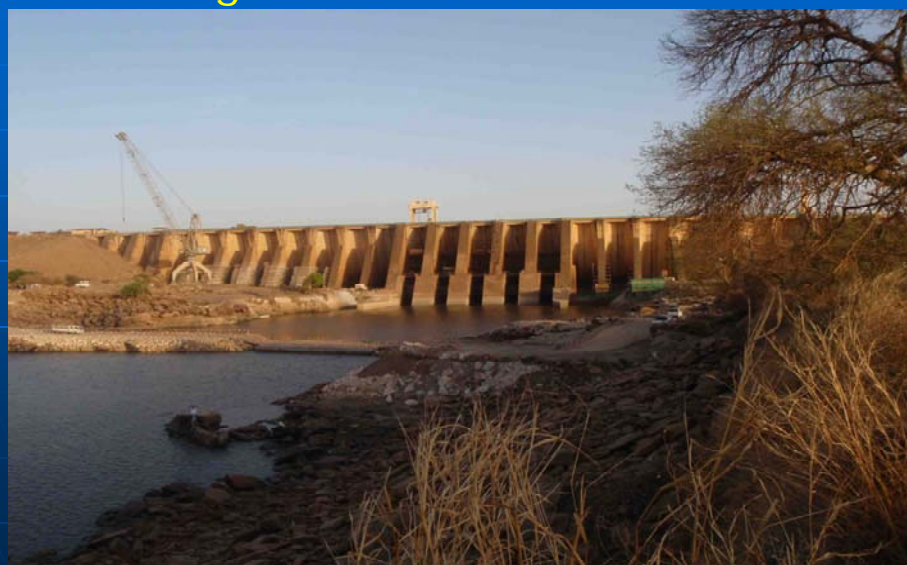


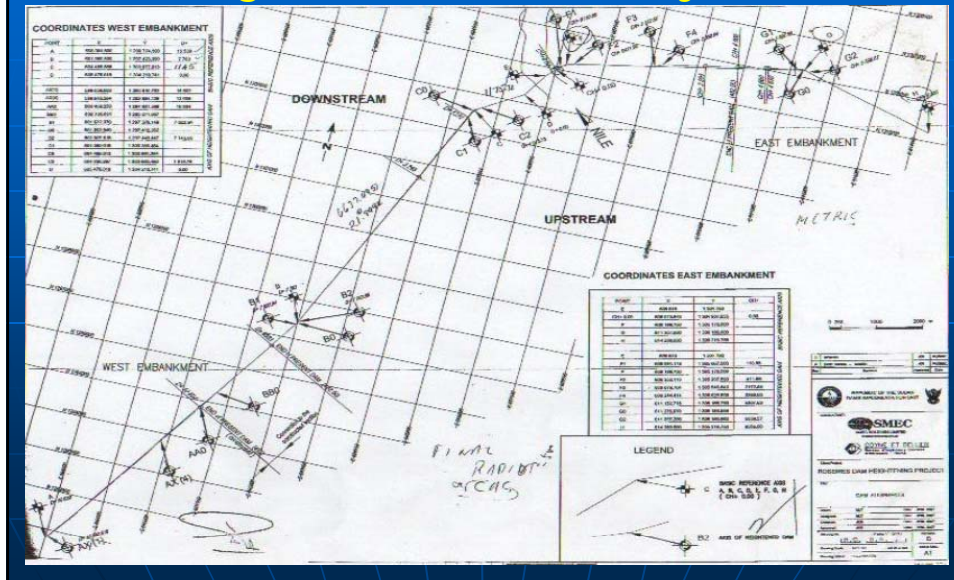
Roseires Dam Heightening Project General Location



Roseires Dam Heightening Project Stage 1 – Constructed 1960's



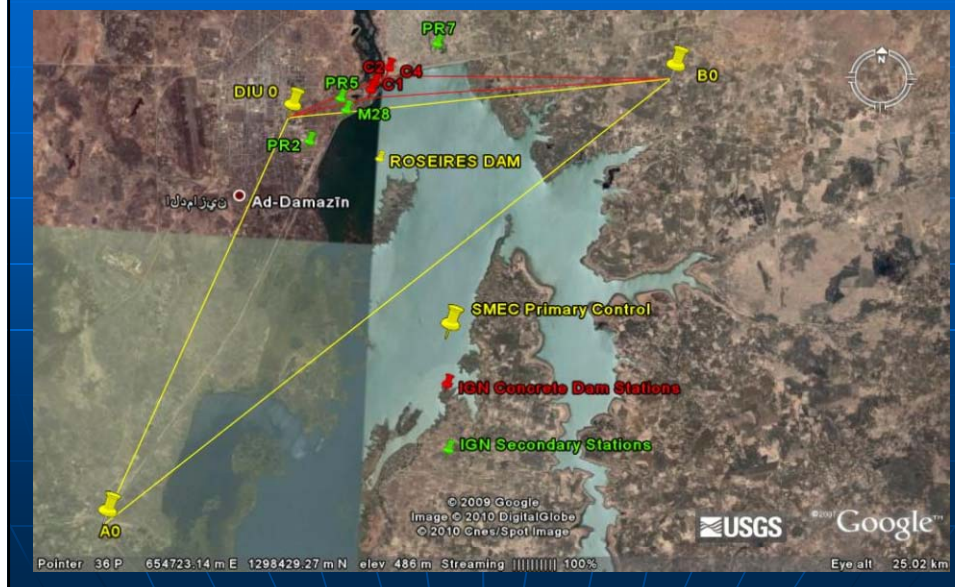
Roseires Dam Heightening Project Stage 2 – 1960's Grid System



Roseires Dam Heightening Project Coordinate Systems

| System | Datum / Epoch | Usage Era | Ellipsoid / Ref Frame |
|---|---|------------------|-----------------------|
| Sudan National Trig Survey | Horizontal Adindan | 1950's - current | Clark 1880 |
| | Vertical – Khartoum | | |
| Roseires Project Stage I Local (OLD) | Horizontal – Unknown | 1960's - 2008 | Unknown |
| | Vertical – Khartoum | | |
| Roseires Project Stage 2 (SMIEC) | Horizontal WGS84 / current Vertical - Alexandria | Current | GRS80 ITRF 2000 |
| Sudan National Irrigation Network DIUREF2007 (IGN France) | Horizontal WGS84 / 2005.0 | 2008 - current | GRS80 ITRF 2005 |
| | Vertical - Alexandria | | |

Roseires Dam Heightening Project Primary Control



Roseires Dam Heightening Project Transformations

SMEC
Obs

Scale, Rotation & Shift of
OLD Coords to WGS84

$$\begin{bmatrix} E \\ N \end{bmatrix}_{\text{WGS84}} = s \begin{bmatrix} R \\ \text{OLD} \end{bmatrix}^{\text{WGS84}} \begin{bmatrix} E \\ N \end{bmatrix}_{\text{OLD}} + \begin{bmatrix} E_0 \\ N_0 \end{bmatrix}_{\text{OLD}}^{\text{WGS84}}$$

Roseires Dam Heightening Project Transformations

SMEC
Obs

Scale, Rotation & Shift of
OLD Coords to WGS84

$$\begin{bmatrix} E \\ N \end{bmatrix}_{\text{WGS84}} = s \begin{bmatrix} R \\ \text{OLD} \end{bmatrix}^{\text{WGS84}} \begin{bmatrix} E \\ N \end{bmatrix}_{\text{OLD}} + \begin{bmatrix} E_0 \\ N_0 \end{bmatrix}_{\text{OLD}}^{\text{WGS84}}$$

SMEC
Obs

IGN Coords
DIUREF2007

Tectonic Plate
Motion

$$\begin{bmatrix} E \\ N \end{bmatrix}_{\text{WGS84}} = \begin{bmatrix} E \\ N \end{bmatrix}_{\text{DIUREF 2007}} + (t_{\text{obs}} - 2005.0) \begin{bmatrix} \dot{E} \\ \dot{N} \end{bmatrix}_{\text{NUVEL-1A}}$$

Roseires Dam Heightening Project Concrete Dam Control Extension



Roseires Dam Heightening Project Concrete Dam Control Extension



Roseires Dam Heightening Project Concrete Dam Control Extension



Roseires Dam Heightening Project Concrete Dam Control Extension



Roseires Dam Heightening Project Concrete Dam Control Extension



Roseires Dam Heightening Project Concrete Dam Control Extension



Roseires Dam Heightening Project Supervision & Contracts

Training

- Local survey staff
- Foreign construction contractor survey staff

Quality Assurance (QA)

- Installation procedures
- Supervision & Monitoring

Working conditions

- Climate – productivity
- Safety & Security

Contract conditions

- Accommodation & Messing
- Transport & Travel
- Leave breaks
- Financial considerations (FOREX, Tax)