Proyecto de abastecimiento de agua potable a las escuelas de enseñanza primaria y secundaria, centro de Salud y comunidad de Mihango mediante la rehabilitación de la balsa de Mugira, construcción de planta de tratamiento, estación de bombeo, depósitos de almacenamiento y red de distribución

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Índice:

1. Introducción

La balsa de Mugira se localiza en la División de Makuyu, en el Condado de Murang´a, región central de Kenia. Su capacidad aproximada de almacenamiento es de unos diez mil metros cúbicos de agua (10.000 m3). El dique de la balsa está construido con materiales sueltos. La balsa se construyó en el año 1976 para la irrigación de una plantación de café (Pundamilia Coffee Plantation Farm). Debido a la situación del sector (fundamentalmente afectado por el precio muy bajo del café para el agricultor), la cooperativa quebró en el año 1988, la plantación se dividió en múltiples parcelas para los agricultores locales y la balsa quedó abandonada ante la incapacidad de éstos de poder explotarla. Ante la falta de acceso a agua potable para las poblaciones de Mugira y Mihango, así como para las escuelas de enseñanza de primaria y secundaria y para el dispensario de salud, la comunidad y el Departamento de Agua e Irrigación del Condado de Murang´a pidieron ayuda a las asociaciones españolas Gota a Gota y Vihda para la rehabilitación de la balsa y la construcción de una planta potabilizadora, estación de bombeo, tuberías de conducción, depósitos de almacenamiento, sistema de distribución y fuentes de agua potable.

Vista aérea de la balsa de Mugira (google maps)

Vistas de la Balsa de Mugira desde el dique

Vista de la Balsa de Mugira desde el aliviadero

2.- Contexto y justificación del proyecto

El suministro de agua y el saneamiento en Kenia se caracterizan por bajos niveles de acceso al agua y saneamiento, particularmente en los barrios marginales de las ciudades y en las zonas rurales, así como por la mala calidad del servicio en forma de suministro de agua intermitente. El Programa Conjunto de Monitorio para el Abastecimiento de Agua y el Saneamiento de la ONU muestra que el 58% de los kenianos (83% en áreas urbanas y 50% en áreas rurales) tenían acceso a alguna fuente básica de agua potable en el año 2015. En el caso del medio rural, solamente el 14% de la población tenía acceso a agua corriente a través de una conexión a la casa o al patio. En ese año, 19 millones de personas carecían de acceso a agua potable en Kenia. Esa era la situación en la región de Mugira, en Diciembre de 2016 cuando los voluntarios de las asociaciones Vihda y Gota a Gota visitaron la zona; no existía ninguna fuente de agua potable ni agua corriente en los poblados de Mihango y Mugira así como tampoco en las escuelas de enseñanza primaria y secundaria y el dispensario de salud de Mihango (población estimada de 2.450 personas en 350 hogares).

Calle principal de Mihango

En el caso del dispensario la ausencia de agua corriente y potable impidió terminar la construcción de una maternidad que permitiera a las mujeres embarazadas de la zona dar a luz sin tener que desplazarse más de 10 km hasta Makuyu, donde está el centro de salud con maternidad más cercano y elevar la categoría de dispensario a centro de salud. El centro se abastecía del agua recogida de los tejados mediante canalones y almacenada en tanques de plástico, si bien no era suficiente para el consumo y teniendo que acarrear agua desde fuera.

Imagen del dispensario de Salud de Mihango

Maternidad de Mihango sin terminar debido a la falta de agua

En esta fotografía y enlace de video (https://youtu.be/fzCwiwu1_G0)se ve a un grupo de estudiantes de la escuela de Mihango. Cada día los estudiantes deben traer agua de fuentes, ríos, charcos… para su consumo y para la limpieza de la escuela. Las parasitosis intestinales, causa más frecuente de anemia en el continente africano, son enfermedades comunes en la región. Todos los niños deben tomar medicación periódicamente para eliminar los parásitos intestinales que además de lesionar la mucosa intestinal, dificultan la absorción de nutrientes generando malnutrición y comprometiendo el crecimiento normal de los niños, en una región con niveles altos de pobreza.

Esta imagen muestra el bidón utilizado para lavarse las manos en la escuela primaria de Mihango antes de la realización del proyecto.

El abandono progresivo de la balsa ponía en peligro la salud de la comunidad, pues muchos niños iban allí a bañarse sin control alguno, pudiendo ahogarse. También se hace uso indebido del agua al convertirse la balsa en un sitio para limpiar motocicletas (ver fotografía), con la consiguiente contaminación del agua.

El crecimiento descontrolado de árboles, arbustos y vegetación en el dique de la balsa va debilitando progresivamente la estructura de la pared, al extenderse las raíces de árboles y arbustos produciendo el fenómeno de tubulización. Esta situación puede condicionar la rotura del dique, sobre todo en época de lluvias, donde la balsa se llena y rebosa abundante agua por el aliviadero. Hay antecedentes en Kenia de roturas de los diques de contención de balsas de riego, registrándose tragedias como la ocurrida en Solai (Nakuru) en Mayo de 2018 (ver apartado 7 de este informe).

Solicitud de ayuda por parte de la comunidad local y del Departamento de Aguas del Condado de Murang´a

Esta fotografía muestra la llegada de la delegación española a la Balsa de Mugira en Diciembre de 2016 cuando la comunidad y el Departamento de Aguas del Condado pidieron ayuda a las Asociaciones españolas Gota a Gota y Vihda.

En este enlace se puede ver un vídeo de la bienvenida que ofreció la comunidad al grupo español· https://youtu.be/wR-J3GG-lF4

La zona propuesta en este proyecto para el abastecimiento de agua potable no estaba incluida en el mega proyecto del Gobierno Central de Kenia del Colector de agua hacia Nairobi que preveía abastecer varias comunidades en Murang´a con agua potable· Al no tener un plan a corto y medio plazo de abastecimiento de agua potable a esta región, sumado al fracaso obtenido en la perforación de pozos, el Condado se planteó la rehabilitación de la Balsa de Mugira como alternativa viable para resolver el problema acuciante de la escasez de agua en la zona· Tras la visita a la Balsa de Mugira, el Departamento de Agua e Irrigación redactó una propuesta de proyecto para el abastecimiento de agua en la zona y se la envió a las asociaciones españolas (ver Anexo 1)·

Firma de convenio y licitación del proyecto

El día 16 de Mayo de 2019 Victorio Torres como Presidente de la Asociación Vihda y representante de la Asociación Gota a Gota firmó un convenio de colaboración con el Ministro del Departamento de Agua del Condado de Muranga, el Honorable Mr· Paul Macharia· El convenio fue también firmado por el Sr Elías Guía, Ingeniero agrónomo y representante del Ministerio Español de Medioambiente en la Delegación de Naciones Unidas en Nairobi (ver Anexo 2)·

En dicho convenio se recogen entre otros los siguientes puntos:

- *La responsabilidad de la comunidad:*

  Proteger y cuidar del proyecto, limpiar y desbrozar los 27 acres de terreno de la balsa, cavar las zanjas para todas las tuberías y rellenarlas con tierra una vez instaladas por parte del constructor.

- *La responsabilidad del Departamento de Aguas del Gobierno del Condado de Muranga:*

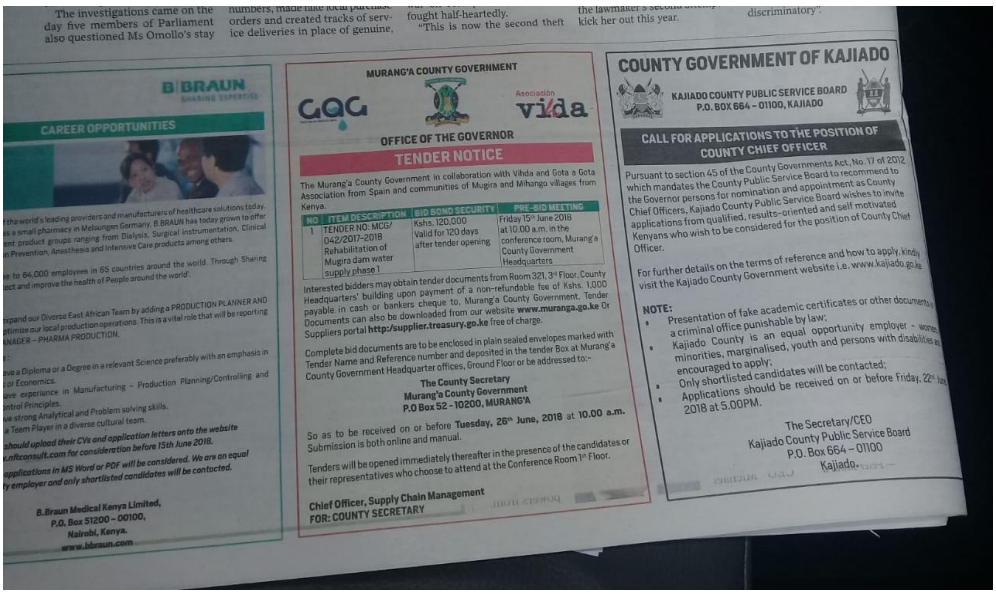
  Coordinar y gestionar el proyecto, supervisando todas las fases, redactando el borrador del proyecto, asegurando una licitación de la obra siguiendo los principios de igualdad, competencia, libre concurrencia, publicidad y transparencia, emitiendo las certificaciones de obra correspondientes, acompañando a las ONGs españolas en sus visitas y llevando a cabo la explotación, conservación y mantenimiento de las obras, corriendo los gastos a su cargo.

- *La responsabilidad de las ONGs españolas:*

  Verificar la información técnica proporcionada por el Condado, supervisando la licitación (vetándola si procediera ante el incumplimiento de los principios arriba citados) y ejecución de la obra y pagando los costes de la obra según el presupuesto establecido y las certificaciones de obra a emitir.

Licitación de la obra

Siguiendo la normativa vigente en materia de adjudicación de obra pública el concurso público se anunció en el periódico de tirada nacional Daily Nation con número de registro MCG/42/2017-2018. La fecha para la apertura de los sobres de las diferentes empresas constructoras concursantes fue prevista para el 26 de Junio de 2018.



MURANG'A COUNTY GOVERNMENT

OFFICE OF THE GOVERNOR

TENDER NOTICE

COUNTY GOVERNMENT OF KAJIADO

KAJIADO COUNTY PUBLIC SERVICE BOARD
P.O. BOX 664 - 01100, KAJIADO

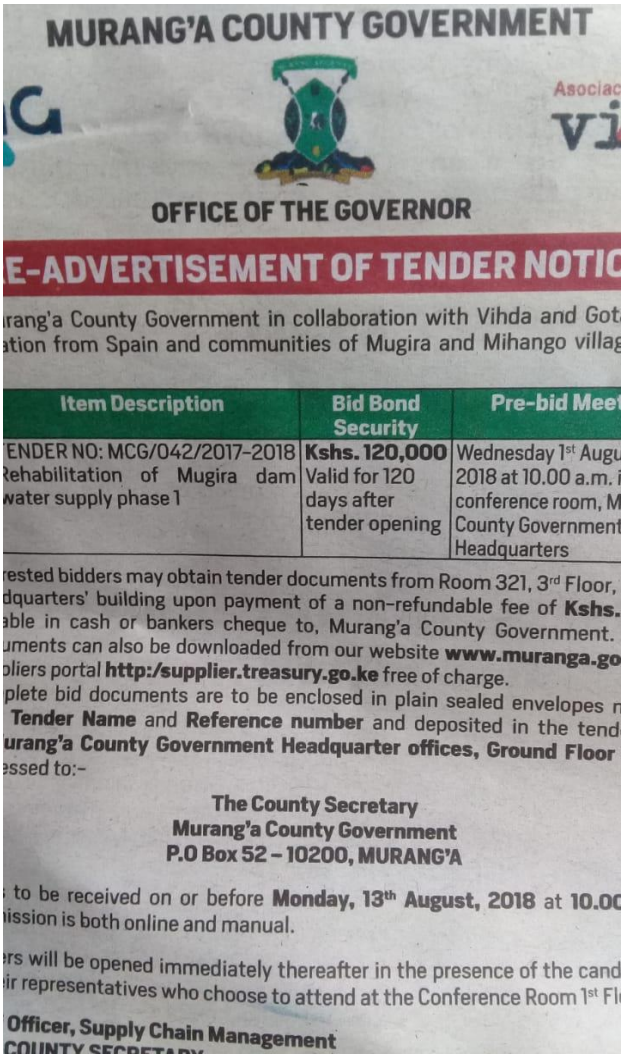
CALL FOR APPLICATIONS TO THE POSITION OF COUNTY CHIEF OFFICER

La delegación española representando a la ONG Gota a Gota estuvo compuesta por los Ingenieros de caminos, canales y puertos Rafael Romeo, Javier Rico, Miguel Zueco y por Victorio Torres en representación de la Asociación Vihda. Por parte del Gobierno del Condado estuvo presente la comisión de adjudicaciones de obra pública con representantes de varios departamentos.

En estas imágenes se ven la apertura de la "tender box" y revisión de las ofertas participantes por parte de la comisión del condado y la delegación española

En el primer procedimiento de licitación concursaron 5 empresas: Nelbut Investment LTD, Munawar Enterprises LTD, Silver One Company LTD, Yashiyona Tradings construction CO· LTD y Amsu communication LTD· Si bien ninguna de las 5 empresas que participaron en el concurso cumplió con los criterios establecidos por el Condado:

Criterios generales obligatorios:
1·- Certificado de Registro
2·- Copia del IVA y CIF emitido por la Hacienda Keniana KRA
3·- Certificado de Hacienda de cumplimiento del pago de Impuestos
4·- Licencia renovada para hacer negocios
5·- Certificados de registro de las entidades y autoridades correspondientes
6·- Auditoría de cuentas de los 3 últimos años
7·- Depósito de 120·000 chelines durante 120 días·
Los informes de evaluación de las empresas, emitidos por el comité de adjudicación están disponibles para su consulta si fuera necesario·



MURANG'A COUNTY GOVERNMENT

OFFICE OF THE GOVERNOR

E-ADVERTISEMENT OF TENDER NOTIC

rang'a County Government in collaboration with Vihda and Got
ation from Spain and communities of Mugira and Mihango villag

Item Description	Bid Bond Security	Pre-bid Mee
ENDER NO: MCG/042/2017-2018 Rehabilitation of Mugira dam water supply phase 1	**Kshs. 120,000** Valid for 120 days after tender opening	Wednesday 1st Augu 2018 at 10.00 a.m. i conference room, M County Government Headquarters

rested bidders may obtain tender documents from Room 321, 3rd Floor, dquarters' building upon payment of a non-refundable fee of **Kshs.** able in cash or bankers cheque to, Murang'a County Government. uments can also be downloaded from our website **www.muranga.go** pliers portal **http:/supplier.treasury.go.ke** free of charge.
plete bid documents are to be enclosed in plain sealed envelopes r **Tender Name** and **Reference number** and deposited in the tend **urang'a County Government Headquarter offices, Ground Floor** essed to:-

The County Secretary
Murang'a County Government
P.O Box 52 – 10200, MURANG'A

to be received on or before **Monday, 13th August, 2018** at **10.0** ission is both online and manual.

rs will be opened immediately thereafter in the presence of the cand ir representatives who choose to attend at the Conference Room 1st Fl

Officer, Supply Chain Management
COUNTY SECRETARY

Criterios Técnicos:
1·- Clasificación NCA nivel 6
2·- Experiencia como constructor principal
3·- Cualificaciones del personal clave
5·- Máquinaria y euipamiento
6·- Capacidad financiera suficiente
7·- Volumen de construcción standard para los últimos 5 años
8·- Sistemática de trabajo·

Ninguna de las empresas que se presentaron en la primera convocatoria cumplió los criterios teniéndose que repetir el proceso de licitación· El día 1 de Agosto se abrieron los sobres de esta nueva licitación, presentándose 4 empresas: Amsu Communication LTD, Silver One Company LTD, Munawar Enterprises LTD and Black Bear Construction LTD·

Proyecto de abastecimiento de agua potable a la comunidad de Mihango

Las últimas dos empresas cumplieron todos los criterios y al final el comité de adjudicaciones optó por la más económica, Black Bear Constructions con una oferta de 6·368·991 chelines (31·384 chelines más barato que el coste incluido en la proyecto original elaborado por el Departamento de Aguas del Condado de Muranga)·

El día 20 de Septiembre de 2018 se firmó el contrato de la obra, por la que la empresa Black Bear se comprometía a realizar la obra y las ONGs españolas a cumplimentar los pagos según las certificaciones de obra· Todas las ofertas presentadas en los dos procedimientos así como los informes emitidos por la comisión de adjudicación y el contrato están disponibles para su consulta·

For and on behalf of MURANG'A COUNTY GOVERNMENT
(Full Name of Client's Authorized Representative) Josphat Kuteya
(Title) Chief Officer
(Signature)
(Date) 11/9/2018
Witnessed by:
VIHDA AND GOTA GOTA ASSOCIATION FROM SPAIN
(Full Name Witness) Dr Victoria Teresa Fecal
(Title) C.E.O. Vihda Association
(Signature)
(Date) 20th - September - 2018
For and on behalf Of BLACK BEAR CONSTRUCTION (K) LTD
(Full Name of Contractor's Authorized Representative) NANCI NJERI MBAGIRU
(Title) DIRECTOR
(Signature)
(Date) 13/09/2018
Witnessed by:
(Full Name Witness) MARGARET WAMBUI WACHIRA
(Title) ADMIN ASSISTANT
(Signature)
(Date) 17/09/2018

Documento de firma de la adjudicación de la obra y toma de posesión en el terreno·

El día 19 de Octubre de 2018 se reunieron en los terrenos de la balsa los responsables de las comunidades de Mugira y Mihango así como representantes del Departamento de Aguas del Condado, de la empresa constructora y de las asociaciones españolas· Se compartió con la comunidad la noticia de la selección de la empresa a través del procedimiento establecido y en esa reunión el

constructor se comprometió a contratar a los casuals (o peones de obra) en los pueblos beneficiaros.

La comunidad también se comprometió a limpiar los terreros y a proteger la obra, así como a comunicar a las personas que habían invadido los terrenos de la balsa la necesidad de evacuarlos.

4.- Desarrollo y ejecución de las obras

El proyecto preveía la rehabilitación de la balsa, construcción de una planta de filtración y tratamiento y una estación de bombeo con acometida eléctrica, construcción de un depósito de 20 m3 enterrado junto a la estación de bombeo, instalación de la conducción principal de 110 mm de diámetro y 1,02 km de longitud con 105 metros de desnivel que conectaría la estación de bombeo con el depósito de almacenamiento de 80 m3 localizado en el dispensario de Salud, rehabilitación e impermeabilización de dicho depósito, instalación de 4 km de tuberías de distribución desde el depósito al dispensario, escuelas de enseñanza primaria y secundaria y poblado de Mihango, instalación de depósito de almacenamiento y construcción de fuentes de agua potable.

A continuación se detallan e ilustran las obras llevadas a cabo durante la ejecución del proyecto.

4.1 Limpieza y desbrozado del dique:

Debido a los años de abandono el dique de contención fabricado de materiales sueltos, presentaba abundante vegetación, incluyendo árboles y arbustos (ver fotografía) con el consiguiente riesgo de debilitación del mismo y la posible rotura en caso de precipitaciones abundantes, algo común durante las épocas de lluvia. Tras la firma del convenio y el comienzo de las obras, la comunidad participó en la limpieza y desbrozado del dique y los terrenos adyacentes. Los líderes comunitarios también

sensibilizaron a los vecinos sobre la necesidad de cuidar de las instalaciones, evitar el uso indebido de las mismas y ayudar al contratista en la ejecución de la obra. El contratista por su parte prometió ofrecer trabajo en la obra a miembros de la comunidad sin empleo y cumplir con lo estipulado en el acuerdo.

4.2 Vallado de la zona de tratamiento y bombeo:

Inicialmente estaba previsto el vallado de toda la balsa, si bien debido a que esto suponía una variación muy significativa en el presupuesto, finalmente se decidió el vallado de las instalaciones de tratamiento y bombeo de agua, a pie de balsa, mediante alambrada y postes de hormigón. También se instaló una puerta de acceso y cerradura con candado. La vigilancia de las instalaciones la proporciona la comunidad como parte de su compromiso y el responsable identificado por la comunidad es el profesor Tarasisio, que vive a pocos metros de las instalaciones y ya está jubilado.

Imagen de la estación de bombeo, planta de tratamiento de agua y vallado

4.3 -- Construcción de un depósito subterráneo:

Para poder alimentar la bomba, se construyó un depósito subterráneo de hormigón de 20.000 litros de capacidad con sistema de ventilación y limpieza, tuberías y válvulas uniendo la planta de filtración y tratamiento del agua con la caseta de bombeo.

Depósito subterráneo de hormigón de 20 m3 para alimentar la bomba

4.4.- Rehabilitación de la caseta de bombeo, instalación de moto-bomba de 30 KW y acometida eléctrica

Durante los años 90 otra ONG intentó optimizar el agua de la balsa y abastecer a las comunidades de Mihango y Mugira con esta agua, si bien debido a la falta de fondos, sus intervenciones se limitaron a la construcción de una caseta de bombeo y del depósito de almacenaje en el centro de salud. Al comenzar este proyecto se comprobó que la caseta de bombeo, necesitaba una reforma integral, pues tras años de abandono estaba practicamente inservible. La caseta se reconstruyó en su totalidad, incluyendo un forjado de hormigón armado en el techo y puerta de acceso de acero, para garantizar la seguridad del motor y la bomba. En esta fotografía se ve la caseta en fase de reforma, con el forjado y la puerta ya instalados.

Una vez terminada la obra de la caseta de bombeo, se procedió a comprar el motor de 30Kw y la bomba de agua correspondiente. Se eligió a la empresa Davis and Shirtliff, empresa líder en la región y con muy amplia experiencia en

este tipo de instalaciones. El motor y la bomba se instalaron en Octubre de 2019.

Imagen del motor, bomba y panel de control, dentro de la caseta de bombeo

Uno de los mayores desafíos con los que se encontró el proyecto fue poder garantizar el suministro eléctrico para el funcionamiento del motor y la bomba. Para ello fue necesario extender la línea eléctrica 1 km desde la población vecina, colocando nuevos postes y tendido eléctrico, así como un transformador eléctrico adecuado. La falta de este tipo de transformador más el confinamiento impuesto por la pandemia hiceron que el proyecto se retrasase más de diez meses. Finalmente en agosto de 2020 se instalaba el transformador y ponía en marcha el motor. Este video muestra, además de otros proyectos, la situación del proyecto en Marzo de 2020, cuando comenzó la pandemia covid-19: https://youtu.be/XN-Opqbd1dw

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En este enlace se puede ver al motor finalmente funcionando y bombeando agua
https://www.youtube.com/watch?v=OdlZXKlzqCU

4.5.- Construcción de una estación de decantación, filtración y tratamiento de agua.

A pie de balsa y siguiendo las especificaciones dadas por el Departamento de Aguas en la propuesta de proyecto, se construyó una planta potabilizadora de 100 m2 de capacidad dividida en 5 compartimentos para la decantación y filtración del agua, más la zona de mezcla de los produtos químicos.

En estas fotografías se ven las fases de construcción de la planta de filtración y tratamiento químico del agua (cloro y soda ash). Los productos químicos se guardan en la caseta que está adyacente a los tanques de decantación y debajo de la zona de mezcla. En este enlace se puede ver a la planta en funcionamiento:
https://youtu.be/IjeO6XpMEXg

4.6.-Compra e instalación de una tubería principal .

La tubería principal subterránea de 110 mm de diámetro de PVC reforzado para soportar altas presiones (12 atmósferas) y de 1,1 km une la caseta de bombeo a pie de balsa con el tanque de distribución, localizado en el dispensario de Mihango. El desnivel a salvar es de 105 metros. La tubería se instaló en las zanjas cavadas por la comunidad como parte de su compromiso con el proyecto.

Imágenes cavanzo las zanjas e instalando la tubería principal

Para la colocación de la tubería fueron necesarias varias juntas y arquetas, montadas a lo largo de la línea. Tras la puesta en marcha inicial del motor y los primeros bombeos, se detectaron algunas pérdidas que retrasaron la puesta en servicio de la obra. Finalmente el contratista reparó las pérdidas encontradas y se ha podido bombear agua hasta el depósito con normalidad. Ver actas de la reunión mantenida con todas las partes en el Anexo 3.

Imágenes de la tubería principal previa a su instalación

4·7·- Rehabilitación del depósito de almacenamiento y distribución

La propuesta de proyecto inicial incluía la construcción de un depósito de agua elevado localizado en el punto más alto del proyecto, el dispensario de salud· Finalmente se consideró la rehabilitación de un depósito ya existente de 80 m3 en esa misma localización· Este depósito había sido construido en los años 90 , si bien nunca llegó a completarse ni a ofrecer servicio pues el proyecto quedó sin terminar·

Los trabajos han incluido el refuerzo e impermeabilización y pintado del mismo, así como la instalación de todas las tuberías, válvulas y arquetas· El depósito sirve para el almacenamiento del agua potable bombeada desde la balsa y su

posterior distribución al dispensario, escuelas de enseñanza primaria y secundaria y al pueblo de Mihang´o. En estas fotografías se ven los trabajos de rehabilitación del depósito.

Imagen del depósito ya terminado

Este enlace muestra el depósito de agua llenándose por primera vez con agua potable bombeada desde la estación de bombeo a pie de balsa.
https://youtu.be/4uPSwwYoKs4

4.8.- Abastecimiento de agua potable a las escuelas de enseñanza primaria y secundaria, al dispensario de salud y a la comunidad de Mihang´o.

Desde el depósito de almacenamiento se instalaron 4 kilómetros de tuberías (ver diagrama de distribución más abajo) para el suministro de agua potable al dispensario adyacente, a las dos escuelas de enseñanza primaria y secundaria y a la comunidad de Mihang´o. Esta agua es gratis para estas instituciones, si bien otros ramales desde propiedades privadas, que se conecten a la línea de distribución llevarán contador. El dinero recaudado de este consumo se destinará al pago de la electricidad para el bombeo, compra de productos químicos y mantenimiento del proyecto.

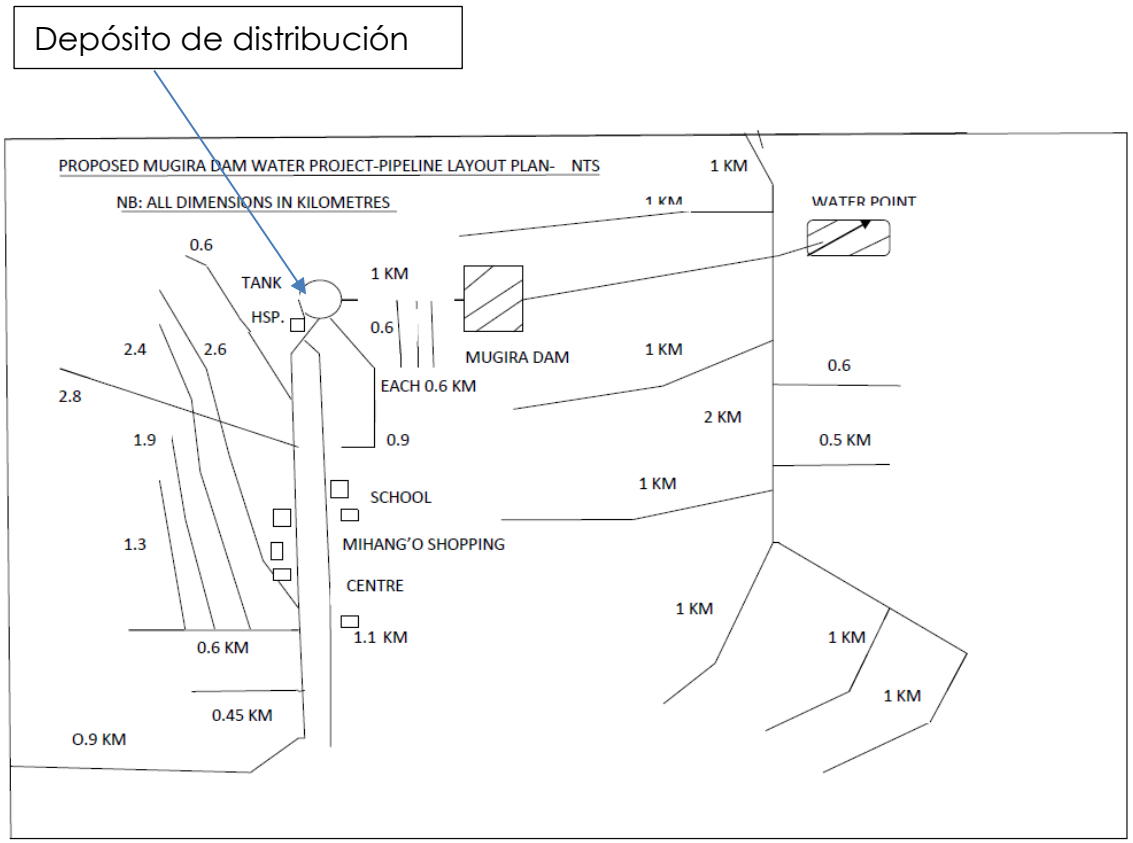

Diagrama de distribución de agua del proyecto. Nótese que este proyecto ha desarrollado la primera fase prevista, que consiste en el abastecimiento a la zona de Mihango, situada a la izquierda de la balsa en este esquema. La segunda fase incluiría el suministro a la zona de Mugira, en la parte derecha del esquema. Las razones por las que se priorizó la zona de Mihango fueron la presencia de escuelas públicas y dispensario de salud.

Estas fotografías muestran a los estudiantes del colegio de Mihango, la construcción de la fuente de agua potable, los estudiantes lavándose las manos y el depósito de diez mil litros donado por el proyecto para evitar así el corte de suministro durante las tareas de mantenimiento del proyecto.

Proyecto de abastecimiento de agua potable a la comunidad de Mihango

Esta fotografía muestra al responsable local del proyecto, Sr Tarasisio con el Director de la escuela de enseñanza secundaria. En este caso y a diferencia de la escuela primaria, el centro contaba con un depósito de agua donado por la empresa de telefonía Safaricom. Este depósito se usaba para recoger el agua de la lluvia a través de canalones en los tejados adyacentes, si bien estaba vació durante las épocas secas, en las que apenas llueve. Gracias al proyecto se ha podido conectar este depósito con la línea principal de distribución y ahora la escuela ya tiene agua potable durante todo el año.

Imágenes mostrando los servicios ofrecidos en el dispensario y la fuente pendiente de conectarse a la línea, construida para los pacientes, próxima a la maternidad.

En el centro del pueblo de Mihango, cerca de la calle principal y las tiendas y gracias al proyecto se ha construido la primera fuente de agua potable gratuita en la localidad. En esta fotografía y enlace de video https://youtu.be/pPn6iqybNYc, se ve a algunos miembros de la comunidad acudiendo a por agua con bidones para transportarla a sus domicilios. Antes del proyecto los miembros de la comunidad, sobre todo mujeres y niños, se tenían que desplazar fuera del pueblo a un manantial sin tratar a recoger agua. Este manantial se secaba y tenían que bajar hasta la balsa de Mugira para recoger agua, también sin tratar. Ahora la vida de la comunidad ha cambiado, pues ya tienen agua potable, gratuita en el centro del pueblo.

Enlaces de agradecimiento de alumnos y profesor por el agua potable
vote of thanks teacher
https://youtu.be/r64z2QSoUXE

vote of thanks student
https://youtu.be/5OCQTlfSswk

Durante el desarrollo del proyecto hubo varias reuniones para certificar el progreso de las obras. También fueron necesarias reuniones de coordinación para la gestión del agua. En el anexo 3 se puede ver las actas de la última reunión con los responsables políticos y administrativos de la zona. El proyecto ha ejecutado la primera fase prevista, el suministro de agua a la Comunidad de Mihango, si bien la segunda fase, el suministro a la Comunidad de Mugira, está todavía pendiente y esto ha sido una fuente de discusión por parte de los miembros de las dos comunidades. Finalmente se ha podido llegar a un acuerdo, y salvaguardar así el suministro de agua a los centros públicos (escuelas de primaria y secundaria pues acuden estudiantes de ambos poblados) y dispensario de salud, que también asiste a ambas poblaciones.

5.- Seguimiento financiero

Proyecto de abastecimiento de agua a la comunidad de Mihango desde la balsa de Mugira			
Concepto	**Chelines kenianos**	**Tipo de cambio**	**Euros**
Primer anuncio de licitación	110.200	115,7	952,5
Addendum al primer anuncio	45.240	115,7	391,0
Segundo anuncio de licitación	91.640	115,7	792,0
Gastos de transporte en Kenia	13.500	116,7	115,7
Pago primer certificado (13-14 Feb 2019)	2.844.367	111,6	25487,2
Pago segundo certificado	2.719.133	111,6	24365,0
Pago parte tercer certificado part 1 (23 Ene 2020)	2.300.000	110,2	20871,1
Pago parte tercer certificado part 2 (5 Nov 2020)	715.157	125,7	5689,4
Pago parte tercer certificado part 3 (5 Nov 20)	900.000	125,7	7159,9
Water tank brand Roto 10000 liters Primary School	83.000	130	638,5
Piedra, madera, arena 1 ton (base del tanque)	11.750	130	90,4
Cemento 3 sacos	2.100	130	16,2
Pago cuarto certificado (Septiembre 21-Enero 22)	2.883.545	128.2	22497.5
Retención de pago correspondiente al 1º y 2º certificado (Enero 2022)	272.720,54	128	2130,6
Retención final de obra 4º certificado (pendiente)	128.729,71	128	1005,7
TOTAL	13.121.082		112202,7

El proyecto, desde el comienzo hasta el final, ha generado un total de 4 certificados de obra (Ver Anexos 4-7)

6. Análisis de la calidad del agua

La colaboración entre el Hospital de Sub-Condado de Maragua, la ONG suiza Aqua Pura y las ONGs españolas Vihda y Gota a Gota hace posible que periódicamente se analice la calidad microbiológica del agua en las distintas intervenciones. El Hospital proporciona la incubadora y el personal para leer los resultados. Aqua Pura dona las placas de Petri para salmonellas, vibrios y coliformes y las asociaciones españolas recogen las muestras de las fuentes, pozos y balsas, las llevan a analizar y comparten los resultados.

En estas fotografías de archivo se ve el resultado del cultivo microbiológico de 4 muestras correspondientes a las fuente de la escuela de niños minusválidos de Kambiti y los pozos con bombas Afri-Dev. En cada uno de las muestras se analizan los 3 grupos de patógenos mencionados arriba. En el caso del pozo de Mukuyu-ini se observó contaminación por enterobacter, en el resto de muestras no se observó crecimiento alguno.

Para el análisis químico del agua se contactó con el Laboratorio de Aguas Paraestatal de Murang´a, localizado en la capital del Condado. Debido a la pandemia Covid-19 no fue posible enviar los reactivos para continuar analizando la calidad del agua en las intervenciones anteriores al proyecto de Mugira y tampoco en este proyecto. Tampoco se pudo mandar muestras de agua al laboratorio de la Confederación del Ebro en Zaragoza. Tras contactar nuevamente con la ONG suiza Aqua Pura en Septiembre de 20201 y relajarse las medidas de confinamiento y restricción de movilidad, se va a proceder al envío de nuevos reactivos durante el mes de Diciembre de 2021 y analizar la calidad microbiológica del agua en todos los puntos clave del proyecto: balsa de Mugira, depósito subterráneo tras la planta potabilizadora, agua del depósito de almacenamiento y puntos de agua (fuentes) en el dispensario, escuela primaria y secundaria y fuente comunitaria en el pueblo de Mihango.

7 Reunión con la Comisión Nacional de Seguridad de Presas

El día 9 de Mayo de 2018 y tras intensas lluvias, cedió el dique de contención de una balsa de riego de una plantación en la localidad de Solai, en el condado de Nakuru. La tromba de agua se llevó por delante gran parte del poblado y murieron 48 personas, incluyendo a muchos niños. Al parecer las balsas de este tipo y otras mayores no están sometidas a ningún tipo de control y su construcción no está regulada.

Imagen de la balsa y el muro cediendo. Poblado de Solai arrasado por la tromba de agua

El día 27 de junio de 2018, el ingeniero Rafael Romeo García, responsable de la Asociación Gota a Gota con ayuda de los ingenieros Miguel Zueco y Javier Rico impartieron una charla a los ingenieros del Ministerio del Agua del Condado Muranga sobre la organización del agua en España y otra por la tarde, sobre seguridad de presas, ante la Comisión Nacional creada exprofeso por expertos del Ministerio del Agua de Kenia en Nairobi con motivo del luctuoso accidente de la presa de Solai mencionado más arriba.

A nuestra vuelta a España les remitimos, traducido al inglés, nuestra normativa sobre protección civil ante el riesgo de inundaciones y la relativa a clasificación de presas ante el riesgo de rotura. Esta información la tuvo en cuenta la Comisión Keniana en sus recomendaciones al Gobierno de Kenia sobre seguridad en la presas.

8.- Lecciones aprendidas

- La firma del convenio ha sido clave para definir roles y responsabilidades antes, durante y después de la ejecución del proyecto. En este convenio la Comunidad es el beneficiario, el Departamento de Agua del Condado el Project manager, el contratista es responsable de la obra y las asociaciones españolas Gota a Gota y Vihda son donantes que proporcionan además apoyo técnico.

- El liderazgo y capacidad del Departamento de Aguas han permitido resolver los problemas encontrados al delimitar un marco común de actuación. (ej: consecución del transformador adecuado, resolución de las disputas políticas por la gestión del agua...).

- Adherirse y seguir el procedimiento de licitación y adjudicación de la obra ha sido crucial para encontrar una empresa competente y capaz de llevar a cabo el proyecto. Además asegura una gestión transparente de los fondos y un sistema competitivo basado en la calidad de los servicios, la experiencia previa y la capacitación.

- Flexibilidad en los plazos y en la consecución de fondos para llevar a cabo el proyecto. Este proyecto ya fue intentando por una ONG internacional bien conocida en Kenia. Sin embargo el proyecto no pudo llevarse a cabo debido a varios problemas, uno de ellos la falta de financiación, la participación local, el procedimiento de licitación…El proyecto estaba previsto que se completase en el plazo de un año desde la firma del convenio, si bien se ha prolongado 3 años. Es necesario mencionar que la pandemia Covid-19 ha contribuido decisivamente a alargar esos plazos. Afrontar este proyecto con la flexibilidad financiera y paciencia suficientes, sin dejar de perseverar, han hecho posible su finalización con éxito.
- Las visitas y apoyo técnico del equipo español han evidenciado la importancia que tiene esta intervención para ambas asociaciones. Esto ha sido constatado por las contrapartes locales (Departamento de Aguas, contratista y comunidad) contribuyendo a proteger la intervención y respetar los procedimientos a pesar de las contrariedades sufridas.

- El pago de los certificados según han sido elaborados también ha contribuido a que el contratista complete la obra.

- Las reuniones in situ para evaluar el estado de la obra y las reparaciones necesarias, en su caso, fueron determinantes para poder entregar la obra funcionando correctamente.

- El compromiso del Sr Tarasisio, chairman del comité comunitario de la Balsa de Mugira y antiguo profesor ya jubilado, ha sido y es muy importante para proteger la intervención, garantizar el cuidado de las instalaciones y el funcionamiento del proyecto.

- La captación de agua en superficie, siguiendo las recomendaciones de Wangari Mathai Premio Nobel de la Paz 2004, se demuestra como la mejor alternativa para resolver la escasez hídrica en Kenia. La balsa almacena el exceso de agua durante la época de lluvias y permite un suministro estable de agua durante todo el año, incluyendo la estación seca. En este mismo proyecto se intentó perforar pozos para tener agua potable en las escuelas, gastando recursos sin encontrar agua.

- La experiencia acumulada en España en materia de seguridad de presas, compartida por el equipo español con la Comisión Nacional de Presas (a través de la presentación y el envío de la normativa y legislación españolas) han servido para informar la política keniana en esta materia y fueron incorporadas al informe emitido por la Comisión Nacional de Seguridad de presas en Kenia.

9.- Listado de Anexos

Anexo 1.- Propuesta del proyecto "Rehabilitación del Balsa de Mugira" redactada por el Departamento de Agua e Irrigación del Condado de Murang´a.

Anexo 2.- Acuerdo de colaboración Asociaciones Vihda y Gota a Gota y Departamento de Agua e Irrigación del Condado de Murang´a-

Anexo 3.- Acta de la reunión mantenida en la obra para revisar las averías y evaluar el progreso de la obra (17 de Febrero 2021).

Anexo 4·- Primer Certificado de Obra
Anexo 5·- Segundo Certificado de Obra
Anexo 6·- Tercer Certificado de Obra
Anexo 7·- Cuarto Certificado de Obra

10 Agradecimientos

En nombre de la comunidad y el Departamento de Agua e Irrigación del Condado de Murang´a, las Asociaciones Vihda y Gota a Gota, queremos agradecer a la empresa Suez Spain, Fundaciones Sorigué, Sacyr, Kyrene y Vidal, al grupo de teatro Campoamor y a todos las personas e instituciones, la confianza y apoyo prestados para el desarrollo de este proyecto· El abastecimiento de agua a poblaciones con pocos recursos contribuye a romper el ciclo enfermedad-pobreza y trae esperanza, ilusión y prosperidad a las comunidades·

ANEXO 1

Propuesta del proyecto "Rehabilitación del Balsa de Mugira" redactada por el Departamento de Agua e Irrigación del Condado de Murang´a.

PROJECT;-

Proposed Mugira dam Water supply project P.O BOX 1 MAKUYU

{Pumping water supply SYSTEM from mugira dam}

DESIGN REPORT; DATED: December 2017

PREPARED BY

SUB –COUNTY WATER OFFICER

MURANG'A SOUTH

P.O BOX 226

SABASABA

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Executive Summary

Water is the most important natural resources since without it life cannot exist and industry cannot operate. There is no substitute for water in most of its uses. Domestic water supply brought closer to the people saves valuable time used in searching for domestic water from far away sources. Whenever possible gravity fed water supply systems are usually preferred since their operation and maintenance costs are very minimal as opposed to pumping water systems.

Good quality water saves the consumer money otherwise used to treat water borne diseases such as cholera, typhoid, diarrhea etc. Sufficient portable water improves not only sanitation but generally enhances social-economic well being of a community. The Kenya constitution 2010 recognizes water as a basic human right. The constitution stipulates in its chapter 4-Rights and fundamental freedoms, article 43 (1) of the economic and social rights that every person has the right to clean and safe water in adequate quantities and improved sanitation services. The Kenya vision 2030 blueprint in its social pillar envisions a population with adequate, clean, affordable and safe water and sanitation services.

The proposed Mugira Dam water supply project targets to supply domestic water to various villages including Mugira with 150 households, Mugira A (150 h/h , Mugira B (700 h/h), Mihang'o/Ngatia Village (350 h/h) . The total households targeted are therefore **407** with each household having a population of 7 people. This makes a total current population targeted to be about **2850** people. The project is located in Gakungu sub-location, Makuyu location in Makuyu /Kirimiri Ward. This area is in Makuyu Division of Murang'a South Sub-county in Murang'a County. There are no factories in the area but the project will serve a health centre and three primary schools with domestic water supply.

Existing water supply facilities

There is not a conventional water supply in the area. Local residents depend on shallow hand dug wells to access water. The wells are far apart since not many of the residents are able to dig and develop them. Residents therefore travel for an average of 3 km in search of water. Others access water from raw Mugira dam which is in the located in the area.

. Scope of the project

The scope is this project is therefore limited to designing a pumping water supply to serve these people at the ultimate design period. The source of water will be Muguira dam which is has sufficient water all the year round. Water will be pumped to two different directions where to access the residents. A pump house was constructed but requires rehabilitation. The two rising mains will be designed and distribution system designed as well. Pumped water will have to be injected into steel elevated tanks one to n constructed at the health centre where a failed ground masonry tank is located. The tank will be positioned at an area set aside as a water point.

Three phase power supply will have to be connected to the pump house where the pump will be installed for the purposes of pumping water.

According to the field data collected and the ground survey conducted for the project, the water demand for the project is **486 m^3/d** which is sufficient to meet the demand of the targeted population for all the villages. The project has a total cost of Kshs. **21.82 Million as** tabulated here below.

SUMMARY OF PROJECT COST

Item	Description	Cost Kshs.
1	KPLC Power supply , Electric Pump Supply , Installation testing and commissioning	1,386,000
2	Underground Water sump construction 20 m^3	494,003
3	Pump House rehabilitation	94,440
4	Laying of Rising Mains "A" 1.02 km long 110 mm diameter	1,712,466
5	Laying of Rising Mains "B" 136 km long 110 mm diameter	2,171,988
6	2 Number Steel elevated water tanks each of capacity 48 m^3	5,600,000
7	**Distribution lines**:-Mirii line 0.9 km long 63 mm diameter	790,272
8	Mukandaini line 1.0 km long 63 mm diameter	826,938
9	Molo line 1.93 km long 63 mm diameter	1,603,728
10	Mugira Catholic line 1.2 km long 63 mm diameter	964,845
11	Ngata main line 1.2 km long 63 mm diameter	953,001
12	Wabeth line 0.5 km long 50 mm diameter	380,016
13	Watonny line 0.6 km long 50 mm diameter	438,606
14	Waguchu line 0.4 km long 50 mm diameter	320,418
15	Chairman line 0.3 km long 32 mm diameter	229,761
16	Wanjane line 0.2 km long 32 mm diameter	177,660
17	Nyambura line 0.28 km long 32 mm diameter	219,744
18	Fencing of water point	432,684
19	Water treatment tanks	2,542,226
20	Permits and licenses	45,000
	TOTAL KSHS.	**21,383,796**
	Add 2 % supervision	427,676
	Grand total Kshs.	**21,811,472**
SAY KSHS 21.82 MILLION KENYA SHILLINGS		

OR 218,115 US DOLLARS

This is the total cost of the project.
References;-Design manual for water supplies in Kenya

MUGIRA DAM DOMESTIC WATER SUPPLY PROJECT

CHAPTER ONE –INTRODUCTION

1.0 Location

The proposed Mugira Dam water supply project is located in both Gakungu sub-locations of Makuyu location of Makuyu division in Murang'a South Sub-County of Murang'a County. The proposed source of water is Mugira dam and has an elevation of 1400 a.m.s.l. while the end of the pipeline of the project at Mihang' o health centre is 76 metres higher. The project area can be traced from Topographical map 135 / 3 Makuyu at coordinates.

1.2 Accessibility

The project area can be accessed from Thika town through Thika –Kenol -Murang'a Teachers college tarmac road. An earth road branches Northwards from Murang'a Teachers College through Ciubu shopping center to access the project area and Mugira dam itself. This project area is accessible all the year round.

1.3 Climate

The area has moderately high temperatures ranging between 10-25^{o} C and varies with altitude. The amount of rainfall is highly affected by the south eastern trade winds. Rainfall is bimodal; the long rains arrive between March and May, while the short rains are experienced between October-December periods of every year. The average annual precipitation ranges between 800mm-1000mm.

1.4 Topography

The topography of the project area is characterized by undulating terrain dissected by low laying ridges. Most of the rivers flow from Abardare forest towards the Tana in the Western direction. However in the project area there are no dominant rivers flowing. Slopes range between 2-10%. The soils are red brown well drained loams which are moderately fertile. Parches of black cotton soils are also evident in the area.

1.5 Agriculture and Rural development

Agriculture dominates the economy of Murang'a South Sub-County. It provides livelihood to about 80% of the total population and employs 75% of the same population. Agriculture contribution to the development of the location is enormous and is bound to remain so in the foreseeable future. Agricultural activities in the location are based on production of food crops such as maize, bananas and beans. Fruits such as avocados and mangoes are also grown in the area. Cattle and goat keeping are also practices though on a small scale.

The project area is located in the Maize -sunflower ecological zone which is a low rainfall regime zone.

1.6 Water source

Mugira dam has been identified as the primary source of water for this domestic water supply project. This is because it is perennial and has sufficient water storage all the year round. The topography of the project area allows recharge of the dame from the expansive catchment area.

No rivers are located in the project area. People depend on shallow dug wells and the dam for water requirements. No other source in the area can provide the quantity water required in this project.

CHAPTER TWO; WATER DEMAND

2.0 Introduction: Water Demand and Design Period

The water demand for any target area is determined by the population of the people in such an area. The population is usually projected to 25 years so that the designed water infrastructure is not changed too soon increase in population.

Water demand projections should normally; be made for the "initial" the "future" and the "ultimate" year. The "initial" year is the year when the project is expected commences operation, That may be assumed to be 5 years from the date of the commencement of the preliminary design. The "future" is 10 years and the "ultimate" year 20 years from the initial year. Once the initial, future and ultimate years have been determined for a project, they should not normally be changed during the design period.

The annual increase method of population projection is usually applied for the projection, viz

$Pi = Po (1+ r \%)^n$

Where Pi= Initial population

Po =Current population

r = population growth rate in percentage

Pf ,Pu substituted for the future and ultimate periods of design respectively.

2.1 Design Demand

A water supply should normally be designed for the ultimate demand. The rates are as given in the Ministry of water and irrigation design manual as shown in the table below.

.

Table 2 Consumption Rates-From the ministry of Water and irrigation design manual;-

CONSUMER	**UNIT**	*RURAL AREAS*			**URBAN AREAS**		
		High potential	**Medium potential**	**Low potential**	**High Class Housing**	**Medium Class Housing**	**Low Class Housing**
People with individual connections	1/head/ day	60	50	40	250	150	75
People without connections	1/head/ day	20	15	10	-	-	20
Livestock unit	1/head/ day	50			-		
Boarding schools	1/head/ day	50					
Day schools with WC without WC	1/head/ day	25 5					
Hospitals Regional District Other	1/bed/ day	400 200 100			+ 20 1 per outpatient and day (minimum 5000 1/day)		
Dispensary and Health Centre	1/day	5000					
Hotels High Class Medium Class Low Class	1/bed/ day	600 300 50					

Administrative offices	1/head/ day	25	
Bars	1/day	500	
Shops	1/day	100	
Unspecified industry	1/ha/day		20,000
Coffee pulping factories	1/kg coffee	25 (when re-circulation of water is used).	

2.2 Livestock demand guidelines

1 Grade cow	equivalent to	1 Livestock Unit (LU)
3 Indigenous cow	,,	1 Livestock Unit (LU)
15 Sheep or goats	,,	1 Livestock Unit (LU)
5 Donkeys	,,	1 Livestock Unit (LU)
2 Camels	,,	1 Livestock Unit (LU)

Each livestock unit is given 50 l/day

2.3 Service Level

The minimum service level should not be less than 14 hours per day.

2.4. Population projections

The targeted community has 407 households each with an average of 7 people making a current total population of 2850 people. Each family keeps two grade cows and 5 sheep on average.

Hence the current population year 2017 = 407 x 7 =**2850 people.**

Using the annual increase method of population projection viz

$Pi = Po (1+ r \%)^n$

The initial population Pi for year 2022 is given as;-(taking the population growth of 2 % per annum)

$Pi = 2850 (1 + 2/100)^5$= **3147 people**

Future population Pf for 2032 **is given as;-**

Pf = 3147 $(1 + 2/100)^{10}$= **3836 people**

Ultimate population Pu for 2042 **is given as;-**

Pu = 3,847 $(1 + 2/100)^{10}$= **4955 people**

This is the design population for the community.

2.5 Water demand for the general population;-

The area being a high potential rural area with a per capita water allocation of 60 l/h/day**;-**

$$\frac{4955 \times 60}{1000} = \mathbf{297.3\ m^3/day}$$

2.6 Demand for livestock –Grade cows

The water demand for the cows with a per capita water allocation of 60 l/h/day shall be gives as follows ;-

$$\frac{1350\ h/h \times 2 \times 50}{1000} = \mathbf{135\ m^3/day}$$

2.7 Demand for goats

The water demand for the goats with a per capita water allocation for 15 goats at 50 litres per day shall be gives as follows;-

$$\mathbf{\frac{1350 \times 5 \times 50}{15 \times 1000} = 22.5\ m^3/day}$$

2.8 Demand for Health centre

The health centre shall be allocated 5000 litres per day since there are no beds. It is only an outpatient facility.

= 5 m^3/day

2.9 ; Demand for Primary schools

There is one primary school by the name Mihang'o which is a day institutions. It has a total of 1000 pupils.

The water demand for the school shall be computed as follows;-

$\frac{1000 \times 5}{1000} =$ **5 m^3/day**

2.10 ; Demand for secondary school

There is one secondary school by the name Faith Sabina which is a boarding institution. It has a total of 400 students.

The water demand for the school shall be computed as follows;-

$\frac{400 \times 50}{1000} =$ **20 m^3/day**

2.11 Demand for shops

The area has 12 shops each with a water demand of 100 l/day. Their total water requirement is given as follows;-

$\frac{12 \times 100}{1000} =$ **1.2 m^3/day**

2.12 Total water demand

The table below the total water demand for the entire project**;-**

Item	Description	Water demand m^3/day
1	General population	297.3
2	Cows	135
3	Goats	22.5
4	Health Centre	5
5	Primary School	5
6	Secondary School	20
6	Shops	1.2
	Sub-total Total	**486 m^3/day**

	Total project water demand	**486 m^3/day**

This is the design water demand for the water project.

Taking a 6 hour pumping period each day , the amount per hour is equivalent to:

$\frac{486}{6}$ = 81 m^3/hr or **0.0225 m^3 /sec** (ie 22.5 litres per second)

This is the demand for both sides pumped using a single pipeline. Since this is not practical and two different pipelines must be laid and pumping done for each side at a time, the discharge **q** for each of the sides will be half of this demand or 81/2 =**40.5 m^3/hr** = o**r 0.01125 m^3/sec** (ie **11.25 litres per second**.)

This will be the design capacity for each of the two pipelines.

CHAPTER THREE - INTAKE AND PUMP DESIGN

3.0 Preamble

Mugira dam has already been rehabilitated by the County Government of Murang'a. However a crib intake consisting at the end of the dam and a delivery mainline from the dam to the pump house will be laid. Since the pump house is already in existence, only rehabilitation works will be necessary for the pump house. It will be followed by installation of three phase KPLC Power supply and then the pumping unit.

3.1 TYPE OF INTAKE

Mugira Dam Water Project is a pumping water system where an electric pump will be used to pump water from the WATER SUMP that will receive water from the dam by gravity. The water sump will be constructed next to the pump house. The suction pipe from the pump will be dipped into the water sump which will receive water from the dam via a pipeline by gravity. A crib intake will have to be constructed inside the dam near the dam embankment that is next to the pump house. (See the drawings attached)

3.2 PUMPING HEAD AND PUMP DESIGN

According to the survey carried out in the project area, there are two sides of the project with varying pumping heads. Considering the first side where the health centre is located, the pumping parameters are as follows;-

1. Delivery/ static head from pump house to tank ……. … = 76.2 m
2. Suction head…….…….... = 5 m

3. Proposed Elevated tank height at tank inlet level……. = 12 m
4. Residual head ……...= 10 m
5. Head loss for 90 mm dia. pipe 1. 02 km …….. = 7.6 m

Sub- Total 110.9 m

Add Minor loses due to fittings at 10 % =11.09 m

Total system head…….121.99 metres

Say 123 metres.

Considering the second side where the water point is located, the pumping parameters are as follows;-

1. Delivery/ static head from pump house to water point … = 93.8 m
2. Suction head…….…….. = 5 m
3. Proposed Elevated tank height at tank inlet level……..... = 12 m
4. Residual head ……= 10 m
5. Head loss for 90 mm dia. pipe 1. 36 km …… = 8.6 m

Sub- Total 129.4 m

Add Minor loses due to fittings at 10 % = 12.94 m

Total system head……,,,,142.34metres

Say 143 metres.

The higher value will be used so that the same pump can be used for pumping water in both directions, hence the total system head shall be **143 meters**.

3.3 Pump Design

The suitable power P (KW) to deliver a predetermined discharge is a factor of the total head H_t, the discharge q , system efficiency(0.6)and a factor of gravitational pull. They have a relationship as follows;-

$$\textbf{P (kw)} = \frac{\textbf{H x Q}}{\textbf{102 x E}}$$

In which

H = is in metres

Q = in Litres per second.

E =Efficiency factor (0.6 for pumping systems)

According to water demand computations in the previous chapter the water demand stands at 40.5 **m^3/hr** or **0.01125 m^3/sec** (11.25 litres per second)

Hence the required pump has a capacity to pump **40.6 m^3 hr** against a total head of **143 meters**

3.4 Power Requirements

The suitable motor required therefore has a Power (P) of;-

$$\textbf{P (kw)} = \frac{H \times Q}{102 \times 0.6} = \frac{143 \times 11.25}{102 \times 0.6} = \textbf{26.3 kw}$$

Considering other factors a 10 % additional rating is recommended for values less than 30 kw, therefore the suitable power rating is 26.3 + ($^{10}/_{100}$ x 26.3) =26.3 + 2.63 = 28.93 kw **SAY 30 KW,** this is equivalent to **40 HP** motor.

3.5 Running costs

The running cost for pumping water will be guided by the KPLC unit rates for power consumption. There are also minimum charges which are added to the consumption rates which consisted of fuel charges, VAT among others. However all considerations having been done, the monthly power charges for this pumping arrangement should not go beyond Kshs. Forty thousand per month. In order to avoid wastages in power consumption, power failure relays and water level relays should be incorporated when the pumping system is being installed.

6 3. Pump house

A standard masonry pump house already exists at the intake point. It was constructed through community initiative when the dam was being rehabilitated. It however requires minimal rehabilitation such plastering and painting.

3.7 Suction

A suction pipe 3'' diameter (80 mm) preferably GI complete with a foot valve will be connected to the pump. The suction head is a maximum of 5.0m and is suitable for the system

3.8. KPLC Power Supply

In the site also the three phase power supply is there. All what ie required is the requisite wiring from the pole to the pump house and installation of electric control panel.

3.9 Pump

An Electrically Powered pumping unit preferably a ground pump complete with motor shall be installed inside the pump housel. All the necessary accessories will be installed as well. Testing and commissioning will complete the exercise.

3.10 Control relays

The pumping system will be installed with a power failure relay. In case of power blackouts, the device ensures that electric components are not affected. It does so by automatically shutting down the pump. Again to safeguard the pump from breaking down a water level relay will be installed so that when the water in the sump goes below the foot valve level, the pump shuts automatically. This prevents the pump from pumping air and destroying the pump.

3.11 Fencing

Good fencing controls access to water points. This in effect safeguards the facility from vandalism and pollution. A barbed wire fence with chain link and a steel gate is adequate. Concrete poles are durable and strong and are recommended for use in this fencing unit. An area 20 metres x 10 metres is adequate as a water point.

It will protect the spring and the pump house where the pump will be located. A lockable steel gate is sufficient for controlling access to the water point. In this digital era more surveillance by use of CCTV is also recommended after full fencing is completed

CHAPTER FOUR –PIPELINE DESIGN

4.0 Pipeline Design-Mainline

The suitable size of pipe to convey a predetermined discharge /flow is computed by use of Darcy's Continuity Equation **Q=AV.**

Where Q=Discharge in m^3/s

A=Pipe internal diameter in m

V =Flow velocity in m/s

The discharge q for this project is **0.01125 m^3/sec** (ie **11.25 litres per second**.)

.From the equation the suitable pipe can be obtained by using Darcy's continuity equation follows; -

Q=AV

Hence;-

0.01125 m^3/sec = $\frac{\pi D^2}{4}$ x 0.1 (taking 1 m/s as the self cleansing flow velocity in pipeline)

From which D= 0.110 m or 110mm

The nearest pipe size is 110 mm or 4'' diameter pipeline. The pumping mainlines for both directions will be laid with 110 mm diameter pipeline. On side which takes water to the health centre has a total distance of 1.02 km while the opposite side to the water point measures 1.36 km long. The lest shall be distribution line ranging from 63 mm to 32 mm in diameter (2''to 1'' in diameter)

CHAPTER FIVE –WATER QUALITY AND WATER TREATMENT

5.0 GENERAL

It is a requirement that all water from surface water sources such as rivers , lakes , dams , etc be subjected to a full treatment process if the water it intended for domestic purposes. A tailor made drinking treatment facility is therefore designed for this project.

5.1 Basic Requirements

The basic requirements for drinking water are that it should be:

- Free from pathogenic (disease causing) organisms.
- Containing no compounds that have an adverse acute or long-term effect on human health.
- Fairly clear (i.e. low turbidity little colour).
- Not saline (salty).
- Containing no compounds that cause an offensive taste or smell.
- Not causing corrosion or encrustation of the water supply system and not staining clothes washed in it.
- **Permissible Aesthetic Quality**
- Under certain circumstances when it is not practicable to produce a water of the desirable aesthetic quality it may be permissible to raise certain guideline values as shown below. Further see chapter "Water Treatment".

- **Table 3 Permissible Aesthetic Quality**

Parameter	Unit	***Guideline value***	Remark
Chloride	mg/1	600	
Colour	TCU	50	
Copper	mg/1	1.5	
Iron	mg/1	1.0	
Manganese	mg/1	0.5	
pH	-	6.5 – 9.2	
Solids	mg/1	1500	
Turbidity	NTU	25	
Zinc	mg/1	15	
Other constituents	-	As in table "Desirable aesthetic quality"	

- Treated water should periodically be subjected to verification tests at the Water Testing Laboratories either at the Kenya Water institute or the Industrial Area laboratories.

It is proposed that a composite sedimentation flocculation tank 100 m^3 in capacity be built at the water point as well as at the health centre to facilitate all the treatment processes. A separate clear water tank 50 m^3 shall be built beside it where chlorination will be administered. The sedimentation tank will facilitate chemical dosing (Aluminum sulphate and lime), a mixing chamber with up horizontal flow baffles, flocculation, sedimentation, sand filtration as well as sludge discharge mechanisms. After the water has been made clear of both suspended and dissolved solids, chlorination will be administered using a chemical dozer at the clear water tank. The composite tank will be provided with a chemical mixing platform for ease of dosage activity.

5.2 Bill of Quantities for 1No. 100 m^3 Composite water treatment tank –Ground masonry

Item	Description	Unit	Qty	Rate Kshs.	Amount Kshs.
1	Excavation of site to remove top unconsolidated soil, grub up roots and dispose the arising commencing ground level up to firm ground	M^3	50	350	17,500
2	Marrum blinding 50 mm thick	M^3	4	3,400	13,600

3	Reinforcement high yield bars Y12	No	20	1,300	26,000
4	Reinforcement high yield bars Y10	No	50	1,100	55,000
5	Quarry stones 225 x 225 mm (9 '' x 9'')	Rft	1500	40	60,000
6	Cement O.P.C	Bag	210	1000	210,000
7	Water proof cement – puddle	Kg	80	500	32,000
8	Ballast ½ ''-$^{3}/_{4}$ ''	Ton	10	3500	35,000
9	Clean river sand	Ton	9	4000	36,000
10	Binding wire (25kg)	Roll	2	4,000	8,000
11	Props 80 mm diameter 3.0 m long	No	100	350	35,000
12	Bituminous paint (20 litres)	Can	1	12,500	12,500
13	Timber sawn soft wood 4'' x 2''	Rm	200	85	17,000
14	Timber sawn soft wood 6'' x 1''	Rm	700	85	59,500
15	Nails ordinary wire 4 '' long	Kg	30	250	7,500
16	Nails ordinary wire 2 '' long	Kg	40	250	10,000
17	GI Pipes 6 '' dia class B Socketed	No	2	32,000	64,000
18	GI Elbows 6 '' dia	No	8	1200	9,200
19	Provide for 80 mm diameter breather pipes fully installed with wire gauze	No	3	2500	7,500
20	Bell mouth 8 '' x 6 ''	No	1	12,000	12,000
21	Provide for construction of valve chambers1200 x 1000 x 1050 mm deep provided with lockable manhole cover.	No	2	30,000	60,000
22	Sluice valves 6 '' dia. Flanged	No	2	45,000	90,000
23	**Sub – total kshs.**				**877,300**
24	Add 30 % labour (Skilled & unskilled)				263190

25	**Total Kshs.**				**1,140,490**
26	Add 10 % contingencies				114,049
27	**Grand Total Kshs..**				**1,254,539**
28	Add 16 % VAT Kshs.				200,727
28	Add 3 % withholding tax Kshs.				37,577
32	**Grand total Kshs.**				**1,492,843**
33	Provide for purchase of 50 x 50 ft piece of land as water point	Ls	Ls	400,000	400,000
	Grand total Kshs.				**1,892,843**

5.3 BILL OF QUANTITIES FOR 50 M^3 –CHLORINATION TANK

Item	Description	Unit	Qty	Rate Kshs.	Amount Kshs.
1	Marrum blinding 50 mm thick	M^3	3	3,000	9,000
2	Reinforcement high yield bars Y12	No	14	1,200	16,800
3	Reinforcement high yield bars Y10	No	36	720	25,920
4	Quarry stones 225 x 225 mm (9 ‘’ x 9’’)	Rft	1050	30	31,500
5	Cement O.P.C	Bag	140	700	98,000
6	Water proof cement – puddle	Kg	65	500	32,500
7	Ballast ½ ‘’-$^3/_4$ ‘’	Ton	7	3,500	24,500
8	Clean river sand	Ton	7	4,000	28,000
9	Binding wire (25kg)	Roll	2	3,000	6,000
10	Props 80 mm diameter 3.0 m long	No	60	350	21,000
11	Bituminous paint (20 litres)	Can	1	12,500	12,500
12	Timber sawn soft wood 4’’ x 2’’	Rm	120	85	12,200

13	Timber sawn soft wood 6'' x 1''	Rm	240	85	20,400
14	Nails ordinary wire 4 '' long	Kg	20	150	3,000
15	Nails ordinary wire 2 '' long	Kg	10	150	1,500
16	GI Pipes 2 '' dia class B Socketed	No	1	12,450	12,450
17	GI Elbows 2 '' dia	No	4	300	1,200
18	Provide for 80 mm diameter breather pipes fully installed with wire gauze	No	3	1,500	4,500
19	Bell mouth 4 '' x 2 ''	No	1	4,500	4,500
20	Provide for construction of valve chambers1200 x 1000 x 1050 mm deep provided with lockable manhole cover.	No	2	2,5000	50,000
21	Gate valves 2'' dia. Peglar type	No	2	4,300	8,600
22	Provide step irons made from 20 mm thick round bars	No	6	200	1,200
23	Provide steel portable ladder 8 m long	No	1	15,000	15,000
24	Provide top steel manhole cover	No	1	3,600	3,600
	Sub – Total Kshs.				**443,870**
	Add 30 % labour Kshs.				**146,478**
	Total Kshs.				**590,348**
	Add 10 % contingencies				59,035
	Grand Total Materials Kshs.				**649,383**

The total cost of chlorination tank construction 50 m^3 and composite treatment tank shall be ;
1,892,843+649,383 =Kshs. 2,542,226

CHAPTER SIX: BILL OF QUANTITIES

The Bill of quantities will comprise of the following components;-

1. KPLC Power installation, wiring and installation of pump
2. Construction of water sump where suction will take place
3. Rehabilitation of pump house
4. The rising mains ‘’A ‘’ 110 mm diameter complete with the suction pipe , foot valve and other relevant fittings
5. Rising Mainline ‘’B’’ 110 mm diameter complete with control valve , TEE Junction and other relevant fittings
6. Steel elevated tanks 2 Number each 48 m^3
7. Distribution lines
8. Water treatment
9. Securing water point by fencing

6.1 BILL OF QUANTITIES FOR PUMP INSTALLATION AND KPLC POWER SUPPLY

Item	Description	Unit	Quantity	Cost Kshs.	Amount Kshs.
1	Supply and install a surface pump capable of pumping **40.6 m^3 hr** against a total head of **143 meters** complete with all accessories, preferably **30 KW** -test and commission	No	1	890,000	890,000
2	Supply KSB Motor 10 Kw or its equivalent complete with a control panel ,Cables, control gears , water level relay and power failure relay-test and commission	No	1	250,000	250,000
3	Supply three phase KPLC electric power to site and connect to the control panel-Test and commission	Item	1	180,000	180,000
				Sub-total Kshs	**1,320,000**
				Add 5 % contingencies	66,000
				Grand Total Kssh	**1,386,000**

6.2 Bill of Quantities Water Sump construction capacity 20 m^3

Item	Description	Unit	Qty	Rate Kshs.	Amount Kshs.
1	Excavation of foundation 3m diameter x 2m depth	M^3	68	500	34,000
2	Marrum blinding 50 mm thick	M^3	3	3,000	9,000

3	Reinforcement high yield bars Y10	No	50	780	39,000
4	Quarry stones 225 x 225 mm (9 ‘’ x 9’’)	Rft	600	30	1,800
5	Reinforcement high yield bars Y12 for top beams	No	4	1200	4,800
6	Cement O.P.C	Bag	60	800	48,000
7	Water proof cement – puddle	Kg	60	500	30,000
8	Ballast ½ ‘’-$^{3}/_{4}$ ‘’	Ton	7	3,500	24,500
9	Clean river sand	Ton	7	4,000	28,000
10	Binding wire (25kg)	Roll	2	3,000	6,000
11	Props 80 mm diameter 3.0 m long	No	60	350	21,000
12	Bituminous paint (20 litres)	Can	1	12,500	12,500
13	Timber sawn soft wood 4’’ x 2’’	Rm	120	85	12,200
14	Timber sawn soft wood 6’’ x 1’’	Rm	240	85	20,400
15	Nails ordinary wire 4 ‘’ long	Kg	20	150	3,000
16	Provide for 80 mm diameter breather pipes fully installed with wire gauze	No	3	1,500	4,500
17	Provide for construction of valve chambers1200 x 1000 x 1050 mm deep provided with lockable manhole cover.	No	2	2,5000	50,000
18	Provide step irons made from 20 mm thick round bars	No	6	200	1,200
19	Provide steel portable ladder 8 m long	No	1	15,000	15,000
24	Provide top steel manhole cover	No	1	3,600	3,600
	Sub – Total Kshs.				**368,500**
	Add 30 % labour Kshs.				**110,550**
	Total Kshs.				**470,050**
	Add 5 % contingencies				23,953
	Grand Total Materials Kshs.				**494,003**

6.3. PUMP HOUSE REHABILITATION- BILL OF QUANTITIES

NO	DESCRIPTION	UNIT	QUANTITY	RATE (KSHS.)	AMOUNT (KSHS)
1	Hark out the old plaster with cold chisel and hammer to provide grip or bond to new plaster to both internal and external faces	Lumpsum	Lumpsum	-	2,000
2	Apply a thin layer 25 mm thick plaster in 1;3 sand cement mortar to both internal and external walls	M^2	25	1200	30,000
3	Apply two coats of paint to both internal and external sides of the pump house	M^2	25	450	10,800
4	Insert a steel door 900 mm x 2100 mm	No	1	12000	12,000
5	Insert ventilations made from Y12 bars and measuring 450 x 300 mm	No	4	1000	4,000
6	Apply a floor screed 25 mm thick made from 1:3 sand cement mortar	M^2	7.2	1200	8,640
	Sub -Total				**67,440**
	Add 30 % labour				**20,232**
	Total				**87,672**
	Allow for a 10% contingency				6,768
	TOTAL				**94,440**

6.4 LAYING OF RISING MAINS ''A'' 1.02 K M LONG 110 MM DIAMETER HDPE PIPES

Item	Description	Unit	Quantity	Rate Kshs	Amount Kshs
1	Excavate trench not exceeding 1.2 m depth, width 450 mm	M^3	660	150	99,000
2	Provide and install HDPE pipes DN 110 , PN 12.5	M	1020	900	918,000

3	Provide for GI pipes 100 mm diameter socketed each 6 m long (4'')	No	5	28,500	142,500
4	Provide for GI elbow 100 mm diameter (4'')	No	4	800	3,200
5	Provide for boss white	Kg	3	500	1,500
6	Provide for hemp	Kg	2	100	200
7	Backfill the trench	M^3	660	100	66,000
8	Allow for pipe work testing	Item	-	-	10,000
9	Provide for road crossings using appropriate technology	No	1	25,000	25,000
10	Provide for HDPE couplings 110 x 110 mm	No	12	1400	16,800
11	Provide for HDPE / GI Adapters 110 mm (4'')	No	5	1500	7,500
12	Provide for standard concrete marker posts at every 200 m distance	No	6	400	2,400
13	Provide for double orifice air release valves 25 mm diameter	No	2	8,500	17,000
14	Allow for lockable manhole chambers 1050 deep x 1200 x 1200 mm to accommodate air valves	No	2	25000	50,000
				Total Raising Mains	**1,359,100**
				Provide 20% skilled & semi skilled labour	271,820
				Sub-total Kshs	**1,630,920**
				Add 5 % Contingencies	81,546
				Grand total Raising Mains	**1,712,466**

6.5 LAYING OF RISING MAINS 'B' 1.36 K M LONG 110 MM DIAMETER HDPE PIPES

Item	Description	Unit	Quantity	Rate Kshs	Amount Kshs
1	Excavate trench not exceeding 1.2 m depth, width 450 mm	M^3	880	150	132,000

2	Provide and install HDPE pipes DN 110 , PN 12.5	M	1360	900	1,224,000
3	Provide for GI pipes 100 mm diameter socketed each 6 m long (4'')	No	5	28,500	142,500
4	Provide for GI elbow 100 mm diameter (4'')	No	4	800	3,200
5	Provide for boss white	Kg	4	500	2,000
6	Provide for hemp	Kg	2	100	200
7	Backfill the trench	M^3	880	100	88,000
8	Allow for pipe work testing	Item	-	-	10,000
9	Provide for road crossings using appropriate technology	No	1	25,000	25,000
10	Provide for HDPE couplings 110 x 110 mm	No	14	1400	19,600
11	Provide for HDPE / GI Adapters 110 mm (4'')	No	5	1500	7,500
12	Provide for standard concrete marker posts at every 200 m distance	No	7	400	2,800
13	Provide for double orifice air release valves 25 mm diameter	No	2	8,500	17,000
14	Allow for lockable manhole chambers 1050 deep x 1200 x 1200 mm to accommodate air valves	No	2	25000	50,000
				Total Raising Mains	**1,723,800**
				Provide 20% skilled & semi skilled labour	344,760
				Sub-total Kshs	**2,068,560**
				Add 5 % Contingencies	103,428
				Grand total Raising Mains	**2,171,988**

6.6 BILL OF QUANTITIES FOR STEEL TANKS 48 M^3 WITH 12 METER ELEVATION

A provisional cost of 2.8 million for each of the tank is given; therefore both tanks will have a total cost of Kenya shilling **5.6 million**

6.7 BILL OF QUANTITIES FOR DISTRIBUTION LINES

6.7.1 Mirii line 0.9 Km Long 63 mm Diameter 'HDPE Pipes

Item	Description	Unit	Quantity	Rate Kshs	Amount Kshs
1	Excavate trench not exceeding 1.2 m depth, width 450 mm	M^3	580	150	87,000
2	Provide and install HDPE pipes DN 63 , PN 12.5	M	900	400	360,000
3	Provide for GI pipes 50 mm diameter socketed each 6 m long (2'')	No	2	8,500	17,000
4	Provide for GI elbow 63 mm diameter (2'')	No	4	100	400
5	Provide for boss white	Kg	1	500	500
6	Provide for hemp	Kg	1	100	100
7	Provide HDPE Reducing tee 110 x 63 mm	No	1	1200	1200
8	Backfill the trench	M^3	880	100	88,000
9	Allow for pipe work testing	Item	-	-	4,000
9	Provide for road crossings using appropriate technology	No	1	25,000	25,000
10	Provide for HDPE couplings 63x 65 mm	No	10	600	6,000
11	Provide for HDPE / GI Adapters 63 mm (2'')	No	5	700	3,500
12	Provide for standard concrete marker posts at every 200 m distance	No	5	400	2,000
13	Provide for single orifice air release valves 25 mm diameter	No	1	7,500	7,500
14	Allow for lockable manhole chambers 1050 deep x 1200 x 1200 mm to accommodate air valves	No	1	25000	25,000
				Total	**627,200**
				Provide 20% skilled & semi skilled labour	125,440
				Sub-total Kshs	**752,640**
				Add 5 % Contingencies	37,632
				Grand total Mirii line	**790,272**

6.7.2 Mukandaini line 1.0 Km Long 63 mm Diameter 'HDPE Pipes

Item	Description	Unit	Quantity	Rate Kshs	Amount Kshs

1	Excavate trench not exceeding 1.2 m depth, width 450 mm	M^3	648	150	97,200
2	Provide and install HDPE pipes DN 63 , PN 12.5	M	1000	400	400,000
3	Provide for GI pipes 50 mm diameter socketed each 6 m long (2'')	No	2	8,500	17,000
4	Provide for GI elbow 63 mm diameter (2'')	No	5	100	500
5	Provide for boss white	Kg	1	500	500
6	Provide for hemp	Kg	1	100	100
7	Provide HDPE Reducing tee 110 x 63 mm	No	1	1200	1,200
8	Backfill the trench	M^3	648	100	64,800
9	Allow for pipe work testing	Item	-	-	5,000
9	Provide for road crossings using appropriate technology	No	1	25,000	25,000
10	Provide for HDPE couplings 63x 65 mm	No	11	600	6,600
11	Provide for HDPE / GI Adapters 63 mm (2'')	No	5	700	3,500
12	Provide for standard concrete marker posts at every 200 m distance	No	6	400	2,400
13	Provide for single orifice air release valves 25 mm diameter	No	1	7,500	7,500
14	Allow for lockable manhole chambers 1050 deep x 1200 x 1200 mm to accommodate air valves	No	1	25000	25,000
				Total	**656,300**
				Provide 20% skilled & semi skilled labour	131,260
				Sub-total Kshs	**787,560**
				Add 5 % Contingencies	39,378
				Grand total Mukandaini line	**826,938**

6.7.3 Molo line 1.93 Km Long 63 mm Diameter 'HDPE Pipes

Item	Description	Unit	Quantity	Rate Kshs	Amount Kshs
1	Excavate trench not exceeding 1.2 m depth, width 450 mm	M^3	1250	150	187,500

2	Provide and install HDPE pipes DN 63 , PN 12.5	M	1930	400	772,000
3	Provide for GI pipes 50 mm diameter socketed each 6 m long (2'')	No	5	8,500	42,500
4	Provide for GI elbow 63 mm diameter (2'')	No	7	100	700
5	Provide for boss white	Kg	3	500	1,500
6	Provide for hemp	Kg	3	100	300
7	Provide HDPE Reducing tee 110 x 63 mm	No	1	1200	1,200
8	Backfill the trench	M^3	1250	100	125,000
9	Allow for pipe work testing	Item	-	-	8,000
9	Provide for road crossings using appropriate technology	No	2	25,000	50,000
10	Provide for HDPE couplings 63x 65 mm	No	20	600	12,000
11	Provide for HDPE / GI Adapters 63 mm (2'')	No	5	700	3,500
12	Provide for standard concrete marker posts at every 200 m distance	No	9	400	3,600
13	Provide for single orifice air release valves 25 mm diameter	No	2	7,500	15,000
14	Allow for lockable manhole chambers 1050 deep x 1200 x 1200 mm to accommodate air valves	No	2	25000	50,000
				Total	**1,272,800**
				Provide 20% skilled & semi skilled labour	254,560
				Sub-total Kshs	**1,527,360**
				Add 5 % Contingencies	76,368
				Grand total Molo line	**1,603,728**

6.7.4 Mugira Catholic line 1.2 Km Long 63 mm Diameter 'HDPE Pipes

Item	Description	Unit	Quantity	Rate Kshs	Amount Kshs
1	Excavate trench not exceeding 1.2 m depth, width 450 mm	M^3	777	150	116,550
2	Provide and install HDPE pipes DN 63 , PN 12.5	M	1200	400	480,000

3	Provide for GI pipes 50 mm diameter socketed each 6 m long (2'')	No	2	8,500	17,000
4	Provide for GI elbow 63 mm diameter (2'')	No	4	100	400
5	Provide for boss white	Kg	2	500	1,000
6	Provide for hemp	Kg	1	100	100
7	Provide HDPE Reducing tee 110 x 63 mm	No	1	1200	1,200
8	Backfill the trench	M^3	777	100	77,700
9	Allow for pipe work testing	Item	-	-	5,000
9	Provide for road crossings using appropriate technology	No	1	25,000	25,000
10	Provide for HDPE couplings 63x 65 mm	No	12	600	4,800
11	Provide for HDPE / GI Adapters 63 mm (2'')	No	3	700	2,100
12	Provide for standard concrete marker posts at every 200 m distance	No	6	400	2,400
13	Provide for single orifice air release valves 25 mm diameter	No	1	7,500	7,500
14	Allow for lockable manhole chambers 1050 deep x 1200 x 1200 mm to accommodate air valves	No	1	25000	25,000
				Total	**765,750**
				Provide 20% skilled & semi skilled labour	153,150
				Sub-total Kshs	**918,900**
				Add 5 % Contingencies	45,945
				Grand total Mugira Catholic line	**964,845**

6.7.5 Ngata Main line 1.2 Km Long 63 mm Diameter 'HDPE Pipes

Item	Description	Unit	Quantity	Rate Kshs	Amount Kshs
1	Excavate trench not exceeding 1.2 m depth, width 450 mm	M^3	777	150	116,550
2	Provide and install HDPE pipes DN 63 , PN 12.5	M	1200	400	480,000
3	Provide for GI pipes 50 mm diameter socketed each 6 m long (2'')	No	1	8,500	8,500

4	Provide for GI elbow 63 mm diameter (2'')	No	2	100	200
5	Provide for boss white	Kg	2	500	1,000
6	Provide for hemp	Kg	1	100	100
7	Provide HDPE Reducing tee 110 x 63 mm	No	1	1200	1,200
8	Backfill the trench	M^3	777	100	77,700
9	Allow for pipe work testing	Item	-	-	5,000
9	Provide for road crossings using appropriate technology	No	1	25,000	25,000
10	Provide for HDPE couplings 63x 65 mm	No	12	600	4,800
11	Provide for HDPE / GI Adapters 63 mm (2'')	No	2	700	1,400
12	Provide for standard concrete marker posts at every 200 m distance	No	6	400	2,400
13	Provide for single orifice air release valves 25 mm diameter	No	1	7,500	7,500
14	Allow for lockable manhole chambers 1050 deep x 1200 x 1200 mm to accommodate air valves	No	1	25000	25,000
				Total	**756,350**
				Provide 20% skilled & semi skilled labour	151,270
				Sub-total Kshs	**907,620**
				Add 5 % Contingencies	45,381
				Grand total Ngata main line	**953,001**

6.7.6 Wabeth line 0.5 Km Long 50 mm Diameter 'HDPE Pipes

Item	Description	Unit	Quantity	Rate Kshs	Amount Kshs
1	Excavate trench not exceeding 1.2 m depth, width 450 mm	M^3	324	150	48,600
2	Provide and install HDPE pipes DN 50 , PN 12.5	M	500	300	150,000
3	Provide for gate valve 50 mm diameter complete with necessary fittings	No	1	4500	4,500
4	Provide HDPE Reducing tee 110 x 50 mm	No	1	700	700
5	Backfill the trench	M^3	324	100	32,400
6	Allow for pipe work testing	Item	-	-	2,000

7	Provide for road crossings using appropriate technology	No	1	25,000	25,000
8	Provide for HDPE couplings 50x 50 mm	No	5	500	2,500
9	Provide for HDPE / GI Adapters 50 mm (1 $^{1}/_{2}$ '')	No	2	700	1,400
10	Provide for standard concrete marker posts at every 200 m distance	No	5	400	2,000
11	Provide for single orifice air release valves 25 mm diameter	No	1	7,500	7,500
12	Allow for lockable manhole chambers 1050 deep x 1200 x 1200 mm to accommodate air valves	No	1	25000	25,000
				Total	**301,600**
				Provide 20% skilled & semi skilled labour	60,320
				Sub-total Kshs	**361,920**
				Add 5 % Contingencies	18,096
				Grand total Wabeth line	**380,016**

6.7.7 Watonny line 0.6 Km Long 50 mm Diameter 'HDPE Pipes

Item	Description	Unit	Quantity	Rate Kshs	Amount Kshs
1	Excavate trench not exceeding 1.2 m depth, width 450 mm	M^3	388	150	58,200
2	Provide and install HDPE pipes DN 50 , PN 12.5	M	600	300	180,000
3	Provide for gate valve 50 mm diameter complete with necessary fittings	No	1	4500	4,500
4	Provide HDPE Reducing tee 110 x 50 mm	No	1	700	700
5	Backfill the trench	M^3	388	100	38,800
6	Allow for pipe work testing	Item	-	-	2,000
7	Provide for road crossings using appropriate technology	No	1	25,000	25,000
8	Provide for HDPE couplings 50x 50 mm	No	6	500	3,000
9	Provide for HDPE / GI Adapters 50 mm (1 $^{1}/_{2}$ '')	No	2	700	1,400
10	Provide for standard concrete marker posts at every 200 m distance	No	5	400	2,000

11	Provide for single orifice air release valves 25 mm diameter	No	1	7,500	7,500
12	Allow for lockable manhole chambers 1050 deep x 1200 x 1200 mm to accommodate air valves	No	1	25000	25,000
				Total	**348,100**
				Provide 20% skilled & semi skilled labour	69,620
				Sub-total Kshs	**417,720**
				Add 5 % Contingencies	20,886
				Grand total Watonny line	**438,606**

6.7.8 Waguchu line 0.4 Km Long 50 mm Diameter 'HDPE Pipes

Item	Description	Unit	Quantity	Rate Kshs	Amount Kshs
1	Excavate trench not exceeding 1.2 m depth, width 450 mm	M^3	260	150	39,000
2	Provide and install HDPE pipes DN 50 , PN 12.5	M	400	300	120,000
3	Provide for gate valve 50 mm diameter complete with necessary fittings	No	1	4500	4,500
4	Provide HDPE Reducing tee 110 x 50 mm	No	1	700	700
5	Backfill the trench	M^3	260	100	26,000
6	Allow for pipe work testing	Item	-	-	2,000
7	Provide for road crossings using appropriate technology	No	1	25,000	25,000
8	Provide for HDPE couplings 50x 50 mm	No	4	500	2,000
9	Provide for HDPE / GI Adapters 50 mm ($1\ ^1/_2$ '')	No	2	700	1,400
10	Provide for standard concrete marker posts at every 200 m distance	No	3	400	1,200
11	Provide for single orifice air release valves 25 mm diameter	No	1	7,500	7,500
12	Allow for lockable manhole chambers 1050 deep x 1200 x 1200 mm to accommodate air valves	No	1	25000	25,000
				Total	**254,300**

Provide 20% skilled & semi skilled labour	50,860,
Sub-total Kshs	**305,160**
Add 5 % Contingencies	15,258
Grand total Mirii line	**320,418**

6.7.9 Chairman line 0.3 Km Long 32 mm Diameter 'HDPE Pipes

Item	Description	Unit	Quantity	Rate Kshs	Amount Kshs
1	Excavate trench not exceeding 1.2 m depth, width 450 mm	M^3	195	150	29,250
2	Provide and install HDPE pipes DN 32 , PN 12.5	M	300	250	75,000
3	Provide for gate valve 32 mm diameter complete with necessary fittings	No	1	3500	3,500
4	Provide HDPE Reducing tee 110 x 32 mm	No	1	600	600
5	Backfill the trench	M^3	195	100	19,500
6	Allow for pipe work testing	Item	-	-	2,000
7	Provide for road crossings using appropriate technology	No	1	25,000	25,000
8	Provide for HDPE couplings 32 x 32 mm	No	3	400	1,200
9	Provide for HDPE / GI Adapters 32 mm (1'')	No	2	600	1,200
10	Provide for standard concrete marker posts at every 200 m distance	No	2	400	800
11	Allow for lockable manhole chambers 1050 deep x 1200 x 1200 mm to accommodate air valves	No	1	25000	25,000
				Total	**181,850**
				Provide 20% skilled & semi skilled labour	36,370
				Sub-total Kshs	**218,220**
				Add 5 % Contingencies	10,911
				Grand total Chairman line	**229,761**

6.7.10 Wanjane line 0.2 Km Long 32 mm Diameter 'HDPE Pipes

Item	Description	Unit	Quantity	Rate Kshs	Amount Kshs

1	Excavate trench not exceeding 1.2 m depth, width 450 mm	M^3	130	150	19,500
2	Provide and install HDPE pipes DN 32 , PN 12.5	M	200	250	50,000
3	Provide for gate valve 32 mm diameter complete with necessary fittings	No	1	3500	3,500
4	Provide HDPE Reducing tee 110 x 32 mm	No	1	600	600
5	Backfill the trench	M^3	130	100	13,000
6	Allow for pipe work testing	Item	-	-	2,000
7	Provide for road crossings using appropriate technology	No	1	25,000	25,000
8	Provide for HDPE couplings 32 x 32 mm	No	2	400	800
9	Provide for HDPE / GI Adapters 32 mm (1 ’’)	No	2	600	1,200
10	Provide for standard concrete marker posts at every 200 m distance	No	1	400	400
11	Allow for lockable manhole chambers 1050 deep x 1200 x 1200 mm to accommodate air valves	No	1	25000	25,000
				Total	**141,000**
				Provide 20% skilled & semi skilled labour	28,200
				Sub-total Kshs	**169,200**
				Add 5 % Contingencies	8,460
				Grand total Wanjane line	**177,660**

6.7.11 Nyambura line 0.28 Km Long 32 mm Diameter ‘HDPE Pipes

Item	Description	Unit	Quantity	Rate Kshs	Amount Kshs
1	Excavate trench not exceeding 1.2 m depth, width 450 mm	M^3	182	150	27,300
2	Provide and install HDPE pipes DN 32 , PN 12.5	M	280	250	70,000
3	Provide for gate valve 32 mm diameter complete with necessary fittings	No	1	3500	3,500
4	Provide HDPE Reducing tee 110 x 32 mm	No	1	600	600
5	Backfill the trench	M^3	182	100	18,200

6	Allow for pipe work testing	Item	-	-	2,000
7	Provide for road crossings using appropriate technology	No	1	25,000	25,000
8	Provide for HDPE couplings 32 x 32 mm	No	3	400	1,200
9	Provide for HDPE / GI Adapters 32 mm (1 ’’)	No	2	600	1,200
10	Provide for standard concrete marker posts at every 200 m distance	No	1	400	400
11	Allow for lockable manhole chambers 1050 deep x 1200 x 1200 mm to accommodate air valves	No	1	25000	25,000
				Total	**174,400**
				Provide 20% skilled & semi skilled labour	34,880
				Sub-total Kshs	**209,280**
				Add 5 % Contingencies	10,464
				Grand total Nyambura line	**219,744**

6.8 BILL OF QUANTITIES –FENCING WATER POINT

No	Description	Unit	Quantity	Rate (Kshs.)	Amount (Kshs)
1	Excavate to of holes 0.45 mm diameter 1m deep @ 3 m c/c and store the arising for reuse	No	64	100	6,400
2	Procure , deliver r,c concrete poles, 3 m long 100 mm diameter precast	No	64	1500	96,000
3	Provide for barbed wire in 6 horizontal strand	M	1200	100	120,000
4	Provide for U nails	Kg	60	200	12,000
5	Provide for Chain link 2.1 metre high medium gauge	m	210	450	94,500
6	Provide for steel gate 1.5 m wide, 2.1 m high	No	1	14,500	14,500
				Sub –TotalKshs.	**343,400**
				Allow for 20 % skilled & semi skilled labour Kshs	**68,680**

Sub-total Kshs	**412,080**
Allow for a 5% contingencies Kshs	**20,604**
Grand Total Kshs.	**432,684**

6.9 COST SUMMARY

Item	Description	Cost Kshs.
1	KPLC Power supply , Electric Pump Supply , Installation testing and commissioning	1,386,000
2	Underground Water sump construction 20 m^3	494,003
3	Pump House rehabilitation	94,440
4	Laying of Rising Mains "A" 1.02 km long 110 mm diameter	1,712,466
5	Laying of Rising Mains "B" 136 km long 110 mm diameter	2,171,988
6	2 Number Steel elevated water tanks each of capacity 48 m^3	5,600,000
7	**Distribution lines**:-Mirii line 0.9 km long 63 mm diameter	790,272
8	Mukandaini line 1.0 km long 63 mm diameter	826,938
9	Molo line 1.93 km long 63 mm diameter	1,603,728
10	Mugira Catholic line 1.2 km long 63 mm diameter	964,845
11	Ngata main line 1.2 km long 63 mm diameter	953,001
12	Wabeth line 0.5 km long 50 mm diameter	380,016
13	Watonny line 0.6 km long 50 mm diameter	438,606
14	Waguchu line 0.4 km long 50 mm diameter	320,418
15	Chairman line 0.3 km long 32 mm diameter	229,761
16	Wanjane line 0.2 km long 32 mm diameter	177,660
17	Nyambura line 0.28 km long 32 mm diameter	219,744
18	Fencing of water point	432,684
19	Water treatment tanks	2,542,226
20	Permits and licenses	45,000
	TOTAL KSHS.	**21,383,796**

Add 2 % supervision	427,676
Grand total Kshs.	**21,811,472**
SAY KSHS 21.82 MILLION KENYA SHILLINGS	
OR 218,115 US DOLLARS	

CHAPTER SEVEN;GENERAL GUIDELINES ON PIPE LAYING

7.1 Cover and Slope of Pipes

- The pipelines shall be put in straight lines between changes in gradient. The slopes shall at no place be less than 0.5% for diameters of 200mm and less and 0.2% for bigger pipes. Hence for 90 mm diameter the slope shall be a minimum of 0.5 %

- To minimize the number of changes in grade the pipes shall be laid with a cover varying from a normal minimum of 0.6m to a normal maximum of 3m.

- The pipeline must not be designed having local high points where air pockets may develop without having any chance of being released.

- The minimum cover over unprotected pipes in areas where motor traffic may occur shall be 0.9m. Pipelines in road reserves should be located, whenever possible 1.5m from the edge of the road reserve.

- Pipelines below road surfaces should be laid as instructed by Ministry of roads.

7.2 Pressure

- The minimum pressure at design flow should be 0.1 Mpa (10 metre water head) in pipe sections to which there may be made consumer connections and 0.04 Mpa (4m) in other cases. The levels of the surrounding areas to be served from the pipeline must be considered when determining the minimum pressure.

- The static pressure in pipes with consumer connections should be not more than 0.6 Mpa (60m) unless the terrain makes higher pressures unavoidable. Higher pressure than 0.6 MPa may require special fittings, ball valves, stop valves etc. for the consumer connections.

- In urban areas with provision for fire-fighting, the minimum pressure of 0.15 Mpa (15m) should be up-held at a withdrawal of 10 1/s. There should be an isolating valve downstream of each fire hydrant in a non-loop system.

- The following is the design pressures of various materials: -

Pipe material	**Maximum working pressure**	**Sizes**
UPVC (Polyvinyl Chloride)	1.4 MPa	25-300 mm
PEH (Polyethylene High Density)	1.2 MPa	15-50 mm
GS (Galvanised Steel)	Depending on grade and size	ALL
CI (Cast Iron)	Depending on grade and size	80-1200

7.3 Water Hammer

Water hammer is a phenomenon which may be caused by closing or opening a valve, or start or stop of pumps etc. Generally the maximum water hammer can be calculated with the following formula:

$$WH = \frac{\pm CV}{g} \qquad (1)$$

Where WH is the pressure rise (or drop) in m of water, C is the velocity of the pressure wave. V is the initial minus the final velocity of water when flowing in the pipe (m/s), g is the acceleration of gravity. For a circular pipe:

$$C = \frac{C_W}{\sqrt{1 + \frac{E_w}{E_p} \times \frac{D_m}{t}}} \qquad (2)$$

Where:-

C_W = Celerity of the pressure wave in water = 1425 m/s

E_w = Elasticity modulus of water (N/mm^2)

E_p = Elasticity modulus of the pipe material (N/mm^2)

D_m = Mean diameter of the pipe $D_m = Di + t$ (mm)

t = wall thickness (mm)

If the pipe is fixed in the longitudinal direction, then Ep must be substituted by $Ep/(1-r^2)$, where

r = Poisson's ratio

Knowing D_m and t, E_w and E_p formulae (1) and (2) can be simplified to:

$WH = \pm \ell V$ where also $C = \ell g$

(The above expressions are based on the assumption that a valve is opened/closed suddenly, or the time taken to close the valve, T<2L/C(s) where L is the length of pipe).

Elasticity modulus and Poisson's ratio

MATERIAL	**ELSTICITY MODULES Ep** **N/mm^2**	POISSONS RATIO
Polyvinylchloride (UPVC)	3×10^3	0.5
Polyethylene (Low Density) (PEL)	0.15×10^3	0.5
Polyethylene (High Density) (PEH)	0.8×10^3	0.5
Galvanised steel, me. Grade (GS.MG)	210×10^3	0.3
Cast Iron (CI)	100×10^3	0.3
Ductile Iron (DI)	170×10^3	0.3
Water	207×10^3	-

Value of ℓ can be found for UPVC pipes and GS pipes in the tales below:

UPVC pipes to KS 06 – 149

Metric Series

Pressure class Mpa	Nominal outside Diameter mm	Celebrity of press. Wave, C m/s	Factor ℓ
0.6	≤ 160	295	30
	> 160	173	28
0.9	≤160	355	36
	> 160	331	34
1.2	≤ 160	399	41
	> 160	378	39
1.5	≤ 160	444	45
	> 160	419	43

STEEL pipes to ISO 65				
Nominal inside diameter mm	**Heavy Series**		**Light Series 2**	
	Celerity, C m/s	Factor ℓ	Celerity m/s	Factor ℓ
50	1345	137	1303	133
65	1324	135	1287	131
80	1320	134	1267	129
100	1301	133	1248	127
125	1276	130	-	-
150	1252	128	-	-

7.4 CORROSION PROTECTION

General Corrosion Protection

Generally, the internal surface of pipes is protected with a centrifugally applied cement mortar lining. The cement should be Portland cement, fly ash cement, or sulphate resisting Portland cement. The standard thickness of the lining is as shown in the table below:

The seal coat, if applied, should be bitumen, acrylic emulsion, or PVC solution.

Nominal Diameter DN (mm)	Lining Thickness (mm)	
	Nominal	Minimum
80 to 250	4	3
300 to 600	6	5
700 to 900	8	6
1000 to 1200	10	7
1350 to 1500	12	8
1600 to 2600	15	11

The internal surface of fittings is protected with hand applied cement mortar lining or with a 0.1mm thick tar-epoxy coating material.

7.5 AIR-RELEASE VALVES

The number of peaks and hence the number of air valves on a pipeline should be kept to a minimum following the design rules earlier outlined in this chapter. Preventing air from entering the pipeline should reduce the amount of air. See e.g. chapter "Water Storage".

Air-release valves serve mainly thee purposes, namely

- To release air from the pipeline during the filling process (large orifice valves)
- To release air from the pipeline during the normal operation of the water supply (small orifice valves)

- To allow air to enter into the pipeline in order to prevent vacuum to occur (large orifice valves).

7.6 Small-orifice Air Valves

- This type of air valves should be placed at all high points relative to the horizontal on pipes with inside diameter of 80mm or larger.

- On smaller pipes air valves should be placed only at accentuate high points and then if air cannot be released through consumer connections.
- In this context it may be considered that a high point is accentuate if it is situated 10m higher than the low points preceding or succeeding it.

- The minimum orifice size with a diameter of approximately 2mm is normally adequate up to a pipe diameter of 300mm.

7.6 Large-orifice Air Valves

- Large orifice valves should be positioned at accentuate high points on pipelines of diameter 80mm or larger at t distance of about 1 km.

- Large-orifice valves should be placed on UPVC pipes class 0.6Mpa at points where vacuum may occur.

- Inlet diameters of 50mm are usually adequate for pipe diameters up to 400mm.

- At locations where a small-orifice and large-orifice valve coincides these should be combined to a double orifice valve.

7.8 Alternative Air Release

The air valves may be replaced with connections to SWPs or Kiosks or with rising branch lines. At the filling of the pipeline system washouts may serve as air release points. Manual air-release valves may replace automatic ones in special cases.

- **Isolating Valves**

All air-release valves should be equipped with isolating valves for easy removal and repair of the air valves.

7.6 WASHOUTS

General

The number of low points and hence the number of washouts should be kept to a minimum following the design rules earlier outlined in this chapter.

7.8 Location

Washouts should be placed only at accentuate low points on raw water and clear water mains of inside diameter 80mm or larger.

In this context it may be considered that a low point is accentuate if the succeeding major high point is situated on a 10m higher level.

7.9 Washout Size

Assuming a shear stress of $10N/m^2$ on the walls of the main pipe and an available pressure of 0.1-.0.2 MPa the diameter, d, of the washout should be:

d = 0.6 D if the upstream and the downstream sides of the main are washed simultaneously.

d = 0.4 D if only one side is washed at a time

Where:

d is the diameter at the washout in mm

D is the diameter of the main pipe in mm

7.1.1 Washout Valves

There shall be a valve only on the washout pipe and **not** on the main pipeline unless the valve can be combined with a section valve (see below).

7.1.2 Drain

There shall be an open drain leading the water from the washout to a suitable steam or discharge point nearby.

7.10 MARKER POSTS

Marker posts shall be provided along pipelines at every 200m, except where they follow permanent roads.

Markers should be placed at all bends, river and road crossings which cannot be easily found otherwise.

Type

The marker should be square 100 x 100mm, height 700mm lettered MAJI. The post should be blue with white lettering.

7.11 VALVE CHAMBER

Dimensions and Design

Valve chambers should be at least 1000 x 1000 mm internally. There must not be UPVC-pipes within the chamber.

The cover should be lockable. The chamber should be drained through the floor or through a drain pipe.

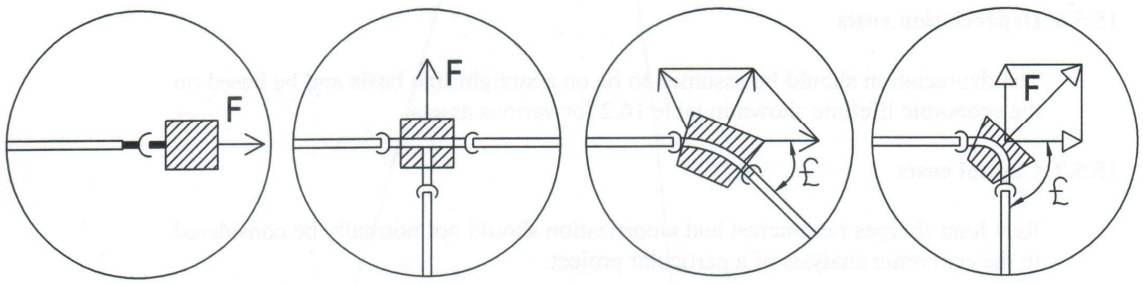
7.12 ANCHOR AND THRUST BLOCKS

Anchor or thrust blocks shall be provided for horizontal and vertical bends, capped ends, change of size and tees and for pipes laid in steep slopes (>1:6).

7.13 Thrust Forces on Pipes

The following table is a guide to be used when designing thrust blocks for pipe systems. The table has been calculated for PVC pipe dimensions, but can also be used for other pipes. The table shows thrust forces for pipelines with an internal pressure of 1.0 MPa.

Fig. 4 Thrust Blocks



The anchor and thrust blocks should be designed for the highest pressure that may occur in the pipeline. The highest pressure usually occurs during the pressure test when e.g. UPVC pipes are tested 1.5 times the nominal working pressure. Anchor or thrust blocks are generally not required when F is lower than 0.05 x d kN where d is the outside diameter in mm.

Table showing axial and resultant forces F kN at 1.0 MPa internal pressure.

Outside Nominal Diameter mm	F = Axial Force	*F = Resultant Force on bends and angles £ = kN*					
		$11\ ^1/_4{}^0$	$22\ ^1/_2{}^0$	30^0	45^0	60^0	90^0
20	0.31	0.06	0.12	0.16	0.24	0.31	0.44
32	0.80	0.16	0.31	0.41	0.61	0.80	1.13
50	1.96	0.38	0.76	1.01	1.50	1.96	2.77
63	3.12	0.61	1.22	1.62	2.39	3.12	4.41
90	6.36	1.25	2.48	3.29	4.87	6.36	8.99
110	9.50	1.86	3.71	4.92	7.27	9.50	13.44
160	20.11	3.94	7.85	10.41	15.39	20.11	28.44
225	39.76	7.79	15.51	20.58	30.43	39.76	56.23
280	61.58	12.07	24.03	31.88	47.13	61.58	87.09
315	77.93	15.28	30.41	40.34	59.65	77.93	110.21

Example: Calculate the thrust force on a 45^0 bend of UPVC 160/6.3 – 0.9

Highest pressure 0.9 x 1.5 = 1.35 MPa occurs during the testing of the pipeline.

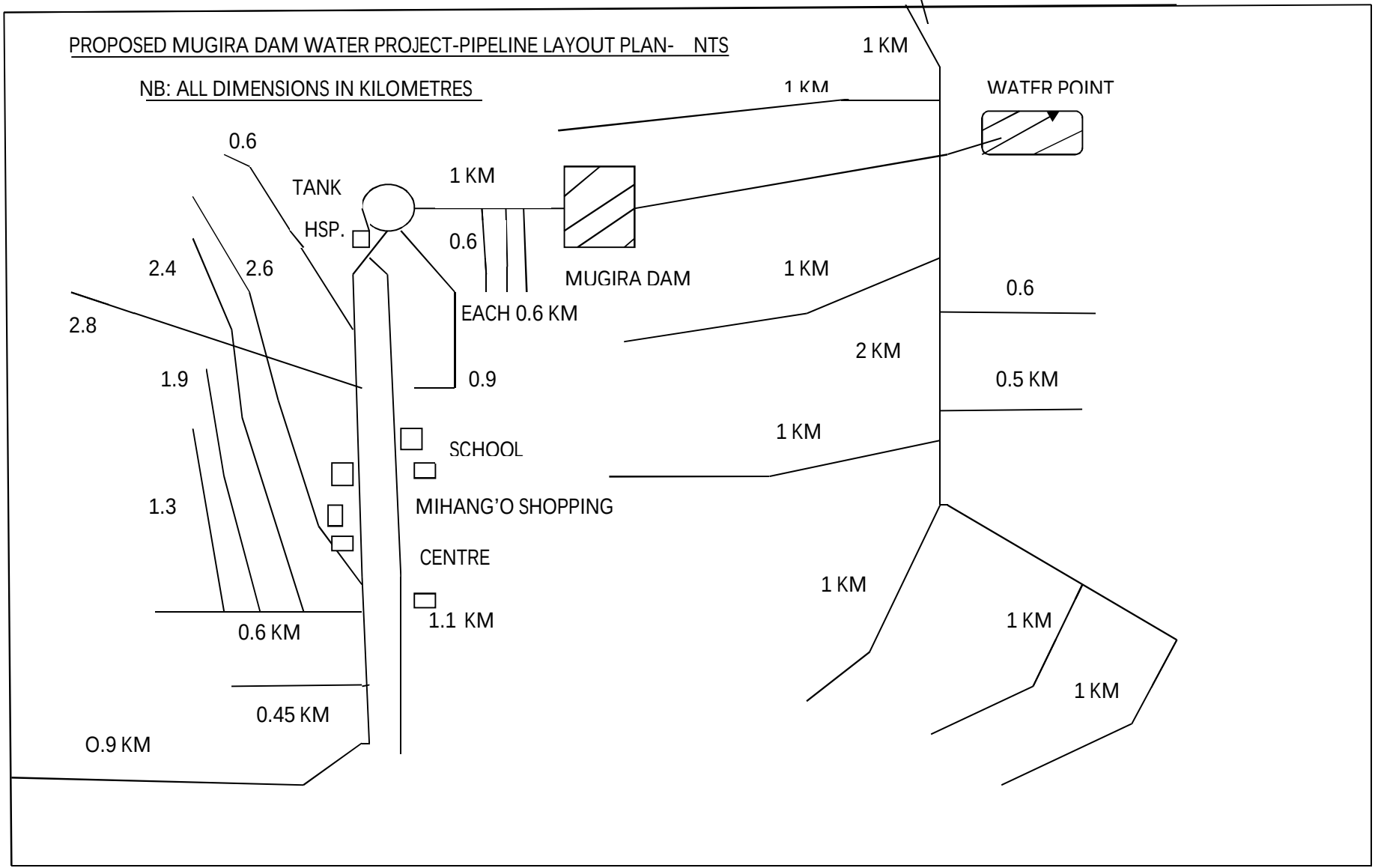
CHAPTER EIGHT- CONCLUSIONS AND RECCOMMENDATIONS

8.1 Conclusions

The completed water project will assist the community access good quality water supply which will be sufficient and available all the time. Time that is usually lost while searching for domestic water from rivers, gravity springs and hand dug wells will be now be used for other economically viable purposes. On the other hand money currently used to treat water born diseases such as typhoid, cholera, diarrhea among others will be used for other better purposes.

8.2 Recommendations;

The project is viable and is highly appraised for funding. Marker posts, air valves, washouts, thrust blocks and anchor blocks should be placed appropriately during project implementation. It is recommended that qualified supervision should also be made available during implementation stage. A master meter to record water abstraction at the intake shall be provided. This is a requirement from the Water Resources Management Authority.


PROPOSED MUGIRA DAM WATER PROJECT-PIPELINE LAYOUT PLAN- NTS
NB: ALL DIMENSIONS IN KILOMETRES
1 KM
1 KM
WATER POINT
0.6
TANK
1 KM
HSP.
0.6
2.4
2.6
MUGIRA DAM
1 KM
0.6
EACH 0.6 KM
2.8
2 KM
1.9
0.9
0.5 KM
1 KM
SCHOOL
MIHANG'O SHOPPING
1.3
CENTRE
1 KM
1 KM
1.1 KM
0.6 KM
1 KM
0.45 KM
O.9 KM

REPUBLIC OF KENYA

MINISTRY OF WATER AND SANITATION

SUB COUNTY WATER OFFICE
P. O. BOX 226 – 10208,
SABASABA

Email: majimaragua@gmail.com

Ref:

Date: 11th May 2018.

Dr Victorio Torres Feced,
VIHDA Association.

RE: MUGIRA DAM WATER PROJECT;

Following our telephone conversation Dr Victorio/Rwigi on 10/05/2018 concerning the phasing of Mugira dam water supply project, here below please find the breakdown of the activities (budget)to be implemented in the first phase of the project.

The phase will include

(I) Clearing the dam area of tree stumps, fencing off the dam area – 334,250.00
(II) Rehabilitation of the pump house. - 108,390.00
(iii) Procurement and installation of the pumping equipments. -1,386,000.00
(iv) Installation of the rising main. - 1,925,500.00
(v) Construction of collection chamber(Sump) - 622,515.00
(vi) Rehabilitation of storage tank - 332,250.00
(vii) Installation of Mihang'o pipeline - 423,250.00
(viii) Construction of treatment tank - 1,268,220.00
Total 6,400,375.00

1.0 Bill of quantities for bush clearing and fencing

Item	Description	Unit	Qty	Rate(Kshs)	Amount(Kshs)
1.	Clearing of the tree stumps on the embankment and in the dam area	L/s	L/s	20,000.00	20,000.00
2.	Excavation of holes 0.45 m diameter, 1 meter deep and store the arising for reuse	No	64	100.00	6,400.00
3.	Procure, deliver r.c concrete poles 3 m long, 150 mm diameter precast	No	64	1,500.00	96,000.00
4.	Provide for barbed wire in 6 horizontal strands (Gauge 12.5)	M	1,200	100.00	12,000.00
5.	Provide for chain link 2.1 M high medium gauge	M	210	450.00	94,500.00
6.	Provide for U nails/binding wire	Kg	60	200.00	12,000.00
7.	Provide for a steel fabricated gate 1.5M wide and 2.1 M high	No	1	14,500.00	14,500.00
	Sub total				255,400.00
	Add 20% labour				51,080.00
	Add 5% contigencies				12,770.00
	Add supervision fee				15,000.00
	Grand Total				334,250.00

1.1 Bill of quantities for composite water treatment tank 100 cubic meters (Ground Masonry)

Item	Description	Unit	Qty	Rate(Kshs)	Amount(Kshs
1.	Excavation of site to remove top unconsolidated soil, grub up roots and dispose the arising commencing ground level up to firm ground.	Cubic meter	50	350.00	17,500.00
2.	Marrum blinding layer 50mm thick	Cubic meter	4	3,400.00	13,600.00
3.	Reinforced high yield bars Y12	No	20	1,300.00	26,000.00
4.	Reinforced high yield bars Y10	No	50	1,100.00	55,000.00
5.	Quarry stones 225 x 225mm(9'' x 9'')	R/ft	1,500	40.00	60,000.00
6.	Ordinary Portland cement	Bag	210	1,000.00	210,000.00
7.	Water proof cement(Pudlo)	Kg	80	400.00	32,000.00
8.	Ballast ½'' – ¾''	Ton	10	3,500.00	35,000.00
9.	Clean river sand	Ton	9	4,000.00	36,000.00
10.	Binding wire	Kg	50	160.00	8,000.00
11.	Props 80mm diam, 3m long	No	100	350.00	35,000.00
12.	Bituminous paint	Litre	20	625.00	12,500.00
13.	Timber sawn soft wood 4'' x 2''	RM	200	85.00	17,000.00
14.	Timber sawn soft wood 6'' x 1''	RM	700	85.00	59,500.00
15.	Ordinary wire nails 4'' long	Kg	30	250.00	7,500.00
16.	Ordinary wire nails 2'' long	Kg	40	250.00	10,000.00
17.	Pipes G.I 6'' diam class 'B' socketed	No	2	32,000.00	64,000.00
18.	G.I Elbows 6'' diam	No	8	1,200.00	9,200.00
19.	Provide for 80mm breather pipes fully installed with wire gauze	No	3	2,500.00	7,500.00
20.	Bell mouth 8'' x 6''	No	1	12,000.00	12,000.00
21.	Provide for construction of valve chamber 1200 x 1000 x 1050mm with lockable cover	No	2	30,000.00	60,000.00
22.	Sluice valve 6'' diam flanged	No	2	45,000.00	90,000.00
	Sub Total				877,300.00
	Add 30% skilled unskilled labour				263,190.00
	Add 10% contigencies				87,730.00
	Add supervision fee				40,000.00
	Grand Total				1,268,220.00

1.2 Bill of quantities for rehabilitation of existing pump house

Item	Description	Unit	Qty	Rate(Kshs)	Amount(Kshs)
1.	Hack out the old plaster with cold chisel and hammer to provide and bond to new plaster to both internal and external faces	L/s	L/s	2,000.00	2,000.00
2.	Apply a thin layer 25mm thick plaster in 1.3 sand cement mortar to both internal and external walls	Meter square	25	1,200.00	30,000.00
3.	Apply 2 coats of paint to both internal and external sides of the pump house	Meter square	25	450.00	11,250.00
4.	Provide and place a fabricated steel door 900 x 2100mm	No	1	12,000.00	12,000.00
5.	Provide and place ventilation made from Y12 bars and measuring 450 x 300mm	No	4	1,000.00	4,000.00
6.	Apply a floor screed 25mm thick made from 1.3 sand cement mortar	Meter square	8	1,200.00	9,600.00
	Sub Total				68,850.00
	Add 30% labour				20,655.00
	Add 10% contigencies				6,885.00
	Add supervision				12,000.00
	Grand Total				108,390.00

Bill of quantities for repair of existing storage tank(Mihang'o Dispensary)

Item	Description	Unit	Qty	Rate(Kshs)	Amount(Kshs)
1.	Hack out the old plaster with a cold chisel and hammer both at the out side,the inside wall and the floor of the storage tank	L/s	L/s	30,000.00	30,000.00
2.	Apply a thin layer 25mm thick plaster in 1.3 cement/sand to both external and internal sides of the tank	Meter square	100	1,200.00	120,000.00
3.	Apply 2 coats of bituminous paint to the internal wall of the tank	Meter square	50	500.00	25,000.00
4.	Apply a floor screed 25mm thick made from 1.;3 cement to sand ratio(mortar)	Meter square	50	1,200.00	60,000.00
	Sub Total				235,000.00
	Add 30% labour				70,500.00
	Add 5% contigencies				11,750.00
	Add supervision fee				15,000.00
	Grand Total				332,250.00

1.3 Bill of quantities for rising main 1.02 Km long 110mm diameter HDPE pipes

Item	Description	Unit	Qty	Rate(Kshs)	Amount(Kshs)
1.	Excavate trench not exceeding 1.2m depth and 450 mm width	M	1,020	150.00	153,000.00
2.	Provide and install HDPE pipes DN 110, PN 12.5	M	1,020	1,000.00	1,020,000.00
3.	Provide for G.I pipes 100mm diam socketed 6M long (4'')	No	5	30,000.00	150,000.00
4.	Provide G.I elbows 4'' diam	No	4	800.00	3,200.00
5.	Provide for bosswhite	Kg	3	500.00	1,500.00
6.	Provide for hemp	Kg	2	100.00	200.00
7.	Back filling of the trench after pipe laying	M	1,020	50.00	51,000.00
8.	Allow for pipeline testing	L/s	L/s	10,000.00	10, 000.00
9.	Provide for road crossing using appropriate technology	No	1	25.000.00	25,000.00
10.	Provide HDPE couplings 110 x 110mm diam	No	12	1,500.00	18,000.00
11.	Provide for HDPE/G.I adapter 110mm (4'') diam	No	5	1,500.00	7,500.00
12.	Provide for standard concrete marker posts at every 200 M distance	No	6	400.00	2,400.00
13.	Provide for double orifice air release valve 25mm diam	No	2	8,500.00	17,000.00
14.	Allow for construction of a lockable valve chamber 1050 x 1200 x 1200 mm to accommodate the air valves	No		30,000.00	60,000.00
	Sub Total				1,516,400.00
	Add 20% labour				303,280.00
	Add 5% contigencies				75,820.00
	Add supervision				30,000.00
	Grand Total				1,925,500.00

1.4 Bill of quantities for water sump construction capacity 20 cubic meters

Item	Description	Unit	Qty	Rate(Kshs)	Amount(Kshs)
1.	Excavation of foundation 3 m diam and 2 m depth	Cubic meter	68	500.00	34,000.00
2.	Marrum blinding layer 50mm thick	Cubic meter	3	3,400.00	10,200.00
3.	Reinforcement high yield bar Y10	No	50	1,100.00	55,000.00
4.	Quarry stones 225 x 225mm(9'' x 9'')	R/ft	600	40.00	24,000.00
5.	Reinforcement high yield bar Y12	No	4	1,300.00	5,200.00
6.	Ordinary Portland cement	Bag	60	1,000.00	60,000.00
7.	Water proof cement (Pudlo)	Kg	60	500.00	30,000.00
8.	Ballast ½'' – ¾''	Ton	7	4,000.00	28,000.00
9.	Clean river sand	Ton	7	3,500.00	24,500.00
10.	Binding wire	Kg	50	160.00	8,000.00
11.	Props 80mm diam, 3.0m long	No	60	350.00	21,000.00
12.	Bituminous paint	Litre	20	625.00	12,500.00
13.	Timber sawn soft wood 4'' x 2''	Rm	120	85.00	10,200.00
14.	Timber sawn soft wood 6'' x 1''	Rm	240	85.00	20,400.00
15.	Ordinary wire nails 4''	Kg	20	250.00	5,000.00
16.	Ordinary wire nails 2''	Kg	30	250.00	7,500.00
17.	Provide for 80mm diam breather pipes fully installed with wire gauze	No	3	1,200.00	3,600.00
18.	Provide for construction of a valve chamber 1200 x 1200 x 1050mm with lockable cover	No	2	30,000.00	60,000.00
19.	Provide for step irons made from 20mm diam thick round bars	No	6	200.00	1,200.00
20.	Provide for steel portable ladder 8 m long	No	1	15,000.00	15,000.00
21.	Provide for fabricated steel manhole cover 500 x 350 mm	No	1	3,600.00	3,600.00
	Sub Total				438,900.00
	Add 30% labour				131,670.00
	Add 5% contigencies				21,945.00
	Add Supervision fee				30,000.00
	Grand Total				622,515.00

1.5 Bill of quantities for pump installation and KPLC power supply

Item	Description	Unit	Qty	Rate(Kshs)	Amount(Kshs)
1.	Supply and install a surface water pump capable of pumping 40.6 cubic meters of water against a total head of 143 meters complete with all accessories, preferably 30 Kw. Test and commission.	No	1	890,000.00	890,000.00
2.	Supply and install KSB Motor 10Kw or its equivalent complete with control panel, control cables, water level relay and power failure relay. Test and commission	No	1	250,000.00	250,000.00
3.	Supply 3 phase KPLC electric power to site and connect to the control panel. Test and commission	No	1	180,000.00	180,000.00
	Sub Total				1,320,000.00
	Add 5% contigencies				66,000.00
	Grand Total				1,386,000.00

Bill of quantities for a distribution line to Mihang'o Primary School 0.5 Km long 50mm diameter

Item	Description	Unit	Qty	Rate(Kshs)	Amount(Kshs)
1.	Excavate trench not exceeding 1.2m depth, 450mm width	M	504	150.00	75,600.00
2.	Provide and install HDPE pipes DN 50, PN 12.5	M	504	300.00	151,200.00
3.	Provide for gate valve 50 mm diam complete with fittings	No	1	4,500.00	4,500.00
4.	Provide HDPE reducing tee 110mm x 50mm	No	1	700.00	700.00
5.	Back filling the trench after pipe laying	M	504	50.00	25,200.00
6.	Allow for pipe line testing	L/s	L/s	5,000.00	5,000.00
7.	Provide for road crossing using appropriate technology	No	1	25,000.00	25,000.00
8.	Provide for HDPE coupling 50mm x 50mm	No	5	500.00	2,500.00
9.	Provide for HDPE adapters 50mm(11/2'') diam	No	2	700.00	1,400.00
10.	Provide for concrete marker posts at every 200m	No	5	400.00	2,000.00
11.	Provide for a single orifice air release valve 25mm diam	No	1	7,500.00	7,500.00
12.	Allow for construction of a valve chamber 1200 x 1200 x 1050 mm with lockable cover	No	1	30,000.00	30,000.00
	Sub Total				330,600.00
	Add 20% labour				66,120.00
	Add 5% contigencies				16,530.00
	Add supervision fee				10,000.00
	Grand Total				423,250.00

S. M. Rwigi
SUB COUNTY WATER OFFICER
MURANG'A SOUTH.

ANEXO 2

Acuerdo de colaboración Asociaciones Vihda y Gota a Gota y Departamento de Agua e Irrigación del Condado de Murang´a.

Acuerdo de colaboración entre Vihda y Gota a Gota de España con el Gobierno del Condado de Murang´a para la rehabilitación de la balsa de Mugira en Kenia (Fase I).

1.- Introducción

El Proyecto de abastecimiento de agua de la balsa de Mugira se encuentra en Gaklunyu Sub-location del Ward de Makuyu en el Condado de Muranga. La fuente de agua propuesta es la balsa de Mugira, la cual tiene suficiente cantidad de agua durante todo el año. La estimación inicial para el proyecto esd e 486 m3 que cubrirán los usos domésticos de unos 400 hogares. El proyecto también suministrará agua al dispensario de Mihang´o y a las escuelas de enseñanza primaria y secundaria entre otras instituciones públicas. El coste estimado del proyecto es de 21.8 millones de chelines y se hará en dos partes. La primera parte tiene un coste de 6.4 millones. La segunda fase se hará según la disponibilidad de fondos.

Roles y responsabilidades:

1.- Gobierno del Condado de Murang´a:

1.1. Departamento de Agua e irrigación del Condado de Murang´a

- Propocionar ayuda técnica
- Gestionar el proyecto
  - Planificación de la puesta en marcha y desarrollo del proyecto
  - Coordinar a todas las partes y asegurar un propósito común
  - Supervisar el desarrollo del proyecto
  - Comunicar a tiempo con todas las partes
  - Monitorizar y evaluar para asegurar cumplimiento de plazos
- Participación de la población
- Llevar a cabo el proceso de licitación
  - Publicar el anuncio
  - Adjudicar el contrato
  - Emitir los certificados de obra completa

2.- Comunidad:

- Provide unskilled labour
  - Limpieza, talado y desbrozado de la balsa
  - Cavar todas las zanjas
  - Rellenar con tierra las zanjas una vez instaladas las tuberías
- Como cliente
  - Participar en las reunions de supervisión
  - Proporcionar segurida a todo el material
- Proporcionar tierras y facilitar el proyecto

3.- Asociaciones Vihda y Gota a Gota

- Verificar la información y los datos
- Asegurar como donante:
  - Revisar el anuncio de licitación previo a su publicación.
  - Pagar el anuncio de licitación directamente al periódico
  - Participar en la evaluación de la adjudicación
  - Confirmar por escrito la adjudicación.
- Participar en las reuniones de evalucación.
- Pagar los certificados de obra al constructor (Fase I)
- Facilitar la aperture de sobres y la evaluación según las tarifas del gobierno

- Facilitar las visitas de las entidades donantes al proyecto
- Proporcionar apoyo técnico

Requisitos previos:

1.- Carta de que no hay duplicidad de fondos para este Proyecto desde la TWSB
2.- Los donantes tiene acceso a toda la información técnica e informes (por email) incluyendo:
- 3.1 Mapas y perfiles
- 3.2 Cálculos hidraúlicos
- 3.3 Memoria de calidades inluyendo especificaciones y presupuesto
- 3.4 Certificados de obra completa

Objetivos específicos de la fase I::

I. Rehabilitación de la balsa
II. Construcción de una estación de bombeo
III. Suministro de la bomba de agua
IV. Tubería principal hasta el dispensario de Mihang´o
V. Rehabilitatción del tanque de agua en el dispensario de Mihang´o
VI. Distribution lines to Health Centre and Mihango Primary and Secondary Schools

Conclusiones:
El desarrollo del Proyecto está previsto que empiece inmediatamente después de firmar el acuerdo. La duración de la fase de implementación del proyecto de la obra es de 3 meses desde el día de su comienzo. Una vez completado, el proyecto se espera que suministre 460 m3 a los 400 hogares, al dispensario de Mihang´o y a las escuelas de enseñanza primaria y secundaria y a otras instituciones públicas en la ziona. El Condado de Murang´a se compromete a asegurar la adecuada planificación, desarrollo a tiempo, ejecución de la obra y gestión eficiente con sostenibilidad a largo plazo de este noble proyecto. Se adjunta el pliego de condiciones con los datos técnicos y prespuestarios.

Acuerdo firmado el día 16 de Mayo de 2018 Por

Hon Paul Macharia
CEC Water and Irrigation
Gobierno del Condado de Muranga

Dr Victorio Torres Feced
Vihda Association (CEO)
Representante de la ONG Gota a Gota

Testigos:
Ingeniero Elías Guía
Representante del Ministerio de Pesca, Agricultura y Medio Ambiente

Stephen Chege Mwangi
Representante comunitario

Collaboration Agreement between Vihda and Gota Gota Associations from Spain and Murang´a County Government for Rehabilitation of Mugira Dam Water Supply, Phase I

1.0 Introduction

Mugira dam water supply project is located in Gakungu Sub-location of Makuyu Ward, Murang'a County. The proposed source of water is Mugira Dam that has sufficient water storage all the year round. The estimated water supply for the project is 486m^3 which is sufficient to meet the domestic demand of around 400 households. The project will also supply water to Mihango dispensary, Mihango primary school and Mihango secondary school among other public institutions. The project, estimated to cost Ksh. 21.82M will be executed in two phases. The first phase of the project is estimated to cost Ksh. 6.4M. The second phase will follow thereafter receiving the funds.

2.0 Roles and responsibilities

2.1 Murang'a County Government:

2.1 Murang´a County Government Water and Irrigation Department:

i. Provision of technical assistance/support role
ii. Project management:
    a. Planning the project's implementation process
    b. Coordinating all stakeholders to ensure unity of purpose
    c. Supervision of project implementation process
    d. Timely communication with all stakeholders
    e. Monitoring and evaluation to ensure effective and timely delivery
iii. Public participation
iv. Carrying out the procurement process
    a. Advertising the tender
    b. Awarding the contract
    c. Issuing certificates of completion of works
v. Ensure, completion, operationalization and sustainability of the water project

2.2 Community:

i. Provision of casual labour
    a. Bush clearing around the dam
    b. Trenching
    c. Backfilling
ii. As the client
    a. Participate in the site meetings
    b. Provision of security of materials and all assets
iii. Provision of the land and easement for the project

VIHDA ASSOCIATION Vida 16 MAY 2018 P.O. Box 63745 - 00619, NAIROBI, KENYA.

2.3 Vihda Association and Gota a Gota Association

i. Verification of information and data
ii. Act as donor to ensure:
    a. Give prior review of draft tender advert
    b. Payment of the tender advert directly to newspaper
    c. Participate in the tender evaluation
    d. Give a no objection to award (with formal letter)

MURANG'A COUNTY GOVERNMENT CEC MEMBER Water & Irrigation 16 MAY 2018 SIGN:..... P. O. Box 52 - 10200 MURANG'A

e. Participate in the site meetings
f. Honour the certificates to the contractor for the construction of Phase 1

iii. Facilitate opening envelopes meeting, evaluation committee meeting, and award meeting as per government rates.
iv. Facilitate visits from the donors to the project
v. To provide technical inputs

3.0 Pre-requisites:

1. Letter of no duplication of funds for the target areas from the TWSB
2. Donor with access to data and all technical reports (via email) including:
   i. Route plans and profiles
   ii. Hydraulic calculations
   iii. Bill of quantities including technical specifications with budget
   iv. Certificates of completion

4.0 Specific Objectives of phase I

i. Rehabilitation of the dam
ii. Construction of a pumping house
iii. Procurement of the water pump
iv. Laying of rising mains A to Mihango Health Centre
v. Rehabilitation of Water Tank at Mihango Health Centre
vi. Distribution lines to Health Centre and Mihango Primary and Secondary Schools

5.0 Conclusion

The project's implementation process is scheduled to commence immediately after signing of this agreement. The expected duration of the phase one of the project's implementation process is 3 months from the day of commencement. Upon completion, the project is expected to supply 486M^3 of water for domestic use to over 400 households, Mihango dispensary, Mihango primary school, Mihango secondary school and other public institutions in the area. The County Government of Murang'a will remain committed to ensure proper planning, timely execution, efficient operationalization and long term sustainability of the noble project. Detailed technical, financial and empirical information is attached herein.

Agreement signed this ..... **Day of** ..... **Year** ..... **By:**

MURANG'A COUNTY GOVERNMENT
CEC - MEMBER
Water & Irrigation
16 MAY 2018
SIGN:.....
P.O. Box 52 - 10200 MURANG'A

Hon Paul Macharia
CEC Water and Irrigation
County Government of Murang'a

VIHDA ASSOCIATION
Vida
16 MAY 2018
P.O. Box 63745 - 00619, NAIROBI, KENYA.

Dr Victorio Torres Feced
Vihda Association (CEO)
Representative of Gota a Gota Association

Witnessed by:
Eng. Elías Guía
Representative from Spanish Ministry of Fisheries, Agriculture and Environment

Stephen Chege Mwangi
Community Representative

ANEXO 3

Acta de la reunión mantenida en la obra para revisar las averías y evaluar el progreso de la obra (17 de febrero 2021).

MUGIRA DAM WATER PROJECT.

OUTCOME REPORT ON A MEETING HELD BESIDES MUGIRA DAM ON 17th FEB 2021.

LOCAL LEADERS IN ATTENDANCE.

1. Hon. STANLEY THUO (MCA MAKUYU WARD)
2. Eng. GICHUKI
3. CHIEF KAMBITI
4. Ass. CHIEF KAMBITI
5. Ass. CHIEF MIHANGO
6. PETER GACHANJA (HEAD MAN PUNDA MILIA VILLAGE)
7. MUGIRA DAM WATER COMMITTEE MEMBERS

The meeting was called to order at 11:20 am by the area Headman Mr Peter Gachanja, with opening prayers done by Pastor Margaret. Mr Gachanja gave the opening remarks and welcomed everyone in attendance to Mugira. He finished by Inviting Hon Stanley Thuo MCA Makuyu ward to chair the rest of the meeting.

MCA. Hon. STANLEY THUO

He started by welcoming everyone to Mugira and in Makuyu ward at large. He said the days meeting was for members of his community to give their views and issues concerning Mugira dam and the water project. He informed the meeting that, he was not aware of the previous meeting for he was not invited. He said he received a phone call while he was attending to county business in Mombasa County and was informed on the issues that arose in the previous meeting. He apologized for any misconduct that may have occurred in the failed meeting and called for cohesion between people of the two sides. (Makuyu/ Kambiti). He said in long run both communities and even others will benefit from the project if capacity allows, but if politics is allowed to take over the project is dead even before it's born. He gave the communities example with the conflicts in pastoral lands commonly in Northan Kenya due to divisions on feeding and watering points, thus no need to put boundaries when the dam water is concerned. He said it was important to hear a short history of Mugira dam. Mr Tarasisio was invited to give a short history on Mugira dam.

After Tarasisio's speech The Mca indicated it is as if public participation is being done after the project completion rather than before the start. He brought to attention that, the Government is constructing a large water dam in Maragua and is nearing completion. The dam will serve Maragua, Makuyu and Kambiti areas with sufficient water supply thus no need of fighting on Mugira dam which is a community dam.

He also gave the following resolutions.

- Environmental Impact Assessment be contacted and put out to the public.
- Value for funds from donors and even the county should be realized by achieving the outcome it was intended for. In our case a well done water project in all dimensions.
- Reports on dam capacity and how many households it can serve be put to public.
- Schools and the Hospital to continue getting water supply from the dam project, but further piping away from the three sites to stop until the reports are out or further notice.
- Handing over of the project to the County and the society at large to happen only when there is certificatory completion of the project by the contractor.
- Peace to be maintained and that elders from both sides should continue to engage each other and have solutions for better running of the project now and in future.
- Leaders from the area not to be assumed in future events as it has been happening. Respect be given to the dam committee and Mr Tarasisio for they have protected and taken care of the dam for long now.

Mr. TARASISIO IRUNGU NJOROGE.

He started by greeting the attendees and introduced his nine member Mugira Dam committee as the executive chairman. He informed us that, the dam in Mugira is manmade and starts back in the year 1976 when the Mugira locals then contributed funds and bought the dam. He said there was an attempt to sell the dam in the years of 2004 to 2008 but Mugira people managed to prevent losing it. Nine member committee elected by the locals has always run the dam till today thus why they don't recognize any other committee as was informed in the other meeting. He insisted that the existing committee which he heads is still in office and in charge of Mugira dam and its project.

DAM ISSUES AS PER MR TARASISIO AND HIS COMMITEE.

- Parallel committee to run the dam without their knowledge. Mugira people neither their leaders participated in the said election.
- Accused Mr. Gichuki and Kambiti area chief for fronting Dam take over from them.
- Mr. Gichuki accused of conducting the said election for another committee and inciting them to take over the project.
- The water project to be handed over not completed to satisfactory. Piping, treatment tank and pump house leakages. Mr. Gichuki and Mr. Muchoki the contractor know about the raised issues but chose to ignore them.
- Mr. Gichuki,s incitement has led to live threats to the chairman and his family.
- Mr Gichuki accused of taking contractors side instead of being impartial as the supervisor of the project.
- Known individuals from Mihango sneaking to the water plant and unlocking the water using pliers thus spoiling the threads.

MR TARASISIO AND COMMITTEE RESOLUTIONS.

- Mugira dam management won't be surrendered to any other committee thus the new committee null and void.
- Contractor to make sure the project work is well completed and working properly before completion certificate and final pay is given to him. Mugira people second it.
- Water to serve the Hospital and the two schools. No further distribution to private homes or entities in Mihango. A seven day automata tam given to Mihango residents who had connected private pipes to disconnect or there won't be further pumping of water from the dam.
- Further water distribution to be done in Mugira area before any other place.
- No water business will be contacted from Mugira dam project thus the built water selling kiosk by the other committee is of no use.
- Leaders from Mihango area to come sit with the original Dam committee on their peoples behave and discus on how distribution will be done in their area.

Mr. Tarasisio finished by praising Dr Victorio and his team plus the county government of Muranga for enabling the project in their community. He recites how school going children carrying water Jere cans from school touched Dr Victorio heart leading to the extension of the water supply to the primary and secondary schools in Mihango from the hospital. He said it will be regrettable for this project to fail due to politics involvement. He invited the MCA to continue with the event.

Eng. GICHUKI.

He explained that he works for Muranga county Government in the water department and he has been with the project since the beginning. He said that the design for the water project is to serve the whole area but in faces. He explains that he knows the design and the map of the project and first face was to supply water to the hospital and the two schools. He explains that water from the dam can server up to 9000 people or 1500 households according to study they did. He also said, due process was followed during tender awarding and had faith with the contractor who won it. He says his interest is both Mugira, Mihango and even other places surrounding the areas to benefit from the water if possible. For that to happen the project must be completed correctly. He said we should not dwell in history for water has no boundaries.

Eng. Gichuki said he never called for the election meeting he is accused of but the chief from Kambiti did and he was just an invitee. He explained their intention of forming a committee was to further distribute the project water and bill individuals by providing water meters. He says there is room to expand the committee from the seven members to fifteen so as to accommodate people from Mugira. He says that the new committee was to be tasked with distribution of water. Funds from the billed water to be used for maintenance of the project. His final call was unity among the people of the area and allow water distribution to happen.

MIHANGO CHIEF.

He started by thanking the MCA for the opportunity to address the people. He said their seemed to be a miscommunication on who to attend the days meeting. The MCA had said meeting was made for people of Mugira side only while in the last meeting it was announced that both sides will be in attendance. He said he has being in the area since the year of 2008 and there have never being conflicts between the two sides and should never begin. He explained that the meeting in which the election was contacted was on notice only that Mugira resides plus Mr. Tarasisio's led committee refused to attend. Mihango assistant chief says she personally called Mr Tarasisio informing him of the meeting but said they won't attend the meeting. She adds that Tarasisio is aware of all water projects they have done together even with even the World vision organization. She insisted that Mihango residents have in no way interfered with the running of the dam project and have always worked together as a community with the Mugira residents.

FINAL RECOMMENDATIONS.

1. Project to be certified before handover to the county and the community at large.
2. Dam assessment to ascertain capacity and sustainability be done before any further water distribution away from the three sites can commence.
3. Concerns of any kind concerning the dam and its water be forwarded to the original Mugira dam committee.
4. Contractor to repair the available defects with the latest technology as advised by Eng. Gichuki and use the same technology to seal all the joints along the piping. No further use of concrete to conceal the defects.
5. Eng. Gichuki to make sure the project is done as supposed and be the eyes of the county and the people so as to get value for money for those are his duties.

At 13:30 hrs. closing remarks was done by the MCA with closing prayers done by Pastor Margaret. The contractor arrived at this stage and water pumping was done for a physical inspection by all the attendees. Before long we had discovered three points with defects. There were points where we learned that repairs to the defect was done up to seven times thus the call for the latest technology and none use of concrete. The contractor in supervision of Eng. Gichuki agreed to use latest technology to correct the defects ASAP. Further communication concerning the project hand over to be done once the project is fully completed.

There being no other business we left Mugira for Muranga at 15:30 hrs.

Attached some pictures below. Please forgive the quality, it's the best my phone would allow.

THANK YOU.

AUGUSTINE M KIKUVI.

Figure 1 Leakage along the piping


10

ANEXO 4

Primer Certificado de Obra

SUMMARY OF STATEMENT FOR PAYMENT ON ACCOUNT.

CONTRACT NAME:	**MUGIRA DAM WATER PHASE 1.**	CERTIFICATE No. :	**1**
CONTRACT No.	**MCG/042/2017-2018**		
CONTRACTOR :	**BLACK BEAR CONSTRUCTION.**		
CONTRACT SUM :	**KSHS 6,368,991.50**	CONTRACT DURATION :	

DESCRIPTION.	PREVIOUS CERTIFICATES (KSHS)	THIS CERTIFICATE (KSHS)	TOTAL TO DATE (KSHS)
A. TOTAL OF WORK DONE	-	2,788,594.80	**2,788,594.80**
B. MATERIAL ON SITE	0.00	0.00	-
C. VARIATION OF PRICES	0.00	0.00	-
D. SUB-TOTAL (A + B + C)	-	**2,788,594.80**	**2,788,594.80**
E. ADD 16% VAT	0.00	446,175.17	**446,175.17**
F. SUB-TOTAL(D + E)	**0.00**	**3,234,769.97**	**3,234,769.97**
G. LESS V.A.T (6% OF F)		167,315.69	**167,315.69**
G. LESS RETENTION MONEY (5) OF F)	0.00	139,429.74	**139,429.74**
G(a). RELEASE OF RETETION 2.5%	0.00	0.00	-
H. WITHHOLDING (3% OF F)	0.00	83,657.84	**83,657.84**
I. SUB-TOTAL(F - (G + H)+G(a))	0.00	**2,844,366.70**	**2,844,366.70**
J. ADVANCE PAYMENT (10% of Contract Sum)	0.00	0.00	
K. LESS REPAYMENT OF ADVANCE	0.00	-	
L. BALANCE OF ADVANCE	0.00	0.00	
M. INTERST ON DELAYED PAYMENT	0.00	0.00	
N. TOTAL OF PAYMENTS (I + M + L)	**0.00**	**2,844,366.70**	**2,844,366.70**
O. LESS PREVIOUS CERTIFICATES			0.00
AMOUNT NOW DUE TO CONTRACTOR			**2,844,366.70**

Submitted by:

P.O. Box 1177 - 10300, KERUGOYA
Tel: 0734 266 302
BLACK BEAR CONSTRUCTION (K) LTD

Contractor.

Date: 16/1/19.

Checked by:

Water Officer(Water&Irrigation)

I hereby confirm the above rates and Quantities

Date: 16/01/19.

Certified by:-

J.Rukenya.
(Chief Officer Water & Irrigation)

Date: 16/1/2019

Approved by:

P.Macharia
C.E.C Water & Irrigation

6/2/2019

Date

BLACK BEAR CONSTRUCTION

Kerugoya Kutus Road I P.O Box 1177-10300
Kerugoya, Cell: +254 734266302
Email: info@blackbearconstruction.co.ke
Web: wwwblackbearconstruction.co.ke

Our Ref: BBC/MCG/2019/0021
Your Ref:
Date: 15th January 2019

Dr. Victorio Torres Feced
Vihda Association
P.O Box 63745-00619
Nairobi, Kenya

Dear Sir,

RE: SUBMISSION OF OUR CERTIFICATE NO.1 OF PAYMENT FOR MUGIRA DAM WATER SUPPLY PHASE 1: CONTRACT NO: MCG/042/2017-2018

With reference to the subject mentioned above, attached herewith please find our certificate number one for the amount of Ksh 3,073,031.50 (Kenya shillings three million, seventy three thousand, thirty one and cents fifty only) for the same. We kindly request you to settle this payment either by raising a cheque in favor of:

"Black Bear Projects (K) Limited" or make a bank transfer to our bank account whose details are as hereunder:

Account Name: Black Bear Projects (K) Limited
Account number: 0100262616307
Name of Bank: Equity Bank Limited
Branch: Kerugoya Branch

We thank you for giving us an opportunity to partner with you in infrastructure development and we look forward to a successful project ahead and more engagements in the future.

Yours Faithfully,
BLACK BEAR CONSTRUCTION (K) LTD

Nancy Njeri Mbagiru
Commercial Director

1.3 Bill of quantities for rising main 1.02 Km long 110mm diameter HDPE pipes

Item	Description	Unit	Qty	Rate (Kshs)	Bill Amount (Kshs)	Quantity Claimed	Claimed Amount
1.	Excavate trench not exceeding 1.2m depth and 450 mm width	M	1,020	250	255,000	1020	255,000
2.	Provide and install HDPE pipes DN 110, PN 12.5	M	1,020	500	510,000	1020	510,000
3.	Provide for G.I pipes 100mm diam socketed 6M long (4'')	No	5	12,000	60,000	0	0
4.	Provide G.I elbows 4'' diam	No	4	2,500	10,000	0	0
5.	Provide for boss white	Kg	3	750	2,250	0	0
6.	Provide for hemp	Kg	2	500	1,000		0
7.	Back filling of the trench after pipe laying	M	1,020	150	153,000	0	0
8.	Allow for pipeline testing	L/s	L/s	10,000	10, 000.00	0	0
9.	Provide for road crossing using appropriate technology	No	1	200,000	200,000	100%	200,000
10.	Provide HDPE couplings 110 x 110mm diam	No	12	1,200	14,400	0	0
11.	Provide for HDPE/G.I adapter 110mm (4'') diam	No	5	1,750	8,750	0	0
12.	Provide for standard concrete marker posts at every 200 M distance	No	6	2,500	15,000	0	0
13.	Provide for double orifice air release valve 25mm diam	No	2	3,500	7,000	0	0
14.	Allow for construction of a lockable valve chamber 1050 x 1200 x 1200 mm to accommodate the air valves	No		75,000	0	0	0
	Sub Total				**1,236,400**		**965,000**
	Add 30% labour				370,920		289,500
	Add 5% contingencies				61,820		48,250
	Add 5% supervision fee				61,820		48,250
	Grand Total				**1,730,960**		**1,351,000**

Yours Faithfully,

BLACK BEAR CONSTRUCTION (K) LTD

Nancy Njeri Mbagiru

Commercial Director

1.5 Bill of quantities for pump installation and KPLC power supply

Item	Description	Unit	Qty	Rate (Kshs)	Bill Amount (Kshs)	Quantity Claimed	Claimed Amount
1.	Supply and install a surface water pump capable of pumping 40.6 cubic meters of water against a total head of 143 meters complete with all accessories, preferably 30 Kw.Test and commission.	No	1	120,000	120,000	0%	0
2.	Supply and install KSB Motor 10Kw or its equivalent complete with control panel, control cables, water level relay and power failure relay.Test and commission	No	1	100,000	100,000	0	0
3.	Supply 3 phase KPLC electric power to site and connect to the control panel.Test and commission	No	1	100,000	100,000	0	0
	Sub Total				320,000		0
	Add 5% contingencies				16,000		0
	Grand Total				**336,000**		**0**

Yours Faithfully,

BLACK BEAR CONSTRUCTION (K) LTD

Nancy Njeri Mbagiru

Commercial Director

Bill of quantities for a distribution line to Mihang'o Primary School 0.5 Km

Item	Description	Unit	Qty	Rate (Kshs)	Bill Amount (Kshs)	Quantity claimed	Claimed Amount
1.	Excavate trench not exceeding 1.2m depth, 450mm width	M	504	250	126,000	504	126,000
2.	Provide and install HDPEpipes DN 50, PN 12.5	M	504	500	252,000	504	252,000
3.	Provide for gate valve 50 mm diam complete with fittings	No	1	7,500	7,500	0	0
4.	Provide HDPE reducing tee 110mm x 50mm	No	1	1,500	1,500	0	0
5.	Back filling the trench after pipe laying	M	504	300	151,200	0	0
6.	Allow for pipe line testing	L/s	L/s	5,000	5,000	0	0
7.	Provide for road crossing using appropriate technology	No	1	200,000	200,000	50%	100,000
8.	Provide for HDPE coupling 50mm x 50mm	No	5	1,200	6,000	0	0
9.	Provide for HDPE adapters 50mm (11/2'') diam	No	2	1,750	3,500	0	0
10.	Provide for concrete marker posts at every 200m	No	5	2,500	12,500	0	0
11.	Provide for a single orifice air release valve 25mm diam	No	1	3,500	3,500	0	0
12.	Allow for construction of a valve chamber 1200 x 1200 x 1050 mm with lockable cover	No	1	50,000	50,000	0	0
	Sub Total				818,700		478,000
	Add 20% labour				245,610		95,600
	Add 5% contingencies				40,935		23,900
	Add 5% supervision fee				40,935		23,900
	Grand Total				**1,146,180**		**621,400**

Yours Faithfully,

BLACK BEAR CONSTRUCTION (K) LTD

Nancy Njeri Mbagiru

Commercial Director

1.2 Bill of quantities for rehabilitation of existing pump house

Item	Description	Unit	Qty	Rate (Kshs)	Bill Amount (Kshs)	Quantity Claimed	Claimed Amount
1.	Hack out the old plaster with cold chisel and hammer to provide and bond to new plaster to both internal and external faces	L/s	L/s	2,000	2,000	100%	2,000
2.	Apply a thin layer 25mm thick plaster in 1.3 sand cement mortar to both internal and external walls	MS	25	550	13,750	25	13,750
3.	Apply 2 coats of paint to both internal and external sides of the pump house	MS	25	450	11,250	25	11,250
4.	Provide and place a fabricated steel door 900 x 2100mm	No	1	18,000	18,000	1	18,000
5.	Provide and place ventilation made from Y12 bars and measuring 450 x 300mm	No	4	4,500	18,000	4	18,000
6.	Apply a floor screed 25mm thick made from 1.3 sand cement mortar	MS	8	750	6,000	8	6,000
	Sub Total				69,000		69,000
	Add 30% labour				20,700		20,700
	Add 10% contingencies				6,900		6,900
	Add 5% supervision				3,450		3,450
	Grand Total				**100,050**		**100,050**

Yours Faithfully,

BLACK BEAR CONSTRUCTION (K) LTD

Nancy Njeri Mbagiru

Commercial Director

DISTRIBUTION TANK BEFORE REHABILITATION

DISTRIBUTION TANK AFTER REHABILITATION

TRENCHES FOR LAYING HDPE PIPES

ANEXO 5

Segundo Certificado de Obra

SUMMARY OF STATEMENT FOR PAYMENT ON ACCOUNT.

CONTRACT NAME:	**MUGIRA DAM WATER PHASE 1.**	CERTIFICATE No. :		**2**
CONTRACT No.	**MCG/042/2017-2018**			
CONTRACTOR :	**BLACK BEAR CONSTRUCTION.**			
CONTRACT SUM :	**KSHS 6,368,991.50**	CONTRACT DURATION :		
DESCRIPTION.		PREVIOUS CERTIFICATES (KSHS)	THIS CERTIFICATE (KSHS)	**TOTAL TO DATE (KSHS)**
A. TOTAL OF WORK DONE		2,788,594.80	2,665,815.97	**5,454,410.77**
B. MATERIAL ON SITE		0.00	0.00	-
C. VARIATION OF PRICES		0.00	0.00	-
D. SUB-TOTAL (A + B + C)		**2,788,594.80**	**2,665,815.97**	**5,454,410.77**
E. ADD 16% VAT		446,175.17	426,530.56	**426,530.56**
F. SUB-TOTAL(D + E)		**3,234,769.97**	**3,092,346.53**	**6,327,116.50**
G. LESS V.A.T (6% OF F)		**167,315.69**	159,948.96	**327,264.65**
G. LESS RETENTION MONEY (5) OF F)		139,429.74	133,290.80	**272,720.54**
G(a). RELEASE OF RETETION 2.5%		0.00	0.00	-
H. WITHHOLDING (3% OF F)		83,657.84	79,974.48	**163,632.32**
I. SUB-TOTAL(F - (G + H)+G(a))		2,844,366.70	**2,719,132.29**	**5,563,498.99**
J. ADVANCE PAYMENT (10% of Contract Sum)		0.00	0.00	
K. LESS REPAYMENT OF ADVANCE		0.00	-	
L. BALANCE OF ADVANCE		0.00	0.00	
M. INTEREST ON DELAYED PAYMENT		0.00	0.00	
N. TOTAL OF PAYMENTS(I + M + L)		**2,844,366.70**	**2,719,132.29**	**5,563,498.99**
O. LESS PREVIOUS CERTIFICATES				2,844,366.70
AMOUNT NOW DUE TO CONTRACTOR				**2,719,132.29**

BLACK BEAR CONSTRUCTION (K) LTD
Date:.....
Tel 0734 266 302
P.O. Box 11... 10300, KERUGOYA

Submitted by: _____ *Contractor*

Date: 30/5/2019

Certified by:-

JOSPHAT M. RUKENYA
CHIEF OFFICER
WATER & IRRIGATION
Email:rukenyajospha@gmail.com

J.Rukenya.
(Chief Officer Water & Irrigation)

Date: 13/6/2019

Checked by: _____
Water Officer(Water&Irrigation)
L hereby confirm the above rates and Quantities

Date: 30/5/19.

Approved by,
P.Macharia
C.E.C Water & Irrigation

Date 13/6/2019

Josphat Rukenya
Chief Officer - W
and Irrigation

BLACK BEAR CONSTRUCTION

Kerugoya Kutus Road I P.O Box 1177-10300
Kerugoya, Cell: +254 734266302
Email: info@blackbearconstruction.co.ke
Web: wwwblackbearconstruction.co.ke

Our Ref: BBC/MCG/2019/0028
Your Ref:
Date: 7th May 2019

Dr. Victorio Torres Feced
Vihda Association
P.O Box 63745-00619
Nairobi, Kenya

Dear Sir,

RE: SUBMISSION OF OUR 2ND CERTIFICATE OF PAYMENT FOR MUGIRA DAM WATER SUPPLY PHASE 1: CONTRACT NO: MCG/042/2017-2018

Reference is made to the subject mentioned above. Attached herewith, please find our 2nd certificate of payment for the amount of Ksh 3,166,393.68 (Kenya shillings three million, one hundred sixty six thousand, three hundred ninety three and cents sixty eight only) for the same.

We kindly request you to settle this payment to enable us progress the remaining bill items to achieve full completion of the project. You may wish to effect payment either by raising a cheque in favor of: **"Black Bear Projects (K) Limited"** or making a bank transfer to our bank account whose details are as hereunder:

Account Name:	Black Bear Projects (K) Limited
Account number:	0100262616307
Name of Bank:	Equity Bank Limited
Branch:	Kerugoya Branch

We thank you for giving us an opportunity to partner with you in the Mugira Dam water supply infrastructure development project and we look forward to more engagements in the future.

Yours Faithfully,
BLACK BEAR CONSTRUCTION (K) LTD

Nancy Njeri Mbagiru
Commercial Director

BLACK BEAR CONSTRUCTION (K) LTD. Date: 07/05/2019 Tel: 0720 226 183 P.O. BOX 1177-10300, KERUGOYA

1.0 Bill of Quantities for Bush Clearing and Fencing

Item	Description	Unit	Qty	Rate (Kshs)	Bill Amount (Kshs)	Quantity Claimed	Amount Claimed
1.	Clearing of the tree stumps on the embankment and in the dam area	L/s	L/s	20,000	20,000	100%	20,000
2.	Excavation of holes 0.45 m diameter, 1 meter deep and store the arising for reuse	No	64	250	16,000	0	0
3.	Procure, deliver r.c concrete poles 3 m long, 150 mm diameter precast	No	64	2,000	128,000	0	0
4.	Provide for barbed wire in 6 horizontal strands (Gauge 12.5)	M	1,200	150	180,000	0	0
5.	Provide for chain link 2.1 M high medium gauge	M	210	750	157,500	0	0
6.	Provide for U nails/binding wire	Kg	60	350	21,000	0	0
7.	Provide for a steel fabricated gate 1.5M wide and 2.1 M high	No	1	30,000	30,000	0	0
	Sub total				552,500		20,000
	Add 20% labour				110,500		4,000
	Add 5% contingencies				27,625		1,000
	Add 5% supervision fee				27,625		1,000
	Grand Total				718,250		26,000

Yours Faithfully,

Nancy Njeri Mbagiru
Commercial Director

BLACK BEAR CONSTRUCTION (K) LTD.
Date: 07/05/2019
Tel: 0720 226 183
P.O. BOX 1177-10300, KERUGOYA

1.1 Bill of Quantities for Composite Water Treatment Tank 100 Cubic Meters (Ground Masonry)

Item	Description	Unit	Qty	Rate (Kshs)	Bill Amount (Kshs	Quantity Claimed	Claimed Amount
1.	Excavation of site to remove top unconsolidated soil, grub up roots and dispose the arising commencing ground level up to firm ground.	CM	50	450	22,500	50	22,500
2.	marram blinding layer 50mm thick	CM	4	3,500	14,000	4	14,000
3.	Reinforced high yield bars Y12	No	20	1,750	35,000	20	35,000
4.	Reinforced high yield bars Y10	No	50	1,500	75,000	50	75,000
5.	Quarry stones 225 x 225mm (9'' x 9'')	R/ft	1500	85	127,500	1500	127,500
6.	Ordinary Portland cement	Bag	210	800	168,000	210	168,000
7.	Water proof cement (Pudlo)	Kg	80	180	14,400	80	14,400
8.	Ballast ½'' – ¾''	Ton	10	3,500	35,000	10	35,000
9.	Clean river sand	Ton	9	2,500	22,500	9	22,500
10.	Binding wire	Kg	50	150	7,500	50	7,500
11.	Props 80mm diam, 3m long	No	100	2,000	200,000	100	200,000
12.	Bituminous paint	Litre	20	500	10,000	20	10,000
13.	Timber sawn soft wood 4'' x 2''	RM	200	275	55,000	200	55,000
14.	Timber sawn soft wood 6'' x 1''	RM	700	250	175,000	700	175,000
15.	Ordinary wire nails 4'' long	Kg	30	250	7,500	30	7,500
16.	Ordinary wire nails 2'' long	Kg	40	250	10,000	40	10,000
17.	Pipes G.I 6'' diam class 'B' socketed	No	2	12,000	24,000	2	24,000
18.	G.I Elbows 6'' diam	No	8	350	2,800	8	2,800

BLACK BEAR CONSTRUCTION (K) LTD. P.O. BOX 1177-10300, KERUGOYA Date: 07/05/2019 Tel: 0720 226 183

"Moving the Earth to Construct Your World"

19.	Provide for 80mm breather pipes fully installed with wire gauze	No	3	750	2,250	3	2,250
20.	Bell mouth 8'' x 6''	No	1	750	750	1	750
21.	Provide for construction of valve chamber 1200 x 1000 x 1050mm with lockable cover	No	2	4,500	9,000	2	9,000
22.	Sluice valve 6'' diam flanged	No	2	1,200	2,400	2	2,400
	Sub Total				**1,020,100**		**1,020,100**
	Add 30% skilled unskilled labour				306,030		306,030
	Add 10% contingencies				102,010		102,010
	Add 5% supervision fee				15,302		15,302
	Grand Total				**1,443,442**		**1,443,442**

BLACK BEAR CONSTRUCTION (K) LTD
P.O. BOX 1177-10300, KERUGOYA
Tel: 0720 226 183
Date: 07/05/2019

"Moving the Earth to Construct Your World"

1.2 Bill of Quantities for Rehabilitation of Existing Pump House

Item	Description	Unit	Qty	Rate (Kshs)	Bill Amount (Kshs)	Quantity Claimed	Claimed Amount
1.	Hack out the old plaster with cold chisel and hammer to provide and bond to new plaster to both internal and external faces	L/s	L/s	2,000	2,000	100%	2,000
2.	Apply a thin layer 25mm thick plaster in 1.3 sand cement mortar to both internal and external walls	MS	25	550	13,750	25	13,750
3.	Apply 2 coats of paint to both internal and external sides of the pump house	MS	25	450	11,250	25	11,250
4.	Provide and place a fabricated steel door 900 x 2100mm	No	1	18,000	18,000	1	18,000
5.	Provide and place ventilation made from Y12 bars and measuring 450 x 300mm	No	4	4,500	18,000	4	18,000
6.	Apply a floor screed 25mm thick made from 1.3 sand cement mortar	MS	8	750	6,000	8	6,000
	Sub Total				69,000		69,000
	Add 30% labour				20,700		20,700
	Add 10% contingencies				6,900		6,900
	Add 5% supervision				3,450		3,450
	Grand Total				**100,050**		**100,050**

BLACK BEAR CONSTRUCTION (K) LTD. P.O. BOX 1177-10300, KERUGOYA Tel: 0720 226 183 Date: 01/05/2019

"Moving the Earth to Construct Your World"

Bill of Quantities for Repair of Existing Storage Tank (Mihang'o Dispensary)

Item	Description	Unit	Qty	Rate (Kshs)	Bill Amount (Kshs)	Quantity Claimed	Amount Claimed
1.	Hack out the old plaster with a cold chisel and hammer both at the outside, the inside wall and the floor of the storage tank	L/s	L/s	30,000	30,000	100%	30,000
2.	Apply a thin layer 25mm thick plaster in 1.3 cement/sand to both external and internal sides of the tank (**Two layers applied**)	MS	100	550	55,000	100	55,000
3.	Apply 2 coats of bituminous paint to the internal wall of the tank	MS	50	650	32,500	50	32,500
4.	Apply a floor screed 25mm thick made from 1.;3 cement to sand	SM	50	750	37,500	50	37,500
5.	Apply a thin layer 25mm thick plaster in 1.3 cement/sand to both external and internal roof slab	SM	0	550	0	100	55,000
	Sub Total				**155,000**		**155,000**
	Add 30% labour				46,500		46,500
	Add 5% contingencies				7,750		7,750
	Add 5% supervision fee				7,750		7,750
	Grand Total				**217,000**		**217,000**

Yours Faithfully,

Nancy Njeri Mbagiru

Commercial Director

BLACK BEAR CONSTRUCTION (K) LTD.
Date: 07/05/2019
Tel: 0720 226 183
P.O. BOX 1177-10300, KERUGOYA

"Moving the Earth to Construct Your World"

1.3 Bill of Quantities for Rising Main 1.02 Km Long 110mm Diameter HDPE Pipes

Item	Description	Unit	Qty	Rate (Kshs)	Bill Amount (Kshs)	Quantity Claimed	Claimed Amount
1.	Excavate trench not exceeding 1.2m depth and 450 mm width	M	1020	250	255,000	1020	255,000
2.	Provide and install HDPE pipes DN 110, PN 12.5	M	1020	500	510,000	1020	510,000
3.	Provide for G.I pipes 100mm diam socketed 6M long (4'')	No	5	12,000	60,000	5	60,000
4.	Provide G.I elbows 4'' diam	No	4	2,500	10,000	4	10,000
5.	Provide for boss white	Kg	3	750	2,250	3	2,250
6.	Provide for hemp	Kg	2	500	1,000	2	1,000
7.	Back filling of the trench after pipe laying	M	1020	150	153,000	1020	153,000
8.	Allow for pipeline testing	L/s	L/s	10,000	10, 000.00	0	0
9.	Provide for road crossing using appropriate technology	No	1	200,000	200,000	100%	200,000
10.	Provide HDPE couplings 110 x 110mm diam	No	12	1,200	14,400	12	14,400
11.	Provide for HDPE/G.I adapter 110mm (4'') diam	No	5	1,750	8,750	5	8,750
12.	Provide for standard concrete marker posts at every 200 M distance	No	6	2,500	15,000	6	15,000
13.	Provide for double orifice air release valve 25mm diam	No	2	3,500	7,000	2	7,000
14.	Allow for construction of a lockable valve chamber 1050 x 1200 x 1200 mm to accommodate the air valves	No	2	75,000	150,000	2	150,000
	Sub Total				**1,386,400**		**1,386,400**

	Add 30% labour				415,920		415,920
	Add 5% contingencies				69,320		69,320
	Add 5% supervision fee				69,320		69,320
	Grand Total				**1,940,960**		**1,940,960**

BLACK BEAR CONSTRUCTION (K) LTD.
Date: 01/05/2019
Tel: 0720 226 183
P.O. BOX 1177-10300, KERUGOYA

BLACK BEAR CONSTRUCTION

"Moving the Earth to Construct Your World"

1.4 Bill of Quantities for Water Sump Construction Capacity 20 Cubic Meters

Item	Description	Unit	Qty	Rate (Kshs)	Bill Amount (Kshs)	Quantity Claimed	Claimed Amount
1.	Excavation of foundation 3 m diam and 2 m depth	Cubic Metre	68	450	30,600	68	30,600
2.	Marram blinding layer 50mm thick	Cubic Metre	3	3,500	10,500	3	10,500
3.	Reinforcement high yield bar Y10	Nos	50	1,500	75,000	50	75,000
4.	Quarry stones 225 x 225mm (9'' x 9'')	R/ft	600	85	51,000	600	51,000
5.	Reinforcement high yield bar Y12	Nos	4	1,750	7,000	4	7,000
6.	Ordinary Portland cement	Bags	60	800	48,000	60	48,000
7.	Water proof cement (Pudlo)	Kgs	60	180	10,800	60	10,800
8.	Ballast ½'' – ¾''	Tons	7	3,500	24,500	7	24,500
9.	Clean river sand	Tons	7	2,500	17,500	7	17,500
10.	Binding wire	Kgs	50	150	7,500	50	7,500
11.	Props 80mm diam, 3.0m long	Nos	60	300	18,000	60	18,000
12.	Bituminous paint	litre	20	550	11,000	20	11,000
13.	Timber sawn soft wood 4'' x 2''	Rm	120	275	33,000	120	33,000
14.	Timber sawn soft wood 6'' x 1''	Rm	240	250	60,000	240	60,000
15.	Ordinary wire nails 4''	Kg	20	250	5,000	20	5,000
16.	Ordinary wire nails 2''	Kg	30	250	7,500	30	7,500
17.	Provide for 80mm diam breather pipes fully installed with wire gauze	No	3	750	2,250	3	2,250
18.	Provide for construction of a valve chamber 1200 x 1200 x 1050mm with lockable cover	No	2	18,000	36,000	2	36,000
19.	Provide for step irons made from 20mm diam thick round bars	No	6	1,500	9,000	6	9,000

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Date: 07/05/2019
Tel: 0720 226 183
P.O. BOX 1177-10300, KERUGOYA

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20.	Provide for steel portable ladder 8 m long	No	1	15,000	15,000	1	15,000
21.	Provide for fabricated steel manhole cover 500 x 350 mm	No	1	4,500	4,500	1	4,500
	Sub Total				**483,650**		**483,650**
	Add 30% labour				145,095		145,095
	Add 5% contingencies				24,183		24,183
	Add 5% supervision fee				24,183		24,183
	Grand Total				**677,110**		**677,110**

Yours Faithfully,

Nancy Njeri Mbagiru

Commercial Director

BLACK BEAR CONSTRUCTION (K) LTD. P.O. BOX 1177-10300, KERUGOYA Date: 07/05/2019 Tel: 0720 226 183

BLACK BEAR CONSTRUCTION

"Moving the Earth to Construct Your World"

1.5 Bill of Quantities for Pump Installation and KPLC Power Supply

Item	Description	Unit	Qty	Rate (Kshs)	Bill Amount (Kshs)	Quantity Claimed	Claimed Amount
1.	Supply and install a surface water pump capable of pumping 40.6 cubic meters of water against a total head of 143 meters complete with all accessories, preferably 30 Kw.Test and commission.	No	1	120,000	120,000	0%	0
2.	Supply and install KSB Motor 10Kw or its equivalent complete with control panel, control cables, water level relay and power failure relay.Test and commission	No	1	100,000	100,000	0	0
3.	Supply 3 phase KPLC electric power to site and connect to the control panel.Test and commission	No	1	100,000	100,000	0	0
	Sub Total				320,000		0
	Add 5% contingencies				16,000		0
	Grand Total				**336,000**		**0**

Yours Faithfully,

Nancy Njeri Mbagiru

Commercial Director

BLACK BEAR CONSTRUCTION (K) LTD.
Date: 07/05/2019
Tel: 0720 226 183
P.O. BOX 1177-10300, KERUGOYA

"Moving the Earth to Construct Your World"

of Quantities for a Distribution Line to Mihang'o Primary School 0.5 Km

Description	Unit	Qty	Rate (Kshs)	Bill Amount (Kshs)	Quantity claimed	Claimed Amount
Excavate trench not exceeding 1.2m depth, 450mm width	M	504	250	126,000	504	126,000
Provide and install HDPEpipes DN 50, PN 12.5	M	504	500	252,000	504	252,000
Provide for gate valve 50 mm diam complete with fittings	No	1	7,500	7,500	1	7,500
Provide HDPE reducing tee 110mm x 50mm	No	1	1,500	1,500	1	1,500
Back filling the trench after pipe laying	M	504	300	151,200	504	151,200
Allow for pipe line testing	L/s	L/s	5,000	5,000	0	0
Provide for road crossing using appropriate technology	No	1	200,000	200,000	1	200,000
Provide for HDPE coupling 50mm x 50mm	No	5	1,200	6,000	5	6,000
Provide for HDPE adapters 50mm (11/2'') diam	No	2	1,750	3,500	2	3,500
Provide for concrete marker posts at every 200m	No	5	2,500	12,500	5	12,500
Provide for a single orifice air release valve 25mm diam	No	1	3,500	3,500	1	3,500
Allow for construction of a valve chamber 1200 x 1200 x 1050 mm with lockable cover	No	1	50,000	50,000	1	50,000
Sub Total				818,700		813,700
Add 30% labour				245,610		244,110
Add 5% contingencies				40,935		40,685
Add 5% supervision fee				40,935		40,685
Grand Total				**1,146,180**		**1,139,180**

Yours Faithfully,

Nancy Njeri Mbagiru

Commercial Director

BLACK BEAR CONSTRUCTION (K) LTD. P.O. BOX 1177-10300, KERUGOYA Date: 07/05/2019 Tel: 0720 226 183

"Moving the Earth to Construct Your World"

Bill of For Approved Variations

Item	Description	Unit	Qty	Rate (Kshs)	Bill Amount (Kshs)	Quantity claimed	Claimed Amount
A	**Perimeter Fence**						
1	Excavate 0.45m dia holes, 1.0m deep at 3.0 meters center to center to receive fencing posts.	No	236	250	59,000	0	0
2	Procure and deliver 100mm dia by 3m long concrete fencing posts.	No	236	2,000	472,000	0	0
3	Procure and deliver 2.1 m high Chain link Fence.	M	700	750	525,000	0	0
4	Procure and deliver G12.5 Barbed wire in 6 horizontal strands.	M	4560	110	501,600	0	0
5	Provide all materials and provide Concrete class 20 for Anchoring the fencing posts.	M3	51.5	16,800	865,200	0	0
6	Provide binding wire for fixing the chain link.	Rolls	3	5,500	16,500	0	0
	Sub Total A				2,439,300		0
	Add 20% labour				487,860		0
	Add 5% contingencies				121,965		0
	Add 5% supervision fee				121,965		0
	Total A				**3,171,090**		**0**
B	**Plastering Top Slab and Underside of The Storage Tank at Mugira Dispensary.**						
1	Provide a 1.3 Cement :Sand Mortar for external and internal plaster.	MS	40	750	30,000	40	30,000
2	Procure and provide water proof cement for plastering.	Kgs	35	180	6,300	35	6,300

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Date: 07/05/2019
Tel: 0720 226 183
P.O. BOX 1177-10300, KERUGOYA

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3	Provide a lockable steel man hole cover size 750mmx750mm	No.	1	8,000	8,000	1	8,000
	Sub Total B				44,300		44,300
	Add 30% labour				13,290		13,290
	Add 5% contingencies				2,215		2,215
	Add 5% supervision fee				2,215		2,215
	Total B				**62,020**		**62,020**
C	**Composite Filtration Tank**						
1	Procure and provide approved hardcore for the base of the Fitration tank	M3	20	1,750	35,000	20	35,000
	Sub Total C				35,000		35,000
	Add 30% labour				10,500		10,500
	Add 10% contingencies				3,500		3,500
	Add 5% supervision fee				1,750		1,750
	Total C				**50,750**		**50,750**
D	**Pipes and General Fittings Ommitted for Tanks and Pipelines.**						
1	100mm dia Flanged GI pipes C/w bolts, nuts, washers and rubber guskets.	No	1	24,000	24,000	1	24,000
2	100mm dia Flanged GI bends C/w bolts, nuts, washers and rubber guskets.	No	6	15,500	93,000	6	93,000
3	100mm dia GI elbows	No	6	6,000	36,000	6	36,000
4	100mm dia by 600mm long spigot pipe complete with bolts, nuts and washers.	No	1	13,500	13,500	1	13,500
5	100mm dia flanged adaptors	No	11	7,600	83,600	11	83,600
6	100mm dia GI pipe, 1.2 m long	No	1	9,500	9,500	1	9,500

BLACK BEAR CONSTRUCTION (K) LTD. P.O. BOX 1177-10300, KERUGOYA Date: 07/05/2014 Tel: 0720 226 183

7	100mm dia GI barrel nipples	No	2	850	1,700	2	1,700
8	100mm dia Union Sockets	No	1	4,500	4,500	1	4,500
9	37.5mm Gate Valve	No	1	6,500	6,500	1	6,500
10	75mm dia GI pipe	No	1	13,000	13,000	1	13,000
11	75mm dia Gi threaded pipe 450mm long.	No	2	3,000	6,000	2	6,000
12	100mm dia GI spigot flanged spigot pipe C/W bolts, nuts, washers and 450mm long.	No	1	14,000	14,000	1	14,000
13	75mmx50mm Reducing Sockets	No	1	900	900	1	900
14	75mm dia GI elbows	No	22	1,100	24,200	22	24,200
15	75mm dia GI Barrel Niples	No	11	800	8,800	11	8,800
16	75mm dia Gate valves	No	3	13,500	40,500	3	40,500
17	75mm dia GI end Caps	No	1	950	950	1	950
18	100mm dia GI flanged sluice valve c/w bolts, nuts, washers and rubber guskets	No	2	22,000	44,000	2	44,000
19	Flanged taper 150mm by 100mm c/w bolts, nuts, washers and rubber guskets	No	2	18,500	37,000	2	37,000
20	Flanged adaptors 150mm c/w bolts, nuts, washers and rubber guskets	No	2	14,500	29,000	2	29,000
21	150mm dia VJ couplings	No	2	5,500	11,000	2	11,000
22	Heavy duty Insertion rubber guskets	M2	2	4,500	9,000	2	9,000
23	150mm dia Socket Valves	No	2	2,600	5,200	2	5,200
	Sub Total D				515,850		515,850
	Add 20% labour				103,170		103,170
	Add 5% contingencies				25,793		25,793
	Add 5% supervision fee				25,793		25,793
	Total D				**670,605**		**670,605**
E	**Motor Rating and Kenya Power Connection Costs**						

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Tel: 0720 226 183
Date: 07/05/2019

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1	Supply KSB Motor rating 30KW or its equivallent c/w control pannel, cables, control gears,water level relay,and power failure relay system, test and comission.	No	1	625,000	625,000	0	0
2	Supply KPLC 3 phase power supply to siteand conect the same to the control pannel. Test and Commisssion.	No	1	965,527	965,527	0	0
	Sub Total E				1,590,527		0
	Add 5% contingencies				79,526		0
	Total E				**1,670,053**		**0**
	GRAND TOTAL (A+B+C+D+E)				**5,624,518**		**783,375**

BLACK BEAR CONSTRUCTION (K) LTD.
Date: 07/03/2019
Tel: 0720 226 183
P.O. BOX 1177-10300, KERUGOYA

SUMMARY OF CERTIFICATE NO. 2

1.0 Bill of quantities for bush clearing and fencing							**26,000.00**
1.1 Bill of quantities for composite water treatment tank 100 cubic meters (Ground Masonry)							**1,443,441.50**
1.2 Bill of quantities for rehabilitation of existing pump house							**100,050.00**
Bill of quantities for repair of existing storage tank (Mihang'o Dispensary)							**217,000.00**
1.3 Bill of quantities for rising main 1.02 Km long 110mm diameter HDPE pipes							**1,940,960.00**
1.4 Bill of quantities for water sump construction capacity 20 cubic meters							**677,110.00**
1.5 Bill of quantities for pump installation and KPLC power supply							**0.00**
Bill of quantities for a distribution line to Mihang'o Primary School 0.5 Kmlong 50mm diameter							**1,139,180.00**
Bill of quantities for variations							**783,375.00**
1		Total this Certificate No.2					**6,327,116.50**
2		Less Advance Paid					**0.00**
3		Less Previous Amount Paid in Certificate No. 1					**2,844,367.00**
4		Less 5% Retention					**316,355.83**
		Amount Due now =(1-(2+3+4))					**3,166,393.68**
		Total Earned for Supervision					191,446.50
		Less Amount Paid for Supervision Certificate No.1					138,000.00
		Amount Due Now for Supervision.					

Yours Faithfully,

Nancy Njeri Mbagiru
Commercial Director

BLACK BEAR CONSTRUCTION (K) LTD. * P.O. BOX 1177-10300, KERUGOYA * Tel: 0720 226 183 Date: 07/05/2019

ANEXO 6

Tercer Certificado de Obra

SUMMARY OF STATEMENT FOR PAYMENT ON ACCOUNT.

CONTRACT NAME:	**MUGIRA DAM WATER PHASE 1**	CERTIFICATE No. :	**3**
CONTRACT No	**MCG/042/2017-2018**		
CONTRACTOR :	**BLACK BAER CONSTRUCTION**		
CONTRACT SUM :	**KSHS 10,324,178.35**	CONTRACT DURATION :	

DESCRIPTION.	PREVIOUS CERTIFICATES (KSHS)	THIS CERTIFICATE (KSHS)	TOTAL TO DATE (KSHS)
A. TOTAL OF WORK DONE	-	3,659,025.37	**3,659,025.37**
B. MATERIAL ON SITE	0.00	0.00	-
C. VARIATION OF PRICES	0.00	0.00	-
D. SUB-TOTAL (A + B + C)	-	**3,659,025.37**	**3,659,025.37**
E. ADD 16% VAT	0.00	585,444.06	**585,444.06**
F. SUB-TOTAL(D + E)	**0.00**	**4,244,469.43**	**4,244,469.43**
G. LESS V.A.T (6% OF F)		219,541.52	**219,541.52**
G. LESS RETENTION MONEY0% OF F)	0.00		-
G(a). RELEASE OF RETETION 2.5%	0.00	0.00	-
H. WITHHOLDING (3% OF F)	0.00	109,770.76	**109,770.76**
I. SUB-TOTAL(F - (G + H)+G(a))	0.00	**3,915,157.15**	**3,915,157.15**
J. ADVANCE PAYMENT (10% of Contract Sum)	0.00	0.00	
K. LESS REPAYMENT OF ADVANCE	0.00	-	
L. BALANCE OF ADVANCE	0.00	0.00	
M. INTEREST ON DELAYED PAYMENT	0.00	0.00	
N. TOTAL OF PAYMENTS (I + M + L)	**0.00**	**3,915,157.15**	**3,915,157.15**
O. LESS PREVIOUS CERTIFICATES			0.00
AMOUNT NOW DUE TO CONTRACTOR			**3,915,157.15**

Submitted by:

BLACK BEAR CONSTRUCTION (K) LTD
Date: 02/01/2020
Tel: 0734 266 302
P. O. Box 1177 - 10300, KERUGOYA

Contractor

Checked by: 2/01/2020.

Water officer(water and irrigation)
L hereby confirm the above rates and Quantities

Date: 3/01/2020

JOSPHAT M. RUKENYA
CHIEF OFFICER
WATER & IRRIGATION
Email:rukenyajospha@gmail.com

Certified by:-

J. Rukenya
(Chief Officer Water & irrigation)

Date:

1.0 Bill of Quantities for Bush Clearing and Fencing

Item	Description	Unit	Qty	Rate (Kshs)	Bill Amount (Kshs)	Quantity Claimed	Amount Claimed
1.	Clearing of the tree stumps on the embankment and in the dam area	L/s	L/s	20,000	20,000	100%	20,000
2.	Excavation of holes 0.45 m diameter, 1 meter deep and store the arising for reuse	No	64	250	16,000	64	16,000
3.	Procure, deliver r.c concrete poles 3 m long, 150 mm diameter precast	No	64	2,000	128,000	64	128,000
4.	Provide for barbed wire in 6 horizontal strands (Gauge 12.5)	M	1,200	150	180,000	1200	180,000
5.	Provide for chain link 2.1 M high medium gauge	M	210	750	157,500	210	157,500
6.	Provide for U nails/binding wire	Kg	60	350	21,000	60	21,000
7.	Provide for a steel fabricated gate 1.5M wide and 2.1 M high	No	1	30,000	30,000	1	30,000
	Sub total				552,500		552,500
	Add 20% labour				110,500		110,500
	Add 5% contingencies				27,625		27,625
	Add 5% supervision fee				27,625		27,625
	Grand Total				718,250		718,250

BLACK BEAR CONSTRUCTION (K) LTD.
Date: 02/01/2020
Tel: 0720 226 183
P.O. Box 177-10300, KERUGOYA
02/01/2020

1.1 Bill of Quantities for Composite Water Treatment Tank 100 Cubic Meters (Ground Masonry)

Item	Description	Unit	Qty	Rate (Kshs)	Bill Amount (Kshs	Quantity Claimed	Claimed Amount
1.	Excavation of site to remove top unconsolidated soil, grub up roots and dispose the arising commencing ground level up to firm ground.	CM	50	450	22,500	50	22,500
2.	marram blinding layer 50mm thick	CM	4	3,500	14,000	4	14,000
3.	Reinforced high yield bars Y12	No	20	1,750	35,000	20	35,000
4.	Reinforced high yield bars Y10	No	50	1,500	75,000	50	75,000
5.	Quarry stones 225 x 225mm (9'' x 9'')	R/ft	1500	85	127,500	1500	127,500
6.	Ordinary Portland cement	Bag	210	800	168,000	210	168,000
7.	Water proof cement (Pudlo)	Kg	80	180	14,400	80	14,400
8.	Ballast ½'' – ¾''	Ton	10	3,500	35,000	10	35,000
9.	Clean river sand	Ton	9	2,500	22,500	9	22,500
10.	Binding wire	Kg	50	150	7,500	50	7,500
11.	Props 80mm diam, 3m long	No	100	2,000	200,000	100	200,000
12.	Bituminous paint	Litre	20	500	10,000	20	10,000
13.	Timber sawn soft wood 4'' x 2''	RM	200	275	55,000	200	55,000
14.	Timber sawn soft wood 6'' x 1''	RM	700	250	175,000	700	175,000
15.	Ordinary wire nails 4'' long	Kg	30	250	7,500	30	7,500
16.	Ordinary wire nails 2'' long	Kg	40	250	10,000	40	10,000
17.	Pipes G.I 6'' diam class 'B' socketed	No	2	12,000	24,000	2	24,000
18.	G.I Elbows 6'' diam	No	8	350	2,800	8	2,800
19.	Provide for 80mm breather pipes fully installed with wire gauze	No	3	750	2,250	3	2,250

BLACK BEAR CONSTRUCTION
Date: 02/01/2020
Tel: 0720 226 183
02/01/2020

20.	Bell mouth 8'' x 6''	No	1	750	750	1	750
21.	Provide for construction of valve chamber 1200 x 1000 x 1050mm with lockable cover	No	2	4,500	9,000	2	9,000
22.	Sluice valve 6'' diam flanged	No	2	1,200	2,400	2	2,400
	Sub Total				**1,020,100**		**1,020,100**
	Add 30% skilled unskilled labour				306,030		306,030
	Add 10% contingencies				102,010		102,010
	Add 5% supervision fee				15,302		15,302
	Grand Total				**1,443,442**		**1,443,442**

02/01/2020

BLACK BEAR CONSTRUCTION (K) LTD.
Date: 02/01/2020
Tel: 0720 226 183
P.O. BOX 1177-10300, KERUGOYA

1.2 Bill of Quantities for Rehabilitation of Existing Pump House

Item	Description	Unit	Qty	Rate (Kshs)	Bill Amount (Kshs)	Quantity Claimed	Claimed Amount
1.	Hack out the old plaster with cold chisel and hammer to provide and bond to new plaster to both internal and external faces	L/s	L/s	2,000	2,000	100%	2,000
2.	Apply a thin layer 25mm thick plaster in 1.3 sand cement mortar to both internal and external walls	MS	25	550	13,750	25	13,750
3.	Apply 2 coats of paint to both internal and external sides of the pump house	MS	25	450	11,250	25	11,250
4.	Provide and place a fabricated steel door 900 x 2100mm	No	1	18,000	18,000	1	18,000
5.	Provide and place ventilation made from Y12 bars and measuring 450 x 300mm	No	4	4,500	18,000	4	18,000
6.	Apply a floor screed 25mm thick made from 1.3 sand cement mortar	MS	8	750	6,000	8	6,000
	Sub Total				69,000		69,000
	Add 30% labour				20,700		20,700
	Add 10% contingencies				6,900		6,900
	Add 5% supervision				3,450		3,450
	Grand Total				**100,050**		**100,050**

02/01/2020

BLACK BEAR CONSTRUCTION (K) LTD.
Date: 02/01/2020
Tel: 0720 226 183
P.O. BOX 1177-10300, KERUGOYA

Bill of Quantities for Repair of Existing Storage Tank (Mihang'o Dispensary)

Item	Description	Unit	Qty	Rate (Kshs)	Bill Amount (Kshs)	Quantity Claimed	Amount Claimed
1.	Hack out the old plaster with a cold chisel and hammer both at the outside, the inside wall and the floor of the storage tank	L/s	L/s	30,000	30,000	100%	30,000
2.	Apply a thin layer 25mm thick plaster in 1.3 cement/sand to both external and internal sides of the tank (**Two layers applied**)	MS	100	550	55,000	100	55,000
3.	Apply 2 coats of bituminous paint to the internal wall of the tank	MS	50	650	32,500	50	32,500
4.	Apply a floor screed 25mm thick made from 1.;3 cement to sand	SM	50	750	37,500	50	37,500
5.	Apply a thin layer 25mm thick plaster in 1.3 cement/sand to both external and internal roof slab	SM	0	550	0	100	55,000
	Sub Total				**155,000**		**155,000**
	Add 30% labour				46,500		46,500
	Add 5% contingencies				7,750		7,750
	Add 5% supervision fee				7,750		7,750
	Grand Total				**217,000**		**217,000**

02/01/2020

BLACK BEAR CONSTRUCTION (K) LTD.
Date: 02/01/2020
Tel: 0720 226 183
P.O. BOX 1177-10300, KERUGOYA

1.3 Bill of Quantities for Rising Main 1.02 Km Long 110mm Diameter HDPE Pipes

Item	Description	Unit	Qty	Rate (Kshs)	Bill Amount (Kshs)	Quantity Claimed	Claimed Amount
1.	Excavate trench not exceeding 1.2m depth and 450 mm width	M	1020	250	255,000	1020	255,000
2.	Provide and install HDPE pipes DN 110, PN 12.5	M	1020	500	510,000	1020	510,000
3.	Provide for G.I pipes 100mm diam socketed 6M long (4'')	No	5	12,000	60,000	5	60,000
4.	Provide G.I elbows 4'' diam	No	4	2,500	10,000	4	10,000
5.	Provide for boss white	Kg	3	750	2,250	3	2,250
6.	Provide for hemp	Kg	2	500	1,000	2	1,000
7.	Back filling of the trench after pipe laying	M	1020	150	153,000	1020	153,000
8.	Allow for pipeline testing	L/s	L/s	10,000	10, 000.00	0	0
9.	Provide for road crossing using appropriate technology	No	1	200,000	200,000	100%	200,000
10.	Provide HDPE couplings 110 x 110mm diam	No	12	1,200	14,400	12	14,400
11.	Provide for HDPE/G.I adapter 110mm (4'') diam	No	5	1,750	8,750	5	8,750
12.	Provide for standard concrete marker posts at every 200 M distance	No	6	2,500	15,000	6	15,000
13.	Provide for double orifice air release valve 25mm diam	No	2	3,500	7,000	2	7,000
14.	Allow for construction of a lockable valve chamber 1050 x 1200 x 1200 mm to accommodate the air valves	No	2	75,000	150,000	2	150,000
	Sub Total				**1,386,400**		**1,386,400**
	Add 30% labour				415,920		415,920
	Add 5% contingencies				69,320		69,320
	Add 5% supervision fee				69,320		69,320
	Grand Total				**1,940,960**		**1,940,960**

02/01/2020

BLACK BEAR CONSTRUCTION (K) LTD.
Date: 02/01/2020
Tel: 0720 226 183
P.O. BOX 1177-10300, KERUGOYA

1.4 Bill of Quantities for Water Sump Construction Capacity 20 Cubic Meters

Item	Description	Unit	Qty	Rate (Kshs)	Bill Amount (Kshs)	Quantity Claimed	Claimed Amount
1.	Excavation of foundation 3 m diam and 2 m depth	Cubic Metre	68	450	30,600	68	30,600
2.	Marram blinding layer 50mm thick	Cubic Metre	3	3,500	10,500	3	10,500
3.	Reinforcement high yield bar Y10	Nos	50	1,500	75,000	50	75,000
4.	Quarry stones 225 x 225mm (9'' x 9'')	R/ft	600	85	51,000	600	51,000
5.	Reinforcement high yield bar Y12	Nos	4	1,750	7,000	4	7,000
6.	Ordinary Portland cement	Bags	60	800	48,000	60	48,000
7.	Water proof cement (Pudlo)	Kgs	60	180	10,800	60	10,800
8.	Ballast ½'' – ¾''	Tons	7	3,500	24,500	7	24,500
9.	Clean river sand	Tons	7	2,500	17,500	7	17,500
10.	Binding wire	Kgs	50	150	7,500	50	7,500
11.	Props 80mm diam, 3.0m long	Nos	60	300	18,000	60	18,000
12.	Bituminous paint	litre	20	550	11,000	20	11,000
13.	Timber sawn soft wood 4'' x 2''	Rm	120	275	33,000	120	33,000
14.	Timber sawn soft wood 6'' x 1''	Rm	240	250	60,000	240	60,000
15.	Ordinary wire nails 4''	Kg	20	250	5,000	20	5,000
16.	Ordinary wire nails 2''	Kg	30	250	7,500	30	7,500
17.	Provide for 80mm diam breather pipes fully installed with wire gauze	No	3	750	2,250	3	2,250
18.	Provide for construction of a valve chamber 1200 x 1200 x 1050mm with lockable cover	No	2	18,000	36,000	2	36,000
19.	Provide for step irons made from 20mm diam thick round bars	No	6	1,500	9,000	6	9,000
20.	Provide for steel portable ladder 8 m long	No	1	15,000	15,000	1	15,000

02/01/2020

BLACK BEAR CONSTRUCTION LTD
Date: 02/01/2020
Tel: 0720 226 183
P.O. BOX 1177-10300, KERUGOYA

21.	Provide for fabricated steel manhole cover 500 x 350 mm	No	1	4,500	4,500	1	4,500
	Sub Total				**483,650**		**483,650**
	Add 30% labour				145,095		145,095
	Add 5% contingencies				24,183		24,183
	Add 5% supervision fee				24,183		24,183
	Grand Total				**677,110**		**677,110**

BLACK BEAR CONSTRUCTION (K) LTD
Date: 02/01/2020
Tel: 0720 226 183
P.O. BOX 1177-10300, KERUGOYA

1.5 Bill of Quantities for Pump Installation and KPLC Power Supply

Item	Description	Unit	Qty	Rate (Kshs)	Bill Amount (Kshs)	Quantity Claimed	Claimed Amount
1.	Supply and install a surface water pump capable of pumping 40.6 cubic meters of water against a total head of 143 meters complete with all accessories, preferably 30 Kw.Test and commission.	No	1	120,000	120,000	0%	0
2.	Supply and install KSB Motor 10Kw or its equivalent complete with control panel, control cables, water level relay and power failure relay.Test and commission	No	1	100,000	100,000	0	0
3.	Supply 3 phase KPLC electric power to site and connect to the control panel.Test and commission	No	1	100,000	100,000	0	0
	Sub Total				320,000		0
	Add 5% contingencies				16,000		0
	Grand Total				**336,000**		**0**

BLACK BEAR CONSTRUCTION (K) LTD
Date: 02/01/2020
Tel: 0720 226 183
P.O. BOX 1177-10300, KERUGOYA

02/01/2020

Bill of Quantities for a Distribution Line to Mihang'o Primary School 0.5 Km

Item	Description	Unit	Qty	Rate (Kshs)	Bill Amount (Kshs)	Quantity claimed	Claimed Amount
1.	Excavate trench not exceeding 1.2m depth, 450mm width	M	504	250	126,000	504	126,000
2.	Provide and install HDPEpipes DN 50, PN 12.5	M	504	500	252,000	504	252,000
3.	Provide for gate valve 50 mm diam complete with fittings	No	1	7,500	7,500	1	7,500
4.	Provide HDPE reducing tee 110mm x 50mm	No	1	1,500	1,500	1	1,500
5.	Back filling the trench after pipe laying	M	504	300	151,200	504	151,200
6.	Allow for pipe line testing	L/s	L/s	5,000	5,000	1	5,000
7.	Provide for road crossing using appropriate technology	No	1	200,000	200,000	1	200,000
8.	Provide for HDPE coupling 50mm x 50mm	No	5	1,200	6,000	5	6,000
9.	Provide for HDPE adapters 50mm (11/2'') diam	No	2	1,750	3,500	2	3,500
10.	Provide for concrete marker posts at every 200m	No	5	2,500	12,500	5	12,500
11.	Provide for a single orifice air release valve 25mm diam	No	1	3,500	3,500	1	3,500
12.	Allow for construction of a valve chamber 1200 x 1200 x 1050 mm with lockable cover	No	1	50,000	50,000	1	50,000
	Sub Total				818,700		818,700
	Add 30% labour				245,610		245,610
	Add 5% contingencies				40,935		40,935
	Add 5% supervision fee				40,935		40,935
	Grand Total				**1,146,180**		**1,146,180**

BLACK BEAR CONSTRUCTION (K) LTD.
Date: 02/01/2020
Tel: 0720 226 183
P.O. BOX 1177-10300, KERUGOYA

02/01/2020

Bill of For Approved Variations

Item	Description	Unit	Qty	Rate (Kshs)	Bill Amount (Kshs)	Quantity claimed	Claimed Amount
A	**Perimeter Fence**						
1	Excavate 0.45m dia holes, 1.0m deep at 3.0 meters center to center to receive fencing posts.	No	236	250	59,000	0	0
2	Procure and deliver 100mm dia by 3m long concrete fencing posts.	No	236	2,000	472,000	0	0
3	Procure and deliver 2.1 m high chain link Fence.	M	700	750	525,000	0	0
4	Procure and deliver G12.5 barbed wire in 6 horizontal strands.	M	4560	110	501,600	0	0
5	Provide all materials and provide Concrete class 20 for Anchoring the fencing posts.	M3	51.5	16,800	865,200	25	420,000
6	Provide binding wire for fixing the chain link.	Rolls	3	5,500	16,500	0	0
	Sub Total A				2,439,300		420,000
	Add 20% labour				487,860		84,000
	Add 5% contingencies				121,965		21,000
	Add 5% supervision fee				121,965		21,000
	Total A				**3,171,090**		**546,000**
B	**Plastering Top Slab and Underside of The Storage Tank at Mugira Dispensary.**						
1	Provide a 1.3 Cement :Sand Mortar for external and internal plaster.	MS	40	750	30,000	40	30,000
2	Procure and provide water proof cement for plastering.	Kgs	35	180	6,300	35	6,300

BLACK BEAR CONSTRUCTION (K) LTD. Date: 02/01/2020 Tel: 0720 226 183 P.O. BOX 1177-10300, KERUGOYA

02/01/2020

3	Provide a lockable steel man hole cover size 750mmx750mm	No.	1	8,000	8,000	1	8,000
	Sub Total B				44,300		44,300
	Add 30% labour				13,290		13,290
	Add 5% contingencies				2,215		2,215
	Add 5% supervision fee				2,215		2,215
	Total B				**62,020**		**62,020**
C	**Composite Filtration Tank**						
1	Procure and provide approved hardcore for the base of the Fitration tank	M3	20	1,750	35,000	20	35,000
2	Construction of Chrorination plant	No	1	256,910	256,910	1	256,910
	Sub Total C				291,910		291,910
	Add 30% labour				87,573		87,573
	Add 10% contingencies				29,191		29,191
	Add 5% supervision fee				14,596		14,596
	Total C				**423,270**		**423,270**
D	**Pipes and General Fittings Ommitted for Tanks and Pipelines.**						
1	100mm dia Flanged GI pipes C/w bolts, nuts, washers and rubber guskets.	No	1	24,000	24,000	1	24,000
2	100mm dia Flanged GI bends C/w bolts, nuts, washers and rubber guskets.	No	6	15,500	93,000	6	93,000
3	100mm dia GI elbows	No	6	6,000	36,000	6	36,000
4	100mm dia by 600mm long spigot pipe complete with bolts, nuts and washers.	No	1	13,500	13,500	1	13,500
5	100mm dia flanged adaptors	No	11	7,600	83,600	11	83,600
6	100mm dia GI pipe, 1.2 m long	No	1	9,500	9,500	1	9,500

BLACK BEAR CONSTRUCTION (K) LTD.
P.O. BOX 1177-10300, KERUGOYA
Tel: 0720 226 183
Date: 02/04/2020

02/04/2020

7	100mm dia GI barrel nipples	No	2	850	1,700	2	1,700
8	100mm dia Union Sockets	No	1	4,500	4,500	1	4,500
9	37.5mm Gate Valve	No	1	6,500	6,500	1	6,500
10	75mm dia GI pipe	No	1	13,000	13,000	1	13,000
11	75mm dia Gi threaded pipe 450mm long.	No	2	3,000	6,000	2	6,000
12	100mm dia GI spigot flanged spigot pipe C/W bolts, nuts, washers and 450mm long.	No	1	14,000	14,000	1	14,000
13	75mmx50mm Reducing Sockets	No	1	900	900	1	900
14	75mm dia GI elbows	No	22	1,100	24,200	22	24,200
15	75mm dia GI Barrel Niples	No	11	800	8,800	11	8,800
16	75mm dia Gate valves	No	3	13,500	40,500	3	40,500
17	75mm dia GI end Caps	No	1	950	950	1	950
18	100mm dia GI flanged sluice valve c/w bolts, nuts, washers and rubber guskets	No	2	22,000	44,000	2	44,000
19	Flanged taper 150mm by 100mm c/w bolts, nuts, washers and rubber guskets	No	2	18,500	37,000	2	37,000
20	Flanged adaptors 150mm c/w bolts, nuts, washers and rubber guskets	No	2	14,500	29,000	2	29,000
21	150mm dia VJ couplings	No	2	5,500	11,000	2	11,000
22	Heavy duty Insertion rubber guskets	M2	2	4,500	9,000	2	9,000
23	150mm dia Socket Valves	No	2	2,600	5,200	2	5,200
	Sub Total D				515,850		515,850
	Add 20% labour				103,170		103,170
	Add 5% contingencies				25,793		25,793
	Add 5% supervision fee				25,793		25,793
	Total D				**670,605**		**670,605**
E	**Motor Rating and Installation Costs**						

BLACK BEAR CONSTRUCTION (K) LTD.
Date: 02/01/2020
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02/01/2020

1	Supply KSB Motor rating 30KW or its equivallent c/w control pannel, cables, control gears,water level relay,and power failure relay system, test and comission.	No	1	910,840	910,840	1	910,840
2	Installation labour	No	1	20,000	20,000	1	20,000
	Sub Total E				930,840		930,840
	Add 5% contigencies				46,542		46,542
	Allow 20% for contractor's attendance and profit				195,476		195,476
	Add 5% Supervision fees				46,542		46,542
	Total E				**1,219,400**		**1,219,400**
F	**Kenya Power Connection Costs**						
1	Supply KPLC 3 phase power supply to site and conect the same to the control pannel. Test and Commisssion.	No	1	1,055,209	1,055,209	1	1,055,209
2	Supply of non Kenya power Electrical accessories	Item	1	39,560	39,560	1	39,560
3	Instalation labour (accessories)	Item	1	9,890	9,890		9,890
	Sub Total F				1,104,659		1,104,659
	Add 5% contingencies				55,233		55,233
	Allow 20% for contractor's attendance and profit				231,978		231,978
	Add 5% Supervision fees				55,233		55,233
	Total F				**1,159,892**		**1,159,892**
	GRAND TOTAL (A+B+C+D+E+F)				**6,706,277**		**4,081,187**

BLACK BEAR CONSTRUCTION (K) LTD.
Date: 02/01/2020
Tel: 0720 226 183
P.O. BOX 1177-10300, KERUGOYA

02/01/2020

SUMMARY OF CERTIFICATE NO. 1

1.0 Bill of quantities for bush clearing and fencing		718,250.00
1.1 Bill of quantities for composite water treatment tank 100 cubic meters (Ground Masonry)		1,443,441.50
1.2 Bill of quantities for rehabilitation of existing pump house		100,050.00
Bill of quantities for repair of existing storage tank (Mihang'o Dispensary)		217,000.00
1.3 Bill of quantities for rising main 1.02 Km long 110mm diameter HDPE pipes		1,940,960.00
1.4 Bill of quantities for water sump construction capacity 20 cubic meters		677,110.00
1.5 Bill of quantities for pump installation and KPLC power supply		0.00
Bill of quantities for a distribution line to Mihang'o Primary School 0.5 Kmlong 50mm diameter		1,146,180.00
Bill of quantities for variations		4,081,186.85
1	Total this Certificate No.2	10,324,178.35
2	Less Advance Paid	0.00
3	Less Previous Amount Paid in Certificate No. 1	2,844,367.00
4	Less Previous Amount Paid in Certificate No. 2	2,719,133.00
6	Less 5% Retention	516,208.92
	Amount Due now =(1-(2+3+4+5+6))	4,244,469.43

BLACK BEAR CONSTRUCTION (K) LTD
Date: 07/01/2020
Tel: 0720 226 183
P.O. BOX 1177-10300, KERUGOYA

Andugusto 21/01/2020

The Chief Officer

Ministry of Water and Irrigation

Murang'a County Government

P.O Box 52

Murang'a

RE; WD /MWP/19/12//02

Date; 31st December 2019

RE: MUGIRA DAM WATER PROJECT-UNDER IMPLEMENTATION

PROGRESS REPORT AS AT 31ST DECEMBER 2019

1.0 Introduction ;

Mugira Dam Water Project is located in Mihang'o Sub-Location, Makuyu ward, Makuyu Division in Murang'a South Sub-County of Murang'a County.

1.1 Source of water

The project sources water from Mihang'o dam that was dug and developed during colonial times but is currently in good condition holding huge volumes of water for use.

1.2. Project ownership

Mihang'o Self Help Group in conjunction with the Sub-County Water officer –Murang'a South have been working together to ensure that the dam benefits the local people. In order to realize this goal, the Sub-County Water officer was able to secure a donor agency from Spain who has been helping Mihang'o community to fund and implement the project.

However all the transactions are sanctioned by the County Government since water supply is a devolved function.

1.3 Scope of the Project

The first phase of the project which has been funded and in the implementation stage comprises of the following components;-

i. Fencing of the water treatment and pump house area to protect the facilities from vandalism and unauthorized access using concrete poles, barbed wire and chain link
ii. Construction of a water sump where water will be pumped from ,provided with a lockable top concrete slab
iii. Rehabilitation of an existing pump house
iv. Construction of a filtration unit to purify raw water from the dam for onward delivery to consumers

v. Installation of a surface pump to pump water
vi. Connection of a three phase power supply from Kenya Power company
vii. Laying of 110 mm diameter (4''}raising mains for a distance of 1.02 km complete with fittings , valley crossings and connecting pipeline from the dam off-take to the filtration unit
viii. Rehabilitation of an existing masonry tank located inside Mihang'o dispensary
ix. Laying a 50 mm diameter {1 ½ '' }HDPE pipeline to Mihang'o Primary School 0.64 km

1.4 The Contractor

After a competitive bidding process spearheaded by the County Government, **Black Bear Construction Company {K} limited of P.O Box 1177 Kerugoya** won the tender to execute the above works and implementation work commenced in early 2019.

2.0 Work progress

To analyze the progress, each of the components earmarked for construction will be dealt with separately.

2.1. Fencing of the water treatment area

All the fencing work has been done using 100 mm square section concrete poles 3 m long firmly concreted on the ground using reinforced concrete class 15 .The total volume of concrete used for the 64 poles being calculated to be 25 m^3 . Barbed wire and chain link 2.1 m high has been completed accordingly. A steel lockable access gate 1.5 m x 2.1 m has also been provided as the facility entrance and adequately painted to enhance durability. A locking device is also provided. Therefore this fencing component is 100% executed.

2.2. Construction of a water sump

The Water sump is complete- All plaster work, installation of inlet pipe, step irons, breather pipes and final finishes are complete –This item is therefore 100 % compete.

2.3 Rehabilitation of the existing pump house

The masonry pump house has been fully rehabilitated, a steel door has been put in place, ventilations, plastering work both in the inside and the outside has been successfully completed. The top roof slab has also been plastered and a sufficient slope allowed for facilitating drainage. Painting is now fully done and ventilations properly finished. This component is also 100 percent 98 % complete.

2.4 Construction of the filtration unit to purify raw water from the dam

The masonry filtration unit 100 m^3 is complete with all the compartments well finished. It has been plastered in the outside, inside and dosage chambers completed, both for chlorine, Aluminum Sulphate and Soda Ash done. The round baffles are also put in place to aid in coagulation of the chemicals. The inlet, outlet, wash out and overflow pipes have been sufficiently installed with relevant manhole chambers also completed.

A 110 mm diameter pipeline to convey water to from the filtration unit to the water sump for onward pumping is also installed. All the accompanying fittings have also been incorporated. To store the chemicals, a chemical store 2.2 x 1.9 m x 2.5 m high in masonry and provided with a reinforced

concrete top slab has also been constructed as part of the filtration unit. Painting of the facility is now complete as well as application of bituminous pant on the inside surfaces of the finished composite filtration unit. This component is therefore 100 complete.

2.5 Installation of the surface pump to pump water

A 40 HP (30 KW), 50 Hz, 2950 RPM Motor and a suitable surface pump have been delivered on site. The pump will use a 415 v three phase power supply as the prime mover. A control panel has been installed and the various accompanying cables delivered. Full installation awaits the supply of KPC power. The construction of the power lines is complete but a transformer is yet to be installed. This component is therefore **90 percent done.** Only installation and testing is remaining. The same has been delayed by the Kenya Power company not finishing the power supply component..

2.6 Connection of a three phase power supply from Kenya Power Company

All the payment s due to Kenya Power Company has been paid and the construction work for power poles and cables done all the way up to the pump house point. The drop cables have however not been done by the KPC. The Kenya Power Company has not delivered or installed the 415 v three phase transformer for use in the project despite having paid all their quoted amounts of money. The control panel is in place and therefore the contractor has done 90 percent of his work for this component.

2.7 Laying of 110 mm diameter (4''} HDPE raising mains for a distance of 1.02 km

The pipeline has been successfully been laid for the entire length of 1.02 km. All the necessary fittings have also been connected and the valley crossing done. It is 100 % done. Three concrete columns have also been constructed to support the GI Pipes used to across the valley at chainage 120 m from the pump house. This component is therefore 100 % completed. The marker posts are also been delivered to site.

2.8 Rehabilitation of the existing masonry tank located inside Mihang'o dispensary

The masonry storage tank 100 m^3 capacity is complete with all the compartments well finished. It has been plastered in the outside, inside and on the underside surfaces as well. All the necessary pipe fittings for the inlet, out let, overflow and washout put in place. The top cover slab is also completed with all breather pipes done and a lockable top manhole put in place. Painting is now fully completed. This item is also 100 % executed.

2.9 Laying of the 50 mm diameter {1 ½ ''} HDPE pipeline to Mihang'o Primary School 0.64 km

The pipeline has been successfully laid for the entire length of 0.64 km. All the necessary fittings have also been connected up to Mihang'o Primary school tank. Connection to the tank is now completely done. This component is 100 % completion stage.

2 REMAINING AUXILLIARY WORKS

i. Laying of the 50 m long 32 mm diameter pipeline from the dam outlet chamber to feed water to the composite filtration unit

ii. Installation of steel access ladders 4 m long at both the 100 m^3 storage tank at the dispensary and at the filtration **unit.**

iii. Laying a 50 m long 25 mm diameter pipeline to serve Mihang'o dispensary from the 63 mm mains from the storage tank.

iv. Concreting the delivered marker posts on the ground along the pipeline route.

v. Land scarping the fenced water treatment area and planting grass

vi. Testing the water supply system once the Kenya Power company has completed power installation exercise.

These works being on the side of the contactor comprise of a vital 3.0 percent o the project.

The project once completed will not only serve Mihang'o dispensary , Mihango primary school , Mihang;o secondary school but also the surrounding community.

Prepared and signed by;-

Isaac Gichuki
S.S.W.E
Project Supervising Officer.

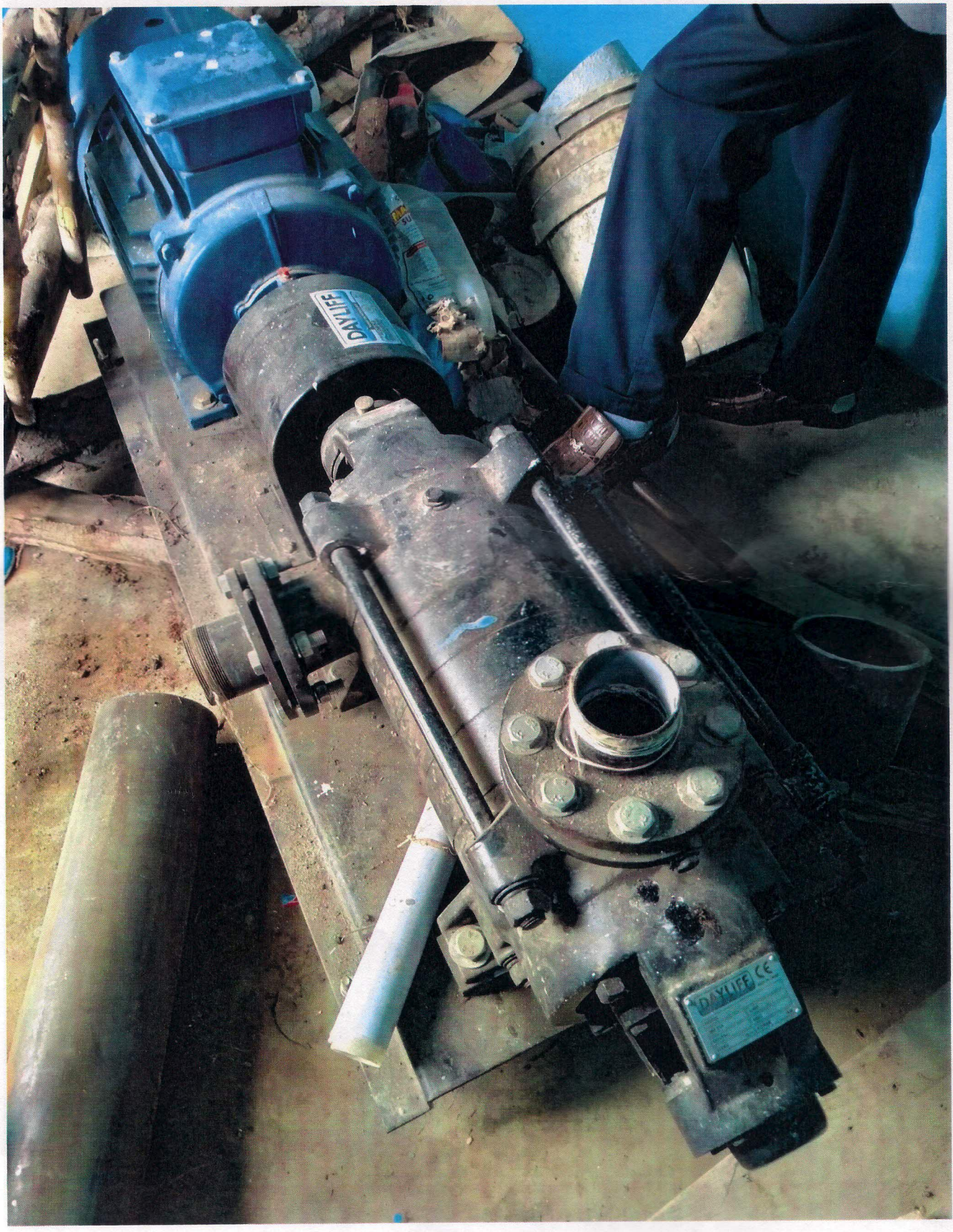
STORAGE TANK AT MIHANGO HEALTH CENTRE

TREATMENT TANK AT MUGIRA DAM SITE

FENCING DONE

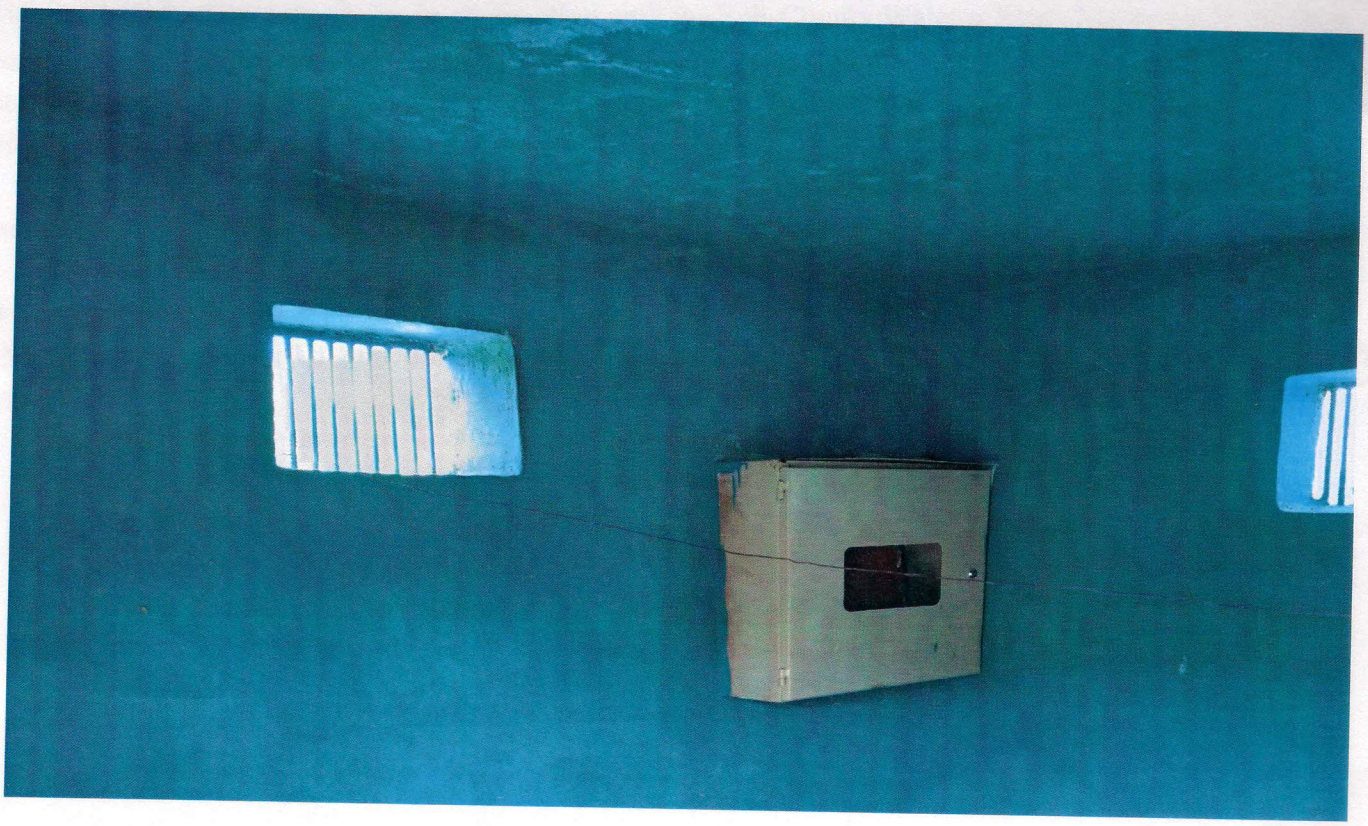
OVERVIEW OF TREATMENT TANK AND PUMP HOUSE

MUGIRA WATER PUMP



KENYA POWER CABLE LINES CONSTRUCTED

ELECTRICAL WORKS DONE



BLACK BEAR CONSTRUCTION

Kerugoya Kutus Road I P.O Box 1177-10300
Kerugoya, Cell: +254 734266302
Email: info@blackbearconstruction.co.ke
Web: wwwblackbearconstruction.co.ke

Our Ref: BBC/MCG/2019/0029
Your Ref:
Date: 2nd January 2020

Dr. Victorio Torres Feced
Vihda Association
P.O Box 63745-00619
Nairobi, Kenya

Dear Sir,

RE: SUBMISSION OF OUR 3RD CERTIFICATE OF PAYMENT FOR MUGIRA DAM WATER SUPPLY PHASE 1: CONTRACT NO: MCG/042/2017-2018

Reference is made to the subject mentioned above. Attached herewith, please find our 3rd certificate of payment for the amount of Ksh 4,244,469.43 (Kenya shillings four million, two hundred forty four thousand, four hundred sixty nine and cents forty three only) for the same.

We kindly request you to settle this payment to enable us progress the remaining bill items to achieve full completion of the project. You may wish to effect payment either by raising a cheque in favor of: **"Black Bear Projects (K) Limited"** or making a bank transfer to our bank account whose details are as hereunder:

Account Name:	Black Bear Projects (K) Limited
Account number:	0100262616307
Name of Bank:	Equity Bank Limited
Branch:	Kerugoya Branch

We thank you for giving us an opportunity to partner with you in the Mugira Dam water supply infrastructure development project and we look forward to more engagements in the future.

Yours Faithfully,
BLACK BEAR CONSTRUCTION (K) LTD

BLACK BEAR CONSTRUCTION (K) LTD. * P.O. BOX 1177-10300, KERUGOYA * Date: 02/01/2020 Tel: 0720 226 183

Nancy Njeri Mbagiru
Commercial Director

ANEXO 7

Cuarto Certificado de Obra

Our Ref: BBC/MCG/2021/0029
Your Ref:
Date: 28th July, 2021

BLACK BEAR CONSTRUCTION

Kerugoya Kutus Road I P.O Box 1177-10300
Kerugoya, Cell: +254 734266302
Email: info@blackbearconstruction.co.ke
Web: wwwblackbearconstruction.co.ke

Dr. Victorio Torres Feced
Vihda Association
P.O Box 63745-00619
Nairobi, Kenya

Dear Sir,

RE: SUBMISSION OF OUR 4TH CERTIFICATE/FINAL AND RETENTION OF 1ST AND 2ND CERTIFICATES PAYMENT FOR MUGIRA DAM WATER SUPPLY PHASE 1: CONTRACT NO: MCG/042/2017-2018

Reference is made to the above-mentioned subject. We are pleased to record that despite several challenges caused by external players, we have completed all our contractual obligations under the above contract.

Consequently, we are also pleased to submit our fourth certificate/ final and retention of 1st and 2nd certificates payment for your settlement. Attached herewith, please find the said 4th certificate of payment for the amount **Ksh2,883,545.43** and retention of 1st and 2nd certificates amounting to **Ksh272,720.54** totaling to **Kshs3,156,265.97(Kenya shillings three million, one hundred fifty-six thousand, two hundred sixty-five and ninety seven cents only).**

We kindly request you to settle this payment either by raising a cheque in favor of:

"Black Bear Projects (K) Limited" or making a bank transfer to our bank account whose details are as hereunder:

Account Name:	**Black Bear Projects (K) Limited**
Account number:	**0100262616307**
Name of Bank:	**Equity Bank Limited**
Branch:	**Kerugoya Branch**

We thank you for giving us an opportunity to collaborate with you in the Mugira Dam water supply infrastructure development project and we look forward to more engagements in the future.

Yours Faithfully,

BLACK BEAR CONSTRUCTION (K) LTD
Date: .....
Tel: 0734 266 302
P.O. Box 1177-10300 KERUGOYA

Nancy Njeri Mbagiru
Commercial Director

SUMMARY OF STATEMENT FOR PAYMENT ON ACCOUNT.

CONTRACT NAME:	**MUGIRA DAM WATER SUPPLY PHASE 1. FINAL CERTIFICATE.**	CERTIFICATE No. :	**4**
LPO No.	**MCG/042/2017-2018.**		
CONTRACTOR :	**BLACK BEAR CONSTRUCTION.**		
CONTRACT SUM :	**KSHS 2,986,529.20**	CONTRACT DURATION :	

DESCRIPTION.	PREVIOUS CERTIFICATES (KSHS)	THIS CERTIFICATE (KSHS)	TOTAL TO DATE (KSHS)
A. TOTAL OF WORK DONE	-	**2,574,594.14**	**2,574,594.14**
B. MATERIAL ON SITE	0.00	0.00	-
C. VARIATION OF PRICES	0.00	0.00	-
D. SUB-TOTAL (A + B + C)	-	**2,574,594.14**	**2,574,594.14**
E. ADD 16% VAT	0.00	411,935.06	**411,935.06**
F. SUB-TOTAL(D + E)	**0.00**	**2,986,529.20**	**2,986,529.20**
G. LESS V.A.T (2% OF F)		51,491.88	**51,491.88**
G. LESS RETENTION MONEY 5% OF F)	0.00	128,729.71	**128,729.71**
G(a). RELEASE OF RETETION 2.5%	0.00	0.00	-
H. WITHHOLDING (3% OF F)	0.00	77,237.82	**77,237.82**
I. SUB-TOTAL(F - (G + H)+G(a))	0.00		**2,883,545.43**
J. ADVANCE PAYMENT (10% of Contract Sum)	0.00	0.00	
K. LESS REPAYMENT OF ADVANCE	0.00	-	
L. BALANCE OF ADVANCE	0.00	0.00	
M. INTEREST ON DELAYED PAYMENT	0.00	0.00	
N. TOTAL OF PAYMENTS (I + M - L)	**0.00**	-	**2,883,545.43**
O. LESS PREVIOUS CERTIFICATES			0.00
AMOUNT NOW DUE TO CONTRACTOR			**2,883,545.43**

BLACK BEAR CONSTRUCTION (K) LTD
P.O. Box 1177 - 10300, KERUGOYA
Date: 13/7/2021
Tel: 0734 266 122

Submitted by:

Contractor

JOSPHAT M. RUKENYA
CHIEF OFFICER
WATER & IRRIGATION
Email:rukenyajospha@gmail.com

Date:

approved by:-

J. Rukenya.
(Chief Officer Irrigation)

Date: 13/07/2021

Checked by:

Engineer.
L hereby confirm the above rates and Quantities

Date: 13/07/2021

SUMMARY OF STATEMENT FOR PAYMENT ON ACCOUNT.

CONTRACT NAME:	**MUGIRA DAMWATER PHASE 1.**		100% RELEASE OF RETENTION	
LPO No.	**MCG/042/2017-2018**			
CONTRACTOR :	**BLACK BEAR CONSTRUCTION**			
CONTRACT SUM :	**KSHS 6,368,991.50**		CONTRACT DURATION :	
DESCRIPTION.			PREVIOUS CERTIFICATES (KSHS)	THIS CERTIFICATE (KSHS)	**TOTAL TO DATE (KSHS)**
A. TOTAL OF WORK DONE			5,454,410.77	0.00	**5,454,410.77**
B. MATERIAL ON SITE			0.00	0.00	-
C. VARIATION OF PRICES			0.00	0.00	-
D. SUB-TOTAL (A + B + C)			**5,454,410.77**	**0.00**	**5,454,410.77**
	E. ADD 16% VAT		872,705.72	0.00	**872,705.72**
	F. SUB-TOTAL(D + E)		**6,327,116.49**	**0.00**	**6,327,116.49**
	G. LESS V.A.T (6% OF F)		**327,264.65**	0.00	**327,264.65**
	G. LESS RETENTION MONEY 5% OF F)		272,720.54	0.00	**272,720.54**
	G(a). RELEASE OF RETETION 5%		0.00	272,720.54	**272,720.54**
	H. WITHHOLDING (3% OF F)		163,632.32	0.00	**163,632.32**
	I. SUB-TOTAL(F - (G + H)+G(a))		5,563,498.99	**272,720.54**	**5,836,219.52**
		J. ADVANCE PAYMENT (10% of Contract Sum)	0.00	0.00	
		K. LESS REPAYMENT OF ADVANCE	0.00	-	
		L. BALANCE OF ADVANCE	0.00	0.00	
		M. INTEREST ON DELAYED PAYMENT	0.00	0.00	
		N. TOTAL OF PAYMENTS (I + M + L)	**5,563,498.99**	**272,720.54**	**5,836,219.52**
			O. LESS PREVIOUS CERTIFICATES		**5,563,498.99**
			AMOUNT NOW DUE TO CONTRACTOR		**272,720.54**

Submitted by: .....

BLACK BEAR CONSTRUCTION (K) LTD
Date: 13/7/2021
P.O. Box 1777 - 10300, KERUGOYA

Contractor

Checked by: .....

Engineer.

I hereby confirm the above rates and Quantities

Date: .....

JOSPHAT M. RUKENYA
CHIEF OFFICER
WATER & IRRIGATION
Email:rukenyajospha@gmail.com

Date: 13/07/2021

Certified by:- .....

J.Rukenya
(Chief Officer Water & irrigation)

Date: 13/07/21

SUMMARY OF STATEMENT FOR PAYMENT ON ACCOUNT.

CONTRACT NAME	MUGIRA DAM WATER PHASE 1.	CERTIFICATE No. :	1
CONTRACT No.	MCG/042/2017-2018		
CONTRACTOR :	BLACK BEAR CONSTRUCTION.		
CONTRACT SUM :	KSHS 6,368,991.50	CONTRACT DURATION :	

DESCRIPTION.	PREVIOUS CERTIFICATES (KSHS)	THIS CERTIFICATE (KSHS)	TOTAL TO DATE (KSHS)
A. TOTAL OF WORK DONE	-	2,788,594.80	2,788,594.80
B. MATERIAL ON SITE	0.00	0.00	-
C. VARIATION OF PRICES	0.00	0.00	-
D. SUB-TOTAL (A + B + C)	-	2,788,594.80	2,788,594.80
E. ADD 16% VAT	0.00	446,175.17	446,175.17
F. SUB-TOTAL(D + E)	0.00	3,234,769.97	3,234,769.97
G. LESS V.A.T (6% OF F)		167,315.69	167,315.69
G. LESS RETENTION MONEY (5) OF F)	0.00	139,429.74	139,429.74
G(a). RELEASE OF RETETION 2.5%	0.00	0.00	-
H. WITHHOLDING (3% OF F)	0.00	83,657.84	83,657.84
I. SUB-TOTAL(F - (G + H)+G(a))	0.00	2,844,366.70	2,844,366.70
J. ADVANCE PAYMENT (10% of Contract Sum)	0.00	0.00	
K. LESS REPAYMENT OF ADVANCE	0.00	-	
L. BALANCE OF ADVANCE	0.00	0.00	
M. INTEREST ON DELAYED PAYMENT	0.00	0.00	
N. TOTAL OF PAYMENTS (I + M + L)	0.00	2,844,366.70	2,844,366.70
O. LESS PREVIOUS CERTIFICATES			0.00
AMOUNT NOW DUE TO CONTRACTOR			2,844,366.70

Submitted by: .....

Contractor

Date: 16/1/19.

Certified by:- .....

J.Rukenya.

(Chief Officer Water & Irrigation)

Date: 16/1/2019

Checked by: .....

Water Officer(Water&Irrigation)

I hereby confirm the above rates and Quantities

Date: 16/01/19.

Approved by: .....

P.Macharia

C.E.C Water & Irrigation

Date 6/2/2019

SUMMARY OF STATEMENT FOR PAYMENT ON ACCOUNT.

CONTRACT NAME	MUGIRA DAM WATER PHASE 1.	CERTIFICATE No.	2
CONTRACT No.	MCG/042/2017-2018		
CONTRACTOR	BLACK BEAR CONSTRUCTION.		
CONTRACT SUM :	KSHS 6,368,991.50	CONTRACT DURATION :	

DESCRIPTION.	PREVIOUS CERTIFICATES (KSHS)	THIS CERTIFICATE (KSHS)	TOTAL TO DATE (KSHS)
A. TOTAL OF WORK DONE	2,788,594.80	2,665,815.97	5,454,410.77
B. MATERIAL ON SITE	0.00	0.00	-
C. VARIATION OF PRICES	0.00	0.00	-
D. SUB-TOTAL (A + B + C)	2,788,594.80	2,665,815.97	5,454,410.77
E. ADD 16% VAT	446,175.17	426,530.56	426,530.56
F. SUB-TOTAL(D + E)	3,234,769.97	3,092,346.53	6,327,116.50
G. LESS V.A.T (6% OF F)	167,315.69	159,948.96	327,264.65
G. LESS RETENTION MONEY (5) OF F)	139,429.74	133,290.80	272,720.54
G(a). RELEASE OF RETETION 2.5%	0.00	0.00	-
H. WITHHOLDING (3% OF F)	83,657.84	79,974.48	163,632.32
I. SUB-TOTAL(F - (G + H)+G(a))	2,844,366.70	2,719,132.29	5,563,498.99
J. ADVANCE PAYMENT (10% of Contract Sum)	0.00	0.00	
K. LESS REPAYMENT OF ADVANCE	0.00	-	
L. BALANCE OF ADVANCE	0.00	0.00	
M. INTEREST ON DELAYED PAYMENT	0.00	0.00	
N. TOTAL OF PAYMENTS(I + M + L)	2,844,366.70	2,719,132.29	5,563,498.99
O. LESS PREVIOUS CERTIFICATES			2,844,366.70
AMOUNT NOW DUE TO CONTRACTOR			2,719,132.29

Submitted by:

BLACK BEAR CONSTRUCTION (K) LTD
P.O. Box 11 10300, KERUGOYA
Date: 15/03/2019
Tel 0734 266 302

Contractor

Checked by:

Water Officer(Water&Irrigation)
I hereby confirm the above rates and Quantities

Date: 3-5-2019

Certified by:-

JOSPHAT M. RUKENYA
CHIEF OFFICER
WATER & IRRIGATION
Email:rukenyajospha@gmail.com

J.Rukenya.
(Chief Officer Water & Irrigation)

Date: 15/5/2019

Date: 3-5-19

Approved by,

P.Macharia
C.E.C Water & Irrigation

Date 13/5/2019

MURANG'A COUNTY GOVERNMENT

ALL CORRESPONDENCE TO BE ADDRESSED:
THE COUNTY SECRETARY

County Hall P.O Box 52
MURANG'A

Telephone:

WATER AND SANITATION DIRECTORATE

RE: CERTIFICATE OF COMPLETION

This is to certify that Black Bear Construction (K) Ltd of P.O Box 1177_Kerugoya has completed construction of Mugira Dam Water project comprising of the following;-

1. Construction of a composite filtration unit,
2. Construction of a water sump,
3. Rehabilitation of a water storage tank,
4. Installation of a pump set
5. Rehabilitation of an existing pump house
6. Connection of three phase KPC power supply
7. Laying of a pipeline mains from the pump house to the storage tank.
8. Laying of a water pipeline to serve Mugira Secondary School, Mugira Primary School, Mugira Dispensary and the community through a communal water point.

These works have been done in accordance with the tender document No._MCG/042/2017-2018.

The purpose of this letter therefore is to request the financier of the project to pay the contractor Black Bear Construction (K) Ltd all the unpaid dues as per the terms of the contract.

Isaac G. Gichuki
Senior Water Engineering Superintendent
Murang'a County Government

DATED 27TH JANUARY 2021

MURANG'A COUNTY GOVERNMENT

ALL CORRESPONDENCE TO BE ADDRESSED:
THE COUNTY SECRETARY

County Hall P.O Box 52
MURANG'A

Telephone:

WATER AND SANITATION DIRECTORATE

REF; MCG/MUS-SC/19/2

The Director
Water and Sanitation Department
Murang'a County

Date; 25th January 2021

RE; PROGRESS REPORT ON MUGIRA DAM WATER PROJECT
CONTRACT No. MCG/042/2017-2018 AWARDED TO BLACK BEARS LTD

1. **Introduction**

Mugira Dam Water Project is located in Mugira Villige of Mihang'o Location,Makuyu Division , Murang'a South Sub-County in Murang'a County. The scope of the project was to execute the following works;-

a)Bush clearing of the dam area
b) Construction of a water sump 20 m^3
c) Trenching and Laying of a 1.02 km raising Mains 110 mm diameter to Mugira Dispensary
d) Trenching and Laying of a 0.5 km pipeline 50 mm diameter to Mugira Pry School
e) Trenching and Laying of a 0.5 km pipeline 50 mm diameter to Mugira Secondary School
f) Rehabilitation of an existing pump house
g) Rehabilitation of an existing ground masonry tank at Mugira Dispensary

h) Construction of a 100 m^3 composite filtration tank

i) Construction of a perimeter fence around the dam area and to secure the water infrastructure constructed in this project

2. **Work progress**

i. Mobilization and bush clearing

The contractor mobilized to site on 23rd November 2018 and embarked on bush clearing. Within the next four days the bush clearing activity was 100 percent completed.

ii. Construction of a water sump

The water sump was constructed laying a firm impermeable foundation with adequate reinforcements

The top concrete slab completes with a lockable manhole cover and breathers were put in place according to the provided working drawings-This component is 100 % complete.

iii. Trenching and Laying of a 1.02 km raising Mains

The trench has been excavated as stipulated and is 100 % complete. The pipes have been procured and laid, backfilled and tested.

iv) Trenching and Laying of a 0.5 km pipeline 50 mm diameter to Mugira Pry School

The trench has been excavated as stipulated and is also 100 % complete. The pipes have been procured, brought to site laid, backfilled and tested.

iv) Trenching and Laying of a 0.4 km pipeline 50 mm diameter to Mugira Secondary School

The trench has been excavated as stipulated and is also 100 % complete. The pipes have been procured, brought to site laid, backfilled and tested.

v)Rehabilitation of an existing pump house

The pump house has been rehabilitated. The construction of the floor screed and painting is also complete. This component is 100 % complete.

vi .Rehabilitation of an existing ground masonry tank at Mugira

The 100 m^3 masonry tank has been rehabilitated by applying a 3 coat plaster on all faces of the tank including the underside of the roof slab. A two coat lender plaster on the outside has also been completed. This tank is provided with a lockable manhole cover and adequate breather pipes. Pipe work for the tank is also complete. The tank was filled with water and no leaks were detected. This tank is now fully completed.

vii. Construction of a 100 m^3 composite filtration tank
The tank is now completed, water poured into it, chemicals put and treatment process tested. The tank is complete and sufficiently working.

viii) Construction of a perimeter fence around the dam area and to secure the water infrastructure constructed in this project
The work on this component has been completed. A lockable steel gate has been provided as well.

3.**Variations**

There are several components that were omitted during the initial preparations of bill of quantities while others came up in the course of project implementation. The fittings and their costs are contained in the attached pages. The financial is called upon to refund these additional expenses for the fittings.

Conclusion

The project is fully completed; the secondary school, the primary school and a section of the community have been supplied with domestic water.

The challenge is now the sustainable operation and maintenance of this project. The same will be addressed once the project is handed over.

Isaac Gichuki
Senior Water Engineering Superintendent
Murang'a County Government

Cc. Black beers limited

MURANG'A COUNTY GOVERNMENT

ALL CORRESPONDENCE TO BE ADDRESSED:
THE COUNTY SECRETARY

County Hall P.O Box 52
MURANG'A

Telephone:

MURANG'A COUNTY GOVERNMENT
CHIEF OFFICER WATER
28 JAN 2021
FORWARDED
P. O. Box 52-10200, MURANG'A

WATER AND SANITATION DIRECTORATE

ADDITIONAL FITTINGS USED TO COMPLETE THE WORK

MUGIRA DAM WATER PROJECT

Item	Description	Unit	Quantity	Rate Kshs.	Amount Kshs
a)	**Installation of air valves**				
1	Single air valve 25 mm diameter	No	1	8250	8,250
2	Double air valve 25 mm diameter	No	1	12,550	12,550
3	Saddle clamp 4''x1'' dia.	No	2	3,500	7,000
4	Barrel nipple 25 mm dia	No	2	180	360
5	GI pipes300 mm long 25 mm dia	No	2	4300	8,600
6	Gate valves 25 mm dia	No	2	1,850	3,700
7	Thread tapes	No	3	60	180
	Sub –Total Kshs.				**40,640**
b)	**Pump installation**	No			
1	Water master meter 80 mm dia	No	1	37,350	37,350
2	Non return valve 80 mm dia	No	1	35,600	35,600
3	Flanged butterfly sluice valve 80 mm dia	No	1	18,400	18,400
4	GI long bend 80 mm dia.	No	4	3,000	12,000
5	Float switch	Noi	1	7000	7,000
	Sub –Total Kshs.				**110,350**
c)	**Mainline pipe fittings**				
1	PPR pipes 20 mm dia	M	76	260	19,760
2	GI elbow 20 mm dia	No	8	250	2,000
3	GI bends 20 mm dia	No	1	150	150
4	Barrel nipple 20 mm dia	No	2	300	600
5	GI sockets 20 mm dia	No	3	300	900
6	Gate valves 20 mm dia	No	2	1500	3,000
7	Reducing bush 20 x 15 mm dia	No	3	350	1,050
8	Clips 20 mm dia	No	6	150	900
9	Steel nails 50 mm	No	14	10	140
10	GI union 20 mm dia	No	1	360	360
11	Potable Steel ladder 8 m long	No	1	15,000	15,000
	Sub –Total Kshs				**43,860**

d)	**Mihang'o Primary School Line**				
1	Construction of a tiled water point double access	No	1	86,250	86,250
2	GI tee 25 mm dia	No	1	450	450
3	GI pipe 20mm dia.	No	1	6500	6,500
4	GI elbow 20 mm dia	No	4	150	600
5	GI tees 20 mm dia	No	8	150	150
6	GI sockets 20 mm dia	No	10	150	1,500
7	Reducing bush 25 x20 mm ia	No	1	550	550
8	Reducing sockets 25 x 20 mm	No	1	550	550
9	Reducing bush 20 x 15 mm dia	No	1	450	450
10	Barrel nipple 20 mm dia	N0	4	150	150
11	PPR pipe 32 mm dia	N0	1	650	650
12	Peglar taps 15 mm dia	No	8	800	6,400
13	Thread tapes	No	4	60	240
14	Long nipple 25 mm dia	No	1	150	150
15	Back nut 25 mm dia.	No	1	150	150
	Sub-Total Kshs.				**104,740**
e)	**Dispensary pipeline**				
1	GI tee 1 ½ '' dia x ¾ '' diameter	No	1	450	450
2	Barrel nipple 1 ½ '' dia	No	2	450	900
3	Gate valve ¾ '' dia	No	3	1850	5,550
4	GI elbow ¾ '' dia	No	6	250	1,500
5	PPR pipe ¾'' dia	M	82	250	20,500
6	GI tee ¾'' dia	No	2	250	500
7	Thread tapes	No	4	60	240
8	Barrel nipple ¾'' dia	No	2	250	500
	Sub-Total Kshs				**30,140**
f)	**Mihang'o water point**				
1	PPR pipe ¾'' dia	M	32	250	8,000
2	GI elbow ¾ '' dia	No	1	250	250
3	GI bends ¾ '' dia	N o	1	250	250
4	Barrel nipple ¾ '' dia	No	2	250	500
5	GI sockets ¾ '' dia	No	3	250	500
6	Gate valve ¾ '' dia	No	2	1850	3,700
7	Reducing bush 20 x 15 mm dia	No	3	200	600
8	Clips ¾ ''	No	6	100	600
9	Steel nails 50 mm	No	14	10	140
10	GI union 20 mm dia	No	1	150	150
	Sub-Total Kshs				**14,690**
g)	**Primary School tank**				
1	PVC pipe 1'' dia class D	No	4	850	3,400
2	Gate valve 1'' dia	No	2	2500	5,000
3	PPR pipe 1'' dia	M	4	450	1,800
4	GI elbow 1 '' dia	No	2	300	500
5	GI sockets 1'' dia	No	2	300	500
6	Valve sockets 1 $^{1}/_{2}$ '' dia	No	1	350	350
7	Reducing bush 1 $^{1}/_{2}$ x1'' dia	No	1	350	350
8	Valve sockets 1'' dia	No	1	300	300

9	Long nipple ¾'' dia	No	1	250	250
10	Back nuts ¾'' dia	N0	2	250	500
11	Gate valve ¾ '' dia	N0	1	1,850	1,850
12	GI sockets ¾'' dia	No	1	250	250
13	Lockable peglar tap ¾'' dia	No	1	1,350	1,350
14	Targit 100 ml	Pkt	1	200	200
	Sub-Total Kshs				**16,600**
h)	**Pump house water fittings**				
1	GI pipe 4'' dia	No	1	28500	28,500
2	Flanged adaptor 4'' dia	No	3	6,000	18,000
3	Flanged tapper 4'' x 3'' dia	No	3	6500	19,500
4	Flanges 4'' dia	No	7	4,500	31,500
5	Foot valve 4'' dia	No	2	3500	7,000
6	GI pipe 3'' dia	Length	1	24,500	24,500
7	Flanged long bend 3'' dia	No	4	1450	5,800
8	Flanges 3'' dia	No	9	3200	28,800
9	GI elbows 4'' dia	N0	4	1200	4,800
10	Rubber gaskets heavy duty	M	4	300	1,200
11	Plastic taps ½'' dia	No	2	250	500
13	Threading taps	No	5	60	300
14	Ordinary cement	Bag	3	900	2,700
15	Pump concrete base slab construction	Item	Item	9,500	9,500
	Sub-Total Kshs				**182,600**
i)	**General repair of water distribution line**				
1	Gate valve 1'' dia	No	2	2500	5,000
2	Barrel nipple 1 '' dia	No	1	300	300
3	Gate valve ½ '' dia	No	2	750	1,500
4	Barrel nipple ½ '' dia	No	5	150	750
5	GI elbows ½ '' dia	No	3	150	450
6	GI unions $^{1}/_{2}$ '' dia	No	1	150	150
7	Hexagonal nipple ½ '' dia	No	1	150	150
8	GI sockets ½'' dia	No	1	150	150
9	Reducing bush ½'' x ¼ '' dia	N0	2	250	500
10	Flanged bar pressure gauge 0-20	N0	1	3950	3,950
11	Gi sockets ¾'' dia	No	1	250	250
12	Lockable peglar tap ¾'' dia	No	1	450	450
13	Flange 4'' dia.	No	4	2900	10,800
14	VJ Coulings 4'' dia.	No	4	4000	16,000
	Sub-Total Kshs				**40,400**
j)	**Secondary School Line**				
1	PPR pipe 1'' dia class D	No	240	385	92,400
2	Gate valve 1'' dia	No	1	2500	5,000
3	Adapter Socket 1'' dia	M	1	240	240
4	Barrel Nipple 1 '' dia.	No	2	200	400
5	GIunion sockets 1'' dia	No	1	300	300
6	Valve sockets 1 $^{1}/_{2}$ '' dia	No	1	350	350
7	Treading taps	No	5	120	600
8	HDPE Couplers 2'' x 1 ' diameter	No	1	3300	3,300

9	PPR Plain Sockets 32 Mm	No	6	120	720
	Sub-Total Kshs.				**103,310**
k)	**Electrical works and fittings**				
1	Master board installation	Item	Item	Item	13,500
2	Angle line installation	Item	Item	Item	1,500
3	PVC pipe 32 mm diameter and accessories	Item	Item	Item	1,000
4	Cut out installation	No	3	1400	3,600
5	Labour	Item	Item	Item	10,000
	Sub-Total Kshs				**29,600**
l)	**Water treatment Testing**				
1	Application chemicals –Aluminum Sulphate	Item	Item	Item	13,500
2	Application chemicals -Tropical chlorine	Item	Item	Item	8,800
	Sub-Total Kshs				**22,300**

Summary of costs

Item	Description	Cost Kshs
a	Mainline pipe fittings	40,640
b	Mainline pipe fittings	110,350
c	Mainline pipe fittings	43,860
d	Mihang'o Primary School Line	104,740
e	Dispensary pipeline	30,140
f	Mihang'o water point	14,690
g	Primary School tank	16,600
h	Pump house water fittings	182,600
i	General repair of water distribution line	40,400
j	Secondary School Line	103,310
k	Electrical works and fittings	29,600
l	Water treatment Testing	22,300
	Grand Total Kshs.	**739,230**

The total cost of the additional fittings is **Kshs. 739,230** (Seven Hundred thirty nine thousands, two hundred and thirty Kenya shillings only.)

NB: The prices are inclusive of 16 % VAT

Isaac Gichuki

Snr. Water Engineering Superintendent

Muranga Count Government

1.0 Bill of Quantities for Bush Clearing and Fencing

Item	Description	Unit	Qty	Rate (Kshs)	Bill Amount (Kshs)	Quantity Claimed	Amount Claimed
1.	Clearing of the tree stumps on the embankment and in the dam area	L/s	L/s	20,000	20,000	100%	20,000
2.	Excavation of holes 0.45 m diameter, 1 meter deep and store the arising for reuse	No	64	250	16,000	64	16,000
3.	Procure, deliver r.c concrete poles 3 m long, 150 mm diameter precast	No	64	2,000	128,000	64	128,000
4.	Provide for barbed wire in 6 horizontal strands (Gauge 12.5)	M	1,200	150	180,000	1220	183,000
5.	Provide for chain link 2.1 M high medium gauge	M	210	750	157,500	252	189,000
6.	Provide for U nails/binding wire	Kg	60	350	21,000	60	21,000
7.	Provide for a steel fabricated gate 1.5M wide and 2.1 M high	No	1	30,000	30,000	1	30,000
	Sub total				552,500		587,000
	Add 20% labour				110,500		117,400
	Add 5% contingencies				27,625		29,350
	Add 5% supervision fee				27,625		29,350
	Grand Total				718,250		763,100

1.1 Bill of Quantities for Composite Water Treatment Tank 100 Cubic Meters (Ground Masonry)

Item	Description	Unit	Qty	Rate (Kshs)	Bill Amount (Kshs	Quantity Claimed	Claimed Amount
1.	Excavation of site to remove top unconsolidated soil, grub up roots and dispose the arising commencing ground level up to firm ground.	CM	50	450	22,500	50	22,500
2.	marram blinding layer 50mm thick	CM	4	3,500	14,000	4	14,000
3.	Reinforced high yield bars Y12	No	20	1,750	35,000	20	35,000
4.	Reinforced high yield bars Y10	No	50	1,500	75,000	50	75,000
5.	Quarry stones 225 x 225mm (9'' x 9'')	R/ft	1500	85	127,500	1500	127,500
6.	Ordinary Portland cement	Bag	210	800	168,000	210	168,000
7.	Water proof cement (Pudlo)	Kg	80	180	14,400	80	14,400
8.	Ballast ½'' – ¾''	Ton	10	3,500	35,000	10	35,000
9.	Clean river sand	Ton	9	2,500	22,500	9	22,500
10.	Binding wire	Kg	50	150	7,500	50	7,500
11.	Props 80mm diam, 3m long	No	100	2,000	200,000	100	200,000
12.	Bituminous paint	Litre	20	500	10,000	20	10,000
13.	Timber sawn soft wood 4'' x 2''	RM	200	275	55,000	200	55,000
14.	Timber sawn soft wood 6'' x 1''	RM	700	250	175,000	700	175,000
15.	Ordinary wire nails 4'' long	Kg	30	250	7,500	30	7,500
16.	Ordinary wire nails 2'' long	Kg	40	250	10,000	40	10,000
17.	Pipes G.I 6'' diam class 'B' socketed	No	2	12,000	24,000	2	24,000
18.	G.I Elbows 6'' diam	No	8	350	2,800	8	2,800
19.	Provide for 80mm breather pipes fully installed with wire gauze	No	3	750	2,250	3	2,250
20.	Bell mouth 8'' x 6''	No	1	750	750	1	750
21.	Provide for construction of valve chamber 1200 x 1000 x 1050mm with lockable cover	No	2	4,500	9,000	2	9,000
22.	Sluice valve 6'' diam flanged	No	2	1,200	2,400	2	2,400
	Sub Total				**1,020,100**		**1,020,100**
	Add 30% skilled unskilled labour				306,030		306,030
	Add 10% contingencies				102,010		102,010
	Add 5% supervision fee				15,302		15,302
	Grand Total				**1,443,442**		**1,443,442**

1.2 Bill of Quantities for Rehabilitation of Existing Pump House

Item	Description	Unit	Qty	Rate (Kshs)	Bill Amount (Kshs)	Quantity Claimed	Claimed Amount
1.	Hack out the old plaster with cold chisel and hammer to provide and bond to new plaster to both internal and external faces	L/s	L/s	2,000	2,000	100%	2,000
2.	Apply a thin layer 25mm thick plaster in 1.3 sand cement mortar to both internal and external walls	MS	25	550	13,750	25	13,750
3.	Apply 2 coats of paint to both internal and external sides of the pump house	MS	25	450	11,250	25	11,250
4.	Provide and place a fabricated steel door 900 x 2100mm	No	1	18,000	18,000	1	18,000
5.	Provide and place ventilation made from Y12 bars and measuring 450 x 300mm	No	4	4,500	18,000	4	18,000
6.	Apply a floor screed 25mm thick made from 1.3 sand cement mortar	MS	8	750	6,000	8	6,000
	Sub Total				69,000		69,000
	Add 30% labour				20,700		20,700
	Add 10% contingencies				6,900		6,900
	Add 5% supervision				3,450		3,450
	Grand Total				**100,050**		**100,050**

Bill of Quantities for Repair of Existing Storage Tank (Mihang'o Dispensary)

Item	Description	Unit	Qty	Rate (Kshs)	Bill Amount (Kshs)	Quantity Claimed	Amount Claimed
1.	Hack out the old plaster with a cold chisel and hammer both at the outside, the inside wall and the floor of the storage tank	L/s	L/s	30,000	30,000	100%	30,000
2.	Apply a thin layer 25mm thick plaster in 1.3 cement/sand to both external and internal sides of the tank **(Two layers applied)**	MS	100	550	55,000	100	55,000
3.	Apply 2 coats of bituminous paint to the internal wall of the tank	MS	50	650	32,500	50	32,500
4.	Apply a floor screed 25mm thick made from 1.;3 cement to sand	SM	50	750	37,500	50	37,500
5.	Apply a thin layer 25mm thick plaster in 1.3 cement/sand to both external and internal roof slab	SM	0	550	0	100	55,000
	Sub Total				**155,000**		**155,000**
	Add 30% labour				46,500		46,500
	Add 5% contingencies				7,750		7,750
	Add 5% supervision fee				7,750		7,750
	Grand Total				**217,000**		**217,000**

1.3 Bill of Quantities for Rising Main 1.02 Km Long 110mm Diameter HDPE Pipes

Item	Description	Unit	Qty	Rate (Kshs)	Bill Amount (Kshs)	Quantity Claimed	Claimed Amount
1.	Excavate trench not exceeding 1.2m depth and 450 mm width	M	1020	250	255,000	1020	255,000
2.	Provide and install HDPE pipes DN 110, PN 12.5	M	1020	500	510,000	1020	510,000
3.	Provide for G.I pipes 100mm diam socketed 6M long (4'')	No	5	12,000	60,000	5	60,000
4.	Provide G.I elbows 4'' diam	No	4	2,500	10,000	4	10,000
5.	Provide for boss white	Kg	3	750	2,250	3	2,250
6.	Provide for hemp	Kg	2	500	1,000	2	1,000
7.	Back filling of the trench after pipe laying	M	1020	150	153,000	1020	153,000
8.	Allow for pipeline testing	L/s	L/s	10,000	10, 000.00	0	0
9.	Provide for road crossing using appropriate technology	No	1	200,000	200,000	100%	200,000
10.	Provide HDPE couplings 110 x 110mm diam	No	12	1,200	14,400	12	14,400
11.	*Provide for HDPE/G.I adapter 110mm (4'') diam*	No	5	1,750	8,750	5	8,750
12.	Provide for standard concrete marker posts at every 200 M distance	No	6	2,500	15,000	6	15,000
13.	Provide for double orifice air release valve 25mm diam	No	2	3,500	7,000	2	7,000
14.	Allow for construction of a lockable valve chamber 1050 x 1200 x 1200 mm to accommodate the air valves	No	2	75,000	150,000	2	150,000
	Sub Total				**1,386,400**		**1,386,400**
	Add 30% labour				415,920		415,920
	Add 5% contingencies				69,320		69,320
	Add 5% supervision fee				69,320		69,320
	Grand Total				**1,940,960**		**1,940,960**

1.4 Bill of Quantities for Water Sump Construction Capacity 20 Cubic Meters

Item	Description	Unit	Qty	Rate (Kshs)	Bill Amount (Kshs)	Quantity Claimed	Claimed Amount
1.	Excavation of foundation 3 m diam and 2 m depth	Cubic Metre	68	450	30,600	68	30,600
2.	Marram blinding layer 50mm thick	Cubic Metre	3	3,500	10,500	3	10,500
3.	Reinforcement high yield bar Y10	Nos	50	1,500	75,000	50	75,000
4.	Quarry stones 225 x 225mm (9'' x 9'')	R/ft	600	85	51,000	600	51,000
5.	Reinforcement high yield bar Y12	Nos	4	1,750	7,000	4	7,000
6.	Ordinary Portland cement	Bags	60	800	48,000	60	48,000
7.	Water proof cement (Pudlo)	Kgs	60	180	10,800	60	10,800
8.	Ballast ½'' – ¾''	Tons	7	3,500	24,500	7	24,500
9.	Clean river sand	Tons	7	2,500	17,500	7	17,500
10.	Binding wire	Kgs	50	150	7,500	50	7,500
11.	Props 80mm diam, 3.0m long	Nos	60	300	18,000	60	18,000
12.	Bituminous paint	litre	20	550	11,000	20	11,000
13.	Timber sawn soft wood 4'' x 2''	Rm	120	275	33,000	120	33,000
14.	Timber sawn soft wood 6'' x 1''	Rm	240	250	60,000	240	60,000
15.	Ordinary wire nails 4''	Kg	20	250	5,000	20	5,000
16.	Ordinary wire nails 2''	Kg	30	250	7,500	30	7,500
17.	Provide for 80mm diam breather pipes fully installed with wire gauze	No	3	750	2,250	3	2,250
18.	Provide for construction of a valve chamber 1200 x 1200 x 1050mm with lockable cover	No	2	18,000	36,000	2	36,000
19.	Provide for step irons made from 20mm diam thick round bars	No	6	1,500	9,000	6	9,000
20.	Provide for steel portable ladder 8 m long	No	1	15,000	15,000	1	15,000
21.	Provide for fabricated steel manhole cover 500 x 350 mm	No	1	4,500	4,500	1	4,500
	Sub Total				**483,650**		**483,650**
	Add 30% labour				145,095		145,095
	Add 5% contingencies				24,183		24,183
	Add 5% supervision fee				24,183		24,183
	Grand Total				**677,110**		**677,110**

1.5 Bill of Quantities for Pump Installation and KPLC Power Supply

Item	Description	Unit	Qty	Rate (Kshs)	Bill Amount (Kshs)	Quantity Claimed	Claimed Amount
1.	Supply and install a surface water pump capable of pumping 40.6 cubic meters of water against a total head of 143 meters complete with all accessories, preferably 30 Kw.Test and commission.	No	1	120,000	120,000	0%	0
2.	*Supply and install KSB Motor 10Kw or its equivalent* complete with control panel, control cables, water level relay and power failure relay.Test and commission	No	1	100,000	100,000	0	0
3.	Supply 3 phase KPLC electric power to site and connect to the control panel.Test and commission	No	1	100,000	100,000	0	0
	Sub Total				320,000		0
	Add 5% contingencies				16,000		0
	Grand Total				**336,000**		**0**

Bill of Quantities for a Distribution Line to Mihang'o Primary School 0.5 Km

Item	Description	Unit	Qty	Rate (Kshs)	Bill Amount (Kshs)	Quantity claimed	Claimed Amount
1.	Excavate trench not exceeding 1.2m depth, 450mm width	M	504	250	126,000	504	126,000
2.	Provide and install HDPEpipes DN 50, PN 12.5	M	504	500	252,000	504	252,000
3.	Provide for gate valve 50 mm diam complete with fittings	No	1	7,500	7,500	1	7,500
4.	Provide HDPE reducing tee 110mm x 50mm	No	1	1,500	1,500	1	1,500
5.	Back filling the trench after pipe laying	M	504	300	151,200	504	151,200
6.	Allow for pipe line testing	L/s	L/s	5,000	5,000	1	5,000
7.	Provide for road crossing using appropriate technology	No	1	200,000	200,000	1	200,000
8.	Provide for HDPE coupling 50mm x 50mm	No	5	1,200	6,000	5	6,000
9.	Provide for HDPE adapters 50mm (11/2'') diam	No	2	1,750	3,500	2	3,500
10.	Provide for concrete marker posts at every 200m	No	5	2,500	12,500	5	12,500
11.	Provide for a single orifice air release valve 25mm diam	No	1	3,500	3,500	1	3,500
12.	Allow for construction of a valve chamber 1200 x 1200 x 1050 mm with lockable cover	No	1	50,000	50,000	1	50,000
	Sub Total				818,700		818,700
	Add 30% labour				245,610		245,610
	Add 5% contingencies				40,935		40,935
	Add 5% supervision fee				40,935		40,935
	Grand Total				**1,146,180**		**1,146,180**

Bill of For Approved Variations A

Item	Description	Unit	Qty	Rate (Kshs)	Bill Amount (Kshs)	Quantity claimed	Claimed Amount
A	**Perimeter Fence**						
1	Excavate 0.45m dia holes, 1.0m deep at 3.0 meters center to center to receive fencing posts.	No	236	250	59,000	0	0
2	Procure and deliver 100mm dia by 3m long concrete fencing posts.	No	236	2,000	472,000	0	0
3	Procure and deliver 2.1 m high chain link Fence.	M	700	750	525,000	0	0
4	Procure and deliver G12.5 barbed wire in 6 horizontal strands.	M	4560	110	501,600	0	0
5	Provide all materials and provide Concrete class 20 for Anchoring the fencing posts.	M3	51.5	16,800	865,200	25	420,000
6	Provide binding wire for fixing the chain link.	Rolls	3	5,500	16,500	1	5,500
	Sub Total A				2,439,300		425,500
	Add 20% labour				487,860		85,100
	Add 5% contingencies				121,965		21,275
	Add 5% supervision fee				121,965		21,275
	Total A				**3,171,090**		**553,150**
B	**Plastering Top Slab and Underside of The Storage Tank at Mugira Dispensary.**						
1	Provide a 1.3 Cement :Sand Mortar for external and internal plaster.	MS	40	750	30,000	40	30,000
2	Procure and provide water proof cement for plastering.	Kgs	35	180	6,300	35	6,300
3	Provide a lockable steel man hole cover size 750mmx750mm	No.	1	8,000	8,000	1	8,000
	Sub Total B				44,300		44,300
	Add 30% labour				13,290		13,290
	Add 5% contingencies				2,215		2,215
	Add 5% supervision fee				2,215		2,215
	Total B				***62,020***		***62,020***
C	**Composite Filtration Tank**						
1	Procure and provide approved hardcore for the base of the Fitration tank	M3	20	1,750	35,000	20	35,000
2	Construction of Chrorination plant	No	1	256,910	256,910	1	256,910
	Sub Total C				291,910		291,910
	Add 30% labour				87,573		87,573
	Add 10% contingencies				29,191		29,191
	Add 5% supervision fee				14,596		14,596
	Total C				**423,270**		**423,270**
D	**Pipes and General Fittings Ommitted for Tanks and Pipelines.**						
1	100mm dia Flanged GI pipes C/w bolts, nuts, washers and rubber guskets.	No	1	24,000	24,000	1	24,000
2	100mm dia Flanged GI bends C/w bolts, nuts, washers and rubber guskets.	No	6	15,500	93,000	6	93,000
3	100mm dia GI elbows	No	6	6,000	36,000	6	36,000

4	100mm dia by 600mm long spigot pipe complete with bolts, nuts and washers.	No	1	13,500	13,500	1	13,500
5	100mm dia flanged adaptors	No	11	7,600	83,600	11	83,600
6	100mm dia GI pipe, 1.2 m long	No	1	9,500	9,500	1	9,500
7	100mm dia GI barrel nipples	No	2	850	1,700	2	1,700
8	100mm dia Union Sockets	No	1	4,500	4,500	1	4,500
9	37.5mm Gate Valve	No	1	6,500	6,500	1	6,500
10	75mm dia GI pipe	No	1	13,000	13,000	1	13,000
11	75mm dia Gi threaded pipe 450mm long.	No	2	3,000	6,000	2	6,000
12	100mm dia GI spigot flanged spigot pipe C/W bolts, nuts, washers and 450mm long.	No	1	14,000	14,000	1	14,000
13	75mmx50mm Reducing Sockets	No	1	900	900	1	900
14	75mm dia GI elbows	No	22	1,100	24,200	22	24,200
15	75mm dia GI Barrel Niples	No	11	800	8,800	11	8,800
16	75mm dia Gate valves	No	3	13,500	40,500	3	40,500
17	75mm dia GI end Caps	No	1	950	950	1	950
18	100mm dia GI flanged sluice valve c/w bolts, nuts, washers and rubber guskets	No	2	22,000	44,000	2	44,000
19	Flanged taper 150mm by 100mm c/w bolts, nuts, washers and rubber guskets	No	2	18,500	37,000	2	37,000
20	Flanged adaptors 150mm c/w bolts, nuts, washers and rubber guskets	No	2	14,500	29,000	2	29,000
21	150mm dia VJ couplings	No	2	5,500	11,000	2	11,000
22	Heavy duty Insertion rubber guskets	M2	2	4,500	9,000	2	9,000
23	150mm dia Socket Valves	No	2	2,600	5,200	2	5,200
	Additional fittings as in letter	No	1	739,230	739,230	1	739,230
	Sub Total D				1,255,080		1,255,080
	Add 20% labour				251,016		251,016
	Add 5% contingencies				62,754		62,754
	Add 5% supervision fee				*62,754*		*62,754*
	Total D				**1,631,604**		**1,631,604**
E	**Motor Rating and Installation Costs**						
1	Supply KSB Motor rating 30KW or its equivallent c/w control pannel, cables, control gears,water level relay,and power failure relay system, test and comission.	No	1	910,840	910,840	1	910,840
2	Installation labour	No	1	20,000	20,000	1	20,000
	Sub Total E				930,840		930,840
	Add 5% contigencies				46,542		46,542
	Allow 20% for contractor's attendance and profit				195,476		195,476
	Add 5% Supervision fees				46,542		46,542
	Total E				**1,219,400**		**1,219,400**
F	**Wash out Accessories**						
	HDPE Tee 4 "	Pc	1	7,300	7,300	1	7,300
	HDPE Adapters Male 4"	Pcs	5	5,500	27,500	5	27,500
	Gate valve pegler 4"	Pc	1	29,000	29,000	1	29,000
	Thread tapes	Pcs	2	50	100	2	100
	HDPE Pipe 4"	m	2	2,000	4,000	2	4,000
	Mihang'o Dispensary Tap Accessories						
	GI Union 3/4	Pc	1	180	180	1	180
	Barrel nipple 3/4	Pc	1	100	100	1	100
	GI Tee 3/4 x 1/2	Pc	1	100	100	1	100
	GI Elbow 1/2	Pc	1	70	70	1	70

	Barrel Nipple 1/2	Pc	1	70	70	1	70
	GI socket 1/2	Pc	1	70	70	1	70
	GI stand pipe 1/2 3ft	Pc	1	500	500	1	500
	Peglar tape 1/2	Pc	1	750	750	1	750
	Pump Gasket 1ft x 2		2	450	900	2	900
	Thread tape	Pc	1	50	50	1	50
	Sub Total F				70,690		70,690
	Add 20% labour				14,138	0	14,138
	Add 5% contingencies				3,535	0	3,535
	Add 5% supervision fee				3,535	0	3,535
	Total F				**91,897**	**0**	**91,897**
G	**Kenya Power Connection Costs**						
1	Supply KPLC 3 phase power supply to site and conect the same to the control pannel. Test and Commisssion.	No	1	1,055,209	1,055,209	1	1,055,209
2	Supply of non Kenya power Electrical accessories	Item	1	39,560	39,560	1	39,560
3	Instalation labour (accessories)	Item	1	9,890	9,890		9,890
	Sub Total F				1,104,659		1,104,659
	Add 5% contingencies				55,233		55,233
	Allow 20% for contractor's attendance and profit				231,978		231,978
	Add 5% Supervision fees				55,233		55,233
	Total G				**1,159,892**		**1,159,892**
	GRAND TOTAL (A+B+C+D+E+F+G)				**7,759,173**		**5,141,233**

ADDITIONAL FITTINGS USED TO COMPLETE THE WORKMUGIRA DAM WATER PROJECT

Item	Description	Unit	Quantity	Rate (Ksh)	Amount (Ksh)
a)	**Installation of air valves**				
1	Single air valve 25 mm diameter	No	1	8,250.00	8,250.00
2	Double air valve 25 mm diameter	No	1	12,550.00	12,550.00
3	Saddle clamp 4"× l" dia.	No	2	3,500.00	7,000.00
4	Barrel nipple 25 mm dia	No	2	180.00	360.00
5	GI pipes300 mm long 25 mm dia	No	2	4,300.00	8,600.00
6	Gate valves 25 mm dia	No	2	1,850.00	3,700.00
7	Thread tapes	No	3	60.00	180.00
	Sub —Total Kshs.				**40,640.00**
b)	**Pump installation**	**No**			
1	Water master meter 80 mm dia	No	1	37,350.00	37,350.00
2	Non return valve 80 mm dia	No	1	35,600.00	35,600.00
3	Flanged butterfly sluice valve 80 mm dia	No	1	18,400.00	18,400.00
4	GI long bend 80 mm dia.	No	4	3,000.00	12,000.00
5	Float switch	No	1	7,000.00	7,000.00
	Sub Total Kshs.				**110,350.00**
c)	**Mainline pipe fittings**				
1	PPR pipes 20 mm dia	M	76	260.00	19,760.00
2	Gl elbow 20 mm dia	No	8	250.00	2,000.00
3	GI bends 20 mm dia	No	1	150.00	150.00
4	Barrel nipple 20 mm dia	No	2	300.00	600.00
5	GI sockets 20 mm dia	No	3	300.00	900.00
6	Gate valves 20 mm dia	No	2	1,500.00	3,000.00
7	Reducing bush 20 x 15 mm	No	3	350.00	1,050.00
8	Clips 20 mm dia	No	6	150.00	900.00
9	Steel nails 50 mm	No	14	10.00	140.00
10	GI union 20 mm dia	No	1	360.00	360.00
11	Potable Steel ladder 8 m long	No	1	15,000.00	15,000.00
	Sub —Total Kshs				**43,860.00**
d)	**Mihang'o Primary School Line**				
1	Construction of a tiled water point double access	No	1	86,250.00	86,250.00
2	GI tee 25 mm dia	No	1	450.00	450.00
3	GI pipe 20mm dia.	No	1	6,500.00	6,500.00
4	GI elbow 20 mm dia	No	4	150.00	600.00
5	GI tees 20 mm dia	No	8	150.00	1,200.00
6	GI sockets 20 mm dia	No	10	150.00	1,500.00

7	Reducing bush 25 x20 mm ia	No	1	550.00	550.00
8	Reducing sockets 25 x 20 mm	No	1	550.00	550.00
9	Reducing bush 20 x 15 mm dia	No	1	450.00	450.00
10	Barrel nipple 20 mm dia	N0	4	150.00	600.00
11	**PPR pipe 32 mm dia**	**N0**	**1**	**650.00**	**650.00**
12	Peglar taps 15 mm dia	No	8	800.00	6,400.00
13	Thread tapes	No	4	60.00	240.00
14	Long nipple 25 mm dia	No	1	150.00	150.00
15	Back nut 25 mm dia.	No	1	150.00	150.00
	Sub-Total Kshs.				**106,240.00**
e)	**Dispensary pipeline**				
1	GI tee 1 ½ " dia x ¾ " diameter	No	1	450.00	450.00
2	Barrel nipple 1 ½ " dia	No	2	450.00	900.00
3	Gate valve ¾ " dia	No	3	*1,850.00*	*5,550.00*
4	GI elbow ¾ " dia	No	6	250.00	1,500.00
5	PPR pipe ¾" dia	M	82	250.00	20,500.00
6	GI tee ¾" dia	No	2	250.00	500.00
7	Thread tapes	No	4	60.00	240.00
8	Barrel nipple ¾" dia	No	2	250.00	500.00
	Sub-Total Kshs				**30,140.00**
f)	**Mihang'o water point**				
1	PPR pipe ¾" dia	M	32	250.00	8,000.00
2	GI elbow ¾" dia	No	1	250.00	250.00
3	GI bends ¾" dia	N o	1	250.00	250.00
4	Barrel nipple ¾ " dia	No	2	250.00	500.00
5	GI sockets ¾" dia	No	3	250.00	750.00
6	Gate valve ¾" dia	No	2	1,850.00	3,700.00
7	Reducing bush 20 x 15 mm dia	No	3	200.00	600.00
8	Clips ¾"	No	6	100.00	600.00
9	Steel nails 50 mm	No	14	10.00	140.00
10	GI union 20 mm dia	No	1	150.00	150.00
	Sub-Total Kshs				**14,940.00**
g)	**Primary School tank**				
1	PVC pipe 1" dia class D	No	4	850.00	3,400.00
2	Gate valve 1'' dia	No	2	2,500.00	5,000.00
3	**PPR pipe 1 " dia**	**M**	**4**	**450.00**	**1,800.00**
4	GI elbow 1 " dia		2	300.00	600.00
5	GI sockets 1" dia	No	2	300.00	600.00
6	Valve sockets 1 ½'' dia	No	1	350.00	350.00
7	Reducing bush 1 ½ x1" dia	No	1	350.00	350.00
8	Valve sockets 1 " dia	No	1	300.00	300.00
9	Long nipple ¾" dia	No	1	250.00	250.00
10	Back nuts ¾" dia	N0	2	250.00	500.00

11	Gate valve ¾" dia	N0	1	1,850.00	1,850.00
12	GI sockets ¾" dia	No	1	250.00	250.00
13	Lockable peglar tap ¾ " dia	No	1	1,350.00	1,350.00
14	Targit 100 ml	Pkt	1	200.00	200.00
	Sub-Total Kshs				**16,800.00**
h)	**Pump house water fittings**				
1	GI pipe 4" dia	No	1	28,500.00	28,500.00
2	Flanged adaptor 4" dia	No	3	6,000.00	18,000.00
3	Flanged tapper 4'' x 3" dia	No	3	6,500.00	19,500.00
4	Flanges 4" dia	No	7	4,500.00	31,500.00
5	Foot valve 4'' dia	No	2	3,500.00	7,000.00
6	GI pipe 3" dia	Length	1	24,500.00	24,500.00
7	Flanged long bend 3'' dia	No	4	1,450.00	5,800.00
8	Flanges 3'' dia	No	9	3,200.00	28,800.00
9	GI elbows 4" dia	N0	4	1,200.00	4,800.00
10	Rubber gaskets heavy duty	M	4	300.00	1,200.00
11	Plastic taps ½ " dia	No	2	250.00	500.00
13	Threading taps	No	5	60.00	300.00
14	Ordinary cement	Bag	3	900.00	2,700.00
15	Pump concrete base slab construction	Item	Item	9,500.00	9,500.00
	Sub-Total Kshs				**182,600.00**
i)	**General repair of water distribution line**				
1	Gate valve 1 " dia	No	2	2,500.00	5,000.00
2	Barrel nipple 1 " dia	No	1	300.00	300.00
3	Gate valve ½ " dia	No	2	750.00	1,500.00
4	Barrel nipple ½ " dia	No	5	150.00	750.00
5	GI elbows ½" dia	No	3	150.00	450.00
6	GI unions ½" dia	No	1	150.00	150.00
7	Hexagonal nipple ½" dia	No	1	150.00	150.00
8	GI sockets ½" dia	No	1	150.00	150.00
9	Reducing bush ¼" x ¼ " dia	NO	2	250.00	500.00
10	Flanged bar pressure gauge 0-20	N0	1	3,950.00	3,950.00
11	Gi sockets ¾" dia	No	1	250.00	250.00
12	Lockable peglar tap ¾'' dia	No	1	450.00	450.00
13	Flange 4" dia.	No	4	2,900.00	11,600.00
14	VI Coulings 4" dia.	No	4	4,000.00	16,000.00
	Sub-Total Kshs				**41,200.00**
j)	**Secondary School Line**				
1	PPR pipe 1'' dia class D	No	240	385.00	92,400.00
2	Gate valve 1'' dia	No	1	2,500.00	2,500.00
3	Adapter Socket 1" dia	M	1	240.00	240.00
4	Barrel Nipple 1 '' dia.	No	2	200.00	400.00

5	Glunion sockets 1" dia	No	1	300.00	300.00
6	Valve sockets 1 ½ " dia	No	1	350.00	350.00
7	Treading taps	No	5	120.00	600.00
8	HDPE Couplers 2" x 1 ' diameter	No	1	3,300.00	3,300.00
9	**PPR Plain Sockets 32 Mm**	No	6	120.00	720.00
	Sub-Total Kshs.				**100,810.00**
k)	**Electrical works and fittings**				
1	Master board installation	Item	Item	Item	13,500.00
2	**Angle line installation**	Item	Item	Item	1,500.00
3	PVC pipe 32 mm diameter and accessories	Item	Item	Item	1,000.00
4	Cut out installation	No	3	1,400.00	4,200.00
5	Labour	Item	Item	Item	10,000.00
	Sub-Total Kshs				***30,200.00***
1)	**Water treatment Testing**				
1	Application chemicals —Aluminum Sulphate	Item	Item	Item	13,500.00
2	Application chemicals -Tropical chlorine	Item	Item	Item	8,800.00
	Sub-Total Kshs				**22,300.00**
	TOTALS (A+B+C+D+E+F+H+I+J+K+L)				740,080.00
	Add 30% labour				222,024.00
	Add 5% Contigency				37,004.00
	Add 5% Supervision				37,004.00
	GRAND TOTAL VARIATIONS				**1,036,112.00**

SUMMARY OF CERTIFICATE NO. 1

1.0 Bill of quantities for bush clearing and fencing		**763,100.00**
1.1 Bill of quantities for composite water treatment tank 100 cubic meters (Ground Masonry)		**1,443,441.50**
1.2 Bill of quantities for rehabilitation of existing pump house		**100,050.00**
Bill of quantities for repair of existing storage tank (Mihang'o Dispensary)		**217,000.00**
1.3 Bill of quantities for rising main 1.02 Km long 110mm diameter HDPE pipes		**1,940,960.00**
1.4 Bill of quantities for water sump construction capacity 20 cubic meters		**677,110.00**
1.5 Bill of quantities for pump installation and KPLC power supply		**0.00**
Bill of quantities for a distribution line to Mihang'o Primary School 0.5 Kmlong 50mm diameter		**1,146,180.00**
Bill of quantities for first variations		**5,141,232.85**
Bill of quantities for second set of variations		***1,036,112.00***
1	Total this Certificate No.4	**12,465,186.35**
2	Less Advance Paid	**0.00**
3	Less Previous Amount Paid in Certificate No. 1	**2,844,367.00**
4	Less Previous Amount Paid in Certificate No. 2	**2,719,133.00**
5	Less Previous Amount Paid in Certificate No. 3a	**2,300,000.00**
6	Less Previous Amount paid in Certificate No. 3b	**1,615,157.15**
7	Release of all Retentions	
	Amount Due now =(1-(2+3+4+5+6))	**2,986,529.20**

Water treatment & chlorination unit

Pump house & swamp tank

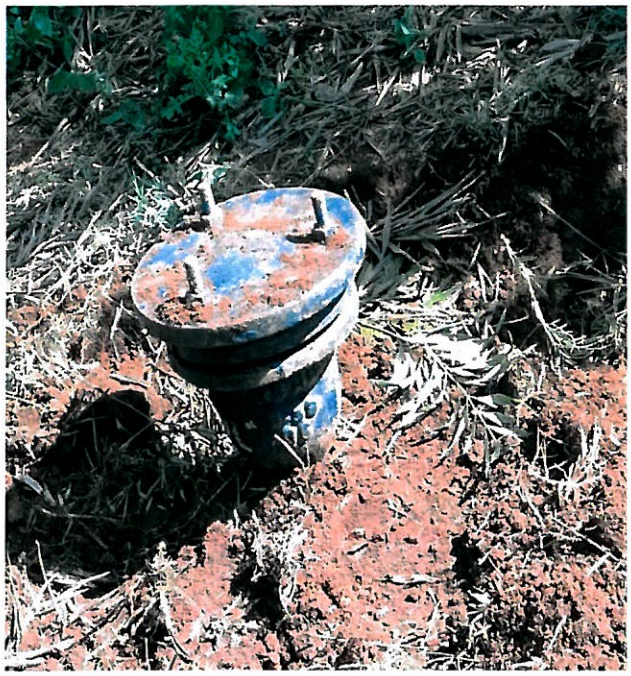
Treatment tank

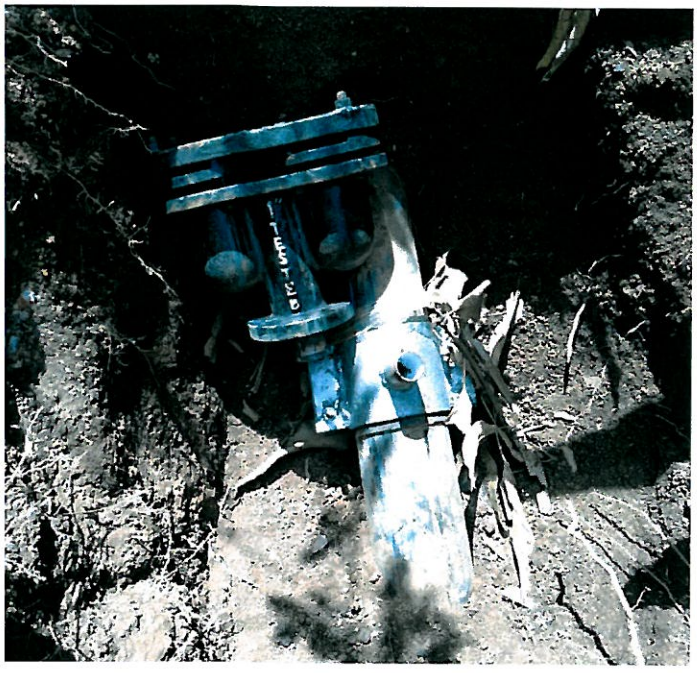
Dustribution Tank

Primary school Water Hand washing unit

Complete Water Pump with accessories

Mihang'o Sec School water line





Single & double air valves