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सम्पादकीय

जलस्रोत तथा सिँचाइ विभागले देशमा उपलब्ध जलस्रोतको प्रभावकारी उपयोग गरी अधिकतम कृषि योग्य भूमिमा सिँचाइ सुविधा पुर्याउने उद्देश्य राखी आफ्ना कार्यक्रमहरु संचालन गर्दै आइरहेको छ । यिनै कार्यक्रमहरु तथा अन्य विभिन्न क्रियाकलापलाई समेट्दै “सिँचाइ गतिबिधि” पुस्तिका जलस्रोत तथा सिँचाइ विभागबाट प्रकाशन हुदै आइरहेको छ। यसको महत्वलाइ आत्मसाथ गर्दा गर्दै पनि बिगत करीब तीन दशक देखि प्रकाशन हुदै आइ रहेको सिँचाइ गतिबिधि बिबिध कारणले बर्ष २०७८ र २०७९ मा प्रकाशन हुन सकेन।

दीगो सिँचाइ व्वस्थापनका लागि सिँचाइ प्रणालीमा रहेका चुनौतिहरू जस्तै पानीको अभाव, जिर्ण पूर्वाधार, वातावरणीय सरोकारहरू लगायतका बिषयलाई सामना गर्न आधुनिक सिँचाई प्रणाली तथा प्रविधिको अबलम्बन गर्नु पर्ने छ। सिँचाइ प्रविधि र अभ्यासहरूमा नवीनतम प्रगतिहरू प्रतिबिम्बित गर्न पुस्तिकालाई आवधिक रूपमा अद्यावधिक गर्दै जानु पर्ने, विषयवस्तुलाई थप सान्दर्भिक र व्यावहारिक बनाउन विभिन्न क्षेत्रका सिँचाइ परियोजनाहरूको सन्दर्भ अध्ययन र सफलताका कथाहरू थप्दै जानु पर्ने हुन्छ ।

जलश्रोत तथा सिँचाइ विभागका गतिबिधिहरू तथा सो सम्बन्धी लेख रचनाहरू समावेश गरी यो पुस्तिका विगतमा चौमासिक तथा त्रैमासिक रुपमा प्रकाशन हुदै आइरहेको थियो। सिँचाइ गतिबिधिलाई द्रुत गतिमा विकास भएको डिजिटल मिडिया सँगै समय सापेक्ष बनाउदै पाठक समक्ष लैजानु पर्ने तथा आज भएका गतिबिधिलाइ इतिहासको रुपमा जगेर्ना पनि गर्नु पर्ने आवश्यक्ता महसुस गरी हाललाई यसलाई बिभागको वेब साइडमा डिजिटल रुपमा प्रकाशित गर्ने तथा केहि प्रति मात्रको कागजी प्रकाशन अर्धबार्षिक रुपमा गर्ने निर्णय गरिएको छ । त्यसैगरी विगतमा नेपाली र अग्रेंजी गरी दुइवटा भाषामा छुट्टा छुट्टै प्रकाशित हुदै आइरहेकोमा अब देखि एउटै अंकमा दुबै भाषा प्रयोग गरी प्रकाशन गर्न सकिने भएको छ। यसर्थ, सिँचाइ गतिबिधिमा प्रकाशन हुने जलस्रोत, सिँचाइ, ड्रेनेज, जल उत्पन्न प्रकोप आदि जस्ता बिषयहरूमा लेख, रचना, सूचना, तथाङ्क, अन्वेषण, खोज, प्रविधि, अनुसन्धान, प्रयोग, अभ्यास, सिकाइ आदि लगायत माथि उल्लेखित बिषयहरू नेपाली वा अग्रेंजी मध्ये कुनै पनि भाषामा लेखि सिँचाइ व्यवस्थापन महाशाखाको इमेल dwri.management@gmail.com मा पठाउनु हुन सरोकारित सबैलाइ अनुरोध गर्दै प्राप्त सामाग्रीहरू आवश्यक्ता अनुसार सम्पादन गरी निकटतम् समयमा प्रकाशन गर्ने व्यवस्था पनि गरिएकोछ । सदाभैँ पाठक तथा लेखक महानुभावहरुबाट हामीलाई आवश्यक सल्लाह, सुझाव र प्रतिक्रिया प्राप्त हुने नै छ भन्ने आशा राखेका छौ ।

सिँचाइ गतिविधि

महानिर्देशकको पदबहाली

जलस्रोत तथा सिँचाइ विभागमा मिति २०८०/०४/२९ गते देखि यसै विभागमा कार्यरत सहसचिब श्री चुर्ण बहादुर वली महानिर्देशकको रुपमा पद बहाली हुनुभएको छ भने तत्कालिन महानिर्देशक सुशील चन्द्र आचार्य उर्जा जलश्रोत तथा सिँचाइ मन्त्रालयमा सरुवा हुनु भयको छ ।

सिँचाइ दिवस एवं ७० औ वार्षिकोत्सव कार्यक्रम २०७९ (२०७९-१२-२५ गते शनिवार)

जलस्रोत तथा सिँचाइ विभागबाट सिँचाइ दिवस एवं ७० औं वार्षिकोत्सव कार्यक्रम मिति २०७९।१२।२५ (तद् अनुसार अप्रिल ८, २०२३) गते विभिन्न कार्यक्रम संचालन गरि सम्पन्न भएको छ । उक्त सिँचाइ दिवस उर्जा, जलश्रोत तथा सिँचाइ मन्त्रालयका माननीय मन्त्री श्री शक्ति बहादुर बस्नेतज्यूको प्रमुख आतित्थ तथा जलस्रोत तथा सिँचाइ बिभागका महानिर्देशक सुशिल चन्द्र आचार्यज्यूको अध्यक्षतामा जलस्रोत तथा सिँचाइ विभाग परिसरमा सन्चालन गरिएको थियो ।

उक्त कार्यक्रममा विशेष अतिथिको रुपमा लोकसेवा आयोगका माननीय सदस्य श्री माधव बेलवासे, योजना आयोगका माननीय सदस्य डा राम कुमार फुयाल मधेश प्रदेशका पुर्व प्रदेश प्रमुख श्री रत्नेश्वर लाल कायशथ, उर्जा जलश्रोत तथा सिँचाइ मन्त्रालयका सचिव (उर्जा) श्री दिनेश घिमिरे, जलश्रोत तथा उर्जा आयोगका सचिव श्री सुशील चन्द्र तिवारी, उर्जा जलश्रोत तथा सिँचाइ मन्त्रालयका सिँचाइ सचिव श्री गोपाल प्रसाद सिग्देल सहभागी हुनुहुन्थ्यो । उक्त कार्यक्रममा स्वागत मन्तव्य जलस्रोत तथा सिँचाइ बिभागका उपमहानिर्देशक श्री चुर्ण बहादुर ओलीबाट भएको थियो भने कार्यक्रमको उद्घाटन प्रमुख अतिथि माननीय शक्ति बहादुर बस्नेतज्यूबाट पानसमा दीप प्रज्वलन गरी गरिएको थियो । सो अवसरमा जलस्रोत तथा सिँचाइ बिभागका अर्का उपमहानिर्देशक श्री संजिव बरालबाट Investment for Sustainable Irrigation Development and Management in the Federal Context: opportunities and Challenges बिषयक कार्यपत्र पस्तुत गरिएको थियो । त्यसैगरि बिगत ७० बर्षमा सिँचाइ विकासमा भएको मुख्य मुख्य उपलब्धीहरूलाई श्रव्य दृश्य मा उतारी 70 years achievements in 7 minutes भन्ने दृश्यावलोकन सामाग्री प्रस्तुत भएको थियो। उक्त कार्यक्रममा बर्ष भरीमा जलश्रोत तथा सिँचाइ बिभागबाट अनिवार्य अवकास भई सेवा निवृत्त हुनु भएका कर्मचारीहरूलाई कदर-पत्र साथ दोसल्ला ओडाई सम्मान गरिएको थियो । साथै अतिरिक्त क्रियाकलाप तर्फ पुरूष र महिला तर्फका फुटसल खेलका बिजेता टिमलाई पुरस्कृत गरिएको थियो ।

द्विपक्षीय समिति बैठकहरु (Bilateral Committee Meetings)

आ.ब. २०७९/०८० मा नेपाल र इन्डिया बीच जलस्रोत तथा सिँचाइ सम्वन्धी बिबिध बिषयहरूमा बिभिन्न तहमा द्विपक्षीय समितिका बैठकहरू भएका थिए, जसमा Joint Committee on Water Resources (JCWR) को ९औं बैठक २३ सेप्टम्बर २०२२ मा काठमाण्डौमा सम्पन्न भयो भने Joint Standing Technical Committee (JSTC) को ७ औं बैठक सेप्टेम्वर २१-२२ मा भएको थियो । त्यसैगरी The Joint Committee on Koshi and Gandak Projects (JCKGP) को दशौं बैठक ९ मार्च २०२२ देखि १३ मार्च २०२२ मा भारतको पटनामा भएको थियो। सोही अनुरुप Nepal–India Joint Committee on Inundation and Flood Management (JCIFM) को १४ औं बैठक मिति ९-१३ मार्च २०२२ मा नेपालको काठमाण्डौमा भएको थियो।

उर्जा, जलश्रोत तथा सिँचाइ मन्त्रालयमा नयाँ मन्त्री तथा सचिवको पदबहाली तथा जलश्रोत तथा सिँचाइ विभागमा स्वागत

मिति २०७९ चैत्र १९ गते देखि उर्जा जलस्रोत तथा सिँचाइ मन्त्रालयका माननीय मन्त्रीको रुपमा श्री शक्ति बहादुर बस्नेतले पदभार समाल्नु भएको छ। वहाँको स्वागतार्थ मिति २०७९ चैत्र १९ गते आइतबार जलश्रोत तथा सिँचाइ बिभागले यसै बिभागका तत्कालिन महानिर्देशक श्रीमान् सुशील चन्द्र आचार्यको सभापतित्वमा स्वागत तथा परिचयात्मक कार्यक्रमको आयोजना गरेको थियो। उक्त कार्यक्रममा माननीय मन्त्री श्री शक्ति बहादुर बस्नेतले आफ्नो निर्देशन सम्बोधनको क्रममा विभागका समस्याहरूलाइ मन्त्रालयको समस्याको रुपमा मन्त्रीपरिषदमा आफुले लैजाने बचन बद्दता व्यक्त गर्दै काम गर्ने सोच, तरीका, संरचना, संयन्त्र लगायतका बिषयहरूलाई अफ सुदृढिकरण गर्न आवश्यक रहेको उल्लेख गर्नु भएको थियो ।

कार्यगत प्राथमिकिकरण तथा एकरुपता कायम गर्दै हाल देखिएको आयोजना निर्माणको लागि तोकिएको समय भन्दा बढी समय लाग्ने प्रवृतिलाई निरुत्साहित गर्ने र प्रगतिलाइ बित्तीय र भौतिक रुपमा मात्र मापन नगरी समय सीमामा सम्पन्न हुन सक्यो वा सकेन भन्ने कुरालाइ समेत आधारमानी यसलाई पनि प्रगतिमा मापन गर्न जोड दिनु पर्ने उल्लेख गर्नु भयो । कुन आयोजनालाइ कति स्रोत साधन आवश्यक हो वस्तुनिष्ठताको साथ एकिन गरी यथार्थपरक भइ उपलब्ध स्रोत साधनको उच्चतम प्रयोगबाट आशातित प्रगति लिनु पर्ने बताउनु भयो । माननीय मन्त्रीज्यूबाट हाल भएको व्यवस्था र देशको अवस्थाको खाडल पुर्नेगरी कार्यक्रम तयार गर्ने र सोही बमोजिम कार्य गर्न निर्देशन दिनु भएको थियो।

त्यसैगरी मिति २०७९ माघ ८ गते देखि उर्जा जलस्रोत तथा सिँचाइ मन्त्रालय अन्तर्गत जलश्रोत तथा सिँचाइ तर्फको सचिव पदको पदबहाल गर्नु भएका श्रीमान गोपाल प्रसाद सिग्देलज्यूलाई स्वागत सहित मिति २०७९।१०।१० मा सिँचाइ विभाग परिसरमा जलश्रोत तथा सिँचाइ विभागका तत्कालिन महानिर्देशक श्रीमान सुशील चन्द्र आचार्यको सभापतित्वमा परिचयात्मक कार्यक्रमको आयोजना भएको थियो । उक्त कार्यक्रममा श्रीमान् सचिव ज्यूबाट आफ्नो निर्देशनात्मक सम्वोधनका क्रममा सिँचाइ मिति २०७९ टुङ्गोमा पुर्याउन अत्यावस्यक भएको बताउदै बहुउदेश्यीय आयोजना जसले सिँचाइ, खानेपानी तथा विद्युतिकरण लगायतलाई समेट्छ यी बिबिध आयामहरुको व्यवस्थापनका लागि सिँचाइ ऐन आवश्यक रहेकाले सोको शिघ्र तर्जुमा गरी पारित गर्नु पर्ने कुरालाई जोड दिनु भयो। यसै क्रममा वहाँले सिँचाइ ऐनमा सिँचाइ मर्मत सम्भारलाई छुट्टै कानुन बनाई सिँचाइका समस्या समाधान हुने प्रावधान राखी छुट्टै कम्पनी मोडेलबाट पनि कार्यान्वयन गर्न सकिने बताउनु भयो। यसका साथै वहाँले ठूला ठूला रिजर्भभ्वायरबाट हुने सिँचाइ सुबिधाको बारेमा इन्गित गर्दै सो बाट के कति एरियामा बाह्रै महिना सिँचाइ पुग्न सक्छ, यसबाट के कति फाइदा हुन्छ भन्ने बारेमा गहन अध्ययन विश्लेषण गरी गर्नु पर्ने उल्लेख गर्नु भयो । स्वागत कार्यक्रमका क्रममा भएको प्रस्तुतिकरणको बिषयलाइ जोड्दै वहाँले करिब १५ लाख हेक्टरबाट २५ लाख हेक्टरमा सिँचाइ सुबिधाको लागि संरचना पुर्याउनु राम्रो कुरा भए तापनि सिँचाइ सुबिधा पुगेको मध्ये जम्मा ३० प्रतिशत खेती योग्य जमिनमा मात्रै बाह्रै महिना सिँचाइ सुबिधा पुग्न सक्ने हालको अवस्थामा गम्भिर हुन जरुरी रहेको बताउनु भयो। यसकालागि नदी डाइभर्सन आयोजना तथा पानी संकलन गर्ने रिजर्भभ्वायर निर्माण गरी बाह्रै महिना सिँचाइ सुबिधा पुर्याउनु तर्फ बिभागको ध्यान जानु पर्ने बताउनु भयो ।

उर्जा, जलश्रोत तथा सिँचाइ विभागमा नयाँ जनशक्तिको प्रवेश

आर्थिक वर्ष २०७९/०८० श्रावण महिनामा नेपाल इन्जिनियरिङ्ग सेवा, सिभिल इरिगेशन समूहका २४ जना इन्जिनियरहरू लोक सेवा आयोगबाट सिफारिस भै आएका मध्ये १७ जनाको यस विभागमा पदस्थापना भएको थियो । नबनियुक्त इन्जिनियरहरूलाई १ हप्ताको अभिमुखिकरण तालिम दिई विभिन्न जिम्मेवारीमा खटाइएको थियो । उक्त तालिममा सिभिल इरिगेशन तर्फका २४ जना र २ जना मेकानिकल तर्फका गरी २६ जना इन्जिनियरहरूको सहभागीता रहेको थियो ।

नेपालमा सिँचाइ विकासको हाल सम्मको प्रगति

आयोजनाको प्रकार	सिंचित क्षेत्रफल (हेक्टर)			
	०७८/७९ सम्मको उपलब्धी	आ.ब. २०७९/८० को लक्ष्य	आ.व. २०७९/८० को उपलब्धि	आ.व. २०७९/८० सम्मको उपलब्धि
सतह सिँचाइ, हे.	१०,१६,४९६	६,०००	६,२३९	१०,२२,७३५
भूमिगत सिँचाइ, हे.	५,१३,५२४	१५,०००	१७,१३०	५३०,६५४
लिफ्ट सिचाई	१,०४९	१,४००	१०७०	२,११९
कूल जम्मा, हे.	१५,३१,०६९	२२,४००	२४,४३९	१५,५५,५०८

आयोजनाको प्रकार	तटबन्ध तथा जग्गा उकास			
	०७८/७९ सम्मको उपलब्धी	आ.ब. २०७९/८० को लक्ष्य	आ.व. २०७९/८० को उपलब्धि	आ.व. २०७९/८० सम्मको उपलब्धि
तटबन्ध (कि.मी.)	१,२८८.२४	६१.९६	७६.२५	१,३६४.४९
जग्गा उकास (हे.)	१२,५५२.३	३२२	२३३.५८	१२,७८५.८८

जलस्रोत तथा सिँचाइ सम्बन्धी लेख रचना

झापा भूमिगत जल सिँचाइ आयोजना: एक परिचय

परिचय

धान, मकै र अन्य बालीहरुको मुख्य क्षेत्र मानिएको झापा जिल्लामा कृषि उत्पादनको प्रचुर सम्भावनाका बावजुत भरपर्दो सिँचाइ सेवाको अभाब तथा कृषिका लागि उन्नत बिउबिजन, मलखाद तथा प्राबिधिक सेवाको अभावको कारण उत्पादन वृद्धिको साटो ह्रास हुदै गएको देखिन्छ। यसबाट तराईको आर्थिक विकास तथा त्यहाँका जनताको सम्वृद्धिमा अपेक्षित वृद्धि हुन नसकिरहेको सन्दर्भमा सो क्षेत्रको सम्वृद्धिको लागि भरपर्दो सिँचाइ सेवाको व्यवस्था गरि किसानको आयआर्जनमा बृद्धिका साथै स्थानिय स्तरमा रोजगारी सिर्जना गरिने कृषियोग्य जमिनमा भूमिगतजलको माध्यमबाट सिँचाइको सेवा र सुबिधा विस्तार गर्न राष्ट्रिय योजना आयोगको मिति २०७८/०७/०५ को निर्णयानुसार झापा जिल्लाको (भद्रपुर न.पा.(वडा नं. १,२,३ र केचनाकवल गा.पा. (वडा नं. १ देखि ७) जम्मा ७००० हेक्टर) क्षेत्रमा सिँचाइ सुविधा पुर्‍याउने उद्देश्यले डीप ट्यूववेल कार्यक्रमहरु कार्यान्वयन गर्ने स्वीकृति प्राप्त भइ चालू आ.व. २०७९/८० देखि झापामा कार्यालय स्थापना भई कार्यान्वयनको चरण रहेको छ। ऊर्जा, जलस्रोत तथा सिँचाइ मन्त्रालयको मिति २०७८/१०/११ को स्वीकृत खरिद गुरुयोजना अनुसार करिब ५ वर्षको अबधिमा निर्माण सम्पन्न हुने यस आयोजनाको कुल अनुमानित लागत रकम रु. २,५१,१२,००,०००/- (अक्षरुपी रु. दुइ अर्ब एकाउन्न करोड बाह्र लाख मात्र) रहेको छाआयोजना अन्तर्गत भद्रपुर न.पा. र कचनकबल गा.पा. मा १७५ वटा डिप ट्युववेल सिँचाइ प्रणालीका आबश्यक संरचनाहरु निर्माण गरिने योजना रहेको छ। यस आयोजनाको कार्यक्षेत्र झापा जिल्लाको भद्रपुर न.पा. को १,२ र ३ वडा तथा कचनकवल गा.पा. का ७ वडाहरु रहेकोमा ऊर्जा, जलस्रोत तथा सिँचाइ मन्त्रालयको मिति २०७९/१०/२० को मन्त्रीस्तरीय निर्णयानुसार आयोजनाको कार्यक्षेत्र सम्पूर्ण झापा जिल्ला र इलाम जिल्लाको दक्षिणी भाग समेत समेट्ने गरी विस्तार भएको छायसरी वृहत कार्यक्षेत्र भएको यस आयोजनाले आफ्नो निर्धारित लक्ष्य समयमै हासिल गर्नेको लागि योजनाबद्ध, आवश्यकता र प्राथमिकताको आधारमा डिप ट्युववेलहरुको निर्माण र विकास गर्दै जानुपर्ने आवश्यकता देखिन्छ।

२. आयोजनाको उद्देश्यहरु

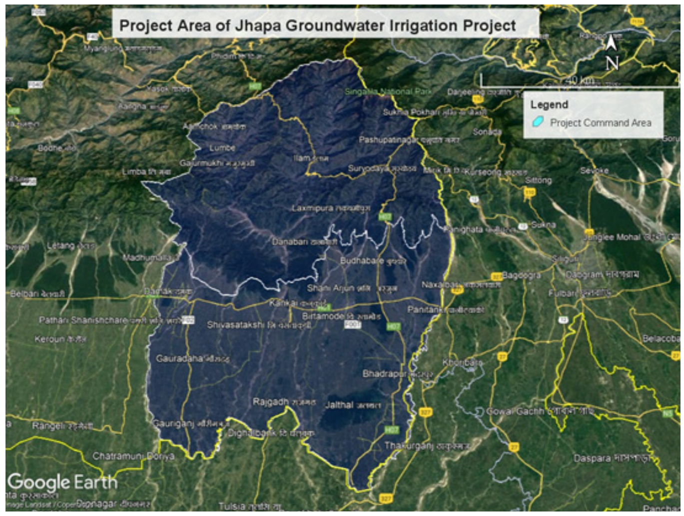
यस आयोजनाबाट झापा र इलाम जिल्लाका कृषियोग्य भूमिमा बाह्रै महिना भरपर्दो सिँचाइ सुबविधाका लागि उपलब्ध स्रोत तथा संभावनाका आधारमा भूमिगत जल सिँचाइ प्रणालीको विस्तारका कार्यक्रमहरु विभिन्न निकायहरुको सहकार्यमा संचालन गरिनेछ। आयोजनाका प्रमुख उद्देश्यहरु निम्न अनुसार रहेका छन्।

१. भूमिगत जल सिँचाइ प्रणालीको माध्यमबाट भरपर्दो दिगो सिँचाइ सेवा विकास गर्ने।

२. कृषि उत्पादनमा बृद्धि गर्न सिँचाइ र कृषिको प्रचार प्रसार तथा कृषकहरको क्षमता अभिबृद्धिका लागि विविध कार्यक्रम गर्ने।

३. आयोजनाको कार्यक्षेत्र

आयोजनाको कार्यक्षेत्र झापाको सम्पूर्ण स्थानिय निकायहरु र इलाम जिल्ला दक्षिणी भुभागहरु रहेको छ।



चित्र १. आयोजनाको कार्यक्षेत्र

४. आयोजनाको विस्तृत विवरण

क्र.स.	आयोजनाको नाम	झापा भुमिगत जल सिँचाइ आयोजना
१	आयोजनाको लक्ष्य	प्रस्तावित कार्यक्रमबाट भूमिगत डीप ट्युववेल निर्माण बाट सतह सिचाइको संभावना नभएको स्थानमा भुमिगत जलको प्रयोग गर ७,०१९ हे. कृषि योग्य भूमिमा सिँचाइ सेवा विस्तार हुने।
२	आयोजनाको उद्देश्य	झापा जिल्लाको भद्रपुर नगरपालिका र केचनाकवल गाउपालिकाका विभिन्न क्षेत्रमा भूमिगत सिँचाइ सेवाको विकास र विस्तार गर्ने।
३	आयोजनाको लक्षित प्रतिफल	कृषकहरुलाई व्यवस्थित सिँचाइ सेवा उपलब्ध गराई कृषि उत्पादनमा दोब्बर बृद्धि तथा रोजगारी उपलब्ध हुनगई गरिवी न्यूनिकरणमा टेवा पुग्ने।
४	क्रियाकलापहरु	डिप ट्युववेल निर्माण, पम्प घर निर्माण, पम्प जडान, विद्युतिकरण, वितरण प्रणाली, सस्थागत बिकास, सामाजिक परिचालन आदी।
५	कार्यान्वयन क्षेत्र	झापा जिल्लाको भद्रपुर नगरपालिका र केचनाकवल गाउपालिका
६	आयोजना अबधी	५ बर्ष
७	आयोजनाको कुल अनुमानित लागत	रु. २,५१,१२,००,०००/- (अक्षरुपी रु. दुइ अर्ब एकाउन्न करोड बाह्र लाख मात्र)
८	चालू आ.व. २०७९/८० मा विनियोजित बजेट	रु.२४, १८,००,०००।०० (अक्षरुपी रु. चौबिस करोड अठार लाख मात्र)

५. आयोजनाको कार्यालय

चालू आ.व. २०७९/८० मा बजेट विनियोजितद्वार झापा जिल्ला, शिबसताक्षी नगरपालिका वडा न. १०, माईधार मा कार्यालय स्थापना भई आयोजनाको कार्य स'रु भएको छ।

चित्र २. कार्यालय भवन

६. आयोजनाको आ.व. २०७९/८० को प्रगती

यस आयोजनाले आ.व.२०७९/८० मा ४९ गोटा डिप ट्युववेल निर्माण, १८ गोटा पम्पघर र ट्याङ्की निर्माण, १६ गोटा पम्प सेट जडान, १६ गोटा विद्युतीकरण र १५ गोटा वितरण प्रणाली निर्माण सम्पन्न गरि ९९.५१% वित्तिय र ९९.४१ % भौतिक प्रगती का साथ उल्लेखनिय उपलब्धि हासिल गरेको छ ।

कम्प्रेसरबाट पानी निकाल्दै

विद्युतीकरण सहितको संरचना

आउटलेट सहितको वितरण प्रणाली

आउटलेटबाट निकालिएको पानी

७. आयोजनाको आगामी कार्य योजना

ञस आयोजनाले झापा र इलाम जिल्लाका कृषि योग्य जमिनमा भुमिगत जल सिँचाइ प्रणालीको माध्यमबाट दिगो सिँचाइ सुविधा विस्तार गर्न योजनाबद्ध डीप ट्युववेलहरु र संरचनाहरको निर्माण, स्वीकृत गुरुयोजना अनुरुप विविध क्रियाकलापहरु गर्ने साथै सिँचाइ र कृषि प्रचार प्रसार तथा किसानहरुको क्षमता अभिबृद्धि गर्ने कार्य योजना रहेको छ।

८. सारांश तथा निष्कर्ष

धानको मुख्य क्षेत्र मानिएको झापा जिल्ला र लाम जिल्लाको कृषि योग्य जमिनमा भुमिगत जल सिँचाइ प्रणालीको संचालनबाट समयमै सिँचाइ सुविधा विस्तार गर्न सकिएको खण्डमा यहाको कृषि उत्पादन बृद्धि हुन गई किसानको आयआर्जन र जीवनस्तर सकारात्मक परिवर्तन हुने बिषयलाई मध्येनजर गरि आयोजना समयमै सम्पन्न गर्नको लागि विभाग र मन्त्रालयले प्रमुख महत्वका साथ लिनुपर्ने आवश्यकता देखिन्छ ।

Research work to identify the impact of climate change in the peak flow and performance of river training work in Karnali River

Authors: Yogendra Mishra,
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Introduction

Flood is a natural phenomenon that occurs when the volume of water flowing in system exceeds its total water holding capacity. Each year many people are killed and made homeless by floods. Private and public properties as well as expensive and often precious infrastructures are damaged. In order to minimize the impact of floods, an effective flood management is required. Now climate change is appear in another dimension of the flood. Climate change has significantly exacerbated the occurrence and intensity of floods around the world. As global temperatures rise, so does the amount of moisture in the atmosphere, leading to more frequent and severe rainfall events. This intensification of rainfall patterns has led to increased instances of flash floods and river flooding, overwhelming natural drainage systems and infrastructure.

Irrigation Feasibility Study and Quality Construction Program has conducted a study to assessment the future peak flow and analyze the performance assessment of the existing river training work of the Karnali River. The first part of our the research focused on the impact of climate change in the peak flow and the second part focus on the performance of existing and ongoing river training work in Karnali river.

Peak flow estimation

The Soil & Water Assessment Tool (SWAT) model is used to estimate the peak discharge. The major steps in modeling are basin delineation and river network extraction, Hydrologic Response Unit (HRU) definition, climate station formation, parameter sensitivity analysis, calibration, and validation. As per the Digital Elevation Model (DEM) and information from the digital stream network, the Karnali River Basin was delineated into different sub-basins. These sub-basins were further divided into different HRUs using the HRU definition threshold of 10% for each land use, soil, and slope. To account for orographic effects on both precipitation and temperature, SWAT allows up to 10 elevation bands to be defined in each sub basin. In this study, we generated 500 m elevation range band in each sub basin. TLAPS and PLAPS are also taking consideration during sensitivity analysis of the model.

The calibration results depict good agreement between observed and simulated data with NSE = 0.86 and R2 = 0.87. The validation result also depicts good agreement between observed and simulated data with NSE = 0.76 and R2 = 0.82 in daily simulation. The study shows that an average observed river discharge is 1410m3/s and the average simulated river discharge is 1950 m3/s (NF), 2060m3/s (MF) and 2200m3/s (FF). The maximum discharge obtained in the year 2035 with peak annual discharge 12750 m3/sec and the minimum annual peak will be obtained in the year 2033 with 6564 m3/sec. In the against of this, the observed flow in the same point is the maximum discharge obtained in the year 2000 with the value of 11300 m3/sec and the minimum annual peak will be obtained in the year 2004 with 5960 m3/sec. It indicates that the peak discharge will increase in future and we should design our structure accordingly. The figure 1 shows a comparison of annual peak discharge at Chisapani outlet in near, mid and far future under ssp245 to the observed discharge from 1995 to 2008.

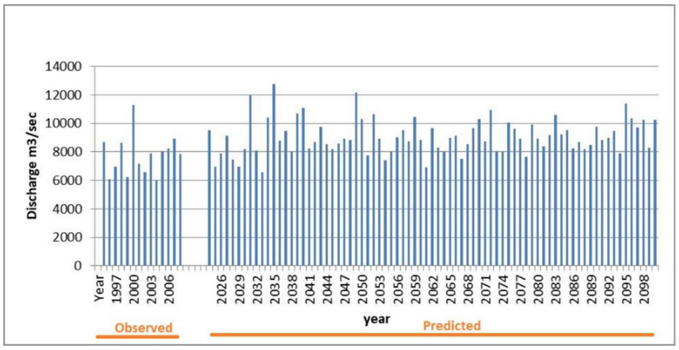

Figure 1. Comparasion of annual peak discharge at Chisapani outlet in near future, mid future and far future under ssp245 and observed discharge from 1995 to 2008

Performance assessment of river training structures

The second part of the study is to analyses the performance of the river training structure of the Karnali River. Studying the performance analysis of river training work is important for assessing the effectiveness, risks, environmental impacts, economic considerations, and opportunities for improvement. It enables informed decision-making, adaptive management, knowledge sharing, and the development of sustainable river management practices. The river training work in the Karnali River has been implementing for more than 10 years from the Rani Jamara Kulariya Irrigation Project and Karnali river management project. The performance is evaluated by two methods. The first one is identify the physical condition of the structures, their performance in site and observe the river morphology. And second is questioner survey to the local people, those are staying near the river bank.

The embankments and spurs are the major structures built in the bank of the Karnali River. Most of the structures are in good condition and well performed. Figure 2 shows the location of those structures. The study findings that, erosion of river bank has decreased as it before project. Sedimentation and flooding problem are considerably reduced. Construction of embankment road performs well for agriculture purpose. Majority of the beneficiary are satisfied with the performance of river training structures. However periodic institutional strengthening activities/trainings will be helpful even after the completion of project. The intervention of river training project has positive impacts on socio-economic condition of beneficiary farmers. Proper outlet work for sheet flow is required for various places. The satisfaction level of beneficiary towards the project is quite acceptable. Stakeholders asked for their involvement in maintenance of the river training structure.

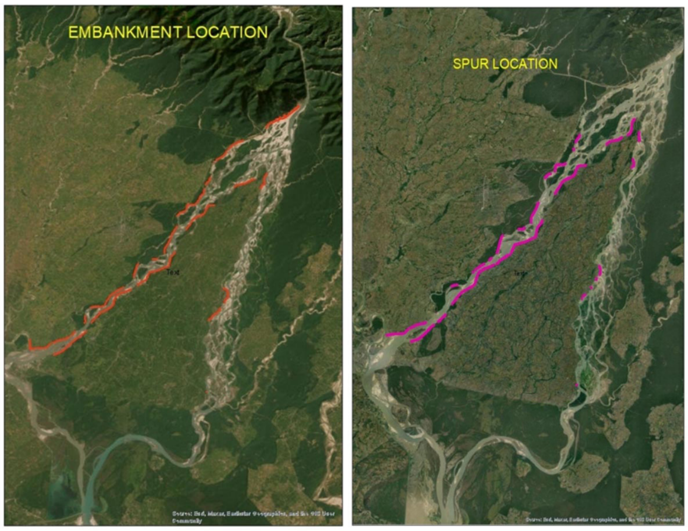

Figure 2. Location of the embankment and spur in Karnali River

Conclusion

The study found that construction of river training structure by using big boulder stone gives high performance. Beneficiaries are demanding for complete reach of river training works to remove the flooding problem. The beneficiaries are complained for contractor working progress that they were not complete the construction work on time and Periodic monitoring and evaluation along with performance evaluation is essential to give sustainability of sub project. Finally, the performance of river training work is good and it protects many agricultural land as well as settlement in Bardiya and Kailali district. The study also shows that, due to the climate change, the peak flow will increase in future and we should design our structures accordingly.

Conjunctive Use of Surface and Ground-water

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Conjunctive use implies the planning of harnessing of Groundwater and surface water resources to achieve optimal utilization of total water resources. It is integrated use of inter-relationship existing between surface and groundwater, it is possible to utilise, during critical periods, the surplus of one to tide over the deficit of the other. Thus, groundwater may be used to supplement surface water supplies to reduce peak demands for irrigation or to meet deficits in years of low rainfall.On the other hand, surplus surface water may be used in overdraft areas to increase the groundwater storage by artificial recharge.

Advantages of Groundwater use include:

- Groundwater storage remains practically unaffected by development.
- Groundwater sources offer more dependable yields than surface reservoirs.
- The physical and chemical quality of groundwater is more consistent than that of surface water.
- Groundwater is less prone to pollution, and any pollutants are naturally removed or diluted during groundwater movement.
- Groundwater is free from sediment load and temperature fluctuations.
- Subsurface storage is possible,without loss of water spread area of surface reservoirs, facilitating cultivation.
- Groundwater can be used where and when needed, without seepage and evaporation losses during storage and transmission.
- Groundwater development schemes have shorter gestation periods.
- Groundwater has minimal ecological hazards compared to surface projects.
- Storing water underground is usually more cost-effective than surface storage work.

Disadvantages of Surface water development compared to groundwater include:

- Evaporation: Large open water areas in surface reservoirs are exposed to high evaporation rates, resulting in significant water losses, sometimes exceeding 20 percent of the average annual runoff. In cases where the impounded valley is wide, the open water area is larger, leading to even higher evaporation losses.
- Sedimentation: Soil erosion in the catchment results in siltation in the surface reservoir and in the equivalent reduction of the storage capacity over time. The more the arid climate, the less the vegetation cover the higher the probability of sediment accumulation in the surface reservoirs.
- Environmental impact: Surface reservoirs may have negative environmental impacts, such as adverse effects on human health and other ecosystems.

Constraints that restrict the exploitation of groundwater and necessitate creation of surface reservoirs include:

- Saline groundwater areas require surface water.
- Areas with limited groundwater resources must rely on surface water.
- Relying solely on wells for large water supply has the potential for adverse interference and land subsidence due to excessive withdrawals.
- Groundwater development requires energy, while surface water is gravity-fed.
- Surface water reservoirs serve multiple uses such as power generation, flood control etc.
- Surface water generally has lower in miniralisation compared to groundwater.

In recent years, the conjunctive use of groundwater with surface water has gained significant attention as an important water management practice in irrigation project command areas.Planning for conjunctive use in the command area involves conducting an inventory of land and water resources, as well as identifying areas suitable for surface irrigation, groundwater irrigation, or a combination of both to ensure optimal utilization of water resources.

The basic studies required for conjunctive use include evaluating hydrometeorological, hydrological, and hydrogeological conditions, assessing seepage rates, examining water quality, analyzing aquifer properties and potentials, determining well yields, and assessing potential interference effects due to pumping from other wells, canal flows, and stream discharges.

The beneficial effects of conjunctive use of Groundwater and Surface-water include:

- Helps reduce peak demands for irrigation, leading to smaller size of canals and lower construction costs.
- Supplemental supplies from groundwater ensure proper irrigation scheduling, allowing for raising multiple crops, and early sowing, even in cases of delayed rainfall.
- Increased water resources ensure adequate supply to tail-end areas and areas of higher elevation.
- Groundwater exploitation lowers the water table and reduces the risk of waterlogging and wastage of water for leaching soils. This leads to saving is drainage network size due to reduced subsurface outflow.
- Surface and subsurface outflows are minimised, resulting in a reduction in peak runoff and flood discharge.
- Constraints and deterrents in implementing conjunctive use programs.
- Possibility of deterioration in groundwater quality due to influx of salts leaching down from the soil because of recycling within cones of depression and or upward and lateral migration of saline water into freshwater zones in response to pumping.
- ncreased power consumption to sustain pumpage from wells, possible disruption of groundwater supplies due to power failure in critical periods and decrease in pump efficiencies due to large fluctuations in water levels.
- Operation, supervision and control of conjunctive se and artificial recharge projects are more complex compared to traditional water management approaches.

Underground storage availability and production capacity of the aquifer

The groundwater reservoirs should present sufficient free space between the ground surface and the water table to accommodate and retain the water to be recharged, for the period during which water is not needed. This condition requires accurate hydrogeological investigations including geological mapping, geophysics, and reconnaissance drilling to determine the configuration and the storage capacity of the underground reservoir.

The suitability of an aquifer for recharging may be estimated from the following parameters:

- Surface materials must be highly permeable to allow water to percolate easily.
- Unsaturated zones should present a high vertical permeability and vertical flow of water should not be restrained by less permeable clayey layers.
- The depth to water level should not be less than 5 to 10 m.
- Aquifer transmissivity should be high enough to allow water to move rapidly from the mound created under the recharge basin but should not be too high so that water cannot be recovered.

Artificial Recharge

Artificial recharge of aquifers can be achieved using three different methods, namely surface spreading, watershed management (water harvesting) and recharge wells.

- Surface spreading: it consists of increasing the surface area of infiltration by releasing water from the source to the surface of a basin, pond, pit, or channel. This is certainly the most efficient and most cost-effective method for aquifer recharge. However only unconfined aquifers can be recharged by this method which required large surface area to accommodate the recharge scheme, allowing water to evaporate if percolation in the ground is slow.
- Watershed management and water harvesting: This method offers an effective method to intercept dispersed runoff. Many techniques of water conservation have been developed along hill slopes with the intention of preventing soil erosion and reducing surface runoff, then increasing the infiltration in the ground, thus recharging the aquifers.
- Recharge wells: Artificial recharge by injection consists of using a conduit access, such as a tubewell, shaft or connector well, to convey the water to the aquifer. It is the only method for artificial recharging of confined aquifers or deep-seated aquifers with poorly permeable overburden. The recharge is instantaneous and there are no transit or evaporation losses. The method is very effective in the case of highly fractured hard rocks.

Groundwater potential and abstraction in Nepal

Nepal possesses abundant water resources. A significant proportion of water resources distributed throughout the country, including glaciers, snow covers, rivers, springs, lakes, and groundwater, with over 6,000 rivers and rivulets with a cumulative length of 45,000 km. The distribution of rainfall in Nepal is extremely uneven in time and space, annual precipitation increases from 1200 mm in the foothills to 3500 mm and higher on the southern slopes of the high Himalayan range. Approximately 60–85 percent of annual runoff of all river systems in Nepal occurs during the three months rainy period from July to September, necessitating the development of groundwater in many areas including the area already under canal irrigation particularly in the Terai region, which has a substantial potential for groundwater resources.

The hydro-geological mapping of Nepal indicates that the Terrain has a tremendous potential of groundwater resources. The estimated groundwater recharge in specific areas of Nepal can be as high as 600 mm per annum, but overall, it is assumed that the recoverable recharge figure for the entire terrain area is around 450 mm. Based on these estimates, the rechargeable groundwater in the Terai region is estimated to be anywhere between 5.8 - 11.5 billion cubic meters.

The Terai region in Nepal covers approximately 20 percent of the country's total area and is characterized by elevations below 300 meters from mean sea level. Out of the total cultivable area of Nepal, around 34 percent, which amounts to about four million hectares, is located in the Terai. Geomorphologically, the Terai is the northern edge of the Gangetic Plain, extending from 20 km to 50 km in width. The altitudes in the Terai range from 100 to 300 meters above mean sea level. The region is composed of alluvial coarse gravels in the north near the foothills of the mountains and gradually transitions to finer sediments towards the south.

Based on preliminary hydrogeological studies, the unconsolidated loose sediments in the Terai and inner Terai regions, as well as the karstified and fractured rocks in the midland and Tethys group, have shown to possess a significant potential as groundwater sources.

In the Terai region, groundwater is found in unconfined shallow aquifers located approximately within 50 meters below ground level, as well as in semi-confined to leaky confined deeper aquifers at depths of around 450 meters bgl. Currently, approximately 22 percent of the available dynamic groundwater recharge in the Terai is being utilized. The transmissivity value, which indicates the ability of the aquifer to transmit water, varies in the shallow aquifer of the Terai region, ranging from less than 10 to over 10,000 square meters per day (m^2/day)

Groundwater abstractions from the aquifers in the Terai region account for less than 20 percent of the total estimated recharge, which is approximately 5,800 million cubic meters (MCM). The Terai sediments benefit from heavy monsoon precipitation and year-round snow-fed river systems, resulting in a high potential for groundwater resources. The aquifer system is highly sensitive to precipitation patterns. As per the National Water Plan of Nepal, an estimated 756 MCM of groundwater resources are currently utilized for irrigation purposes, while 297 MCM are used for domestic purposes in the Terai.

Conjunctive use Practice in Nepal

The figures given above indicate significant untapped potential for groundwater utilization in different sectors. However, none of the irrigation system in the country have so far formulated clear-cut operational plan for conjunctive use in any irrigation command area or projects though some attempts through research and extension agencies have been undertaken and developed in the country.

Groundwater is considered the most suitable alternative source of water supply in the Terai region. Consequently, government agencies have been dedicated to developing groundwater for irrigation purposes in specific districts of the Terai for the past three decades. However, there has been a lack of comprehensive efforts to integrate the management of both surface water and groundwater resources. Currently, no irrigation system in the country has formulated a clear operational plan for conjunctive use in any irrigation command area or projects. Implementing a planned approach to conjunctive use that optimizes the utilization of surface water during the wet season and available groundwater during the subsequent dry season would not only meet crop water requirements but also enhance agricultural productivity in the region.

Furthermore, the blending and cyclic use of different qualities of surface and groundwater have the potential to enhance the quantity and quality of agricultural water. This highlights the wide scope for employing groundwater in an integrated system, which can provide more water at more economical rates compared to managing surface and groundwater separately. Currently, most of the irrigation systems in the Terai rely on medium or small rivers that are heavily reliant on rainfall. Approximately 80 percent of the rainfall occurs during the monsoon months of June to September, which corresponds to 70-75 percent of the total annual river flows. Perennial irrigation covers about 20 percent of the Terai's land, while the remaining 80 percent of irrigable land relies on supplemental irrigation. Due to the dependence on monsoonal rainfall with variations in space and time, water use efficiency and agricultural productivity remain low in these regions of the Indo-Gangetic Plain. Additionally, depletion of groundwater levels, salinity, waterlogging, and pollution of water resources are recognized as common threats to the sustainability of agriculture in the Terai region.

Conclusion

Conjunctive use of surface and groundwater for irrigation purposes in a planned manner is a relatively recent practice in Nepal. Nevertheless, there have been efforts to develop planning models and optimization techniques at both the river basin level and within the irrigation command areas of the Terai region. Literature on these topics has emerged, indicating the recognition of the benefits of groundwater irrigation in South Asia, including the Terai region of Nepal. However, there is a lesser emphasis on the sustainability of groundwater resources, mainly due to concerns regarding the depletion of groundwater tables and the deterioration of water quality resulting from unregulated extraction practices.

Farmers in the Terai region are primarily concerned about the high energy costs associated with groundwater extraction and the unreliable electricity supply, rather than the declining water tables or issues of salinity. Nevertheless, the importance and benefits of employing conjunctive use of surface and groundwater resources for sustainable agricultural development in the Terai region have been well established. These benefits stem from the distinct characteristics of each resource. Surface water typically entails lower delivery and extraction costs but is subject to supply variability. Groundwater, on the other hand, may be expensive to pump but offers a more reliable supply. By utilizing both sources in a conjunctive manner, the risks associated with irrigation water supply in the Terai can be mitigated. Although conjunctive use has been practiced to some extent, it has not been implemented in a planned manner. Therefore, it is essential to evaluate various operational policies for conjunctive water use to maximize the associated benefits.

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