Environmental problems of Naini-Lake Basin with special reference to Slope Instability and dwindling water resources

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At
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Geological Layout
Geological cross section of the Nainital Hills
Tectonics and Lake development
SELWAKANJ
GHRAKHAL
MHRAGAON
GHHIRANI
RINGARH
THRRST.

TIRCHAKHET
PUNATAL
1669
1786

SATTAL
STHATTAL
TANTAL
RANJALIYAGAON
MALWATAL

JANTWALGAON
BHIMTAL
BILASPUR

Quaternary Sediments
Present day Lakes
Study Area
Cumulative movements of pillars in Sher-Ka Danda

Cumulative Movement (in cms.)

YEARS

1910 15 20 25 30 35 40 45 50 55 60 65 70 75 79

(4) Reven Wood
(6) Edge Hill Spur (Pillar NO. 6)
(7) Edge Hill Spur (Pillar NO. 7)
(5) Edge Hill

(2) Alma Spur
Blyth Cottage

(1) Glenly
Cumulative movements of pillars in Kailakhan
Indicator of Instability and faults in Nainital
The Balia Ravine
Land Stability Zonation of Nainital Hills
The Drainage Network: Nainital Catchment
“The drainage network: gullies descending transversely and the Bara Nala have been dumping sediments in large quantity in the lake”

Springs
Sukhatal: the main recharge Zone of Naini Lake

Sukhatal 2006 and 2014
Inflow into the Naini Lake:

- 30% of its total inflow of water as surface runoff from the catchment.
- 16% as input from the direct precipitation falling on the lake surface.
- 15% as inflow from perennial drains such as Bara Nala or Parda Dhara.
- About 39% as subsurface inflow
- Sukhatal contributes 40-50% out of total subsurface inflow to the lake.

Outflow from Naini Lake:

- 32% of its outflow by pumping the lake water through infiltration well and deep tube-wells to meet out the water requirement of Nainital town.
- 41% is drained out through sluice gates to control the water level in the lake during monsoon season.
- 12% through evaporation.
- About 15% as the subsurface outflow through springs discharging downstream of the lake catchment.

Underground flows play an important role in the lake water quality. Many subsurface springs have been suspected to be issuing in the Ridge region and along the Nainital Faults inside the lake. The underground flow of groundwater have been observed in the Tallital side of the lake where the dyke is cutting across the lake and extending up to the Nainital Fault. Many springs, outside the lake catchment, have also been identified as having lake as the source Viz. Rais Hotel, Siphai Dhara, Gupha Mahadev, Takula, Kailakhan springs.
Lake lets in the Lake Basin (which remain dry except during rainy spells).
Bathametary of Naini Lake
“Bathymetric map of the Naini lake prepared by Hashimi et al., 1993, by using sophisticated echosounder, sub bottom profiler, side-scan sonar with position fixing Motorola Miniranger”.
Shape of the bottom of the southeastern part of the Naini Lake portrayed in echosounder drawn to scale

(a) Narrow V-shaped underwater valley profile showing steep slopes with the local scarps
(b) accumulation of soft sediments in the southern part of the lake showing slumping on steeper slopes
(c) step like features (t) in the Tallital side of the lake floor.
(d) shallow seismic profile of SE part delineating the bottom and sub-bottoms multiples.
Underwater topography of Naini lake

(a) Profile showing lake filled thickly with soft sediments, terrace like features(t) development
(b) NW part of the lake is also characterized by scarps and slumping of sediments
(c) Semi consolidated sedimentary layers in the NW part of the lake basin showing deformation and displacement
(d) deltaic features developed on the NE shore of the lake
Detailed bathymetric study permits division of this crescent-shaped lake into two sub basins separated by approximately 100 m wide transverse underwater ridge, 7-20 m below the lake surface.

- The SE is 11-25 m and NW part is 4-27 m deep respectively, are filled with unconsolidated sediments of about 15 m thick on an average.

- The semi-consolidated sedimentary layer shows slumping on slopes and deformation on channel bed.

- A large number of small but rapidly growing deltas along the shore indicates accelerated pace in sedimentary inputs resulting from fast erosion in the catchment area.

- Comparison of the bathymetry maps indicates progressive reduction in the lake capacity due to accumulation of sediments-5500 cubic meter in eighty years at the rate of 67 cubic meter per year between 1895-1969.

- However during 1969 – 1979, the sediments accumulation was at the rate of 78 cubic meter per year.

- This is evident by the growing fronts of 23 deltas.
लेल; को% विगत कुछ वर्षों से नैनीठील में जलागम क्षेत्र से जल आपूर्ति में कमी दर्ज की जा रही है। जिसके फलस्वरूप इस वर्ष झील के जलस्तर में 6–7 मीटर की गिरावट आई है, जिससे कि नगर जल आपूर्ति पर विपरीत प्रभाव पड़ने की आशंका बनी है एवं झील के नैसर्गिक सौन्दर्य में कमी आई है।

dkj. k&%

- जलागम क्षेत्र में वर्षा की तीव्रता का बढ़ना व समयावधि का कम होना।
- जलागम क्षेत्र के ऊपरी भागों में स्थित प्राकृतिक चाल-खाल में मलवा डालने के कारण से जलसंग्रह क्षमता समाप्त होना।
- जलागम क्षेत्र में कच्चे लिंग मार्गों का सीमेंटीकरण एवं डामरीकरण के फलस्वरूप भूजल रिसाव में कमी होना।
- शीतकालीन वर्षा एवं हिमपात् इत्यादि में विगत वर्षों में भारी कमी के फलस्वरूप झील के रिचार्ज में कमी।
- झील से स्थायी एवं अस्थायी जनसंख्या के बढ़ने के कारण अत्यधिक मात्रा में जल निकासी होना।
- जैसा कि सर्व विदित एवं तार्किक है कि सूखाताल क्षेत्र नैनीठील के पानी का मुख्य रिचार्ज जोन है। विगत वर्षों में सूखाताल झील के झूठे क्षेत्र में मलवा निरस्तारण के कारण कमी आई है एवं ताल के जल संग्रहण क्षमता एवं उसके तल से जल रिसाव में कमी आई है।
वर्षा जल संग्रहण हेतु भवनों एवं जलागम क्षेत्र में उपयुक्त प्रावधान सुनिश्चित किया जाये साथ ही जलागम क्षेत्र के उपयुक्त भागों में समुचित जल संग्रहण संरचना का निर्माण किया जाये।

बरसाती पानी की निकासी को सीवर लाइन से संयोजित ना किया जाये।

सूखाताल एवं अन्य चाल-खालों में मलवा, गाद इत्यादि को हटाकर वर्षा जल संग्रहण क्षमता एवं भूजल रिसाव को बढ़ाया जा सकता है।

सूखाताल जलागम क्षेत्र के अन्तर्गत सभी भवनों से वर्षा जल संग्रहण कर सूखाताल में निपटाया किया जाये। यह एक प्रकार से सूखाताल जलागम क्षेत्र के लिए केंद्रीकृत वर्षा जल संग्रहण योजना (Central Rainwater Harvesting Scheme) होगी। इससे न केवल नैनीजील का रिचार्ज होगा अपितु सूखाताल क्षेत्र की नैसर्गिक सौन्दर्य में वृद्धि होगी और पर्यटन की भी सम्भावना बढ़ेगी।

सूखाताल के परिधि क्षेत्र में वृक्षारोपण (यथा Salix, Weeping Willows प्रजातियों के वृक्ष) तथा सम्पूर्ण डूबे क्षेत्र को सुदृढ़ कटिले तार बाढ़ से घेराबंदी करना सुनिश्चित किया जाय।
Hundreds join ‘Save Naini’ campaign

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Irrigation department (Kumaon Zone) chief engineer DCS Khetwal said, “The water level has been declining continuously.”

In the past few summers, the water level had been recorded at three to four feet below zero. Last May, the level of water was two feet below zero. In the 1970s, when the quaint town was emerging as a popular shooting destination for Bollywood and real estate developers had started arriving, the water level in the summer would be measured at one feet below the zero mark.

Another contributing factor, experts pointed out, was the neglect of Sukhatal, which recharges more than 50% of the lake. “Despite strong evidence through research conducted by the National Institute of Hydrology approximately 20 years ago about the importance of Sukhatal, it was blatantly neglected by the authorities,” Vishal Singh of Cedar said. A 2015 study by Cedar, in collaboration with Cambridge University, found Sukhatal provides more than 40% subsurface flow to Naini lake round the year, including in the drier months. Sukhatal can absorb large amounts of rainwater due to its topography, which includes limestone and dolomite.

After Ajay Singh Rawat filed a PIL in the Uttarakhand high court in 2012 requesting the court to convert Nainital into an eco-sensitive zone in order to save the area’s ecosystem, the court last year ordered IIT Roorkee to submit a detailed project report about the beautification and recharge of the Sukhatal area.

Experts also said the town and the lake are unable to meet the needs of a burgeoning population and the increased tourist inflow. “The consumption of water in the hill town has increased manifold. Earlier, it was around 6-7 MLD per day; it has now shot up to 16 MLD,” Rawat said.

There has been no comprehensive research in the last two decades of the changes required to preserve the lake and surrounding water bodies.

The dire state of the eye-shaped water body has prompted concerned citizens to launch a petition on change.org urging chief minister T S Rawat to save the lake. The petition has garnered more than a thousand signatures in a few weeks, including those of celebrities such as singer Shubha Mudgal. A barefoot march is also being organised in the city on June 3 to raise awareness of the need to save the lake.