่ทำการรวบรวมข้อมูลหรือพัฒนาแบบจำลองใหม่แต่จะเน้นที่การพัฒนากระบวนการตัดสินใจเพื่อรองรับการวางแผน

ในขณะที่การยืนยันความถูกต้องและการทดสอบวิธีการดำเนินงานนี้จะใช้ข้อมูลและแบบจำลองที่มีและใช้งานอยู่ในปัจจุบัน

โครงการนี้จะไม่พัฒนาแผนการบริหารจัดการใหม่ในพื้นที่ลุ่มน่าน้ำร่องแต่จะสนับสนุนการใช้งานของระบบสนับสนุนการตัดสินใจที่ใช้งานอยู่ในกระบวนการวางแผนปัจจุบัน

ผลลัพธ์หลักจากโครงการนี้คือระบบสนับสนุนการตัดสินใจที่จะช่วยองค์กรระดับลุ่มน้ำและผู้ใช้งานหลัก ได้แก่

ผู้ให้บริการด้านสาธารณสุขทั่วโลก ในกระบวนการวางแผนและสนับสนุนกิจกรรมต่างๆ ในแผนจากเครื่องมือเฉพาะ ในขณะเดียวกันจะพิจารณาถึงสถานการณ์อุทกภัยและภัยแล้งร่วมไปด้วย

การประชุมผู้มีส่วนเกี่ยวข้องในการบริหารจัดการลุ่มน้ำเจ้าพระยา

โครงการนี้เริ่มดำเนินการตั้งแต่เดือนมิถุนายน 2557 และมีระยะเวลาดำเนินการโครงการในช่วงเริ่มต้น 6 เดือน ซึ่งหน่วยงานปฏิบัติการ คือ IWA และ DHI จะมีการประชุมปรึกษาหารือกับผู้มีส่วนได้ส่วนเสียในแต่ละลุ่มน้ำ การประชุมมีวัตถุประสงค์เพื่อทำความเข้าใจกับผู้มีส่วนได้ส่วนเสียว่าโครงการนี้จะช่วยปรับปรุงการวางแผนในลุ่มน้ำ นาร่องได้อย่างไร

และข้อมูลที่ได้รับจะช่วยในการจัดทำรายละเอียดการทำงานของโครงการเพื่อนำเสนอในการประชุมโครงการเบื้องต้นต่อไป ในการประชุมนี้ได้พิจารณาถึงความสนใจและการตอบรับจากผู้มีส่วนได้ส่วนเสียที่จะเข้าร่วมกับโครงการ

วัตถุประสงค์ของการประชุมปรึกษาหารือ ได้แก่

- ผู้มีส่วนได้ส่วนเสียหลักเข้าใจและรับรองวัตถุประสงค์ของโครงการ
- เพื่อทำความเข้าใจประเด็นปัญหาที่ผู้มีส่วนได้ส่วนเสียหลักต้องเผชิญในการวางแผนการจัดการน้ำ โดยเน้นในประเด็นด้านการข้ามพรมแดนที่เกี่ยวข้องกับการเปลี่ยนแปลงสถานะอากาศโลก อุทกภัยและภัยแล้ง
- เพื่อทำความเข้าใจวิธีการดำเนินการหรือกระบวนการที่หน่วยงานลุ่มน้ำและหน่วยงานด้านสาธารณสุขโลกใน ช้างงานอยู่ปัจจุบันในการวางแผน และเครื่องมือที่ใช้ในการวางแผน
- เพื่อรับทราบข้อมูลโครงการอื่นๆ หรือ การริเริ่มอื่นๆ ที่โครงการสามารถพิจารณาทำงานร่วมด้วยและสามารถตอบสนองประเด็นในด้านการเก็บรวบรวมข้อมูลแล องค์ความรู้ที่ต้องการของลุ่มน้ำ
- เพื่อรับทราบการตอบรับต่อวิธีการดำเนินการที่โครงการนำเสนอ

โครงการได้มีการประชุมปรึกษาหารือกับผู้มีส่วนได้ส่วนเสียในลุ่มน้ำเจ้าพระยา ดังต่อไปนี้

หน่วยงาน	ความรับผิดชอบหลัก
สถาบันสารสนเทศทรัพยากรน้ำและการ เกษตร	ที่ปรึกษาสำหรับการบริหารจัดการแหล่งน้ำและการเกษตร
กรมชลประทาน	วางแผนและบริหารจัดการระบบชลประทานในประเทศไทย
การไฟฟ้าฝ่ายผลิตแห่งประเทศไทย	ผลิตไฟฟ้าจากพลังน้ำ และแบ่งน้ำจากอ่างเก็บน้ำหลักเพื่อการใช้งานในด้านต่างๆ
สมาคมทรัพยากรน้ำแห่งประเทศไทย	เพื่อส่งเสริมเผยแพร่และแลกเปลี่ยนความรู้ ประสบการณ์การบริหารจัดการทรัพยากรน้ำแห่งประเทศไทย
กรมทรัพยากรน้ำ	เป็นองค์กรในการจัดทำนโยบายและแผนการบริหารจัดการทรัพยากรน้ำ แบบบูรณาการเป็นระบบลุ่มน้ำ
เค วอเตอร์ (K water)	บริษัทที่ปรึกษาจากประเทศเกาหลีที่มีส่วนเกี่ยวข้องกับโครงการบริหารจัดการน้ำประเทศไทย
การประปานครหลวง	ให้บริการน้ำประปาในเขตกรุงเทพมหานคร นนทบุรี และสมุทรปราการ
สำนักงานพัฒนาเทคโนโลยีอวกาศและ ภูมิสารสนเทศ (องค์การมหาชน)	ให้บริการข้อมูลด้านภูมิสารสนเทศแก่หน่วยงานราชการไทย
ศูนย์เตรียมความพร้อมป้องกันภัยพิบัติแ ห่งเอเชีย (Asian Disaster Preparedness Centre, ADPC)	หน่วยงานให้คำปรึกษาและสถาบันวิจัยเกี่ยวกับด้านภัยพิบัติ

กรมอุตุนิยมวิทยา	ข้อมูลด้านอุตุนิยม การพยากรณ์สภาพอากาศล่วงหน้า
สถาบันสิ่งแวดล้อมสต็อกโฮล์ม ภาคพื้นเอเชีย (Stockholm Environmental Institute, SEI)	องค์กรเอกชนให้คำปรึกษาและวิจัยเกี่ยวกับสิ่งแวดล้อม
ศูนย์วิจัยวิศวกรรมน้ำและโครงสร้างพื้นฐาน (CWEIR) มหาวิทยาลัยเทคโนโลยีพระจอมเกล้า พระนครเหนือ	สถาบันการศึกษาที่เชี่ยวชาญด้านการพัฒนาระบบสนับสนุนการตัดสินใจ และองค์ความรู้ด้านแบบจำลอง
องค์กรระหว่างประเทศเพื่อการอนุรักษ์ ธรรมชาติ (International Union for Conservation of Nature, IUCN)	ทำงานร่วมกับหน่วยงานราชการและผู้มีส่วนได้ส่วนเสียระดับท้องถิ่น
การประสานงานภูมิภาค	ให้บริการน้ำประปาในจังหวัดต่างๆ นอกเหนือจากกรุงเทพ นนทบุรี และสมุทรปราการ

ลุ่มน้ำเจ้าพระยาเป็นลุ่มน้ำที่ใหญ่ที่สุดในประเทศไทยและมีประเด็นเรื่องอุทกภัยและภัยแล้ง
อ่างเก็บน้ำหลักของลุ่มน้ำนี้คือ เขื่อนภูมิพลและเขื่อนสิริกิติ์ ซึ่งควบคุมการไหลของน้ำประมาณ 22%
ของการไหลทั้งหมด ส่วนการไหลของแม่น้ำยมและแม่น้ำวังที่เป็นแม่น้ำสาขาไม่ได้ถูกควบคุมโดยเขื่อน
ปัญหาอุทกภัยและภัยแล้งเป็นประเด็นหลักในระดับลุ่มน้ำ
การวางแผนสำหรับภัยแล้งเป็นเรื่องสำคัญสำหรับการจัดสรรน้ำระหว่างการผลิตกระแสไฟฟ้าจากพลังน้ำและการชล
ประทานโดยที่มีปริมาณน้ำที่เก็บกักในเขื่อนเป็นแหล่งน้ำหลัก
ปัญหาอุทกภัยก็ได้รับการพิจารณาเป็นประเด็นหลักเช่นกัน
อย่างไรก็ตามมีหลายโครงการที่ดำเนินการเกี่ยวข้องกับอุทกภัยในลุ่มน้ำเจ้าพระยา
การวางแผนระยะยาวจะถูกจัดทำขึ้นภายใต้การจัดทำแผนหลักสำหรับบริหารจัดการน้ำในประเทศไทย
ซึ่งจะรวมถึงอุทกภัย ภัยแล้ง และคุณภาพน้ำ ในการจัดทำแผนหลักแห่งชาติได้มีการแต่งตั้งคณะกรรมการขึ้นมา
5 กลุ่ม เพื่อจัดทำแผนบริหารจัดการน้ำในภาพรวมประกอบด้วย

- กลุ่มที่ 1 รับผิดชอบลุ่มน้ำในพื้นที่ภาคเหนือ ภาคกลาง ภาคตะวันออก (กรมชลประทานเป็นหน่วยงานหลัก)
- กลุ่มที่ 2 รับผิดชอบลุ่มน้ำในพื้นที่ภาคตะวันออกเฉียงเหนือ และภาคใต้ (กรมทรัพยากรน้ำเป็นหน่วยงานหลัก)
- กลุ่มที่ 3 รับผิดชอบระบบฐานข้อมูล (สถาบันสารสนเทศทรัพยากรน้ำและการเกษตรเป็นหน่วยงานหลัก)
- กลุ่มที่ 4 รับผิดชอบการจัดองค์กร ข้อกำหนด กฎหมายที่เกี่ยวข้อง
(คณะกรรมการเศรษฐกิจและสังคมแห่งชาติเป็นหน่วยงานหลัก)
- กลุ่มที่ 5 รับผิดชอบด้านการสร้างการรับรู้และความเข้าใจต่อประชาชน (กรมประชาสัมพันธ์เป็นหน่วยงานหลัก)

แผนหลักแห่งชาติจะพิจารณารวมถึงประเด็นการเปลี่ยนแปลงสภาวะภูมิอากาศโลกด้วย

ประเทศไทยมีคณะกรรมการลุ่มน้ำ 25 ลุ่มน้ำ แต่โครงสร้าง อำนาจหน้าที่และศักยภาพในการปฏิบัติงานยังจำกัด
คณะกรรมการลุ่มน้ำนี้อยู่ภายใต้ความรับผิดชอบของกรมทรัพยากรน้ำ

โครงการนี้จะเน้นที่พื้นที่ลุ่มน้ำเจ้าพระยาแต่ละลุ่มน้ำบางปะกงร่วมด้วยตามคำแนะนำจากกรมชลประทาน
ลุ่มน้ำบางปะกงมีพื้นที่อุตสาหกรรมที่ได้รับผลกระทบจากน้ำท่วมและพื้นที่เหนือน้ำที่ได้รับผลกระทบจากภัยแล้ง
ความเค็มเป็นอีกประเด็นปัญหาหนึ่งสำหรับลุ่มน้ำบางปะกง
เหตุผลที่โครงการสมควรพิจารณาลุ่มน้ำบางปะกงร่วมด้วยคือลุ่มน้ำนี้ยังขาดข้อมูลที่จำเป็นในการวางแผนเนื่องจาก
มีการศึกษาที่สนใจศึกษาลุ่มน้ำนี้เพียงเล็กน้อยเท่านั้น

สภาพภูมิอากาศในลุ่มน้ำเจ้าพระยาได้แบ่งอย่างชัดเจนเป็นฤดูฝนและฤดูแล้ง การวางแผนสำหรับฤดูฝนและฤดูแล้งได้จัดทำขึ้นในการประชุมที่จัดเป็นประจําระหว่างหน่วยงานราชการหลัก การประชุมจะพิจารณาถึงสถานการณ์น้ำท่วมและภัยแล้ง การเตือนภัยล่วงหน้า และการตัดสินใจที่ควรทำในการควบคุม กรมชลประทานเป็นหน่วยงานหลักในการประชุมการวางแผนสำหรับฤดูแล้งและสถาบันสารสนเทศทรัพยากรน้ำและการเกษตรสำหรับฤดูฝน

สำหรับโครงการนี้จะทำงานร่วมกับสถาบันสารสนเทศทรัพยากรน้ำและการเกษตร (สสนท) เป็นหน่วยงานหลัก ในระดับของลุ่มน้ำสถาบันสารสนเทศทรัพยากรน้ำและการเกษตรเป็นหน่วยงานหลักสำหรับข้อมูลด้านน้ำและมีประสบการณ์และความเชี่ยวชาญในเรื่องระบบสนับสนุนการตัดสินใจ แบบจำลองและระบบปฏิบัติการแบบทันที สถาบันสารสนเทศทรัพยากรน้ำและการเกษตรยังมีหน้าที่หลักในการบูรณาการข้อมูลน้ำของทั้งประเทศ ซึ่งหน้าที่นี้เป็นส่วนหนึ่งของการพัฒนาระบบสนับสนุนการตัดสินใจของโครงการ

กรมชลประทานเป็นผู้มีส่วนได้ส่วนเสียหลักในลุ่มน้ำเจ้าพระยา รับผิดชอบการวางแผนการชลประทานและวางแผนการจัดสรรน้ำในฤดูแล้งร่วมกับไฟฟ้าฝ่ายผลิต กรมชลประทานได้ดำเนินโครงการร่วมกับ JICA ในการพัฒนาระบบปฏิบัติการแบบทันทีสำหรับการพยากรณ์น้ำท่วมสำหรับลุ่มน้ำเจ้าพระยา

การไฟฟ้าฝ่ายผลิตแห่งประเทศไทยรับผิดชอบการผลิตพลังงานไฟฟ้าซึ่งรวมถึงการผลิตกระแสไฟฟ้าจากพลังน้ำ การไฟฟ้าฯจัดทำแผนสำหรับฤดูฝนและฤดูแล้งโดยคำนึงถึงการจัดสรรน้ำจากแหล่งน้ำหลัก การวางแผนนี้จัดทำขึ้นจากการปรึกษาหารือกับคณะกรรมการวางแผนสำหรับฤดูฝนและฤดูแล้ง การไฟฟ้าฯ มีศักยภาพในด้านเทคนิคสูงสำหรับแบบจำลอง MIKE 11 และ NAM และมีศักยภาพที่จะเป็นผู้ใช้งานระบบสนับสนุนการตัดสินใจสำหรับอุทกภัยและภัยแล้งของโครงการนี้

หน่วยงานต่างๆที่เกี่ยวข้องในการบริหารจัดการน้ำสำหรับลุ่มน้ำเจ้าพระยามีเครือข่ายสำหรับเก็บรวบรวมข้อมูลของตนเอง ดังนั้นอาจเป็นไปได้ที่ระบบจะมีความซ้ำซ้อน การเข้าถึงข้อมูลและการจำแนกข้อมูลที่มีคุณภาพดีที่สุดเป็นความท้าทายหนึ่งของโครงการ

โครงการนี้จะทำการทดสอบระบบสนับสนุนการตัดสินใจกับผู้ใช้บริการด้านสาธารณสุขโรค ซึ่งได้แก่ การประปานครหลวงและการประปาส่วนภูมิภาค การประปานครหลวงรับผิดชอบให้บริการน้ำประปาในพื้นที่กรุงเทพมหานคร จังหวัดนนทบุรี และจังหวัดสมุทรปราการ โดยมีแหล่งน้ำดิบ 2 แหล่งด้วยกันคือ แม่น้ำเจ้าพระยาและแม่น้ำแม่กลอง การประปานครหลวงรับผิดชอบให้บริการน้ำประปาในพื้นที่ 74 จังหวัดทั่วประเทศไทย ยกเว้นกรุงเทพมหานคร จังหวัดนนทบุรี และจังหวัดสมุทรปราการ การประปานครหลวงมีระบบผลิตน้ำประปาทั้งหมด 233 แห่งทั่วประเทศ ทั้งสองหน่วยงานนี้ได้มีการวางแผนการสร้างความปลอดภัยในการใช้น้ำ รายละเอียดเพิ่มเติมจากสองหน่วยงานนี้จะช่วยในการประเมินระดับของการมีส่วนร่วมของแต่ละหน่วยงานขึ้นอยู่กับความต้องการข้อมูลและความสนใจที่จะเข้าร่วมโครงการ

หน่วยงานราชการที่เกี่ยวข้องอื่นๆ

ได้รับทราบข้อมูลเกี่ยวกับโครงการนี้และจะเข้าร่วมหรือไม่ขึ้นอยู่กับความสนใจที่จะเข้าร่วมโครงการ ซึ่งหน่วยงานเหล่านี้ได้แก่ กรมทรัพยากรน้ำ กรมอุตุนิยมวิทยา

และสำนักงานพัฒนาเทคโนโลยีอวกาศและภูมิสารสนเทศ (องค์การมหาชน)

กรมทรัพยากรน้ำเป็นหน่วยงานหลักที่รับผิดชอบการบริหารจัดการน้ำนอกพื้นที่ชลประทานและไม่ได้อยู่ในพื้นที่ของเขื่อน

กรมอุตุนิยมวิทยาดำเนินงานโครงการเกี่ยวกับสถานการณ์จำลองด้านสถานะอากาศและพยากรณ์ในระดับฤดูกาล สำนักงานพัฒนาเทคโนโลยีอวกาศและภูมิสารสนเทศ (องค์การมหาชน)

มีข้อมูลภูมิสารสนเทศจากดาวเทียมและมีความสนใจที่จะผนวกข้อมูลด้านอุทกวิทยาเพื่อให้สามารถให้บริการข้อมูลเกี่ยวกับการบริหารจัดการน้ำได้ดียิ่งขึ้น

หน่วยงานที่เกี่ยวข้องอื่นๆ ที่โครงการพิจารณาที่จะร่วมมือด้วย ได้แก่ สถาบันสิ่งแวดล้อมสต็อกโฮล์ม ภาคพื้นเอเชีย (SEI) และศูนย์เตรียมความพร้อมป้องกันภัยพิบัติแห่งเอเชีย (ADPC) SEI เป็นผู้พัฒนาแบบจำลอง WEAP (Water Evaluation and Planning System)

ซึ่งมีความเป็นไปได้ที่จะใช้เป็นเครื่องมือสำหรับระบบสนับสนุนการตัดสินใจที่พัฒนาโดยโครงการนี้ (<http://www.weap21.org/>) ADPC

ดำเนินการโครงการหลายโครงการด้านการบริหารจัดการความเสี่ยงจากการเปลี่ยนแปลงสภาพภูมิอากาศโลกและทำงานเกี่ยวกับการพยากรณ์สภาพอากาศ

ดังนั้นจึงมีความเป็นไปได้ที่จะใช้งานข้อมูลจากระบบสนับสนุนการตัดสินใจในกิจกรรมดังกล่าว นอกจากนี้ ADPC ยังได้จัดการฝึกอบรมให้แก่หน่วยงานและผู้เกี่ยวข้องต่างๆ ดังนั้นมีความเป็นไปได้สำหรับโครงการที่จะร่วมมือกับ ADPC ในการจัดการฝึกอบรมเพื่อเพิ่มศักยภาพแก่ผู้มีส่วนได้ส่วนเสียในโครงการ

การปรับปรุงเรื่องการสื่อสารระหว่างหน่วยงานมีความจำเป็นอย่างมาก โดยเฉพาะในเรื่องของการแบ่งปันข้อมูลผลที่ตามมาคือ

โครงการสามารถให้การสนับสนุนเรื่องของการบูรณาการข้อมูลจากหน่วยงานต่างๆและทำงานร่วมกับหน่วยงานต่างๆ

เพื่อปรับปรุงประสิทธิภาพในการวางแผนสำหรับสถานะน้ำท่วมและภัยแล้งให้ดีขึ้นได้ที่ระดับของการทำงานของแต่ละหน่วยงาน โครงการนี้จะเปิดโอกาสที่ดีสำหรับการร่วมมือและการแบ่งปันข้อมูลระหว่างหน่วยงานและระหว่างขอบเขตการทำงาน เช่น พื้นที่รับน้ำถึงระบบสาธารณสุขโลก

การดำเนินงานขั้นต่อไป

การประชุมผู้มีส่วนได้ส่วนเสียที่กรุงเทพมหานครเป็นการประชุมแห่งสุดท้ายของการประชุมในลุ่มน้ำน่านร่อง 3 แห่ง และหลังจากนั้นจะเป็นการประชุมโครงการเบื้องต้นร่วมกับตัวแทนจากทั้ง 3 ลุ่มน้ำ ซึ่งการประชุมนี้จะจัดขึ้นในวันที่ 23 พฤศจิกายน (ทัศนศึกษา) และ 24 พฤศจิกายน 2557

วัตถุประสงค์ของการจัดการประชุมนี้เพื่อให้ข้อมูลโครงการที่เป็นปัจจุบันรวมถึงแผนงานและงบประมาณที่แก้ไขโดยอ้างอิงจากข้อมูลต่างๆ ที่ได้รับการประชุมผู้มีส่วนได้ส่วนเสีย

จากข้อมูลที่ได้รับจากการประชุมผู้มีส่วนได้ส่วนเสียและการประชุมโครงการเบื้องต้น DHI

จะประสานงานกับโครงการวิจัยภายในของ DHI รวมถึงโครงการอื่นๆ

และจะพัฒนาวิธีการดำเนินงานซึ่งประกอบไปด้วยระบบสนับสนุนการตัดสินใจที่ผนวกประเด็นน้ำท่วมและภัยแล้งเข้าไปด้วย ในระยะเวลา 6-12 เดือนข้างหน้า (ประมาณครึ่งปีแรกของ พ.ศ. 2558)

จะมีการประชุมเพื่อติดตามการทำงานในแต่ละลุ่มน้ำอีกครั้งเพื่อประเมินวิธีการดำเนินงานและเริ่มทดสอบระบบที่พัฒนากับลุ่มน้ำน่านร่องและผู้ให้บริการด้านสาธารณสุขโลก

ผู้ประสานงานในลุ่มน้ำต่างๆ ซึ่งในเบื้องต้นคือเจ้าหน้าที่จาก IWA

จะเป็นผู้ประสานงานตลอดโครงการและจะทำหน้าที่เป็นผู้ติดต่อหลักระหว่างคณะทำงานโครงการและผู้มีส่วนได้ส่วนเสีย DHI จะติดต่อโดยตรงกับผู้ที่เกี่ยวข้องแต่ละแห่งจะให้ผู้ประสานงานได้รับทราบถึงการติดต่อสื่อสาร

ในฐานะที่จะเป็นผู้สนับสนุนการประสานต่อไปในอนาคต

Executive Summary

Overview

The **Flood and Drought Management Tool (F&DMT) project** is funded by the Global Environment Facility (GEF) International Waters (IW) and implemented by UNEP, with IWA and DHI as the executing agencies. The project aims at developing methodologies and tools including decision support systems (DSS) to incorporate information about floods and droughts and likely climate scenarios into integrated water resource management (IWRM) planning, Water Safety Planning (WSP's) and Transboundary Diagnostic Analyses (TDAs). The project is being implemented from 2014 - 2018, and three pilot basins (Volta, Lake Victoria and Chao Phraya) have been identified for development and testing of the methodologies.

The F&DMT Project defines a need to develop a methodology that works both on a transboundary level and the local level. GEF International Waters projects have planning tools which focus at the transboundary level. However, decisions made at the regional level (basin) and the local level needs

to be linked, the project looks to also address this aspect of inter-level communication. The methodology being developed will be based on an open platform solution, meaning basin authorities, national authorities, utilities, etc. can further develop the methodology and tools after the completion of the project to enhance their planning experience. The methodology will be flexible, i.e. stakeholders can develop their own indicators, and there will be linkage to different model types (MIKE models and WEAP as default). Usability is a key priority for the project and the main focus will be on a user friendly and flexible framework supporting planning activities.

The project will develop a DSS which will be tested and applied in 3 very different pilot basins; however the methodology will be available for all other basins. This also includes training modules available at the end of the project so that methods can be applied to other basins. The aim is to develop a methodology that is usable and interfaces with existing planning practices. The project will support planning activities related to TDA/SAP, IWRM or WSP, but will not embrace all activities within the planning methods. The focus will be on supporting key activities within the planning methods, by developing a usable and flexible framework, containing a few key tools of high value for the stakeholders in the project. The flexibility of the DSS will ensure that further development and extension of the DSS could be done outside of the project.

It is important to note that the F&DMT Project will not collect data or develop new models, but will focus on the development of a DSS for supporting planning, while the validation and testing of the methodology will be done using existing information and models. The project will not develop new plans within the pilot basins, but support the use of the DSS in ongoing planning processes. The main output from the project will be a DSS that will assist basin level organisation and end users (i.e. utilities) in their planning processes and support the individual activities with specific tools, where special attention will be given to flood and drought events.

Stakeholder meetings

The project started officially in June 2014 and had a 6 month inception phase during which the executing agencies had a series of stakeholder consultations in each basin. The consultations aimed to improve understanding of how the F&DMT can improve the water planning in the three basins, to be used in formulating a detailed project description for the inception meeting. The meetings were also to determine which stakeholders were interested in actively engaging with the project.

The objectives of these consultations included:

- Key stakeholders understand and endorse the objective of the F&DMT project
- To understand issues the key stakeholders are facing during water planning, focusing on transboundary issues related to climate change, floods and droughts
- To understand the methods/processes which the basin organizations and utilities go through during planning, and tools they currently use in planning
- To identify other projects or initiatives that we can work with that could potentially fill issue of data collection and knowledge gaps of the basin
- To gather feedback on the proposed methodology for the F&DMT project

The project had consultations with the following stakeholders in the Chao Phraya Basin:

Organisation	Main responsibility
Hydro and Agro Informatics Institute (HAI)	Advisor for agricultural and water resources management
Royal Irrigation department (RID)	Irrigation planning and management within Thailand
Electricity Generating Authority Thailand (EGAT)	Hydropower generation and water allocation from the main reservoirs.
Thailand Water Resources Association (TWRA)	

Department of Water Resources (DWR)	Responsible for basin commissions
K water	Korean consultancy company involved in water projects in Thailand
Metropolitan Waterworks Authority (MWA)	Water supply for Bangkok
Geo-informatics and space technology development Agency (GISTDA)	Data supplier to Thai government institutions for remote sensing data
Asian Disaster Preparedness Centre (ADPC)	Non-government consultancy and research institute
Thai Metrological Department (TMD)	Meteorological data, forecast and climate projections
Stockholm Environmental Institute (SEI)	Non-government consultancy and research institute
King Mongkut's university of Technology (CWEIR)	
International Union for Conservation of Nature (IUCN)	
Provincial Water Authority (PWA)	Water supply for provinces outside of Bangkok

The Chao Phraya basin is the largest in Thailand and has both flood and drought issues. The main reservoirs in the basin are the Bhumiphol and Sirikit dam (control approximately 22% of the flow). The Yom and Wang tributary rivers are unregulated. At the basin level, floods and droughts are the main issues. Drought planning is critical for water allocation between hydropower generation and irrigation, where surface water and the water storage within reservoirs are the main water source. Flooding is also a high concern, however there are numerous projects addressing floods in the basin. Long term planning is in being undertaken through the development of a new Water Master Plan for water management in all 25 basins in Thailand which addresses floods, droughts and water quality. The development of the master plan is being conducted through 5 working groups.

Working group 1 – North and Central Thailand (led by RID)

Working group 2 – North East and Southern Thailand (led by the Department of Water Resources - DWR)

Working group 3 – Information management (led by HAI)

Working group 4 – Policy and regulation (led by National Economic and Social Development Board)

Working group 5 – Public Relations (led by Public Relations Department)

The master plan is taking into account climate change.

Basin committees do exist in each of the 25 basins, however they have very little capacity and institutional structure. The Department of Water Resource is responsible for the 25 committees.

The project will focus on the Chao Phraya Basin, but will consider the inclusion of Bang Pakong basin on the recommendation of RID. The Bang Pakong basin has industrial areas affected by flooding, and upstream areas affected by drought. Salinity is also a main issue in this basin. One of the key concerns in including this basin is the lack of available data as few studies have been conducted focusing on this basin.

The climate in Chao Phraya is divided clearly into a wet and dry season. Wet and dry season planning is conducted in regular meetings between the key governmental institutions. The meetings address the flood and drought situation, early warnings and in particular possible control decisions. RID is chairing the meetings for dry season planning and HAI the meetings for wet season planning.

The project will work with the Hydro and Agro Informatics Institute (HAIL) at the basin level. HAIL is the lead organisation for the Water Data Centre, and has extensive experience with DSS, modelling and real time systems. They also have a key role in data integration in Thailand, which is part of what the DSS will aim to achieve.

The Royal Irrigation Department (RID) is a key stakeholder in the Chao Phraya basin, and is responsible for the irrigation planning, and planning the dry season water allocation together with the Electricity Generating Authority of Thailand (EGAT). RID has recently completed a project with JICA on the development of a real time flood forecasting system for Chao Phraya.

EGAT is responsible for energy production in Thailand including hydropower generation. They undertake wet and dry season planning with respect to water allocation from the main reservoirs. This planning is carried out in consultation with wet and dry season planning committees. EGAT has strong technical capabilities with respect to modelling (MIKE 11 and NAM), and could potentially be one of the end users for the flood and drought DSS.

It should be noted that each of the organisations involved in water management in the Chao Phraya have a network to collect information, so there is considerable replication in the system. Data is available; however access to information and identifying the best quality data will be the challenge.

The project also will test the DSS with end users focusing on water utilities – Metropolitan Water Authority (MWA) and the Provincial Water Authority (PWA). MWA is responsible for water services in Bangkok, Nonthaburi Province, and Samut Prakan Province. MWA provides water supply using 2 raw water resources: the Chao Phraya River and the Mae Klong River. PWA is responsible for the production of clean water supplies in 74 provinces throughout Thailand (except Bangkok, Samut Prakan and Nonthaburi). PWA has a total of 233 water utilities scattered throughout the country. Both utilities have started implementing water safety planning. More detailed follow is needed to determine the level of engagement with each of the utilities depending on information need and interest.

Other government stakeholders that have been informed of the project and will be involved depending on interest include DWR, the Thai Meteorological Department (TMD), and the Geo-informatics and space technology development Agency (GISTDA). DWR is specifically responsible for management of water outside of the irrigated areas and generally do not operate large infrastructure. TMD runs regular projects of climate scenarios and undertakes seasonal forecasting. GISTDA has remote sensing data collected via satellites and is interested in integrating hydrological information to provide better information for water management.

Additional stakeholders that the project will aim to actively collaborate with include the Stockholm Environmental Institute (SEI) and the Asian Disaster Preparedness Centre (ADPC). SEI is the developer of the *Water Evaluation and Planning System (WEAP)* which could potentially be a tool within the DSS (<http://www.weap21.org/>). ADPC has several projects on climate risk management and has worked on climate forecasting, hence there is potential scope for use of the DSS information in their activities. IN addition, they carry out training courses so capacity building collaboration can be explored.

There is a great need for improved communication between various institutions, in particular with the sharing of data. Consequently, there is the opportunity for the project to support the integration of information from different organizations and work with the various stakeholders to improve on their capacity to plan better for flood and drought events at their respective levels. The project also provides a unique opportunity to ensure collaboration and knowledge sharing between institutions and across scales (catchment to water utility).

Next steps

The stakeholder meetings in Bangkok were the last in series of meetings across the 3 pilot basins. The stakeholder meetings are being followed by an Inception meeting with representatives from the three basins. The meeting is taking place on November 23rd (field trip) and November 24th. The purpose is to provide an update of the project including revisions of the workplan and budget based on inputs from the stakeholder meetings.

Using the outputs of the stakeholder consultations and inception meeting, DHI will coordinate with their internal research projects as well as outside projects, and further develop the methodology which consists of the flood and drought decision support system. There will be follow up meetings within each basin in the next 6-12 months (during the first half of 2015) to verify the methodology and start testing among basins and end users (utilities).

Basin focal points (primarily IWA staff) will be used throughout the project, and will serve as a valuable local contact between the project team and the stakeholders. DHI will have direct contact with the key stakeholders, but keeping the focal points copied in any communication as they will be in a good position to further support continued cooperation.

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Annex 1 – Organigram

About the project

“Flood and Drought Management Tools” project – Katharine Cross, IWA

Project methodology and proposed deliverables – Oluf Jessen, DHI

Climate change is altering weather and water patterns around the world, causing increased floods in some areas and shortages and droughts in others. These floods and droughts have become increasingly common, more severe, and at the same time, less predictable than they used to be.

There is a growing sense of urgency around the need to improve resilience within river basins, and for this to become a critical part of water management plans.

The objective of the project is to improve the ability of land, water and urban area managers operating in transboundary river basins to recognise and address, as part of the Transboundary Diagnostic Analysis (TDA) / Strategic Action Plan (SAP), Integrated Water Resource Management (IWRM) plans and Water Safety Plan (WSP) processes, the implications of the increased frequency, magnitude and unpredictability of flood and drought (F&D) events.

The Flood & Drought Management Tools (F&DMT) project will develop methodologies, using tools and Decision Support Systems (DSS), to incorporate information about F&D and likely climatic scenarios (and using various channels of information and capacities) into IWRM planning, WSPs and TDAs. The methodology will be tested in 3 (pilot) basins (i.e. Volta Basin, Lake Victoria Basin and Chao Phraya Basin). The project will also engage with learning basins (e.g. Danube Basin, Nile River Basin) to feed the project with relevant information and best practices that we can use to further develop the methodology

The outcome will enable stakeholders to compile information, with models, indicators and existing planning methods, to develop future planning scenarios that are robust and resilient and pragmatic on both a regional basin scale and local scale for urban and industrial areas.

At the local scale, the WSP approach will complement wider basin planning as it provides risk assessment and management options within national boundaries as well as those in the wider river basin context.

It is important to note that the F&DMT Project will not collect data; however, tools will be put in place to assist stakeholders in monitoring the status of their basin. The project will utilise existing models such and not develop something new, we are not in a position to develop new models to facilitate data generation. What the project will produce is a tool that will assist basin level organisation and end users (i.e. utilities) in their planning processes in the likelihood of a flood and drought events.

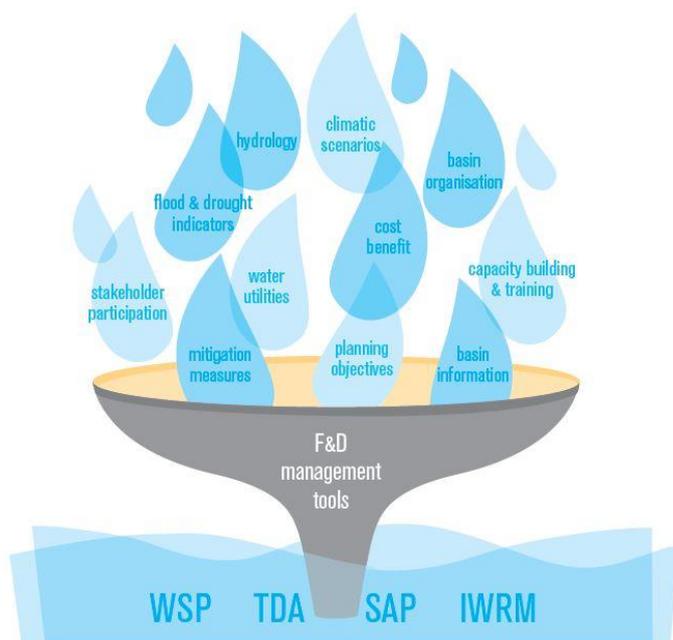


Figure 1. Infographic depicting the types of information and tools integrated into the decision support system to support different types of planning

Project partners

The F&D Management Project is being implemented from 2014-2018, and is supported by the Global Environment Facility (GEF) trust fund with the United Nations Environment Programme (UNEP) as the implementing agency. DHI (technical coordinator – methodology, modelling, testing at basin level, guidelines) and the International Water Association (IWA) (outreach coordinator – stakeholder engagement, testing at local level, communication, capacity building) are the executing organisations.

The project will look to target a number of key stakeholders ranging from the regional– (transboundary) basin level to the local–utility level; i.e. transboundary river basin organisations, local authorities, water utilities, local and indigenous communities, urban and (agro) industrial water users and civil society groups.



Figure 2. Partners involved in the F&DMT project

Stakeholder engagement

Project activity	Involvement	Benefits
Development of DSS	<ul style="list-style-type: none"> • Provide information sources • Indicate what outputs are needed 	<ul style="list-style-type: none"> • DSS is designed to be applied by a variety of users
Testing DSS <ul style="list-style-type: none"> • Basin level • End user (utility level) 	<ul style="list-style-type: none"> • Use test cases to tailor DSS • Use of DSS with available data to consolidate information on floods and droughts 	<ul style="list-style-type: none"> • Generic DSS is tailored for specific user in each basin • Recommendations developed to use information in flood and drought management planning
Capacity building and training	<ul style="list-style-type: none"> • Training materials provided and use cases for future application 	<ul style="list-style-type: none"> • Ability to train other users – future business case?
Communication and dissemination	<ul style="list-style-type: none"> • Networking with other users across basins to understand how to overcome gaps and challenges • Presentation of DSS application at key events 	<ul style="list-style-type: none"> • Gain experiences and learning from other users and basins • Showcasing of basins and utilities

Stakeholder meetings

Chao Phraya Basin Stakeholders Meeting

The F&DMT project team organised a series of individual meetings the week of October 6th with key stakeholders in the Chao Phraya basin. The meetings provided the project team with the opportunity to provide an overview of the F&DMT project and the expected deliverables while receiving feedback and suggestions from key stakeholders. Details of these meetings can be provided separately upon request.

The following sections will present the main findings from the held meetings.

Thailand Water Resources Association (TWRA)

Discussion with TWRA, the following people participated in the meeting:

Name	Position/department	Email
Dr. Apichart	President TWRA	apichart.twra@gmail.com

URL: <http://www.dwr.go.th/twra/main.htm>

About TWRA

TWRA focuses on integrated water resource management. The organisation is a source of personnel with knowledge and understanding of integrated water resource management leading to sustainable economic and social development. TWRA has the following objectives:

1. To be a center of academic, practitioners and those interested in the field of water resources management.
2. To promote the dissemination and exchange of knowledge, experience, management of water resources both at the domestic and international levels, and to maximise the economic, social and environmental benefits.
3. To promote technology transfer and research, and to provide advice to organisations, both public and private to achieve the goal of improved water resource management.

Key minutes from meeting

- DWR is the regulatory agency but they are not doing this very well at the moment. At this point it is important to meet with MWA, PWA, RID.
- International Centre for Environmental Management (ICEM) has developed a training to use a basin planning tool they developed through a private company hired by the Mekong River Commission (MRC). The tool uses various models; i.e. social, economic, etc. linking the various models together for a more integrated approach to planning.
- What is the status on the River Basin Committees (RBC)? The River Basin Committees (RBC) are not currently functioning as they have little to no capacity. There are 25 basin committees established by the prime minister. There is no national water law, therefore DWR acts as the secretary for all 25 committees. The committees consist of:
 1. Government offices – about 15 people, compromised of for example a member from RID
 2. Users (stakeholders) – about 15 people compromised of farmers, trade offices, and industry; depends on the focus of the basin, so if it is tourism then the tourism industry would be represented in the committee). This group increased to 20-26 members as 15 is too small to represent all users within the basins
 3. Experts – 3 experts sit on the committee
- RBC should be the overall water management office of the basins. There is pressure from TWRA to encourage the government to announce that all projects under their respective

basins should submit a request to be approved by the RBC in order to carry out the project. In such a way, activities in the basins can be monitored and recorded.

- DWR is the secretary, as such, they receive the budget. Instead of giving it to the RBC, they keep most of it for themselves. The RBC has no legal status, so legally DWR cannot transfer the money to them; they have no legal backup for this. DWR provides every basin about 2 million baht, enough for 2-3 meetings a year, however this is not enough for the level of dialogue needed for proper management of the basin and its water resources, yet this remains the way that it is done. This has also resulted in the development of 75 provincial plans for the management of water; this means another list to go through. The plans developed are quite different as each basin has its own agenda. At the larger basin level, nothing exists, it is complicated, and will require a lot of effort, to incorporate all the provincial plans into one larger basin plan.
- Who decides how to control the reservoir? RID operates a reservoir, so they decide how that is managed. For Hydropower, EGAT operates another reservoir. There is an agreement between RID and EGAT (but EGAT wants more water to produce more hydropower). There is an understanding on how much water to release but not the timing of when to release or when it is released, this becomes an issue.
- IWRM in Thailand should be viewed or understood as a process, not a plan. This is how they can get the committees to endorse IWRM, and then get the cabinet to tell the basins to have a plan which incorporates aspects of IWRM. Therefore, IWRM is a process; a slow one, but a process to get the basins to accept and implement IWRM activities in their planning.

Issues

- Sea water intrusion; the fresh water to push the salt water is not enough because of farmers taking too much water (this relates to Thailand issue of putting too much focus on increasing the country's GDP). Due to the increasing salt water intrusion, utilities supplying water are facing numerous challenges as they do not have the infrastructure to treat that water anymore. This is an example of where catchment-utility coordination is needed.
- Each department has to establish a budget plan. However there is not a well-established water budget plan; this is an issue. There is too much focus on GDP and how to increase the country's GDP. To increase GDP requires the exploitation of resources making it difficult to sustainably manage the water resource. Big dams only have 30% storage and every year it gets worse. There is a need for a water budget plan at the national or basin plan, based perhaps on a water balance plan. Also at the national level, politicians need to endorse and understand a plan if it is to succeed, therefore they need to understand the water sector and the water resources.
- Water quality source issues at the point source water as well as non-point source water (e.g. water that comes from farmers after they use it; drainage water)
- Another issue in Thailand is that when there is a problem, a committee is set up; if you do not want something done, you set up a committee. Where there is success depends largely on who sits on this committee, but for the most part, nothing much comes out of a committee. For almost a decade, there have been attempts at establishing a master national water law. Also, every time there is a new government, a new flood plan is developed, often with new priorities.

Future actions for F&D project

- Keep TWRA informed about the project.

Hydro and Agro Informatics Institute (HAI)



Discussion with HAI, the following people participated in the meeting:

Name	Position/department	Email
Piyamarn	Hydro and Agro Informatics Institute (HAI)	piyamarn@haii.or.th
Sisomphon	Hydro and Agro Informatics Institute (HAI)	atthanat@haii.or.th
Atthanat Khurat	Hydro and Agro Informatics Institute (HAI)	jutarat@haii.or.th
Jutarat Maneelok	Hydro and Agro Informatics Institute (HAI)	natta@haii.or.th
Natta Ariyananthakul	Hydro and Agro Informatics Institute (HAI)	pharkpoom@haii.or.th
Pharkpoom	Hydro and Agro Informatics Institute (HAI)	surajate@haii.or.th
Arunmuang	Hydro and Agro Informatics Institute (HAI)	sutat@haii.or.th
Surajate Boonyaroonnet	Hydro and Agro Informatics Institute (HAI)	teerachai@haii.or.th
Sutat Weesakul	Hydro and Agro Informatics Institute (HAI)	winai@haii.or.th
Teerachai	Hydro and Agro Informatics Institute (HAI)	
Amnuaylojaroen	Hydro and Agro Informatics Institute (HAI)	
Winai Chaowiwat	Hydro and Agro Informatics Institute (HAI)	

URL: <http://www.haii.or.th/index.php?lang=en>

About HAI

[HAI presentation](#)

Their work areas: water, agriculture and community development:



HAI is a public organisation under the Ministry of Science and Technology with main responsibilities in developing and applying science and technology to support better agricultural and water resource management in order to cope with critical climate change; and expanding the accomplishment through the design and development of strong and effective networking.

Missions

- Conducting research and development of science and technology, including collecting, synthesizing, and analysing data in respect to agricultural and water resource management;
- Disseminating the research and development outcomes to other agencies for the efficiency improvement in agricultural and water resource management;
- Promoting the research and development collaboration, nationally and internationally;
- Expanding the services and disseminating the research and development outcomes, accessibly and effectively, to the benefits of others.

Key minutes from meeting

- In Thailand, there is no agency that monitors flood over the whole country, perhaps just DWR. PWA and MWA have a focus more on drought. HAI have tools that are specific, not general tools for flood management (or drought management).
- Technology:
 - 777 stations in operation (telemetry) – taking rainfall and water levels
 - Terabyte Server (24 TB capacity) for data storage
 - High performance computing centre
 - www.thaiwater.net provides the data online (with some analysis of the data)
 - Media box – provided to the local municipality, with an internet connection they are able to get regular update through the device (this was an in-house development by HAI, provided for free)

- HAI has a lot of data related to water management integrated from various agencies at different levels:
 1. Flood forecasting (MikeFlood) (7 days) – used to monitor the river, they put it in a report for further management (They have 3 month forecasting, but this is used very little (less certainty). Used for seasonal planning)
 - The 3 month forecasting system is also used for scenario management, for both short- and long-term planning. It addresses questions such as: if this happens, what will be the impact in this area? If you take such an action how will it change the impact? etc.
 2. Water Resource Management (MikeHydroBasin) – water allocation management within the Chao Phraya, only for irrigated areas

The information is provided to the government through various channels, e.g. water management team meetings every 1-2 weeks in which the information is presented there. Key stakeholders attend this meeting. If something will happen, e.g. a flood is predicted based on the flood forecast, then they can inform the responsible agencies.

- How do you take into account the various users, e.g. agriculture? RID, EGAT (they operate the reservoir based on an agreement with RID, but this needs to be approved by a committee, who consist of member from EGAT, RID, etc.; all from related water management agencies). They do monitoring analysis and they make decisions, this decision goes to the parliament. All conclusion of the meeting, even if it involves an action, go through a recommendation process. Depending on the situation they provide either a recommendation or an action (action is more for short term needs).
- HAI is not the main institute providing information. They combine information with other institutes such as RID, TMD who have their own data. Online, www.thaiwater.net, you can see the various data from the different agencies. So you can make a comparison (release of reservoir, and compare the inflow and outflow, for example).
- For dry years, is there a drought forecasting system? It is listed in one of HAI's targets, but so far no tool for drought indication has been developed. They will have tools for soil moisture testing, based on statistics to see water the level in the river and reservoir used as an indicator of the situation they may have in future. For the real index, this will require a lot of study, which they do not have yet.
- There is a new flood plan process (addressing flood, drought and water quality), which consists of 5 working groups. HAI is in charge of Working Group 3 (Climate change is considered in the planning), which is in parallel with their mission: developing a DSS of which they have collected partly the monitoring data, and link to the original source of data. Now it is about filling the jigsaw. However, there are other important data they require before the platform is cleared; e.g. linking with the economic plan, social plan, etc.
 - Work Group 1 and 2 are more area oriented, focus on the north and central part (group 1) and group 2 is focused on the north east. Group 3 is more data oriented.
 - Work Group leads
 - RID: Work Group 1,
 - DWR: Work Group 2,
 - HAI: Work Group 3,
 - NESDB (national economic and social development board): Work Group 4
 - Public Relations Department: Work Group 5 is led by public relations department
- How far is HAI with their respective contributions to the master plan? HAI have submitted the first report and are waiting for a response. They are not aware of the progress of others, and where they are. For HAI, the DSS is already developed, and they have strong technical capabilities within DSS.
- How can a planning DSS add more value in Chao Phraya? This will depend on which stakeholders use the tool. Flexibility is a good thing so that end users can experience it in a way that brings them more value.

Future actions for F&D project

- We have identified HAI as a key stakeholder. Following the inception meeting, the project team will engage in developing a clear work plan with HAI in order to ensure productive collaboration with respect to the DSS development and project outputs. Therefore we need to

develop a clear work plan with HAI in order to ensure good collaboration, especially as both HAI and the Project team are busy, but there are clear benefits to collaboration with regards to the DSS development and project outputs.

Department of Water Resources (DWR)



Discussion with DWR, the following people participated in the meeting:

Name	Position/department	Email
Mr. Khunphot Buatone	Water Crisis Prevention Centre	khunphot@gmail.com
Satit Phiomchai	Bureau of International Cooperation	
Supon Sodsoon	Water Operation Centre	sodsoon@yahoo.com
Satit Sueprasertsuk	Water Operation Centre	

URL: <http://www.dwr.go.th/home> (in Thai)

About DWR

Department of Water Resources, Ministry of Natural Resources and Environment has the mandate:

1. To be the core agency in proposing policy, master plan, and measures for water resources management, development, rehabilitation, utilization and problem solving as well as directing and coordinating the implementation
2. To set guidelines on preparation of action plans for water resources management, development, conservation and rehabilitation, with emphasis on public participation
3. To study, research, survey, develop, conserve and rehabilitate water resources
4. To monitor and evaluate water resources management in accordance with the policy, master plans and measures specified for national and basin levels

5. To develop database and information network systems pertaining to water resources
6. To specify or recommend amendments or additions to laws, rules and regulations relating to the management of the country's water resources
7. To promote, disseminate, publicize, and transfer water-related technology including campaigns to build awareness and understanding among various organizations and stakeholders to fully realize the importance of water resources
8. To coordinate with other countries and international organizations in relation to water resources
9. To promote and provide technical support and advice on standards and legislation in relation to water resources management to government agencies and local authorities
10. To carry out other duties as stipulated by law or assigned by the Ministry or the Cabinet.

Its mission is:

1. To be the core agency in formulation of policy and integration of policy and integrated water resources management plan in river basin context system
2. To promote, support and increase capacity for organization driven process and river basin network
3. To conserve, rehabilitate, repair, improve and develop for increasing water resources capacity
4. To develop knowledge base, database and standard of integrated water resources management and early warning system which all sectors are encouraged to adopt and adapt for practical uses
5. To promote international cooperation on water resources management

Key minutes from meeting

- Bureau of Mass Promotion and Coordination (DWR) – coordinate the work of the River Basin Committees (RBC) – and Water Resource Policy and Planning (DWR) attend the organised meetings. This bureau focusses on promotion of people's participation in water resource management, conservation and rehabilitation, based on mechanism of river basin committees.
- They deal with the upper (natural river) and lower (more controlled, therefore not a natural river – information here will be dictated by the institutions that manage and monitor this part of the river) Chao Phraya.
- There are 25 Basin Committees under DWR. How does DWR engage with them? The committees are at different levels, so it is hard to incorporate all and there is no one main overarching committee. RBC submits their plan to the DWR and they use that information and consolidate it; 1 year action plan, 5 year master plan.
- When it comes to planning in the Chao Phraya, DWR has a separate system in which they work with the different committees. However, there is no plan for the whole basin.
- Generally RID has the responsibility of irrigated areas and DWR has work outside of the irrigated areas. RID has specific areas, e.g. lower Chao Phraya basin, they control the dam and just allocate the water to the surrounding areas. The DRW do not have large dams, they do not have the infrastructural capacity for this. Last policy of the new government indicated who controls or manages which part of the water. Now the DWR will be dealing with water in the north east and southern part of Thailand. RID will work in the central part and the rest of the northern part of Thailand.
- DWR looks primarily at surface water. Groundwater is handled by the Department of Groundwater Resources (DGR).
- With the Department of Underground Water Resource (DUWR), DWR works with them especially with regards to drought related issues. There is a committee to facilitate the cooperation between DRW and DUWR. They have monitoring stations in the catchment (they use for flash floods). They use different stations than HAI, but they share information in the committee (most water agencies attend the meetings, therefore data and information can be shared in this way). The DUWR tends to come when there is an issue of drought or other relevant concerns.
- DWR has established a strategic plan for the Master Plan that incorporates flood, drought and water quality aspects. They are not yet in the action plan for the next 5 years. Currently they are outlining the general strategy of how water resources are used. The final strategy plan will be completed in the next 2-3 weeks for consideration. They are doing this by themselves,

collecting the relevant information. The various water management plans developed for each provinces by the respective RBC are useful in that information can be taken from them.

- To assess risk, they use water levels in the river

Future actions for F&D project

- It is not clear how the RBC will benefit from the tools that are developed in this project. Therefore it is a good idea to meet with the stakeholders to understand what they do, etc. There is also a concern that the tool being developed is not different to what already exists. More clarity needs to be made to address this issue. We do not want to replicate, but add value. If it will not add value then we would need to re-assess our objectives.
- Approach Provincial Authorities, or sub-basin organisations through DWR. This can help in incorporating local stakeholders and help in capacity building for local stakeholders who are important to consider in the project.
- Identify other systems that already exist, in particular the Mekong system (DSS). Mekong River Commission (MRC) developed Decision Support Framework (DSF) for Mekong countries.

Royal Irrigation Department (RID)



Discussion with RID, the following people participated in the meeting:

Name	Position/department	Email
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Mr. Suchon duang-Ngern	Telemetering Centre for Water Management
Mr. Lertviroj Kowattana	General Director
Phattaporn Mekpruksawong	Office of Project Management
Thongplew Kongjun	Director of Office of Hydrology and Water Management

URL: <http://www.rid.go.th/eng/index.php>

About RID

RID's authority is governed by three Acts. It is part of the Ministry of Agriculture and Cooperatives. The main / original objective of RID is water for agriculture (their legal priority), however their current objective is to ensure sufficient water supply for usage by various stakeholders within their designated operational area; i.e. the Water Distribution Plan put a priority on household use (a small portion). The areas in which they do not operate are covered by DWR.

Its mission is:

1. To develop water resources and to increase irrigated area according their potential and natural balance
2. To manage water allocation in equitable and sustainable manners
3. To prevent and mitigate water hazards as appropriate mission
4. To encourage people participation in water resources management and development

Key minutes from meeting

- RID is one of the end users in the Chao Phraya (at their level, as they are the ones most engaged and manage the water).
- They do not have models for drought, only flood related models.
- RID are responsible for the Irrigation area but also for the information outside the irrigation area. However, they do not have the necessary tools to fulfil this obligation.
- There exists a platform that brings together various models (i.e. JICA, DHI, etc.) so that it can be accessed in one interphase. They have rainfall models and river flow models, but not for other basins; e.g. Bang Pakong River Basin (BPRB), where they need to know the levels of water, information on salt intrusion, etc.
- RID has an issue regarding irrigation from the river and PWA who use the water for water supply as they are not aware of the water abstraction by these users. There is a need for a DSS for the region on how to operate the barrage or perhaps a DSS for the connection between the BPRB and Chao Phraya to understand levels and if water can be diverted. The BPRB is also within a natural forest, which poses issues of its own. RID is also having conflict with industry. There are industrial estates (many industries) and they extract water from the irrigation canals. They also have a plan to expand the industrial estate, which will bring more issues.
- How is climate change information incorporated in planning? RID already has some climate change forecasting, but not long term forecasting, this is more on a seasonal level; what will happen in the next season (more or less rain); 3-6 months planning. However, this is not included in the existing DSS that they have now, but they can still access this and use this.
- Seasonal forecasts are based on indicators from statistical records, to indicate that this year will be above normal or below. In the current DSS, RID has planned to develop a climate change model and incorporate this in the DSS (HAO climate change system). JICA will be supporting this process in the next coming months.
- RID do not have any online stations to measure soil intrusions, they do, however, have stations to monitor river flows. Satellite information can also be used through GISTDA.

- Is there any regulation on industrial estates and any coordination with DWR in that respect? No they have information from industrial use largely because of the Master Plan (as part of the planning process). The Pumping from the irrigation canal (which connects the Chao Phraya River and the Bang Pakong River) they are not aware of, but the Provincial Irrigation Offices should have figures on this.
- DWR under the Ministry of Interior manage areas outside the irrigated areas which are managed by RID. At the policy level there is the committee to manage the function areas (irrigation areas and outside areas)
- How is information shared between DWR, HAI and RID? This is done through the Government Information Network (GIN), through HAI, through the TOT (telecom communication) and there is also a mobile application that can be downloaded which will have certain information. However, HAI is the main platform.

Future actions for F&D project

The project will consider the possibility of working in another basin, however due to the request by the GEF to work in the Chao Phraya; this will have to be discussed at a higher level. An alternative basin is the Bang Pakong River Basin (BPRB) in which there are issues of water quality because of industry, issues of salinity (salt intrusion from tidal impacts), issues with the operation of the dam – operation is not stabilised due to various factors.

It should be noted that DHI might develop a new model for Bang Pakong.

K water



Discussion with K water, the following people participated in the meeting:

Name	Position/department	Email
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URL: <http://english.kwater.or.kr/>

About K water

Korea Water Resources Cooperation (K water) is the governmental agency for comprehensive water resource development, providing both public and industrial water in South Korea. K water was established in 1967, and has been implementing national water resources management policies regarding multi-purpose dams, water supply dams and regional water supply systems.

K water has been trying to expand its portfolio to include overseas projects in the energy business, including large water-works projects. K water (Thailand) has won the bidding for two major Thai water projects in 2013 worth Bhat 160 billion combined: for water-retention areas, and a flood-diversion channel on both sides of the Chao Phraya River. The two projects form part of the government's Bhat 350 billion water- and flood-management programme.

Key minutes from meeting

South Korea

K water is a total water service provider; ranging from survey, engineering (design), construction, management of water facility and operation. They supply about 50% of domestic water throughout the South Korea. They deal with flood control capacity, in terms of the volume, from multipurpose dams, which account for about 80% of water supply.

K water is mainly responsible for:

- Constructing multi-purpose dams, managing and operating them
- Produce hydropower, installed in the multipurpose dams as a secondary product
- Deal with water works, but all connected to multipurpose dams
- Provide water for industrial land, however, this is not their main job, this is a secondary job

As such, they are a total service provider for water resources.

How does K water plan for the various activities and work with various institutions such as RID? K water mainly works with the supply of water for industrial use, and not so much for irrigation. There is a state owned company dealing with this aspect of irrigation water in South Korea.

Thailand

Since the 2011 flood, Thailand has engaged in project bidding in Thailand. K water worked with Thailand in 2011 with regards to disasters, in 2012 they got engaged in international projects and so they participated in the bidding process. Since then they have been working on such bidding jobs. The Bidding process has been stalled due to the political crisis in Thailand, however.

They do not control any of the dams in Thailand but they hope to do this in the future. They have their own DSS for managing multi-purpose dams. Therefore, they want to show this to Thailand to manage one or more of these dams and introduced their system.

Power is sold to the state owned company such as EGAT.

Discussion

The model developed in the F&DMT project will focus on the planning and not real time systems. It is important to understand and clarify the connection between the results of climate change model to the planning process. For simplified models, data can be based on a 30 year historical data, for example, and used to project that for the future. It is assuming that the past experience will occur in the future; of course there is no certainty with this.

One thing to consider, that can tie into the project is about planning for the operation of multi-purpose dams. A tool can be put in place to control all these dams, but this is something the project needs to consider (real time operation, as this is an important aspect of planning, were to set priorities, etc.). Before planning for the construction measures, one needs to think of the non-constructive methods, and then consider the constructive measures. That is the general approach to planning. There is a need to think about several options on how to operate a dam, where the priorities are, i.e. for allocation of water, what the purpose of the dam will be, etc. It is hard to determine which one comes

first. One solution is to show trade-offs for the various sectors and see where you want to be; show this to the decision makers and they can use this to come up with a plan.

When it comes to drought management, usually one comes up with an optimal management for multi-purpose dams. However, where priorities are with multi-purpose dams also has a political element to it.

How does K water decide the optimal allocation? They have their own water budget model. They can consider all multi-purpose dams and all their water sources and they know the demand of all kinds of users and then they can calculate the water budget, using optimisation technologies. Then they update on a weekly basis, 10 days, monthly, etc. depending on what they want for optimum allocation based on their findings. Important is that in their DSS systems there is a big classification and difference between flood control and drought control; they are two totally different systems.

DWR mainly deals with the policy. Coordination is not the greatest. DWR also works on transboundary river management, law and policy. There are a lot of committees but little cooperation. There is also a lot of repetition, in terms of monitoring systems and DSS. Therefore, a single command authority is needed to manage the water resources for the whole country. They should communicate with the RBC and consider their needs. RBC are currently very weak with many agencies in it. RID is a strong agency.

Are there regional climate models (RCM), or projections in Thailand? They have APCC (Asian Climate Change Centre), however in Thailand they will use a global model. The F&DMT project is not just about climate change, it is important to refer to future changes, as this includes more than climate change, including for instance land changes, etc., which could have a higher impact.

Metropolitan Waterworks Authority (MWA) and site visit



Discussion with MWA, the following people participated in the meeting:

Name	Position/department	Email
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Management

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Mr Ekkarat Meewassana	MWA Environmental Engineer	Ekkarat.big@gmail.com

URL: http://www.mwa.co.th/ewtadmin/ewt/mwa_internet_eng/main.php?filename=index

About MWA

The Metropolitan Waterworks Authority is a Thai state enterprise under the Ministry of Interior. It is responsible for water services in Bangkok, Nonthaburi Province, and Samut Prakan Province.

MWA provide water supply using two raw water resources: Chao Phraya River and Mae Klong River. There are four water treatment plants: Bangkhen water treatment plant, Samsen Water treatment plant, Thonburi water treatment plant and Mahasawat water treatment plant.

Its mission is:

- To provide securing quality water supply and service coverage by latest technology and professional workforce for customer satisfaction and confidence

Key minutes from meeting

This year there is a drop in the water level therefore there is likely to be a drought situation until next year.

MWA

MWA staff is divided into 2 departments:

- Water quality
- Water resources

The mandate of MWA is not well defined, but they work through RID which provide water to MWA to treat and supply. Their responsibility is to control the raw water and treat it for water supply.

They are not engaged in the design, however they have a ToR open bidding process (so a private consultant will design this). The design used is recommended by the consultant and MWA has to consider this.

During flood situations how does MWA protect their facilities, are there flood risk assessments? During the flood, they address a number of things. The raw water canal; the water canal department has to protect the canal to the treatment plant from contamination as a result of flooding. The department works with its own staff and volunteers. Also the military helps to protect the water quality. At the treatment plants, they use chemicals with support from JICA.

How do they get information if a flood is coming? MWA receives information from the media, public relations, as this is an open source. Also they receive information via the telemetering that belongs to DWR and RID. They have information of the release of water from the Chao Phraya, when it reaches a certain amount they can then prepare for flooding. After the big floods in Thailand (2011), they had a meeting with relevant organisation (PWA, RID, etc.) for water management in order to find solutions

to deal with the flooding event. Now they meet before the rainy season to prepare a plan in case of flooding. Under the big committee they have a sub-committee, in which this is addressed. This takes place at DWR.

HAI has the most complete data; however the physical characteristic of the river is often unknown. There may be information available after the flooding, but this is merely a cross section. They do not have the data themselves, but they have a link to HAI through which they can receive information.

According to the Master Plan, there are 5 components, of which component 3 is done by HAI. They will finalise a Government Information Network linking all information systems in one platform. MWA's information will be linked to HAI.

MWA uses WSPs, which they started developing in 2013; however, they have not completely fulfilled the plan. There is a department leading on WSP called the Governor of Planning Department, within which they have people responsible for this. They have included F&D in the WSP and they also think about all impacts to ensure that their operation is not interrupted. For more information visit: http://www.mwa.co.th/ewtadmin/ewt/mwa_internet_eng/ewt_news.php?nid=621&filename=index.

Issue

MWA has 2 main challenges with regards to water supply:

1. Salinity, the treatment facility cannot manage this.
2. Water quality because they use downstream water. Along the Chao Phraya there is a lot of contamination from industry and agriculture. Also from the community, as they do not treat the water before discharging.
 - Water quality: There is some communication between MWA and the Pollution Department for water quality monitoring station. They have 6 monitoring stations upstream before the intake for water supply. Pollution department only have the means to monitor but not do something about it. They have to connect with other institutes that have more authority to deal with the issue (legally) such as the police.

Site visit



The F&DMT project team visited the Bangkhen Water Treatment Plant, the 5th largest treatment plant in the world (<http://www.youtube.com/watch?v=oYCgjtvpYBw>).

- The plant supplies water to the city of Bangkok
- They take water from Samlae Pumping Station
- The Plant has a capacity of 3.6 million cubic meters per day
- Their reservoir can keep just 10% of their production
- The supply from Reservoir to tap takes about 4 hours

The quality of water follows the WHO guidelines. When there are flood events, the plant will increase the frequency of water quality checks.

In total, MWA have 4 treatment plants: Bang Khen, Mahasawat, Samsen and Thonhuri. They withdraw water from 2 sources: Tabia raw water pumping station and Samlae raw water pumping station.

Future actions for F&D project

- Engage further with MWA to better understand what their needs are and where the gaps lie in terms of data, knowledge and capacity.

Geo-informatics and Space Technology Development Agency (GISTDA)



Discussion with GISTDA, the following people participated in the meeting:

Name	Position/department	Email
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URL: http://www.gistda.or.th/gistda_n/en/

About GISTDA

In order to enhance the utilisation in remote sensing and GIS, GISTDA was established as a public organisation which assumes all responsibilities and activities for space technology and geo-informatics applications. Essentially the objective of establishing GISTDA was to further enhance geo-informatics and space technology as a non-boundary knowledge for the country's development.

Roles

- To develop space technology and geo-informatics applications to be beneficial to the general public
- To develop the satellite data base and the derived natural resources information center
- To provide data services relating to space technology and geo-informatics
- To provide technical services and develop human resources in satellite remote sensing and geo-informatics
- To conduct researches and development as well as to implement other activities related to space technology, including the development of small satellites for natural resources survey
- To be the core organisation to establish common standards for remote sensing and geo-informatics systems

Key minutes from meeting

GISTDA has 30 years-experience with satellite information; with Thailand even having its own satellite. There are various categories of what they use remote satellites for:

- Climate
- Urban design
- Land use change
- Remote sensing for LDBI/NDBI (index)

They also have flood control stations based on satellite readings; they therefore have a lot of archived information. As such they are able to do flood modelling based on satellite modelling. They use the satellite data for validation with a look up table. If they have a certain water level, they can use satellite images to see the impact, and use this in future if they have a similar water level; they can predict the potential impact. This will be provided as a service through the internet. Data is used from RID as they have a forecasting system (JICA system); this is used to predict the water level based on a 7 day prediction.

Often, GISTDA buys information at certain rates from other agencies, however during the floods of 2011, information was provided freely; no one bought or sold information during flood event. Normally what is done is that agencies go to the Ministry of Science and Technology to buy their information (however, for organisation or agencies within the ministry, i.e. GISTDA and HAI, the information can be shared freely; they therefore work with HAI in one form or another). They work with various institutions for various purposes. For example, water level forecasting they have decided to work with RID, while HAI who are likely to have this information as well, they work on something different.

They have been doing flood maps and land use maps for the past year; i.e. forest changes, also for plantation (e.g. rice). These are their basin tasks. Other institutions have rainfall distribution data of which GISTDA makes as much use of as they can. However, they want to develop a unique flood model not based on hydrology. They want to see what happened in the past in order to learn how to better do things in the future. They also want to further establish a model on land based information that has a certain level of predictability. They are interested in forecasting as well.

GISTDA is stuck on the work scenario analysis (you do a change and analyse the impact of that change) and operational forecasting. They are not sure if their thinking is correct or not. They do not go into hydrological modelling, they go more into rainfall models, infiltration, percolation, evaporation; i.e. the water balance. There are various models that pick up on various aspects of water balance.

They are not interested in the classical knowhow; they want information for the big picture, the whole basin, the overall picture of Thailand. Not a hydrological model for a specific area.

As GISTDA works in the agriculture zoning of Thailand, they pay attention to the flood and drought aspects with regards to this (saturation of soils, for example). This requires good collaboration with RID who are operating within the irrigated areas of the Chao Phraya.

Future actions for F&D project

- The F&DMT project wants to take into account climate variations; this is where we see additions from GISTDA (among other potential areas) into the project. There can also be collaboration on obtaining information water balance models that GISTDA is working on, this can tie into the discussion with TWRA. The project should explore the linkages in this respect and how to proceed with this.
- As GISTDA are the only ones working with remote sensing, satellite work, in Thailand, it is good to elaborate further on how GISTDA can further contribute in the project. We need to see what we need from GISTDA; how they can help (i.e. space, time aspect). We need to find some common interest and establish some understanding of how we can work together.

Asian Disaster Preparedness Centre (ADPC)



Discussion with ADPC, the following people participated in the meeting:

Name	Position/department	Email
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URL: <http://www.adpc.net/igo/>

About ADPC

Established in 1986, ADPC is as an independent non-governmental organisation. It works in a number of countries in the Asia region. Their well-established networks with government line agencies and strong partnerships with regional organisations and development agencies provide the foundation for their work.

ADPC deploys disaster risk management (DRM) information and systems to reduce local, national and regional risk across Asia-Pacific. Its portfolio focuses on DRM capacity building, improving DRM for cities and climate change, mainstreaming DRM into national and local development, improving DRM systems and undertaking disaster risk assessments.

Key minutes from meeting

- Climate forecast application (CFA) funded by USAID – working with farmers and farm schools. They educate the district and national level related to agricultural sector to disseminate training on the CFA to farmers. This was first approached in the Philippines, then moved to Bangladesh to enhance the flood forecasting system (CFA in Bangladesh is now the continuation of the USAID project)
- They have helped to improve the lead time from 2-3 days to 7 days (using Mike 11 system ideas). There are limitations, but they want to expand the similar system to other basins.
- They have tried to move beyond climate risk management. Asian Development Bank (ADB) will work in Nepal with Department of Hydro Metrology to develop climate change scenarios. This will consist of 5 Global Climate Models (GCM) and 3 Regional Climate Models (RCM), 2 scenarios within a climate data portal; all the information goes to this portal so that it can be accessed by anyone
 - Are there any available RCM for South East Asia? TMD may have done something. Another project that is from Rockefeller Foundation ACCI, work with TEI to develop scenarios, up to 2040. But they are able to run other simulations on a 25km grid.
- ADPC also works with AUSAID in Sri Lanka and Vietnam, working with farmers to enhance consistent resilience.
- There are other projects they are involved in with the Norwegian Ministry of Foreign Affairs, to further develop climate disaster aspects to the work of ADPC. This would address both hydro and metrological issues. They will assist ADPC to enhance observation systems for floods. ADPC also works with the National Hydro and Metrology Service (NHMS) and the communities on issues of flash floods, so they want to put in place a model for the river to monitor river flow, etc.
- They have access to empirical modelling systems – HBB, in particular for Myanmar. NBE, Norway provides access to rainfall runoff, primarily based on empirical information. Unfortunately this cannot include land use changes.
- Chao Phraya Basin received funding from USAID for a capacity development project
 - 1st phase/component 1: Understanding the needs of the community and what information would be useful to the community, while also providing the community with the knowledge on how to deal with floods; i.e. which place you need to evacuate when you have a flood. The 1st phase would be developed using information obtained to establish a training course on flood disaster risk management. The training was provided to RID, local government from 19 provinces in Chao Phraya in order to help develop the capacity of communities in flood prone areas to better prepare for floods.
 - 2nd phase/component 2: Focus on early warning activities working with TMD, DDPM, RID, etc. and using the Mr Warning system of the Department of Disaster Prevention and Mitigation (DDPM); forecast used to be primarily for landslide and flash flood, but now also includes river flooding.

- 3rd phase/component 3: information and networking in order to help support collaboration and flood risk information sharing with all stakeholders through a Flood Forum.

Technical agencies (such as RID) provide information on rainfall levels and what impact dam releases in the Chao Phraya will have on communities. At the community level, committees are in place that have an understanding of their community's threshold and they will judge the impact of the information that is provided. This enables the community to decide and create their own early warning system for the community, a plan of action based on the information they receive. They set up their own criteria for the various volumes that will be released from the dam. What the project tries to do is enable communities understand the information that is provided and who to contact for more information, etc. All information comes from RID and TMD.

Discussion on Project

ADPC also did something in Bangladesh, a DSS but not linked to models, but what they did is use used hazard mapping based on historical data, after developing this they inserted this in the DSS and introduced it to local government. The system was simple to ensure that it was easier to use and understand.

They are capable of doing drought forecasting. However, there are still areas to improve in seasonal forecasting. MME approach they feel is the most ideal right now for their operation

Future actions for F&D project

- Collaborate on various training courses that ACPD has. One way is see how they teach the community to understand the information that a DSS provides. And use this in the F&DMT project.

Thai Metrological Department (TMD)



Discussion with TMD, the following people participated in the meeting:

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About TMD

As the TMD's missions have been designed to carry on meteorological administrations and managements for the sake of 2 vital aims:

1. Guarantee the best economic, social, agricultural, and industrial benefits
2. Protect human lives and properties possessed by public members, private sectors and governmental units against natural disasters

It has been authorised to perform the following 5 duties:

1. To supply weather forecasts for the entire country and publicize disaster warnings to fulfill the requirement from administration and management in natural disaster mitigation
2. To build the people's awareness toward natural disasters; enable them to perform correct surviving practices; and reduce effects from natural disasters by using modern technologies together with IT services
3. To become the meteorological IT data and service center at the national level for users in any ventures
4. To improve and develop the Departments research works
5. To strengthen the Department's roles in international cooperation concerning meteorology and environment with the purpose of profound comprehension on changing world situation

Key minutes from meeting

TMD

- 1000 telemetering sites. Most of the data is provided to the government agencies, but not to be disseminated. Normally the government agencies can provide for free given that it has been requested; case by case requests.
- Chao Phraya is impacted by the management of two dams, this makes it interesting. Interested in 5 basins because they are based on natural factors, they are not controlled. This is useful for disaster monitoring.
- In the central part of the Chao Phraya there are also issues of drought
- Some developed products
 - QC in southern Thailand
 - Products form telemetering

- Heavy rainfall warning application (based on QPE FY)

Discussion

- Projection of climate scenarios that TMD run are based on 100 year projections on a 50 km downscaled resolution. Data on the RCM is from the UK office.
- TMD has experience with working on the impact of climate change in the Lam Dibang Basin (MRC project for 3 years, just complete)
- Hard to collect data, many institutes have data for one thing, and others for other information, there is not one main database. Different departments at the government scale have information, others do not have it. They hope that the Government Information System will help change this issue.
- TMD use seasonal forecasting information for F&D. However, it is important to define the kind of drought you are looking at; is drought in terms of hydrology, agriculture, metrology, socio-economic drought. They address all these types as all have their specific impacts.
- The government has data, but often they are reluctant to share with others, this is an issue at times.

Future actions for F&D project

- Follow up meeting with TMD on how to collaborate further with TMD as they have valuable information that can be used within the project.

Stockholm Environmental Institute (SEI)



Discussion with SEI, the following people participated in the meeting:

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About SEI

The Asia Centre in Bangkok plays a key role in fulfilling SEI's mission to bridge science and policy to help advance sustainable development, through research, capacity-building, and engagement with stakeholders.

Its work cuts across SEI's four research themes, but focused on two key areas:

- Climate change and resilient development in Southeast Asia: the governance of disaster risk and adaptation at multiple scales.
- Sustainable land, water, energy and food management (i.e. nexus planning), looking at cross-scale impacts of policy decisions on the resilience of livelihoods and the reduction of persistent poverty.

SEI Asia has expertise in adaptation science, environmental education, environmental engineering and sustainable infrastructure, environmental science, development communications, geochemistry, geography, hydrology and water resources engineering, natural resource management, rural and regional development planning, social economy, sociology and public policy.

Key minutes from meeting

Presentation by SEI on the organisation and some of the key projects:

- Independent, international research institute
- LEAP model for power networks and WEAP model for water networks (lumped model as Mike Basin)
- LEAP+WEAP link for water-energy nexus studies. Seamless energy-water system integration: cooling water, hydropower, groundwater pumping
- SEI is also engaged in the social side of Disaster Risk Management

Discussion

- Ministry of Interior (department of disaster prevention and mitigation) is responsible for defining if there is a drought in Thailand.
- One of the challenges is the communication of flood and drought indicators to policy makers and the public, (Chusit conducts research on this)
- In Thailand it is not worth using groundwater for irrigation.
- Thailand Development Research Institute (TDRI) has an ongoing project on flood impact on government institutes.
- The new paddy variations was one of the reasons for the flood event as the new paddy variations do not allow to be flooded, and areas that normally were flooded could not be flooded.

- The storage in the system from the small dams to the large reservoirs are critical for the flooding on the downstream areas. Reservoir operation faces complications with respect to the trade-off between flood and drought objectives.
- WEAP model exist in the North of Thailand and the ESAN area as well as eastern part of Thailand. A simple model exists for Bangkok, and another for the lower part of the Mekong Delta.

Future actions for F&D project

- Have a follow up meeting with SEI and identify how the various models (weADAPT, WEAP) they use can be applied in this project.

Electricity Generating Authority of Thailand (EGAT)

Discussion with EGAT, the following people participated in the meeting:

Name	Position/department	Email
Boonsong Peetanonchai	Survey Division Engineer level 11	Boonsong.p@egat.co.th
Chaiyuth Jarupattana	Chief, Water resources department	Chaiyuth.ja@egat.co.th
Maitree Foitong	Survey Division Engineer Level 10	maitree.f@egat.co.th

URL: <http://www.egat.co.th/en/>

About EGAT

EGAT is a state enterprise that owns and manages the majority of Thailand's electricity generation capacity, as well as the nation's transmission network.

EGAT is managed by the Ministry of Energy.

Most of EGAT's electricity is sold to the Metropolitan Electricity Authority (which supplies the Bangkok region) and the Provincial Electricity Authority (which supplies the rest of Thailand).

Key minutes from meeting

Presentation by EGAT on dry and wet season management of the reservoirs.

EGAT Responsibilities:

- Power system security(e. G. Guarantee minimum capacity in the dams for possible blackouts)
- Estimate water budget for the end of the flood season (31 Oct)
- Sub divide weekly water demands (provided by RID) into daily/hourly releases. Hydropower is used for peak hour demand.
- They have estimates of inflow and a water budget. They plan cropping area (for RID) based on water availability. Additional release of water for additional power generation.
- Using MIKE 11 model or trend analysis for planning of the water availability.
- Uses MIKE 11 + NAM model to evaluate the catchment runoff and the downstream impact.
- There are committees for the dry and rain season water planning. The chairperson of the rainy season committee is RID.

- The weather forecast from TMD is used to predict the inflow into the reservoir. The inflow needs to be estimated at the end of October (Mike 11 is used). The model is used for estimating planning for the dry season. This information is given to the dry season plantation committee.
- RID and EGAT plan together on water use and present this to the relevant committee, this is then reviewed and each organisation uses the information in their respective plans. There is a need to consider downstream constraints from each reservoir.
- One of the challenges is that EGAT often has to release more water than originally planned for irrigation which can result in a deficit. RID decides if the farmers should go for the 2nd crop. If they follow the advice they will be compensated. If they decide to go for the 2nd crop then it is at their own risk and they will not be compensated in case the crop fails.
- Seasonal forecast (3 month forecast based on TMD data and NAM model) is based on historical analysis of reservoir levels.
- At the moment they do not do long term planning taking climate change into account.

Future actions for F&D project

EGAT is a key stakeholder with respect to operational planning and as potential end-user of the DSS for their wet and dry season planning activities.

CWEIR, King Mongkut's University of Technology North Bangkok



Discussion with CWEIR, King Mongkut's University of Technology North Bangkok the following people participated in the meeting:

Name	Position/department	Email
Pinthong Panuwat	Director	Panuwat.pinthong@yahoo.com
Supitcha Thaikeaw	Researcher	cweirra@gmail.com

URL: <http://www.kmutnb.ac.th/en/>

Key minutes from meeting

- A Flood DSS was developed for RID which is in use for flood planning and forecasting.

- There was an idea to combine flood extension maps with land use maps to give an estimate of socio-economic impact of forecasted floods.
- The Planning DSS should be usable for irrigation projects, cropping area estimates and crop cycle planning.

Future actions for F&D project

- The project will explore the possibility of including the Bang Pakong basin.
- Get more information on the DSS that are being developed.

International Union for the Conservation of Nature (IUCN) - Thailand

Discussion with IUCN - Thailand, the following people participated in the meeting:

Name	Position/department	Email
Dr. Chamniern Vorrantnchaiphan	Country Representative, IUCN Thailand Programme	Chamniern.VORRATNCHAIPHAN@iucn.org

URL: <http://www.iucn.org/about/union/secretariat/offices/asia/>

About IUCN - Thailand

Conserving biodiversity is central to the mission of IUCN. IUCN demonstrates how biodiversity is fundamental to addressing some of the world's greatest challenges such as climate change, sustainable development and food security.

All of their work is framed by a Global Programme, developed with and approved by IUCN member organisations every four years, of which the current programme runs from 2012 to 2016.

Key minutes from meeting

IUCN is specifically working with more than 40 local organisations including the provincial administration.

The outcome is the development of a strategic plan for these basins as well as community mapping and capacity development on data collection and disaster management.

Overall IUCN links with local governments and connect with the national government organisations. The aim is to build the capacity at the local level and feed information to better inform national level processes. They are also trying to revitalise the basin committees.

Future actions for F&D project

Request more information on projects in which IUCN is working with the local governments in the Thadee, Tapi and Tram basins on water management. The aim is to collect and disseminate information on rainfall, flows and irrigation. There is an emphasis on community participation.

Provincial Waterworks Authority (PWA)

Discussion with PWA, the following people participated in the meeting:

Name	Position/department	Email
Mr Vutinun Pothongnard	Director of Engineering Department	vutinup@pwa.co.th
Mrs Kittiya Paosila	Chief of Business Development Section	kittiyap@pwa.co.th
Mr. Chamnien	Water Resources Department	

URL: <http://en.pwa.co.th/>

About PWA

The Provincial Waterworks Authority (PWA) is a Thai state enterprise under the Ministry of Interior. PWA has been responsible for the production of clean water supplies that are of WHO standard in response to the consumption demand of people in 74 provinces throughout Thailand (except Bangkok, Samut Prakan and Nonthaburi).

PWA has a total of 233 water utilities scattered throughout the country. These utilities (waterworks) are classified into 4 groups based on the number of their customers or connections listed below:

1. 169 small-scale water utilities have fewer than 15,000 connections in their service area.
2. 41 medium-scale water utilities have between 15,001 – 40,000 connections in their service area.
3. 14 large-scale water utilities have between 40,001 – 80,000 connections in their service area.
4. 9 special water utilities have over 80,000 connections in their service area.

Key minutes from meeting

- PWA have started the WSP process and applied to the 234 waterworks that they manage. The WSP are currently under review but there is the common WSP and each plant will develop their own detailed WSP based on their situation. They also have business continuity plans which aim to ensure water supply even during flood and drought events.
- There are measures in place to protect the intakes and pumping stations during flood events.
- They did have questions on how the DSS would work for them at the utility level and how they were interested in being involved in the project.

Future actions for F&D project

- Engage further with PWA to better understand what their needs are and where the gaps lie in terms of data, knowledge and capacity.

Concluding remarks



The F&DMT Project defines a need to develop a methodology that works both on a transboundary level and the local level. GEF projects tend to look just at the transboundary level. Lately there has been a push to put emphasis on end users, such as utilities (this is also why IWA is involved). Decision made at the regional level (basin) and the local level needs to be linked, the project looks to also address this aspect of inter-level communication. The methodology being developed will be an open system, meaning basin authorities, national authorities, utilities, etc. can take up the methodology and further develop to enhance their planning experience. The methodology will be flexible, i.e. stakeholders can develop their own indicators, are free to decide which models to use, pull experiences from other basins, etc.

A key part of the DSS is around data. DHI will look to use remote sensing and available data on the ground, to tailor to the situation of the country

Therefore, the intention of the project is to develop a DSS which will be tested and applied in 3 very different pilot basins; however the methodology will be available for all other basins. This also includes training modules available at the end of the project so that methods can be applied to other basins. Learning basins are not basins in which this methodology exists and is taking place. They are used to feed the project with relevant information and best practices that we can use to further develop the methodology.

The project will focus on the Chao Phraya Basin, but will consider the inclusion of Bang Pakong basin on the recommendation of RID and the University in Bangkok. The Bang Pakong basin has industrial areas affected by flooding, and upstream areas affected by drought. Salinity is also a main issue in this basin. One of the key concerns in including this basin is the lack of available data as few studies have been conducted focusing on this basin.

The climate in Chao Phraya is divided clearly into a wet and dry season. Wet and dry season planning is conducted in regular meetings between the key governmental institutions. The meetings address the flood and drought situation, early warnings and in particular possible control decisions. RID is chairing the meetings for dry season planning and HALL the meetings for wet season planning.

The project will work with the Hydro and Agro Informatics Institute (HAI) at the basin level. The Royal Irrigation Department (RID) is a key stakeholder in the Chao Phraya basin, and is responsible for the irrigation planning, and planning the dry season water allocation together with the Electricity Generating Authority of Thailand (EGAT) who are responsible for energy production in Thailand including hydropower generation.

It should be noted that each of the organisations involved in water management in the Chao Phraya have a network to collect information, so there is considerable replication in the system. Data is available; however access to information and identifying the best quality data will be the challenge.

The project also will test the DSS with end users focusing on water utilities – Metropolitan Water Authority (MWA) and the Provincial Water Authority (PWA). Other government stakeholders that have been informed of the project and will be involved depending on interest, including DWR, TMD GISTDA.

Additional stakeholders that the project will aim to actively collaborate with include SEI and ADPC.

There is a great need for improved communication between various institutions, in particular with the sharing of data. Consequently, there is the opportunity for the project to support the integration of information from different organisations and work with the various stakeholders to improve on their capacity to plan better for flood and drought events at their respective levels. The project also provides a unique opportunity to ensure collaboration and knowledge sharing between institutions and across scales (catchment to water utility).

The Stakeholder visit in Chao Phraya was the last of 3 stakeholder visits. The project has had 2 similar meetings in the Volta Basin (20 to 29 August) and in Lake Victoria (15 to 19 September). This will be followed by an Inception meeting with representatives from the basins in November, in which the revisions to the project components (i.e. objectives, activities and deliverables, etc.) are addressed and shared among all stakeholders.

Using the outputs of the stakeholder consultations and inception meeting, DHI will coordinate with their internal research projects as well as outside projects, and further develop the methodology which consists of the flood and drought decision support system. There will be follow up meetings within each basin in the next 6-12 months to verify the methodology and start testing among basins and end users (utilities).

Basin focal points (primarily IWA staff) will be used throughout the project, and will serve as a valuable local contact between the project team and the stakeholders. DHI will have direct contact with the key stakeholders, but keeping the focal points copied in any communication as they will be in a good position to further support continued cooperation.

Annex 1 – Organigram

Institutional arrangement on water management

